


# User's Guide

## APT v4.80 (Jun 4th)

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www.astrophotography.app

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APT stands for "AstroPhotography Tool" and it is like Swiss army knife for your astro imaging sessions. No matter what are imaging with - Canon EOS, Nikon, CCD or CMOS astro camera, APT has the right tool for planning, collimating, aligning, focusing, framing, controlling, imaging, synchronizing, scheduling, meridian flipping, analyzing and monitoring. All its features are packed in an easy and comfortable to use interface with design that had no alternative back in 2009 when it was released. Since then APT is constantly being improved and refined by the real experience of many astro photographers from all over the world including one of the APT authors. Currently APT works on MS Windows Vista, 7, 8, 8.1, 10 and 11.

APT has time unlimited "demo" version with almost all features of the full one. In fact this "demo" is one of the most loaded astro applications available for free.

**How and Why to support APT you can find at - Having alternatives drives the progress!**

## About this document

The approach to this document is minimalistic - a description of all features in APT and the related information in the short and easy to use form. The two main sections are Application Interface and APT Features. In the first one you can find explanation for everything you see in APT. The second one is a kind of index of the main APT functions. There are few more sections that are focused on important areas like Dithering, PointCraft and SessionCraft.

This guide is designed to use the full power of the hyper-links and to give possibility to track easily all the linked information without text duplication. In the same time is used common naming of the sections in order to make easier for reading if one decide to print it (PDF version here). The User's Guide is not book in its classic form and there is no proper or right way to read it :) You can read it page-by-page or in random order. Every topic contains a focused information and links to all related topics.

Special thanks to Dennys Turcotte for his work to make this document better and more clear to read!

Special thanks to Mark Kelly for his YouTube channel Southern Cross Amateur Astro! It is a project in progress to make using and understanding APT easier! The User's Guide pages are constantly updated the with links to corresponding video clips from the Mark's channel.

## Support

*Related videos:*
*APT - Getting Help - Guides, Tutorials & Forums*

**APT has a dedicated forum - www.aptforum.com.** It is a place where you can ask or search specific questions. Also it is a growing source of information related to astro-photography in all of its aspects - imaging, automation, processing and etc. It is the preferred way to discuss everything around APT because your questions, answers, suggestions or ideas can be in help to others. The registration is more than easy!

There is also a group in **Facebook - APT Group**. It is mainly focused on sharing news and images taken with APT. You can find help there too, but because of the Facebook nature it is harder to find previously asked questions...

If you prefer or need more private communication then you can use support@astroplace.net.

All feedback, suggestions and ideas are highly appreciated!

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## Installation

Related videos:
Installation,
Pre-Install (Windows) Part 1 - Drivers,
Pre-Install (Windows) Part 2 - Plate Solving,
Pre-Install (Windows) Part 3 - PHD2 Guiding,
Pre-Install (Windows) Part 4 - Stellarium (making connections)

Open the ZIP archive downloaded from APT site and execute the contained executable file. Follow the simple installation wizard and you are ready to start using APT with a Canon EOS camera or in most cases with your CCD/CMOS camera (you may need a driver and/or few more components).

If you are using more hardware or want to use some of the special APT features you may need some additional components. Take a look of the list below and make sure that you have installed and tried indoors everything needed in order to save precious time under the sky!

- If you are using ASCOM compatible CCD/CMOS camera, Mount, Filter Wheel, Focuser, Rotator you have to install also the ASCOM platform and the corresponding ASCOM **and** Native drivers for your devices.
- If you are using INDIGO / INDI compatible CCD/CMOS camera, Mount, Filter Wheel, Focuser, you have to configure access to your INDIGO / INDI server.
- If you use Canon EOS camera with Digic 2 processor you will need a Bulb (Serial) cable and possibly a driver.
- If you use older Nikon camera you will need a Bulb (Serial) cable and possibly a driver.
- If you are using Altair Astro camera install the latest camera drivers from Altair Astro site.
- If you are using Player-One camera install the latest camera drivers from Player-One site.
- If you are using QHY camera install the latest camera drivers from QHY site.
- If you are using QSI camera install the latest camera drivers from QSI site.
- If you are using SBIG camera install the latest camera drivers from SBIG site.
- If you are using SVBony camera install the latest camera drivers from SVBony site.
- If you are using ToupTek (or based on ToupTek platform) camera install the latest camera drivers from ToupTek site or from the camera brand site.
- If you are using ZWO (ASI) camera install the latest camera drivers from ZWO site.
- If you want to use guiding and dithering, refer to the section Guiding and Dithering and download the needed applications like PHD, MetaGuide, MGEN2/3 drivers and etc.
- If you want to use plate-solving, refer to the section PointCraft and Plate-Solving and download ASTAP, PS2, PS3 and/or ASPS in combination with the needed indexing files.
- If you want to use an integration with planetarium application, refer to the section Planetarium and download the needed applications and their components like plug-ins and catalogs.
- If you want to use AstroTortilla download it with the needed indexing files.

On Windows 8 and newer depending on the installation in some cases there is need to enable .NET 2.0. It is included in .NET 3.5 and the steps to follow are described in this article in the Microsoft site:

https://docs.microsoft.com/en-us/dotnet/framework/install/dotnet-35-windows-10

or see this clip in YouTube:

https://www.youtube.com/watch?v=fKE0k2ePblY

## Starting APT (DSLR or CCD/CMOS)

*Related videos:*
*Starting & Camera Connections*

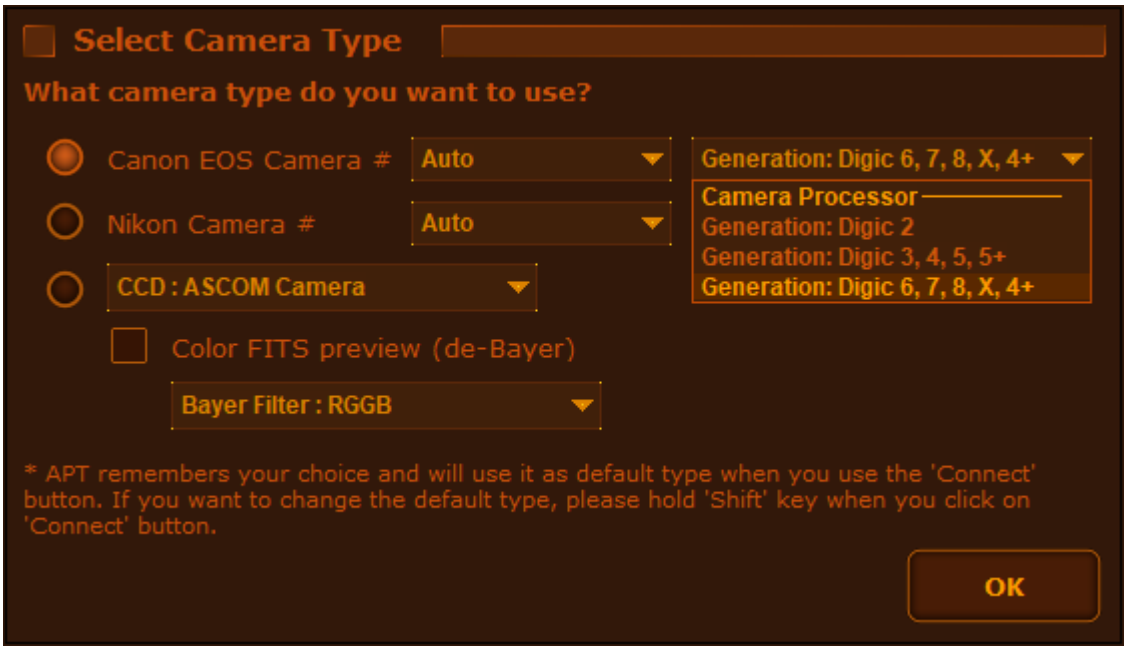
APT has two modes of operation depending on the camera you are using - DSLR (Canon EOS, Nikon) or CCD/CMOS (ASCOM / INDIGO/ INDI compatible, SBIG, ZWO, QHY, Altair Astro, ToupTek, RisingCam, OGMA, Lacerta, MallinCam, Omegon Pro, Orion StarShoot G, Explore Scientific, Bresser, SVBony). Here are the instructions how to make the initial connection to your camera depending on its type.

In rare cases there is need to start APT using the "Run As Administrator" option in order to resolve camera connection problems. When it is started this way, you have to use the same option for PHD, Planetarium and the other applications that APT can communicate with. Here are mode ideas how to solve connection problems - Modern CMOS camera troubleshooting

*If Shift key is pressed during APT start, the automatic connections to devices like camera, mount and etc. will not be made.*

1. **Starting with Canon EOS camera:**

   On the first start APT starts in EOS mode. If you use EOS model with processor Digic 6, 7, 8, X or 4+ you can simply connect your camera to the computer, turn it on and click on Connect button in Camera Tab. If you use Digic 2, 3, 4, 5, 5+, camera, hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box and select the corresponding Digic generation. Click on OK, connect your camera and turn on your camera, then click again on Connect button. APT will remember your selection, so next time you can simply click on Connect button. If you use more than one imaging camera at the same time see Multi-Camera Operation section.

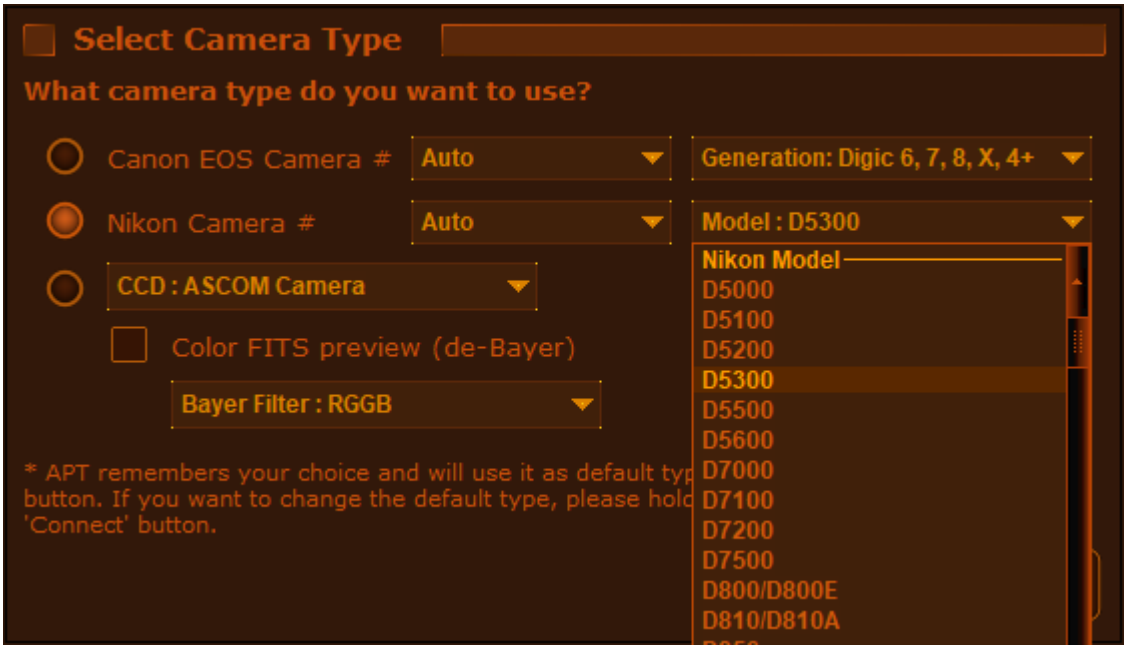



   Information about the Canon EOS models including the built-in processor can be found in the Canon EOS Matrix page on the APT site.

Note: For EOS 1300D (T6, X80) select the option Digic 6, 7, 8, X, 4+!

2. **Starting with Nikon camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. Select the Nikon Camera option, then select model from the Models list box and click OK. APT will remember your selection, so next time you can simply click on Connect button. If you use more than one imaging camera at the same time see Multi-Camera Operation section.

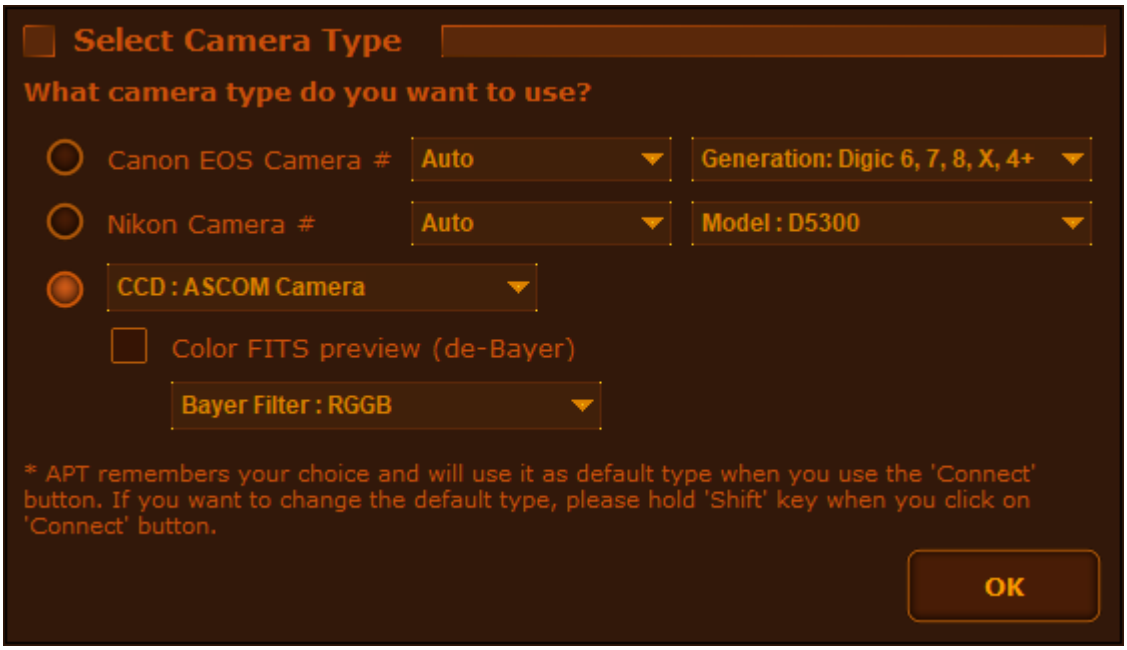



Information about the Nikon models can be found in the Nikon Matrix page on the APT site.

Note: Make sure auto-focusing is set the ***MF (manual focus)*** in the camera menu.

3. **Starting with ASCOM compatible CCD/CMOS camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "ASCOM Camera". Click on OK and you will see the standard ASCOM dialog box for selecting the driver for your camera. APT will remember your selection, so next time you can simply click on Connect button in order to use the previously selected driver. If you want to change the driver or the camera type use again Shift+Connect. If you use more than one imaging camera at the same time see Multi-Camera Operation section.




If your ASCOM compatible camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

***Note: Both, the ASCOM platform and the camera ASCOM diver, have to be installed!***

***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

4. **Starting with SBIG CCD camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "SBIG Camera". From the "Port" list box select the port where your camera is connected. If you use SBIG filter wheel then select the model form the "Wheel" list box. Click on OK. APT will remember your selection, so next time you can simply click on Connect button. If you use more than one imaging camera at the same time see Multi-Camera Operation section.

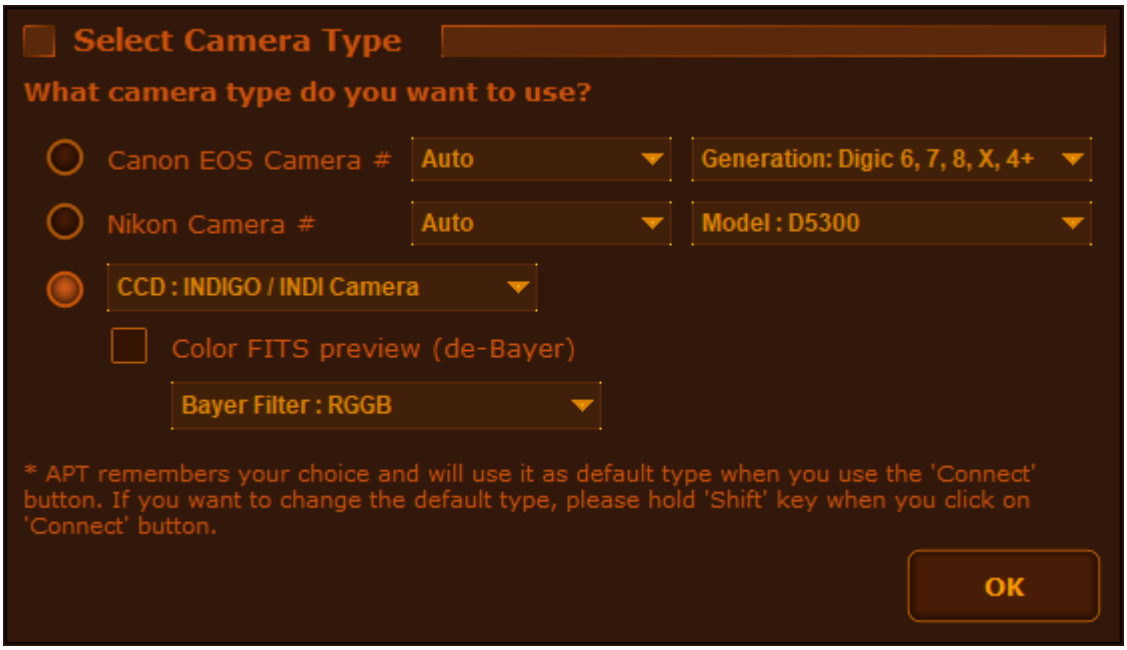


If you have filter wheel, make sure to describe the used filters in Filter Wheel settings tab.

If your SBIG camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

5. **Starting with INDIGO/ INDI CCD camera:**

Connect the camera to the INDIGO/ INDI device and turn it on. Make sure that you have connection to the INDIGO / INDI server. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "INDIGO/ INDI Camera". Click on OK and you will see a dialog box for selecting the driver for your camera. APT will remember your selection, so next time you can simply click on Connect button in order to use the previously selected driver. If you want to change the driver or the camera type use again Shift+Connect. If you use more than one imaging camera at the same time see Multi-Camera Operation section.

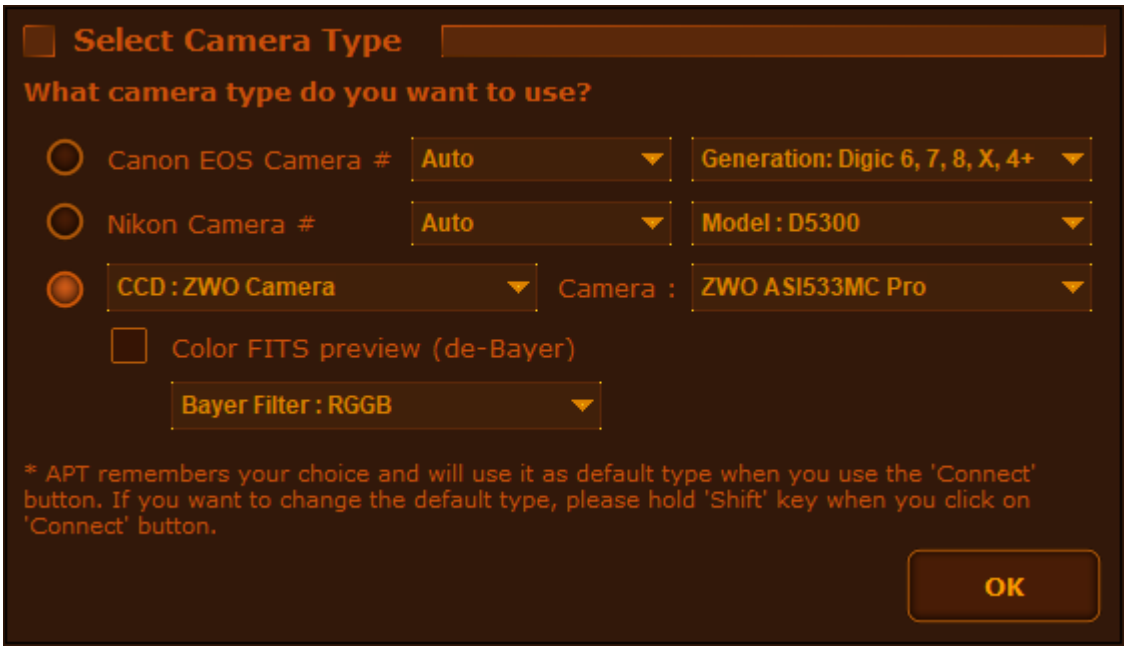



***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

If your INDIGO/ INDI camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

6. **Starting with ZWO CCD / CMOS camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "ZWO Camera". If you use more than one imaging camera at the same time see Multi-Camera Operation section.




***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

If your ZWO camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

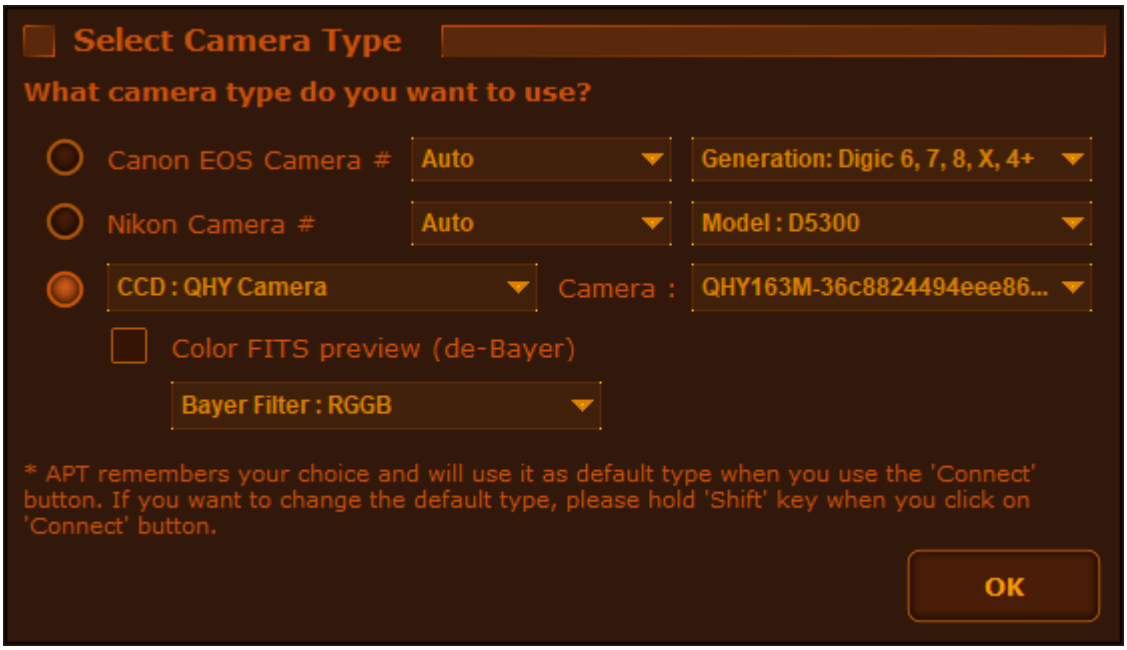
You can control the camera specific options from the Settings button in Camera Tab.

7. **Starting with QHY CCD / CMOS camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "QHY Camera". If you use more than one imaging camera at the same time see Multi-Camera Operation section.

***Note: Make sure to install the latest All-In-One driver from the QHY Downloads page!***

***Note: If you are using older model with CCD sensor (not CMOS camera) make sure to install the system driver and the ASCOM driver from the section "Classic CCD DEVICES" of the QHY Downloads page and make the connection via the ASCOM Camera.***




If you have QHY filter wheel connected directly to the camera, make sure to describe the used filters in Filter Wheel settings tab.

If your QHY camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

You can control the camera specific options from the Settings button in Camera Tab.

8. **Starting with ToupTek, Altair Astro, RisingCam, OGMA, Lacerta, MallinCam, Omegon Pro, Orion StarShoot G, Explore Scientific CMOS, Bresser camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option for your camera brand. If you use more than one imaging camera at the same time see Multi-Camera Operation section.



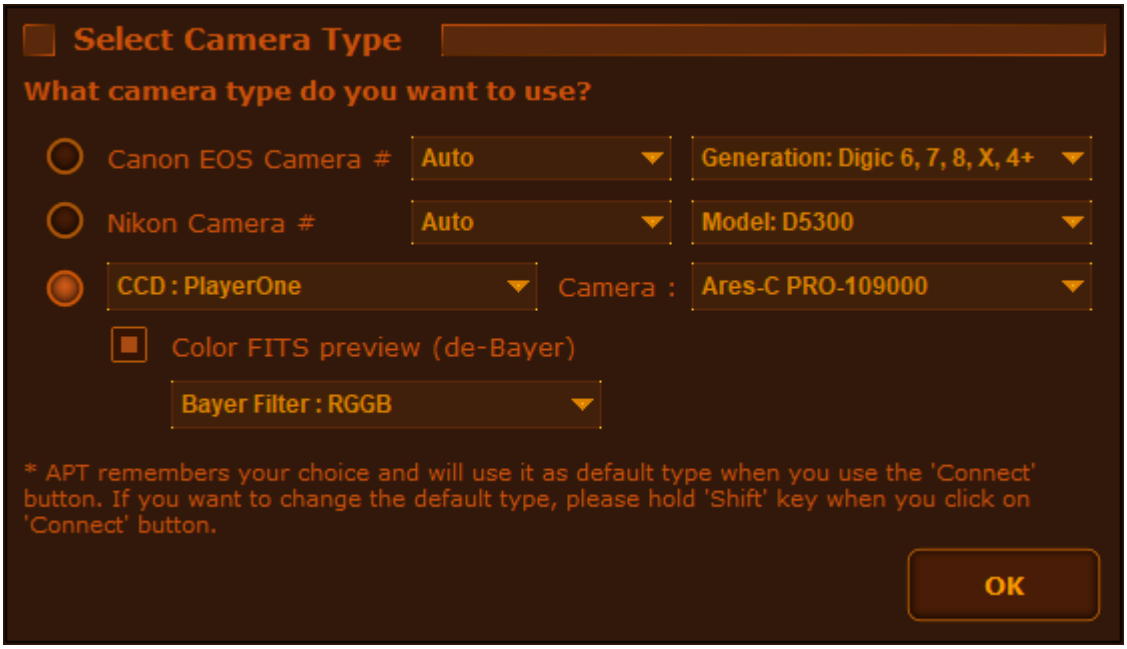

***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

If your camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

You can control the camera specific options from the Settings button in Camera Tab.

9. **Starting with PlayerOne CMOS camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "PlayerOne Camera". If you use more than one imaging camera at the same time see Multi-Camera Operation section.



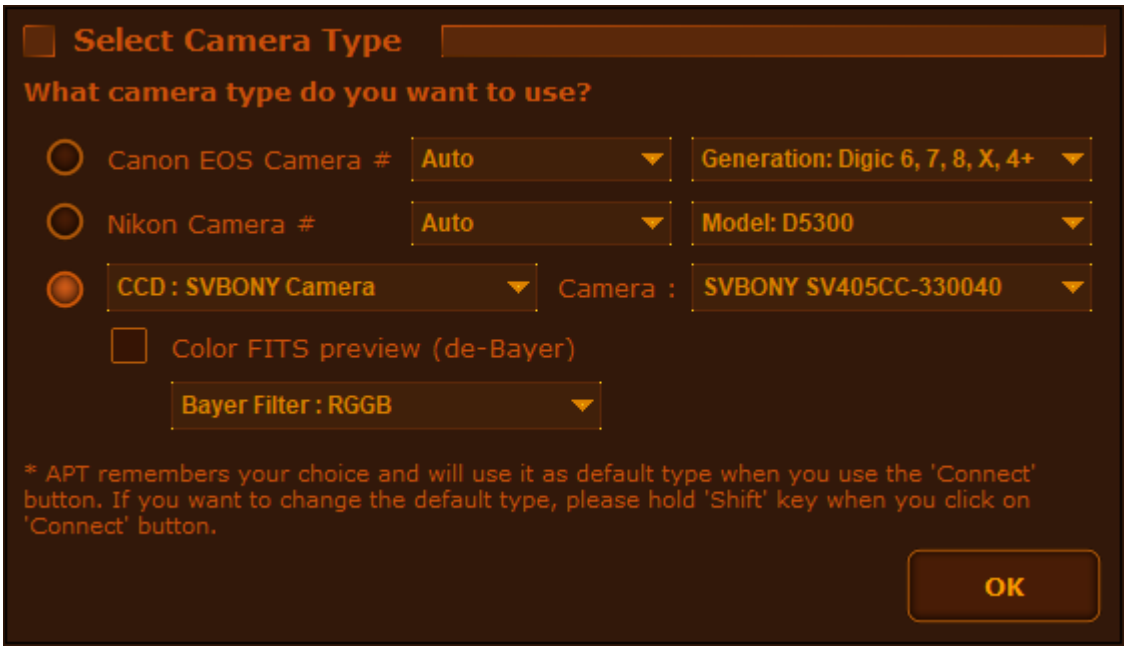

***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

If your PlayerOne camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

You can control the camera specific options from the Settings button in Camera Tab.

10. **Starting with SVBony CMOS camera:**

Connect and turn on your camera. After that hold the Shift key and click on Connect button in Camera Tab to open the Camera Selection dialog box. From the dropdown list named CCD select the option "SVBony Camera". If you use more than one imaging camera at the same time see Multi-Camera Operation section.




***Note: If you have filter wheel and want to define gain value per filter and/or auto focusing exposure per filter, describe the used filters in Filter Wheel settings tab.***

If your SVBony camera is color and you want to see color preview of the images, enable "Color FITS / XISF Preview" and select the corresponding Bayer matrix configuration. You can enable/disable this feature later from CCD Settings tab.

You can control the camera specific options from the Settings button in Camera Tab.

## Modern CMOS camera troubleshooting

The modern CMOS cameras are coming with multi-megapixel sensors and all this information should be transferred to the computer. Everyone wants that transfer to be as fast as possible and if you have a model built in the last several years it is a USB3 camera. So far so good! However it happens that your camera could not play nicely with your computer. As a result you will see problem with the image downloading - usually the software is hanging waiting for image than never comes and the only solution is camera restart.

**First of everything check if the USB power management is disabled! Here is short clip how to check / disable it - Clip in YouTube. Here is a written instruction.**

**Second, never operate the camera without AC adapter unless it has no powering port! Use power adapter that could feed the camera without being on the limit! If your camera needs 2 Amps, use 3-4 Amps adapter.** Some adapters could perform significantly worse under cold conditions, so have good amount of amps in advance.

**Third, try to keep the data and power cables separated! Don't bind data and power cables in one bundle. Don't make a roll/coil of a long cable during your cable management, use shortest possible cables!**

During the time several solutions have proven that give results in solving the problem of the USB3 instability problem:

1. Try to lower the USB Speed setting - this the speed of the communication between the camera and the computer. This could be made via the ASCOM driver Properties or via the CCD Settings, both available via Settings button in Camera Tab
2. If you are using USB Hub try to connect the camera directly to the computer in order to exclude the hub as source of the problem.
3. Try to connect the camera to other port of the USB Hub or computer.
4. If you have other cable or/and hub try them. Powered USB Hubs are always a better option! If you have round USB cable try it instead the flat cables that usually come with the cameras.
5. Check the computer BIOS and if there is setting for CPU power management disable it. If there is setting for USB power management disable it too.
6. In case you are reaching this point try to put powered USB **2.0** between the camera and the computer. This will solve general incompatibility between the camera and the computer.
7. *If you are using active USB cable/repater make sure that it is from same or newer generation, compared to the USB hub generation.*

In addition, make sure that there are no running USB speed booster applications (some laptops come with pre-installed application that could offer optimized transfer)

General rule - keep your Windows updated.

## Application Interface

*Related videos:*
*Interface Extras*
*Interface*

In this section are described all the elements of APT the user interface. You can use it to find information for every element that you are seeing on the screen.

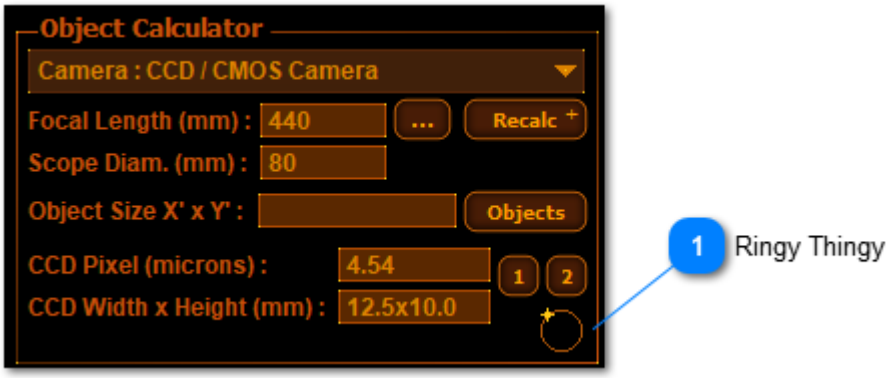
Here are some general notes.

• The color (skin) of the interface can be changed from Main Settings tab.

• The buttons that have small plus sign "+" in the upper right corner (like 

) has additional functionality when Shift key is pressed.

• There is one special control named **Ringy Thingy**. It helps to change/enter numeric data only with the mouse or touch pad. Here as it looks in the Tools tab. It is included in many places in APT and can be connected to multiple edit boxes. Once an edit box gets the input focus (by clicking on it) if **Ringy Thingy** is connected a small star will blink once in its center to show you that connection. To change the edit box value click and hold on the **Ringy Thingy**, move away from the center - farther you move more accurate the changes will be, then start to move the mouse in circle. Clockwise direction increases the value, counter clockwise direction decreases the value.



What makes **Ringy Thingy** smart and unique is not the design (its idea is not totally new) but the way it handles the different value types. When you are changing ISO it will work with the ISO values. Exposures will give the expected values for camera exposure. It can work with whole numbers and with decimal numbers. If the number is decimal you can click in left or right of the decimal point and change that part of the number using the **Ringy Thingy.** In the image below object size can have up to 4 sections controlled just with mouse - the left and right of the X value and left and right of Y value. If your targets are in the Object Browser it is possible to drive the whole imaging session without touching the keyboard!

Here is an animation how it works (visible only in the CHM help file and in the on-line help):

If you are reading the PDF version of this document you can see the animation at:
https://astrophotography.app/RingyThingy.GIF

Or by scanning the code with your mobile phone:

• Another interesting feature is named **Keys Thingy**. It also designed to help to change/enter numeric data with the mouse, touch pad but also for use on tablets. It gives big buttons that allow entering the correct data for selected text box. To open it just double click on the edit box you want to edit. Depending on the data type you are entering **Keys Thingy** will provide a different set of available keys.




• Many APT tools are possible to be minimized and to stay floating for easier access. Their opened state and position are saved between the sessions. Double clicking on a minimized window will expand the tool. Double clicking in open window's background will minimize it, same as clicking on "-" button. Clicking the corresponding button in Gear or Tools tab will close the Aid and on the next use will start in opened state. Also dragging one of the minimized windows holding the Shift key will arrange and move all the minimized windows like this:

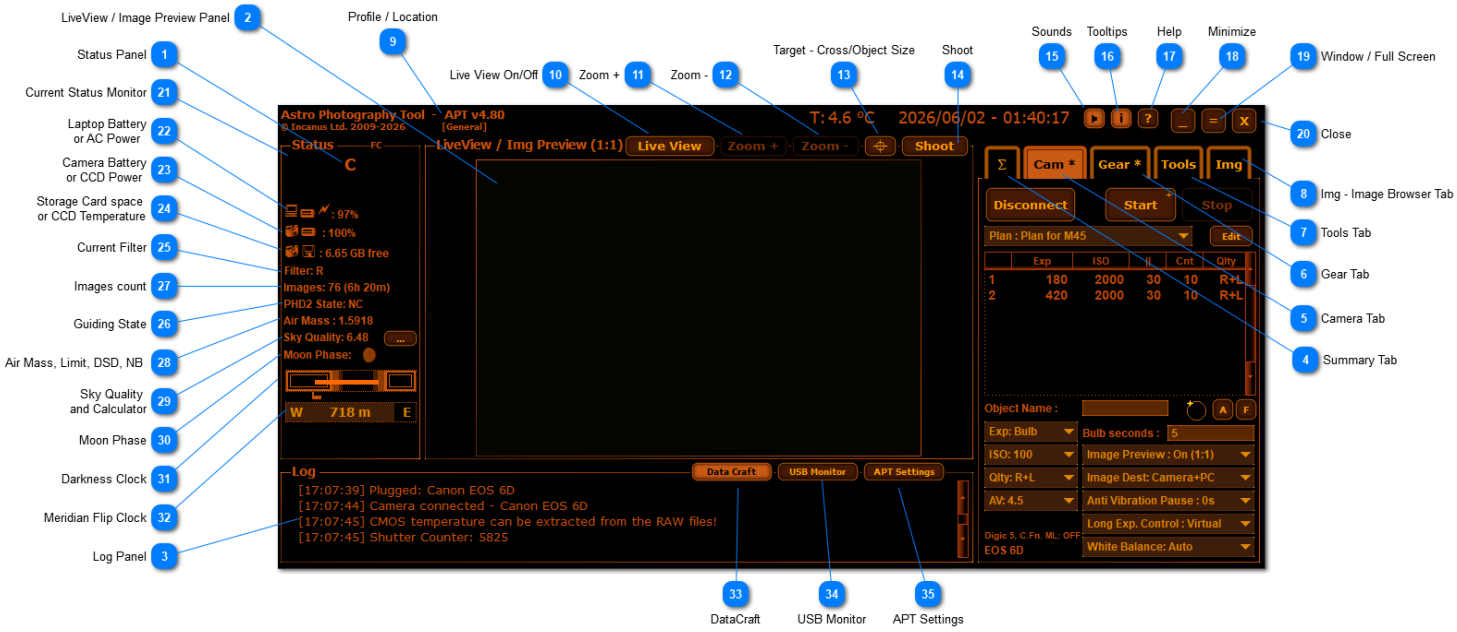



## Main Screen

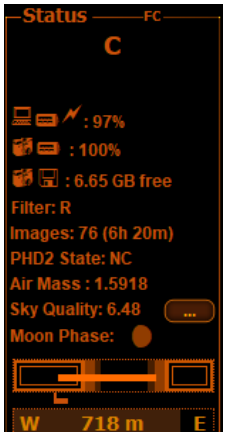
*Related videos:*
*Main Screen - 4.60+*
*The Status Panel - 4.60+*
*Main Screen*
*The Main Screen*

This is the main screen of APT. It is divided in several areas - Status Panel, LiveView / Image Preview Panel, Log Panel and control tabs (Summary, Camera, Gear, Tools, Image Browser).

There are some differences in the appearance in DSLR and CCD/CMOS modes in order to cover the specific properties and features of the Canon/Nikon and CCD/CMOS cameras. These differences are described in details in the following sections Camera Battery / CCD Power, Storage Card space / CCD Temperature, Plan Editor, Histogram Panel and Camera Tab. All other features are common for both DSLR and CCD/CMOS modes.




## 1 Status Panel





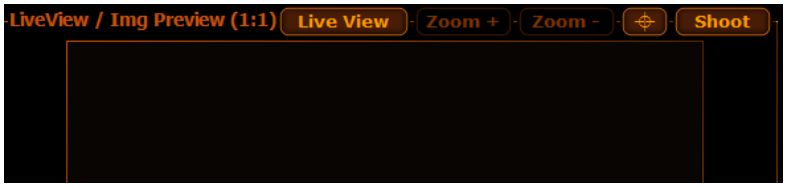


This panel contains various status information.

Note: When the laptop screen is with 4:3 aspect ratio (not "wide-screen") the Status panel is placed between the "LiveView / Image Preview" and "Log" panels.

The position of the Status Panel could be manually controlled via Status Panel Position in Main Settings tab

## 2 LiveView / Image Preview Panel

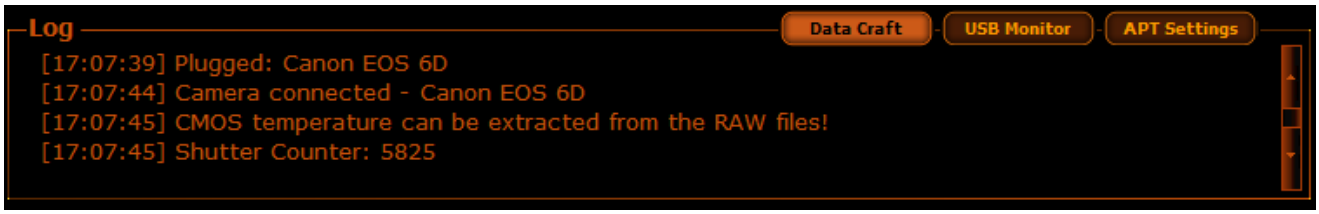


In this panel you can see the image that comes from LiveView, the last taken image or a loaded image using the Image Browser.

In the top left corner there is a small rectangle which is visible for every even image displayed and is hidden for the odd images. This makes easier to see when the picture on the screen is changed when you are using LiveView or you are loading similar images when small differences like such taken without dithering.




## 3 Log Panel




In this panel is displayed logging information for the current session since the APT start. This includes details about the camera like shutter count, imaging plan execution progress, errors, warnings and etc.

**Double Click** in the Log Panel will open the log file in Notepad.

## 4 Summary Tab




Makes active the Summary tab - it shows a summarized information from the other tabs, tools and aids, that is most needed during the imaging imaging process. See Summary tab section for details.

## 5 Camera Tab




Makes active the Camera tab. There are two layouts of the Camera tab depending on the selected mode - DSLR mode or CCD/CMOS mode. This tab gives access to the camera control and image acquisition features. See Camera Tab (DSLR mode) or Camera Tab (CCD/CMOS mode) sections for details.

When there is asterisk symbol (*) that means that there is active connection to a camera.

When multiple cameras are used at the same time the tab name changes to "Camera [n]" where "n" is the APT instance number. See Multi-Camera Operation section for more information.

## 6 Gear Tab




Makes active the Gear tab. It gives access to features for Telescope, Focuser, Filter Wheel and Rotator control as well as to PointCraft. See Gear tab section for details.

When there is asterisk symbol (*) that means that there is active connection to one or more devices like Telescope, Focuser, Filter Wheel and Rotator.

## 7 Tools Tab




Makes active the Tools tab. It gives access to various additional features including the Settings dialog box. See Tools tab section for details.

## 8 Img - Image Browser Tab




Makes active the Img tab - this is the images browser of APT. See Img tab section for details.

## 9 Profile / Location




Shows the current Profile name and the Location name ( if the the Show Location is enabled in Location tab)

## 10 Live View On/Off




Turns On/Off the LiveView feature. See the LiveView section for details.

## 11 Zoom +




Available only in DSLR mode. Increase the LiveView zoom level to 5x (or 10x of it is clicked two times). For most EOS cameras Zoom x5 is very close to the representation "1:1" - "one pixel from the image, represents one sensor pixel". It is a valuable feature when planetary astro-photography.

The CCD/CMOS cameras have no hardware supported Zoom. In order to make a software zoom you can use Tools->Magnifier feature.

## 12 Zoom -



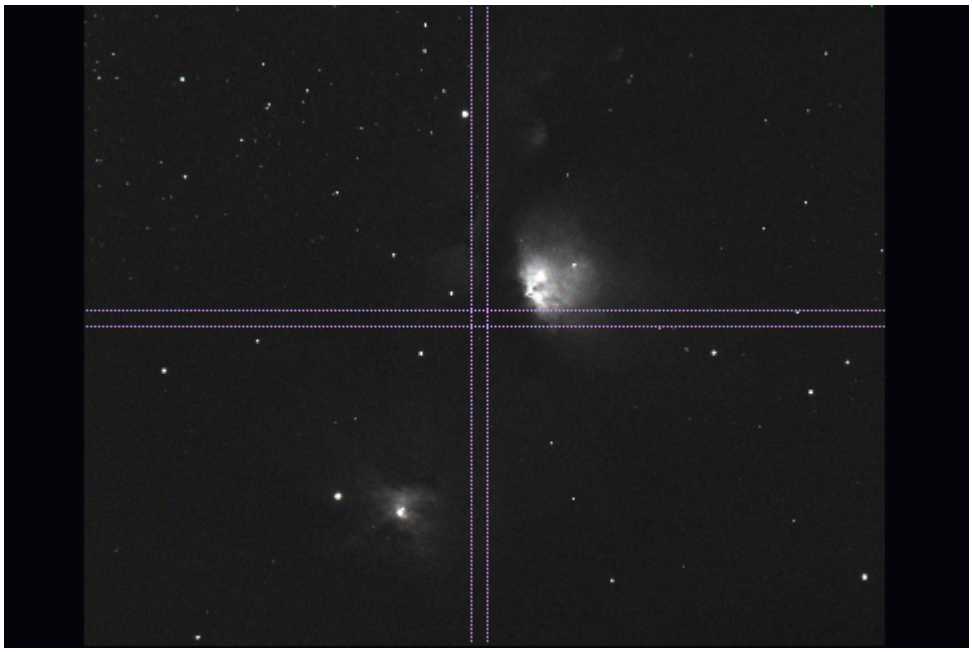

Available only in EOS mode. Decrease the LiveView zoom level to 5x (or disable zoom if it is clicked two times).

## 13 Target - Cross/Object Size



It is a tri-modes button. The modes toggle in the flow OFF -> Crosshair mode -> Object Scale mode -> OFF. These modes use the preview area and work without camera connection, during LiveView or over a previously taken image. Crosshair mode is designed to help in alignment tasks like: Drift Alignment, GoTo Alignment, Precise mode checks for Meade mounts and everything else that you can think of.

Crosshair Mode:



Hold the **Shift + Left Mouse Button** and move mouse to change the place of the cross center.
Hold the **Control + Left Mouse Button** and move the mouse horizontally to rotate the cross.
Shift or **Control + Double Click** with the left mouse button will restore the initial centered cross position.

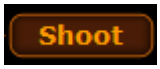
See the Crosshair section for more screenshots.

“Object scale mode” will show oval-shaped outline of defined object in exact scale for your camera and telescope/ lens. See Object Calculator section.

Object scale mode:



## 14 Shoot




Takes one image using the exposure parameters set in Camera tab. If Image destination is set to PC, the stored file will have prefix "Single_". It is useful to take test images when you are framing an object or determining the optimal exposure.

For actual imaging use the Plan Editor to create an imaging plan.

## 15 Sounds



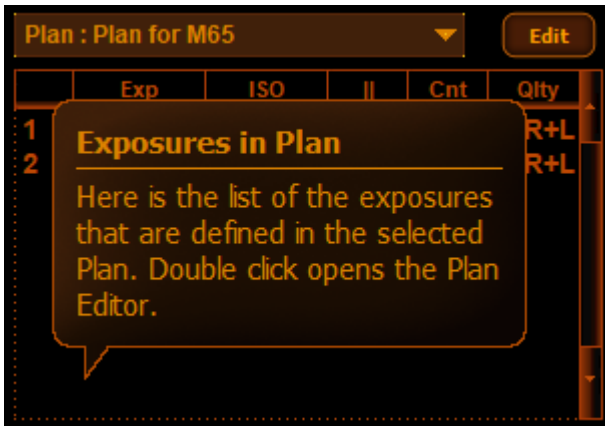
Enables/Disables the sounds

## 16 Tooltips



Enables/Disables the Tooltips (balloon) help. When enabled you can point a button, list, label and etc. to get a short help.

Sample:




## 17 Help




Opens this User's Guide.

## 18 Minimize




Minimize the main APT windows and if it is configured shows Minimized mode.

## 19 Window / Full Screen




Toggles between "Full Screen" and "Window" modes for the main APT window. "Full Screen" mode covers the whole screen and doesn't allow window resizing.

## 20 Close




Closes APT.

## 21 Current Status Monitor




Shows the current status.

| | |
|---|---|
| NC | No camera connection |
| C | Camera connected, but it is in idle mode, no plan in progress |

| | |
|---|---|
| D 0000” | In Delayed plan execution (See Advanced Settings) |
| A 0000” | In Anti-vibration pause and the count of the seconds passed |
| E 0000” | In Exposure and the count of the seconds passed |
| P 0000” | In "after exposure" Pause and the count of the seconds passed |
| BUSY | The camera and/or APT are busy at the moment |
| PAUSE | The plan is paused |
| DITHER | Dithering in progress (see Dithering and Guiding) |
| SYNC | Multi-cameras synchronization is in progress (see Multi-camera Dithering / Synchronizing) |
| DARV | DARV in progress |
| Scheduled | Plan execution is scheduled (See DSLR Start or CCD/CMOS Start buttons in Camera Tab) |

Once a plan is started the Status monitor becomes like :




On first line is the number of the image that is in progress, the total count of the images that will be taken, the current status and the seconds since the start of the current image, pause and etc.
On the second line is the estimated remaining time for the plan execution followed by the expected time for the plan completion. APT monitors the transfer and saving times, so these values can be revaluated during the plan execution.

## 22 Laptop Battery or AC Power




Show the laptop battery percent and the remaining time to batter depletion (when not charging). It can be configured to flash when critical level is reached. See Advanced Settings.

## 23 Camera Battery or CCD Power

In DSLR mode shows the remaining camera battery power. It can be configured to flash when critical level is reached. See Advanced Settings.




In the CCD/CMOS mode shows the cooling power load.




## 24 Storage Card space or CCD Temperature

In DSLR mode shows the remaining free space on the camera storage card. It can be configured to flash when critical level is reached. See Advanced Settings.



In CCD/CMOS mode shows the current temperature of the camera sensor.




## 25 Current Filter




Shows the name of the current filter. See Gear tab.

## 26 Guiding State




Shows the status of the guider. See Dithering and Guiding.

NC – No connection to guiding program or device.
C – Connected and distance to the star is 0.
0.00 - distance to the guiding star.

You can use Graphs to see the changes in the distance to the guiding star during the imaging sessions.

## 27 Images count




Shows the images count in the current folder selected in Img Tab.
For the FITS / XISF images is calculated the total exposure time. It may need some time to show the value for folders with many images.

## 28 Air Mass, Limit, DSD, NB




This is a scrolling text control that show four values:

The current **Air Mass** value. This is the thickness of the atmosphere between the object and the scope. The value in Zenith is 1.00 - one atmosphere. At altitude 30 degrees above the horizon the air thickness is the equivalent of two atmospheres. Near the horizon there are 35 atmospheres between the object and the scope... The value is stored in the FITS / XISF header when CCD/CMOS camera is used.

**AM Limit** Starts XX / in XX / Passed / N/A / No Limit. Shows information related to the defined Air Mass Limit for the current Ra/Dec coordinates. If the scope is not raised above the limit will show **Starts** and the moment. If the scope is already raised above the limit will show **In** and how much time is left till goes below the limit. If the scope position passed the observing window above the limit will show **Passed**. If object will never go above the defined limit will show **N/A**. If the current Ra/Dec coordinates never goes below the limit will show **No Limit**.

**DSD T Left** - Shows the Deep Sky Darkness time left for the current/ coming night. If the Deep Sky Darkness is not started yet it shows the total duration that will have. Check the Deep Sky Darkness Details to see the starting time.

**NB T Left** - Shows the Narrow Band time left for the current / coming night. If the astro night is not started yet it shows the total duration that will have. Check the Deep Sky Darkness Details to see the starting time.

**CI Cover** - Shows the detected cloud coverage. Requires an Observing Condition device with clouds detection sensor.

This feature needs an active connection to telescope - See Gear Tab.

## 29 Sky Quality and Calculator

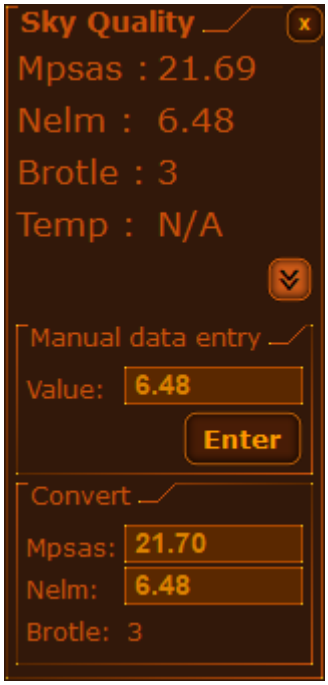



Shows the current sky quality value. Sky quality can be tracked by devices like SQM (Sky Quality Meters), Pegasus Astro Uranus, PrimaLuceLab Eagle or evaluated by the observer estimation and manually entered. In order to see this section you have to enable it from Temperature & Sky settings tab.

Double click on this section, clicking on the button, or using the Alt+Q shortcut opens the Sky Quality calculator where you can convert value between MPSAS (magnitude per square arc-second) and NELM (naked eye limiting magnitude). When if it is enabled manual entry via settings you can enter the measured sky quality value here.

Also The Sky Quality shows always shows the corresponding Bortle scale value

When there is available sky quality value it is stored in the images FITS / XISF header and in Database.



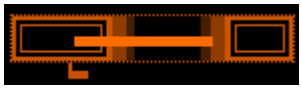

Sky Quality value can be used as part of the image file names and to be stored in the FITS / XISF keys when CCD/ CMOS camera is used. See Main Settings Tab.

## 30 Moon Phase




Shows the current Moon Phase

## 31 Darkness Clock



The Darkness Clock shows various information in a compact form - Sun set/rise, Moon set/rise and Civil, Nautical, Astronomical twilights and the full darkness. See Darkness Clock

Double click on this section will open the Deep Sky Darkness calculator where can see data for various events, to see how much imaging time you have for a given night or to search for night with needed dark hours. See Deep Sky Darkness calculator.

In order for Darkness Clock and Deep Sky Darkness calculator to make accurate calculations you have to enter your site geographic location in the Location settings tab.

## 32 Meridian Flip Clock




The Meridian Flip Clock show information related to Meridian. How much time there is till flip, or passed after the flip and the exact flip time. See Meridian Flip Clock.

This feature needs an active connection to telescope - See Gear Tab. It can be hidden from Main Settings Tab.

## 33 DataCraft




Opens the DataCraft window. It allows to transfer automatically or manually the image files to other computer or to other drive.

## 34 USB Monitor




Opens the USB Monitor Aid to show the connected USB devices and the logged events of connection/ disconnection.

## 35 APT Settings




Opens the Settings dialog box where you can handle most of the APT settings. Some APT features has their local settings which are described the corresponding sections.

See Settings section.

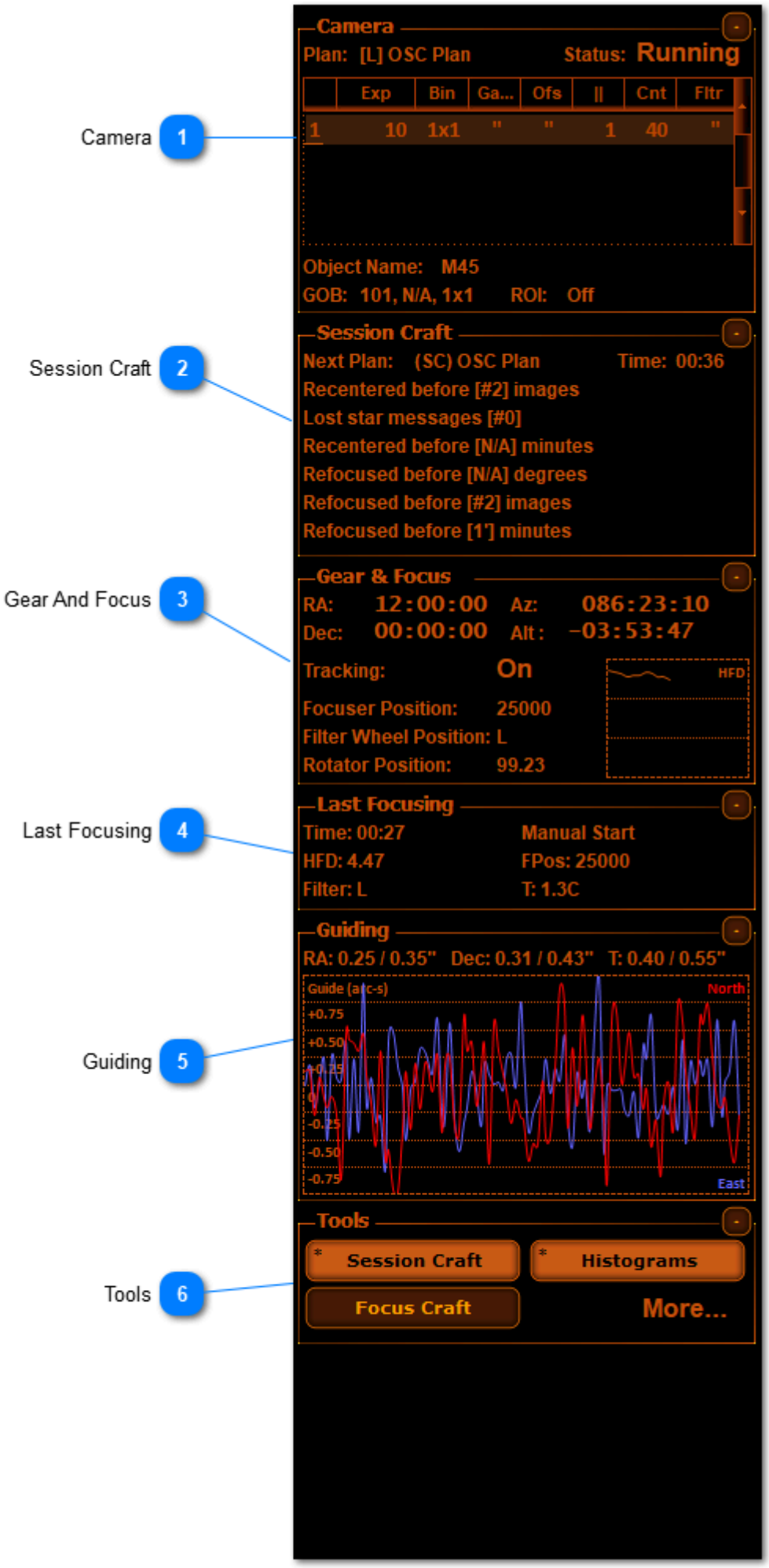
# Σ - Summary Tab

*Related videos:*
*Summary Tab - 4.60+*
*Summary Tab 2*, *Summary Tab*

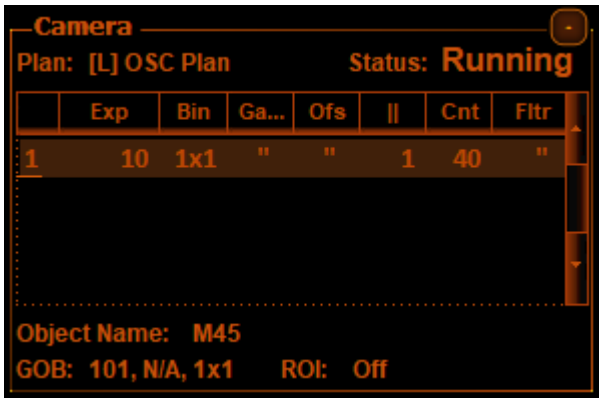
The Σ - Summary Tab shows carefully selected information from the Camera, Gear and Tools tabs in order to minimize the switching between the tabs after the initial start of the imaging session. We have analyzed what information is needed when the imaging is up and running and also tried to minimize the number of the opened tools in order to provide more screen space for the images.

This tab can work in two modes like regular tab and in "Auto-Redirecting" mode. In the second mode when you point a section, the corresponding tab will be activated. When you move the mouse out of the tabs area the Summary will be activated back. For example you can point the "Camera" section for fast switching to Camera in order to pause the running plan and after that to get back without clicking on tabs buttons. This logic is used only if you have made the Summary tab active, if other tab is active what will not be auto-switching.

This operation mode and the sections you want to see in the Summary can be controlled by the Σ tab in Settings.


Camera
Plan: [L] OSC Plan
Status: Running
Exp
Bin
Ga...
Ofs
||
Cnt
Fltr
1
10
1x1
1
40
Object Name: M45
GOB: 101, N/A, 1x1
ROI: Off
Session Craft
Next Plan: (SC) OSC Plan
Time: 00:36
Recentered before [#2] images
Lost star messages [#0]
Recentered before [N/A] minutes
Refocused before [N/A] degrees
Refocused before [#2] images
Refocused before [1'] minutes
Gear & Focus
RA: 12:00:00
Az: 086:23:10
Dec: 00:00:00
Alt: -03:53:47
Tracking: On
HFD
Focuser Position: 25000
Filter Wheel Position: L
Rotator Position: 99.23
Last Focusing
Time: 00:27
Manual Start
HFD: 4.47
FPos: 25000
Filter: L
T: 1.3C
Guiding
RA: 0.25 / 0.35"
Dec: 0.31 / 0.43"
T: 0.40 / 0.55"
Guide (arc-s)
North
+0.75
+0.50
-0.25
-0.50
-0.75
East
Tools
Session Craft
Histograms
Focus Craft
More...
Camera
1
Session Craft
2
Gear And Focus
3
Last Focusing
4
Guiding
5
Tools
6

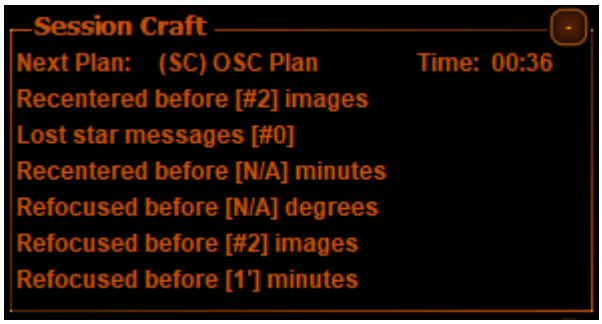
## 1 Camera




Shows information from the Camera tab - the selected plan, is it running, the entered object name. The last line depends on the APT mode:

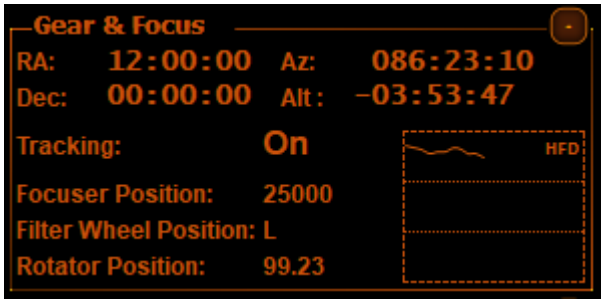
- in DSLR mode on the last line are displayed the current ISO and image quality
- in CCD/CMOS mode the last line show the current GOB (Gain, Offset, Bin) and if the ROI is activated. Note that the ASCOM drivers can't provide the Offset value, so you have to use native driver to see that value.

## 2 Session Craft



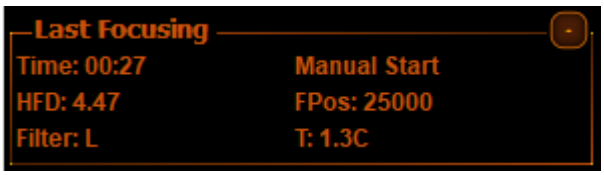

Shows summarized information from Session Craft sections. It shows the next scheduled plan and when approximately it will start. Also the log data of the Clouds & Target and Refocus Control areas.

## 3 Gear And Focus



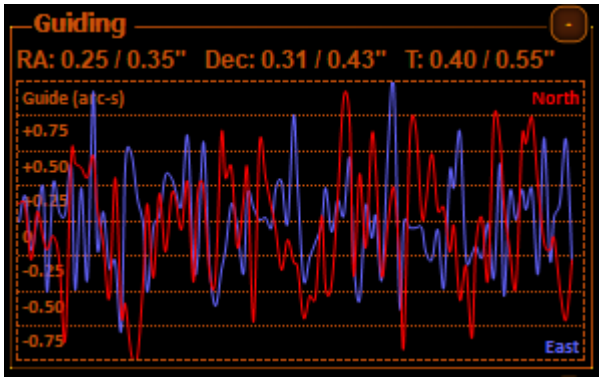

Shows information from Gear tab and from FocusCraft. Displayed are the scope coordinates, tracking status as well as the status of Focuser, Filter Wheel and Rotator. Also there is part of the graph displayed in FocusCraft to see how the focus is changing during the night.

### 4 Last Focusing



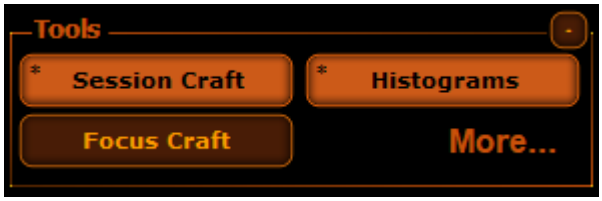

Shows information about the last executed automatic focusing. Same information as in SessionCraft.

### 5 Guiding




Shows guiding graph from Gear tab.

### 6 Tools




Gives fast access to the tools that are most used during the imaging session. If the "Auto-Redirecting" mode is activated pointing "More..." is switching to Tools tab, if redirecting is no activated, clicking on "More..." switches to Tools tab.

## Camera Tab

*Related videos:*
*Camera Tab - 4.60+*
*Camera Tab 2*, *Camera Tab*

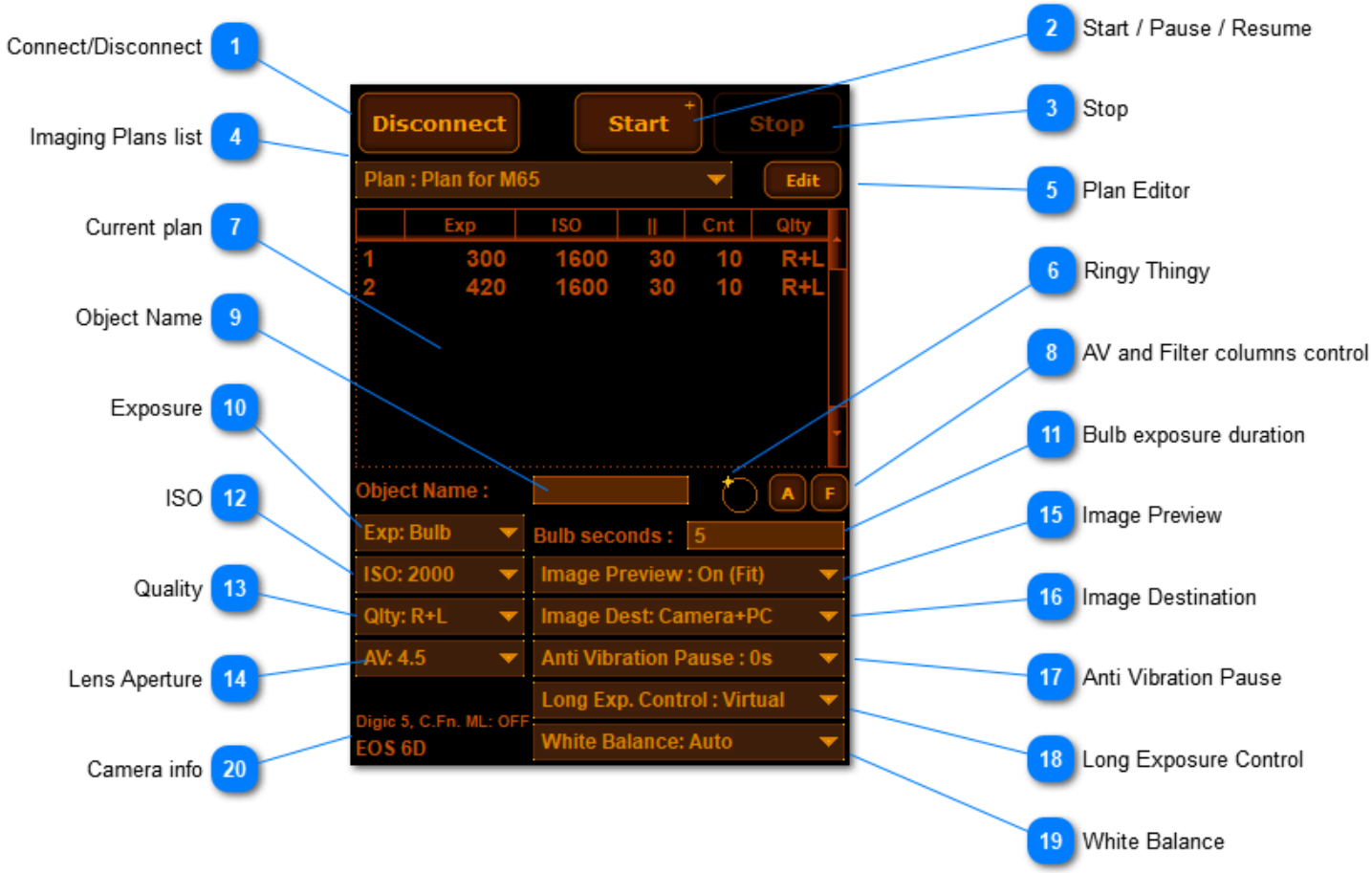
In order to provide better control and a more clean user interface, the Camera tab has different look in DSLR and CCD/CMOS modes.

Use **Shift+Click** on the Camera tab button in order to make the tab a floating window. Click on the "x" button or use **Shift +Click** to dock it back.

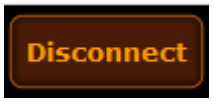
## Camera Tab (DSLR mode)

*Related videos:*
*Camera Tab - 4.60+*

This is how Camera Tab looks like when APT is in DSLR mode (when connected is Canon EOS or Nikon camera). If you want to change the camera type use Shift + Click on Connect button to open the Select Camera Type dialog box.




## 1 Connect/Disconnect

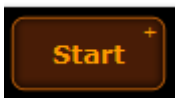



Connect or disconnects the camera. Shift + Click on Connect button opens the Select Camera Type dialog box where you can change the default camera type, to change the Digic generation of Canon camera or to change the Nikon camera model. APT uses different type of communications with the camera depending on the Canon Digic generation or Nikon model, so make sure that you are using the right one.

Information about the Canon EOS models including the built-in processor can be found in the Canon EOS Matrix page on the APT site.

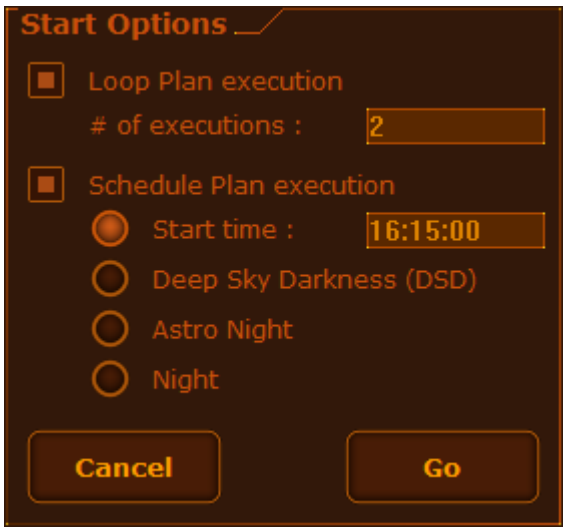
Information about the Nikon models can be found in the Nikon Matrix page on the APT site.

## 2 Start / Pause / Resume



Starts execution of the selected imaging plan. Once it is started the button is replaced with Pause button that will pause the plan after the current exposure is finished. If a plan is paused it can be resumed by pressing the Resume button that will become visible.

**Shift + Click on Start** button opens the Start options dialog box.




You can loop a plan to be executed several times (or unlimited times if you enter 0 in "# of execution) or to schedule the plan execution start at a defined local time or event.

The following scheduling options works in combination with Darkness Clock:

- Deep Sky Darkness (DSD) - the moment when full darkness starts
- Astro Night - the moment when astro twilight finished
- Night - the moment when Sun sets

If the starting event has already passed for the current night you will be asked if you want to start the plan immediately or you want to wait for the event in the next night.

If you combine Loop and one of the options DSD, Astro Night or Night, APT will stop the next iteration of the plan if the scheduling event is no longer valid - for example no more full darkness.

If you set Loop to 0 and one of the options DSD, Astro Night or Night, APT will pause the next iteration of the plan till the scheduling event becomes valid again on the next night. It is useful for unattended operation for all sky cameras or meteor hunting. Scripts and Commands feature can be used for advanced functionality like remote images uploading.

**Shift+Click** on Pause button restarts the execution of the current exposure.

**Ctrl+Click** on Pause button stops the execution of the current exposure, puts the plan on Pause. One resume will restart the canceled exposure.

**Tips&Tricks**. *You can turn off the camera display before plan execution. This will save some battery energy that can be used for more exposures and more importantly will lead to* ***lower noise*** *in the images!*

See Plan Editor section.

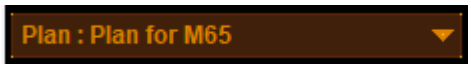
### 3 Stop




Stops the execution of the running plan.

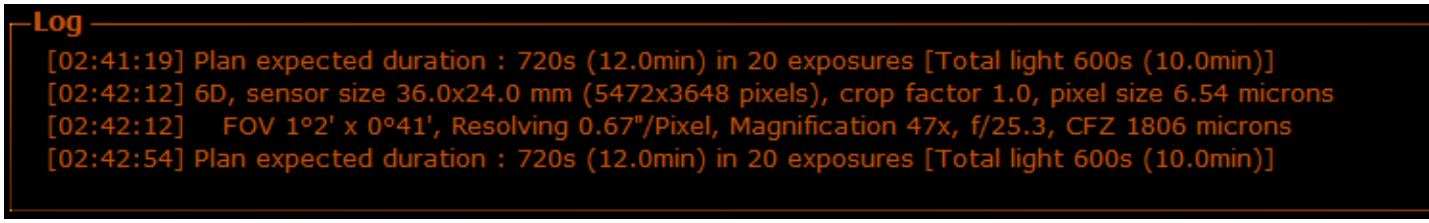
The running exposure is stored with prefix "Incomplete_"

## 4 Imaging Plans list

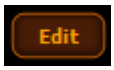



List of the saved imaging plans. There are different type of plans that has specific features. See Plan Editor for information the plans, how to create and manage them.

When a plan is selected the expected execution duration will be printed in the Log panel. If the plan is from Light type a be calculated the actual total light exposure.




## 5 Plan Editor




Opens the Plan Editor. Double click in the plan table does the same.

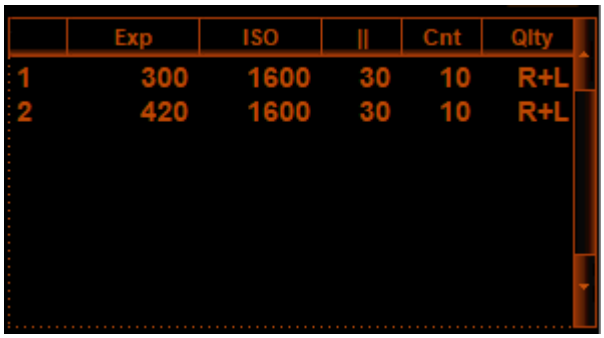
A plan which is in running execution can not be changed, there is no problem to edit the others.

## 6 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 7 Current plan




Shows the lines of the selected imaging plan.

The columns are:

- Order
- Exposure duration
- ISO
- Pause duration
- Count of the exposures
- Quality
- Lens Aperture (visible when A button is checked)
- Filter (visible when F button is checked)

During the execution the current line is selected and under it there is a small progress bar to show the line execution percentage.




Double click in the table opens the Plan Editor for the selected plan.

## 8 AV and Filter columns control




A button shows/hides the lens aperture (AV) column in the current plan list.
F button shows/hides the filter name (F) column in the current plan list.

## 9 Object Name




Defines a name part that to be added to the image file names stored on PC. For example if you enter “M11” the image name stored will be:“M11_ IMG_5034.JPG”. In order to use this feature select "Object Name" as "Name Part" in Main Settings Tab. In Advanced Settings Tab you can define if APT have to remember the entered name between the sessions.

The name is automatically populated when an object is selected from Object Browser.

## 10 Exposure




Defines the exposure to be used when Shoot button is used. It doesn't affect the settings of the selected imaging plan. If Bulb is selected then duration should be entered in "Bulb exposure duration".

The Digic 2 cameras need additional cable in order to make Bulb exposures. For more information see the section EOS Shutter Cables and “Long exposure control”.

## 11 Bulb exposure duration




Defines how long the bulb exposure to be when "Bulb" is selected from "Exp." list and when Shoot button is used.

## 12 ISO




Defines the ISO to be used when Shoot button is used. It doesn't affect the settings of the selected imaging plan.

## 13 Quality




Defines the image quality to be used when Shoot button is used. It doesn't affect the settings of the selected imaging plan.

| | |
|---|---|
| R+L | Raw + Large JPG |
| L | Large JPG |
| M | Medium JPG |
| S | Small JPG |
| Raw | Raw only |
| *R1L* | *Raw1 + Large JPG* |
| *R2L* | *Raw2 + Large JPG* |
| *S1* | *Small 1 JPG* |
| *S2* | *Small 2 JPG* |

The options in *italic* are not supported by all Canon EOS models and are not available in Nikon mode!

## 14 Lens Aperture




Defines the lens aperture to be used if there is a lens mounted on the camera.

## 15 Image Preview




Controls the preview of the last taken or loaded image in the "LiveView / Image Preview" panel.

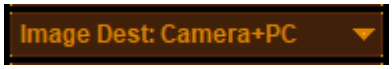
| | |
|---|---|
| **On (Fit)** | Shows the image in the preview area after every exposure. The image will be scaled to fit in the area |
| **Off** | No preview |
| **On (1:1)** | Shows un-scaled part from the loaded image that fits in the preview area |
| **On (1:1) Scroll** | Shows scrolling buttons to select the image area that you want to see in mode “On (1:1)”. Click on the central rectangle to view the center of the image |

To scroll the image smoothly in “On (1:1)” or “On (1:1) Scroll” modes, hold the Shift key and drag with the mouse. You can also use the right mouse button to drag the image.

To switch quickly between “On (Fit)” and “On (1:1)” modes double click on the image. This allows to center the part of the image without scrolling.

If you double click on a scroll arrow, position will be moved to the corresponding border.

## 16 Image Destination




Defines where to store the images. The supported options are:

| | |
|---|---|
| Camera | Store the images only on the camera memory card |
| Camera + PC | Store the images on the camera memory card and on the PC disk in folder set in Main Settings tab |
| PC | Store the images only on the PC disk in folder set in Main Settings tab |

It is recommended to use the PC or Camera+PC options because they provide flexible naming and organizing of the image files - useful during the processing and archiving.

Camera option is not supported for Nikon at this stage.

## 17 Anti Vibration Pause




Not supported for Nikon at this stage.

Anti Vibration Pause is used within exposures plan or bulb Shoot exposures. It defines how many seconds to wait after the camera mirror is flipped before starting the exposure. This is a valuable option for short exposures when mirror flipping is causing vibrations into your setup. During long exposures the size of the bright stars became much bigger than the artifacts from mirror move, so in such cases you can skip the use of anti-vibration pause. Recommended is to experiment to find how long it has to be. Keep in mind that in some positions of your telescope the vibrations can be bigger/longer than in others.

Here are the requirements for making mirror lock with the different models:

| Processor | Mirror Lock C.Fn. | Mirror Lock needs shutter cable |
|---|---|---|
| Digic 2 | Manual | Yes |
| Digic 3 | Automatic | Yes or simulation |
| Digic 4 and later | Automatic | No |

If the camera has Digic 3 processor and "Long exposure control" to "Virtual", APT will simulate Mirror Lock using LiveView. **Note that simulated "Mirror lockup" leads to amp glow when is used in long exposures!**

The Digic 2 and Digic 3 cameras need an additional PC operated shutter cable in order to make mirror lockup. Some options for such cable are listed in the section EOS Shutter Cables.

For Digic 2 cameras you have to enable/disable manually the "Mirror Lock C.Fn." function from the camera menu. Enable it with Anti-Vibration Pause is greater than 0s. Disable it when Anti-Vibration Pause is 0s.

Note that in order to manage automatically the "Mirror Lock C.Fn." function from the camera menu, you have to enable the option "Mirror Lock Automation" from Main Settings tab.

## 18 Long Exposure Control



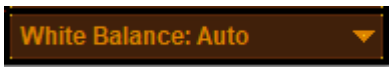

Defines how the camera shutter is controlled. The list contains the options:

| | |
|---|---|
| Virtual | Commands the camera only through the USB cable connected to your camera. **NOTE: This feature works only for Canon EOS models after 2006 and Nikon models after 2012.** |
| COM port | Uses the selected COM port to control the shutter and the mirror lockup. Still needs the USB cable. |
| DSUSB / DSUSB2 | Uses the attached DSUSB or DSUSB2 controller to control the shutter and the mirror lockup. Still needs the USB cable. |
| USB Relay (SDR-05V) | Uses cable based in the SDR-05V relay board |
| Biula Audio Trigger | Use the audio output connector and special cable to control the shutter and the mirror lockup. Still needs the USB cable. |

For more information about the shutter cables see the section Canon/Nikon Shutter Cables.

**Tips & Tricks.** *If you connect the camera and shutter cable to the same USB ports you will have same COM port number between the sessions.*

## 19 White Balance




Defines the white balance to be used (for preview or JPG). Note that this setting has no effect on the data saved in the RAW file, so it is not critical what you will select here.

### 20 Camera info




Shows information about the connected camera.

**For Canon:**

In the first line is the camera model. In the second is the Digic processor generation and the current setting in the camera menu for the Mirror Lock custom function.

For Digic 2 cameras you have to enable/disable manually the "Mirror Lock C.Fn." function from the camera menu.

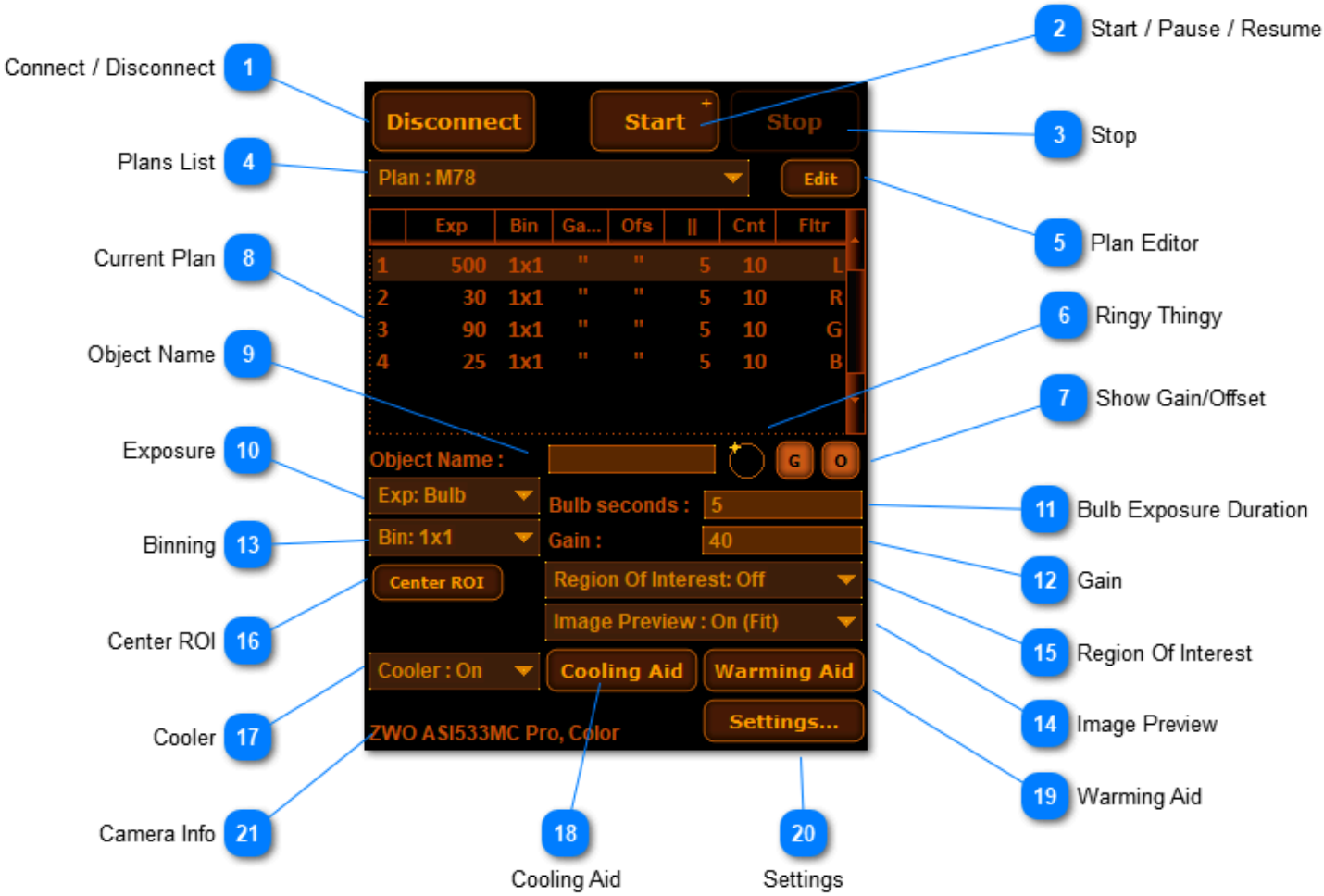
**For Nikon:**

Displays the model of the connected camera.

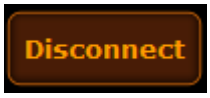
## Camera Tab (CCD/CMOS mode)

*Related videos:*
*Camera Tab - 4.60+*
*Camera Tab - 2, Camera Tab*

This is how Camera Tab looks like when APT is in CCD/CMOS mode (when connected is ASCOM / INDIGO / INDI, ZWO, Altair Astro, SBIG camera). If you want to change the camera type use Shift + Click on Connect button to open the Select Camera Type dialog box.

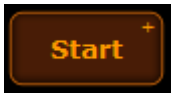



## 1 Connect / Disconnect



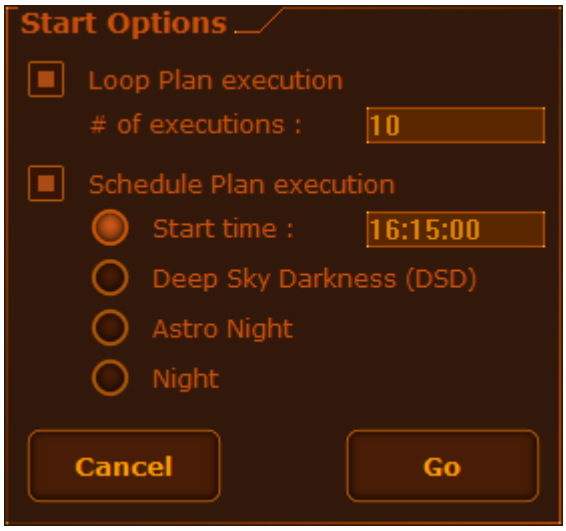

Connect or disconnects the camera. **Shift+Click** on Connect button opens the Select Camera Type dialog box where you can change the default camera type or to change ASCOM/ INDIGO / INDI driver or CMOS camera connection parameters. Use **Ctrl+Click** to forget the selected connection parameters.

## 2 Start / Pause / Resume




Starts execution of the selected imaging plan. Once it is started the button is replaced with Pause button that will pause the plan after the current exposure is finished. If a plan is paused it can be resumed by pressing the Resume button that will become visible.

**Shift + Click on Start** button opens the Start options dialog box.




You can loop a plan to be executed several times (or unlimited times if you enter 0 in "# of execution) or the schedule the plan execution for a defined local time or event.

The following scheduling options work in combination with Darkness Clock:

- Deep Sky Darkness (DSD) - the moment when full darkness starts
- Astro Night - the moment when astro twilight finished
- Night - the moment when Sun sets

If the starting event has already passed for the current night you will be asked if you want to start the plan immediately or you want to wait for the event in the next night.

If you combine Loop and one of the options DSD, Astro Night or Night, APT will stop the next iteration of the plan if the scheduling event is no longer valid - for example no more full darkness.

If you set Loop to 0 and one of the options DSD, Astro Night or Night, APT will pause the next iteration of the plan till the scheduling event becomes valid again on the next night. It is useful for unattended operation for all sky cameras or meteor hunting. Scripts and Commands feature can be used for advanced functionality like remote images uploading.

**Shift+Click** on Pause button restarts the execution of the current exposure.

**Ctrl+Click** on Pause button stops the execution of the current exposure, puts the plan on Pause. One resume will restart the canceled exposure**.**

See Plan Editor section.

## 3 Stop



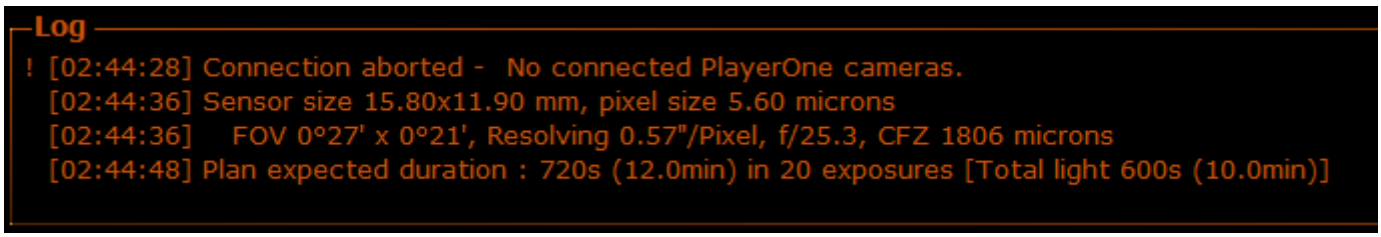

Stops the execution of the running plan.

## 4 Plans List

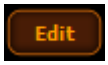


List of the saved imaging plans. There are different type of plans that has specific features. See Plan Editor for information about the plans, how to create and manage them.

When a plan is selected the expected execution duration will be printed in the Log panel. If the plan is from Light type also will be calculated the actual total light exposure.




## 5 Plan Editor




Opens the Plan Editor. Double click in the plan table does the same.

## 6 Ringy Thingy



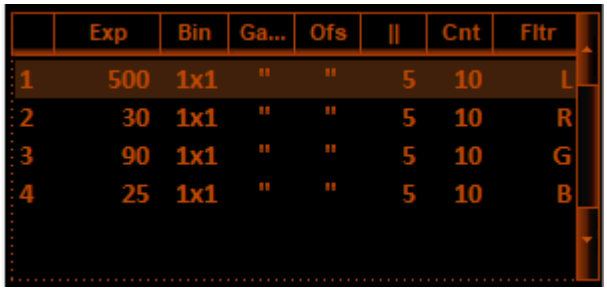
Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 7 Show Gain/Offset




Shows/Hides the Gain and Offset columns in the current plan grid.

## 8 Current Plan




Shows the lines of the selected imaging plan.

The columns are:

- Order
- Exposure duration
- Binning

- Gain (can be set hidden)
- Offset (can be set hidden)
- Pause duration
- Count of the exposures
- Filter

During the execution the current line is selected and under it there is a small progress bar to show the line execution percentage.




Double click in the table opens the Plan Editor for the selected plan.

## 9 Object Name




Defines a name part that to be added to the image file names stored on PC. For example if you enter “M78” the image name stored will be:“M78_ IMG_5034.JPG”. In order to use this feature select "Object Name" as "Name Part" in Main Settings Tab. In Advanced Settings Tab you can define if APT have to remember the entered name between the sessions.

The entered value will be stored in the FITS / XISF keywords header.

The name is automatically populated when an object is selected from Object Browser.

## 10 Exposure




Contains the list of the predefined exposure durations to be used for making single images by Shoot button or for LiveView. If you want to make exposures longer than 30s or shorter than 1s select the “Bulb” option and enter the desired duration "Bulb exposure duration".

It doesn't affect the settings of the selected imaging plan.

## 11 Bulb Exposure Duration




Defines how long the bulb exposure to be when "Bulb" is selected from "Exp." list and when Shoot button is used.

## 12 Gain



Defines what gain value to use for LiveView or Shoot image. Empty value leaves the gain control to the camera driver and driver settings. If Remember Gain is enabled this value will be saved between the session and will be automatically set on camera connection.

If there are no gain values defined in the Imaging Plan and no value per filter in Filter Wheel settings tab the value in this field will be used during imaging plan.

Note: If Manage Gain is disabled, all gain values entered in APT are ignored and the gain control is left to the camera driver and driver settings.

## 13 Binning




Defines the Binning to be used when Shoot button is used. It doesn't affect the settings of the selected imaging plan.

## 14 Image Preview




Controls the preview of the last taken or loaded image in the "LiveView / Image Preview" panel.

| | |
|---|---|
| **On (Fit)** | Shows the image in the preview area after every exposure. The image will be scaled to fit in the area |
| **Off** | No preview |
| **On (1:1)** | Shows un-scaled part from the loaded image that fits in the preview area |
| **On (1:1) Scroll** | Shows scrolling buttons to select the image area that you want to see in mode “On (1:1)”. Use the central rectangle to view the center of the image |

To scroll the image smoothly in “On (1:1)” or “On (1:1) Scroll” modes, hold the Shift key and drag with the mouse. You can also use the right mouse button to drag the image.

To switch quickly between “On (Fit)” and “On (1:1)” modes double click on the image. This allows to center the part of the image without scrolling.

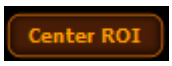
If you double click on a scroll arrow, position will be moved to the corresponding border.

## 15 Region Of Interest



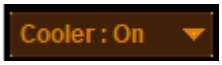

Allows speeding up the image download, by selecting just small part of the image. Provided are several options that are fraction of the sensor size for easier selection. If Center ROI is is active (high-lighted), APT automatically uses the center of the sensor where usually is the focusing star. If Center ROI is not is active (high-lighted) then the area of ROI can be selected by left clicking in the "LiveView / Image Preview" panel which in this case contains a thin frame that represents the CCD/CMOS sensor. Note that in order to see the data for the new ROI there is need to download a new image from the camera.

## 16 Center ROI



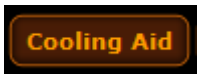

Enables/Disables the ROI centering.

## 17 Cooler




Turns ON/OFF the camera cooler.

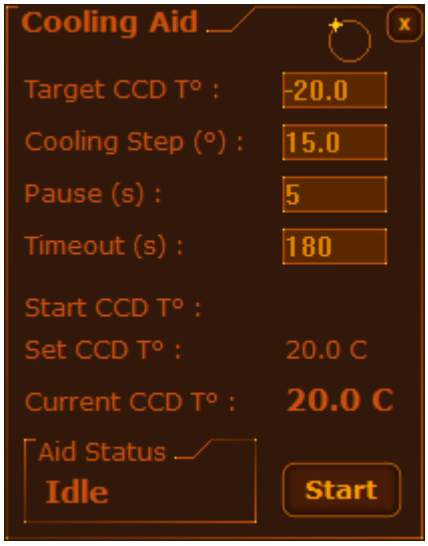
## 18 Cooling Aid




Allows controlling the camera cooling to a "Target CCD T" in small "Cooling Steps" making "Pause" between every step. This way the cooling is smoother and prevents thermal shock.

If the "Cooling Step" is set to 0 (zero), APT sends one command to the camera with the desired temperature and leaves the camera driver to manage cooling process. It is an option set the wanted temperature in one step. Similar effect could be archived by setting the step to 50 or more, again one command will be send to the camera and the driver, however The Cooling Aid will still use the Timeout to monitor the process. It is useful when #CCDCool Script Command is used.

Cooling Aid turns the cooler on automatically.




Required is camera with temperature control.

**Note: There is no need to keep the Cooling Aid open after the cooling process is finished!**

## 19 Warming Aid



Allows controlling the camera warming to a "Target CCD T" in small "Warming Steps" making "Pause" between every step. This way the warming is smoother and prevents thermal shock.

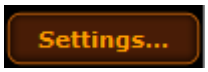
If there is available external Temperature sensor, the Warming Aid will use it to suggest the end point of the warming. If there is no external sensor available you can easily set something like 20C and the let the aid timeout near the current ambient temperature.

If the "Warming Step" is set to 0 (zero), APT sends one command to the camera with the desired temperature and leaves the camera driver to manage warming process. It is an option set the wanted temperature in one step. Similar effect could be achieved by setting the step to 50 or more, again one command will be send to the camera and the driver, however The Warming Aid will still use the Timeout to monitor the process. It is useful when #CCDWarm Script Command is used.




Required is camera with temperature control.

## 20 Settings



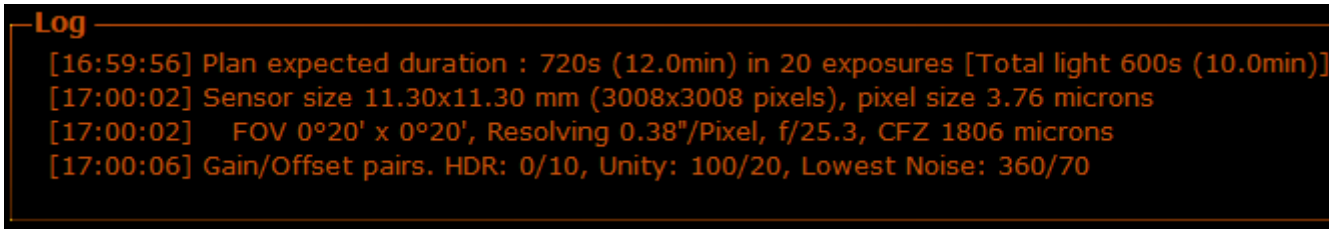

Opens the Settings dialog box of the CCD/CMOS driver (if such is available). For Altair Astro, ZWO and INDIGO / INDI cam a custom dialog box to tune parameters like offset/black level, USB Speed, Dew Heater control and etc.

• Here is how the dialog box looks when **ZWO camera** is connected via native driver :




Please don't change WB_R and WB_B values unless you know what you are doing. They control the internal c color cameras. The default values are 50:50. ZWO suggest to leave the hardware binning unchanged!

When you open the settings dialog box, in the Log Panel will be printed HDR, Unity and Lowest Noise pairs of ga




• Here is how the dialog box looks when **QHY camera** is connected via native driver :




• Here is how the dialog box looks when **ToupTek, Altair Astro, Lacerta, MallinCam, OGMA, Omegon Pro, Orion RisingCam, Explore Scientific, Bresser camera** is connected via native driver :



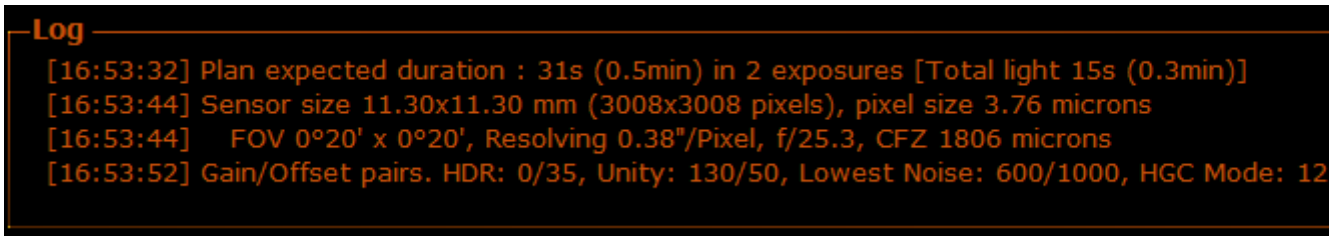

**Bin Type** is giving control to define how the camera to handle the binning. "Saturating Add" is the default mode cameras, "Unsaturated Add" is increasing the bit depth of the image, "Average" is again not altering the bit depth

• Here is how the dialog box looks when **PlayerOne camera** is connected via native driver :

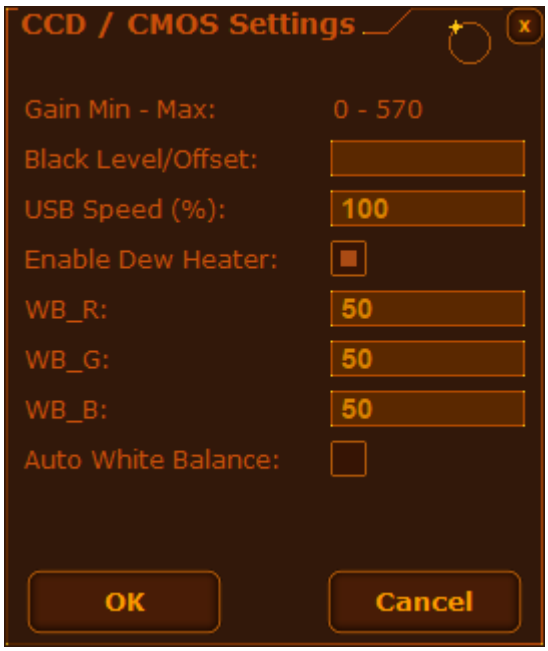



Please don't change WB_R, WB_G and WB_B values unless you know what you are doing. They control the intern for color cameras. The default values are 0.

When you open the settings dialog box, in the Log Panel will be printed HDR, Unity, Lowest Noise and HGC Mo and offset.




• Here is how the dialog box looks when **SVBony camera** is connected via native driver :




Please don't change WB_R, WB_G and WB_B values unless you know what you are doing. They control the intern for color cameras. The default values are 50.

Auto White Balance populates the WB_R, WB_G and WB_B values with the values detected by the camera. S empirically is found that is not a good idea for deep sky imaging. When you switch from disabled to enabled disconnect and connect the camera.

### 21 Camera Info



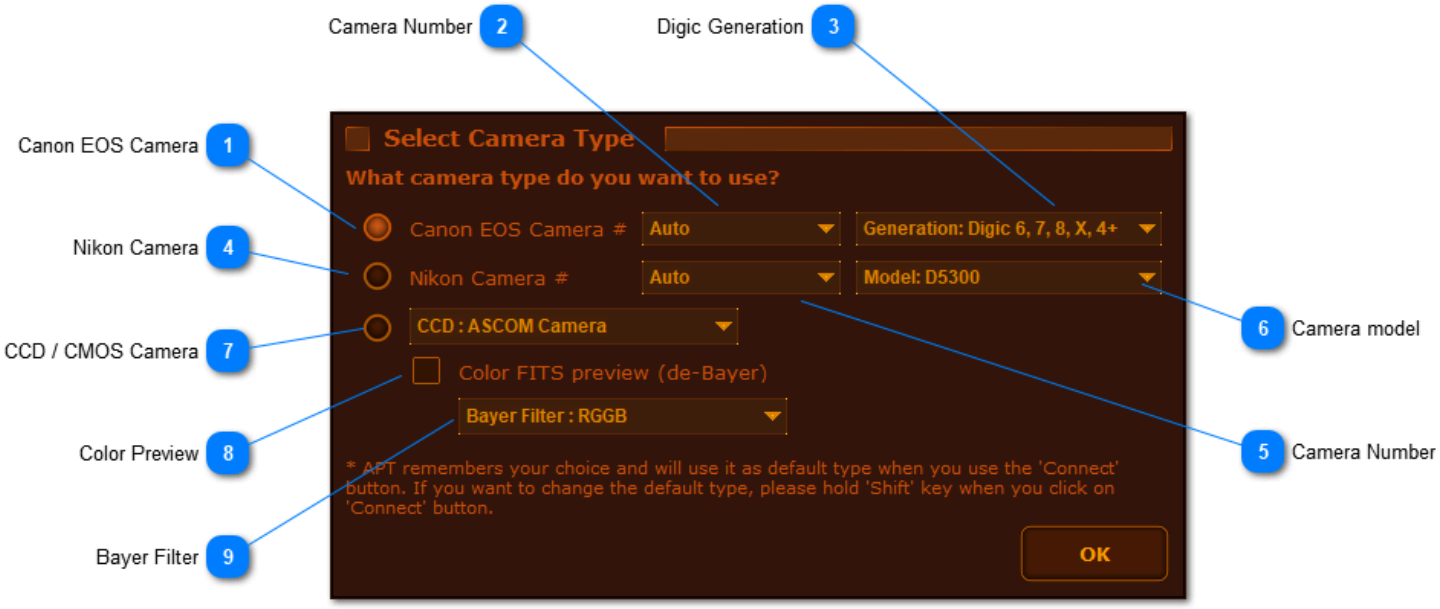

Shows information about the connected camera like name and if the sensor is mono or color. The information is provided by the camera driver.

## Select Camera Type

*Related videos:*
*Camera Tab*

This dialog box allows selecting the camera type you want to use. To open it use **Shift+Click** on Connect button in Camera Tab

In rare cases there is need to start APT using the "Run As Administrator" option in order to resolve camera connection problems. When APT is started this way, you have to use the same option for PHD, Planetarium and the other applications that APT can communicates with.




## 1 Canon EOS Camera




Switches APT in Canon EOS DSLR mode.

## 2 Camera Number




If you use only one camera leave this to "Auto". If you use more than one camera at the same time select the number of the EOS camera that you want to use into this instance of APT. The number is defined by the order of EOS camera connected to the computer. The first camera is #1, the second #2 and etc.

See Multi-Camera Operation for more information on how to use in such configuration.

## 3 Digic Generation




APT uses different type of communications with the camera depending on the Digic generation. Select the generation of the Digic processor of the current camera.

Information about the EOS models including the built-in processor can be found in the EOS Matrix page on the APT site.

Note: For EOS 1300D (T6, X80) select the option Digic 6, 4+!

## 4 Nikon Camera




Switches APT in Nikon DSLR mode

## 5 Camera Number




If you use only one camera leave this to "Auto". If you use more than one camera at the same time select the number of the camera that you want to use into this instance of APT. The number is defined by the order of Nikon camera connected to the computer. The first camera is #1, the second #2 and etc.

See Multi-Camera Operation for more information on how to use in such configuration.

## 6 Camera model



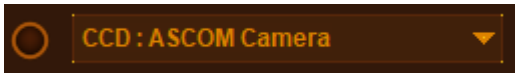

APT uses different type of communications with the camera depending on the Nikon model. Select the model of the current camera.

Information about the EOS models including the built-in processor can be found in the Nikon Matrix page on the APT site.

## 7 CCD / CMOS Camera

Switches APT in CCD/CMOS mode. Depending on the CCD/CMOS type there are different parameters.

See Multi-Camera Operation for more information if you want to use more than one camera at the same time.




Select "ASCOM Camera" if you have ASCOM compatible CCD/CMOS camera. When you click on OK button you will see the standard ASCOM dialog box for selecting the camera driver. APT will remember your selection, so if you want to change the driver use again Shift+Connect.

Note: Both, the ASCOM platform and the camera ASCOM diver, have to be installed!




Select "ZWO" if you have ZWO camera. Select the camera model you want to use. Connect all ZWO cameras before starting APT in order to see the model number.



Select "QHY" if you have QHY camera. Select the camera model you want to use. Connect all QHY cameras before starting APT in order to see the model number.

***Note: Make sure to install the latest All-In-One driver from the QHY Downloads page!***

***Note: If you are using older model with CCD sensor (not CMOS camera) make sure to install the system driver and the ASCOM driver from the section "Classic CCD DEVICES" of the QHY Downloads page and make the connection via the ASCOM Camera.***




Select "ToupTek or similar" if you have ToupTek, Altair Astro, Lacerta, OGMA, RaisingCam, MallinCam Omegon, Orion StarShoot G, Explore Scientific, Bresser camera. Select the camera model you want to use. Connect all cameras before starting APT in order to see the model number.




Select "SVBony" if you have SVBony camera. Select the camera model you want to use. Connect all SVBony cameras before starting APT in order to see the model number.




Select "SBIG Camera" if you have SBIG camera. From the "Port" list box select the port where your camera is connected. If you use SBIG filter wheel then select the model form the "Wheel" list box. Click on OK. APT will remember your selections, so if you want to change the any of the parameters use again Shift+Connect.

If you have a filter wheel, make sure to describe the used filters in Filter Wheel settings tab.



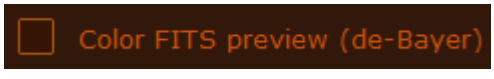

Select "Altair Astro Camera" if you have Altair Astro camera. Select the camera model you want to use. Connect all Altair Astro cameras before starting APT in order to see the model number.




Select "INDIGO / INDI Camera" if you have CCD/CMOS camera connected to INDIGO / INDI server (make sure that you have active connection to the server). When you click on OK button you will see a dialog box for selecting the camera driver.

Click on OK. APT will remember your selections, so if you want to change the any of the parameters use again Shift +Connect.

## 8 Color Preview

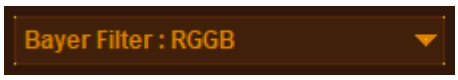



Enables / disables the color FITS / XISF preview in the "LiveView / Image Preview" panel. There is need to select the corresponding Bayer matrix configuration from the list Bayer Filter.

Note - this affects only the image preview and is not altering the saved images.

This feature can be also controlled from CCD Settings tab.

### 9 Bayer Filter




Defines the Bayer matrix configuration to be used by the de-bayering algorithm.

This feature can be also controlled from CCD Settings tab.

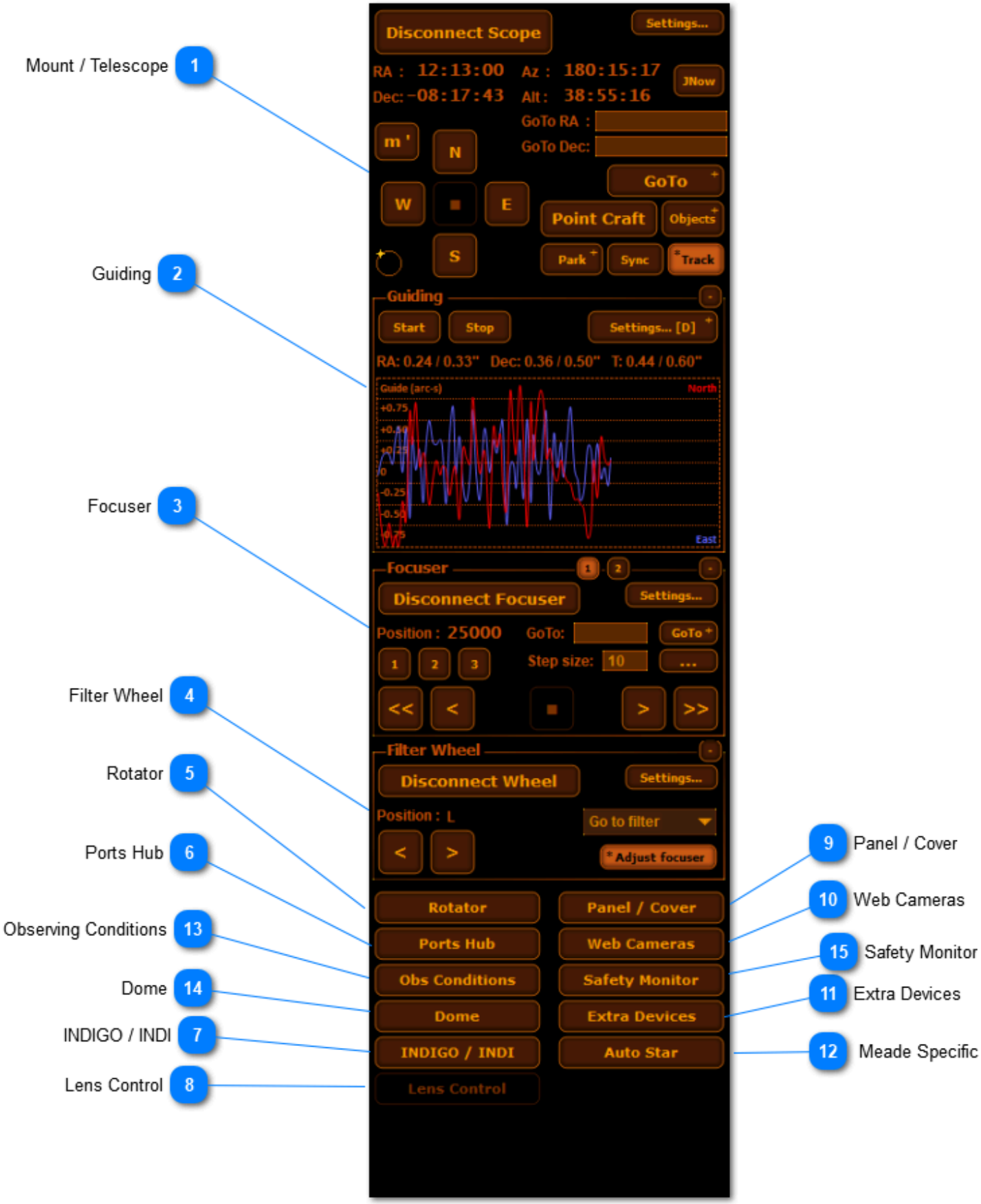
## Gear Tab

*Related videos:*
*Gear Tab - 4.60+*
*Gear Tab - 2, Gear Tab*

The Gear tab is the control center for the additional devices of your imaging kit - Telescope/Mount, Focuser, Filter Wheel, Rotator. If you don't need or don't use a section click on the small button in the upper right corner to collapse it and to save screen space.

Use **Shift+Click** on the Gear tab button in order to make the tab a floating window. Click on the "x" button or use **Shift+Click** to dock it back.

Use **Ctrl+Click** on all Connect Buttons to forget the selected driver and prevent auto connecting.

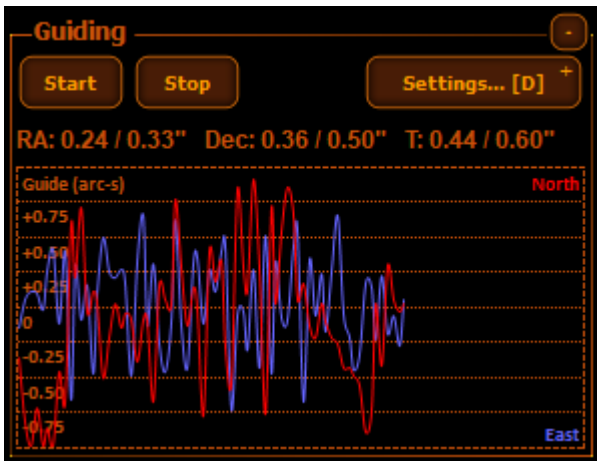



## 1 Mount / Telescope




Controls the Telescope/Mount. For detailed information see the section Telescope.

## 2 Guiding




This section shows the status and gives control over the guiding process. For detailed information see the section Guiding.

## 3 Focuser



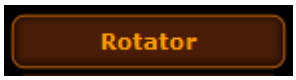

Controls the Focusers. For detailed information see the section Focusers.

## 4 Filter Wheel




Controls the Filter Wheel. For detailed information see the section Filter Wheel.

## 5 Rotator




Controls the Rotator. For detailed information see the section Rotator.

## 6 Ports Hub




Controls the Ports / Switches Hub. For detailed information see the section Ports Hub.

## 7 INDIGO / INDI




Opens/Closes the INDIGO / INDI Panel gives control over connection to INDIGO / INDI server.

See INDIGO / INDI Section.

## 8 Lens Control




Opens/Closes the EOS Lens Control aid. It gives control over the attached EOS lens and allows to make precise auto-focus using FWHM (Full Width Half Maximum) or HFD (Half Flux Diameter) metrics. This method is better than camera built-in auto-focus which is not optimized for astro-photography.

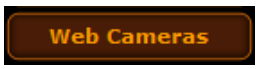
See EOS Lens Control and Auto-Focus section.

## 9 Panel / Cover




Controls the Flats Panel / Cover. For detailed information see the section Flats Panel / Cover.

### 10 Web Cameras




Opens/Closes the Web Cameras panel that allows connection to web camera and have a look on the setup.

See Web Cameras Section..

### 11 Extra Devices




Opens/Closes the Extra Devices Panel that gives control over additional devices.

See Extra Devices Section.

### 12 Meade Specific



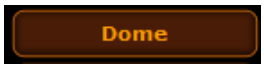

Gives access to Meade specific features. For detailed information see the section Meade Specific.

### 13 Observing Conditions




Gives access to the Observing Condition devices. For detailed information see the section Observing Conditions.

### 14 Dome




Controls the Dome / Roof. For detailed information see the section Dome.

### 15 Safety Monitor




Controls the Safety Monitor. For detailed information see the section Safety Monitor.

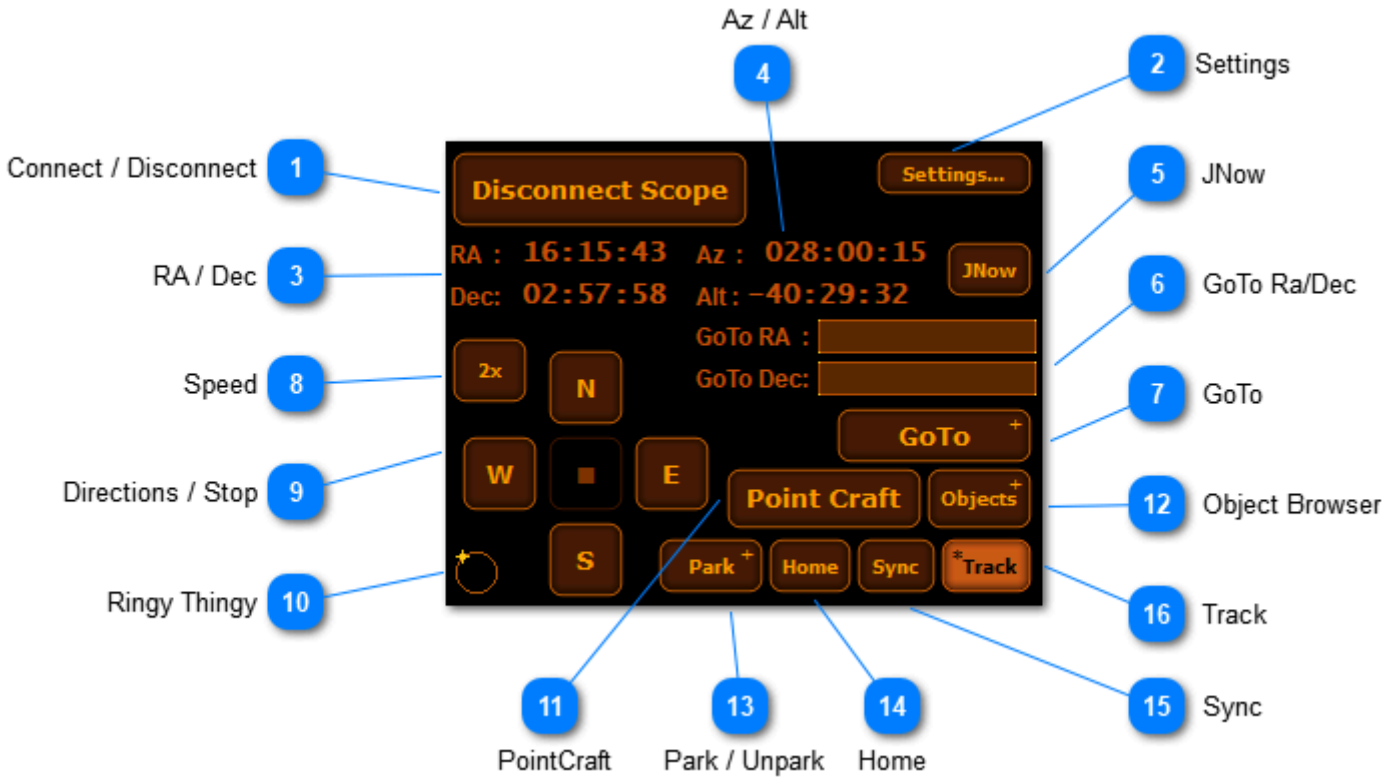
## Telescope

This section gives control over the telescope/mount. In this document telescope and mount will be considered as same thing - the device that points the optical tube.

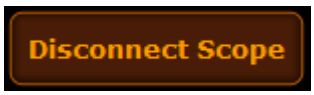
The mount connection is used or can be used by the following APT features:

- PointCraft
- Dithering - direct mount control when there is no guiding - APT Dithering (Direct Dithering)
- Meridian Flip Clock
- Imaging plans - Scripts and Commands
- Use current position to create Custom item in Object Browser

**Note:** APT has a special feature **Mount Tracking Watch-Dog** that is configurable by setting. When a mount is connected and the tracking is enabled the watch-dog will monitor if the Alt/Az coordinates are changing. If there is no change in 60s (and the declination less than +-85 degrees, i.e. away from celestial poles), this is sign for problem with the mount connection or with the mount itself. APT will start to beeping and the Alt/Az coordinates will start flashing to notify you about the problem. In such case disable the tracking to stop the alarm and take care for the problem.




## 1 Connect / Disconnect




Connects / Disconnects telescope. When Connect button is used for the first time you will see the ASCOM or INDIGO / INDI telescope chooser dialog box where to select the driver for your mount. APT remembers the selection and next time will use the same driver without need to select it. If you want to change the driver or to tune its settings, hold the Shift key when you click on Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

To control a telescope via ASCOM simultaneously from several programs use one of the hubs that are installed by the ASCOM platform. The mount connection is made in the hub, then all applications make connection to that hub in order to use the shared mount connection. The Devices Hub is preferred choice, but for very old drivers the POTH or Generic hub is the only option.

**Note:** Some ASCOM drivers works better with APT when the connection is made through hub. If you have mount connection or control problems try this solution.

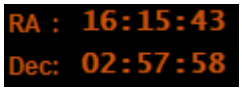
## 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

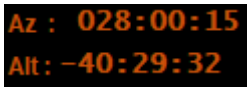
Note: Not all mount drivers support opening the properties dialog box during active connection!

## 3 RA / Dec




The Right Accession and Declination coordinates reported by mount. The values are changing in real time.

## 4 Az / Alt




The Azimuth and Altitude coordinates reported by mount. The values are changing in real time.

## 5 JNow




The coordinates in Object Browser or these returned from PointCraft are in J2000 epoch while some mounts are working in JNow epoch. When JNow buttons is active (high-lighted) APT will convert the coordinates from J2000 to JNow before sending them to the mount. This action is made on GoTo, GoTo++, Sync and #GoTo APT command.

## 6 GoTo Ra/Dec




The coordinates that you want to use for next GoTo. Accepted is any format and you can paste a value stored in the clipboard.

## 7 GoTo



Goes to the coordinates entered in the GoTo RA/Dec fields. If any of these fields are empty APT will take the current coordinate from the mount and will use it. For example if you want to make move only by Right Accession enter the new value and leave Declination empty.

Use **Shift+Click** on GoTo button or Alt+V shortcut to open the Advanced GoTo dialog box.




The first section allows making GoTo to Az/Alt coordinates.

The second section allows making GoTo to an offset from the current Az/Alt coordinates. Useful if you want to move the scope by few minutes without need to calculate the exact coordinates.

The third section allows making GoTo to an offset from the current RA/Dec coordinates. Useful if you want to move the scope by few minutes without need to calculate the exact coordinates.

The last section allows making GoTo near the celestial equator (with possibility to define Declination offset form the equator) near the meridian in order to train guiding in optimal way.

If the mount is not supporting movements by Alt/Az coordinates APT will convert them to RA/Dec for current time and for the current Location.

## 8 Speed




Changes the speed of the mount moves when any direction buttons are used. The available options are 1x, 2x, 64x and 256x times the sidereal speed, or the nearest supported by the mount in Scope & Focuser tab in Settings is possible to redefine one fast speed (applied when 256x is selected) and one slow speed (applied when 2x is selected).

## 9 Directions / Stop



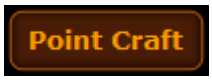

Move the mount with the selected speed in the corresponding direction. The center button will stop the current mount slew / GoTo  action.

## 10 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 11 PointCraft




PointCraft is one of the most important features of APT. It uses the power of plate-solving to give way for easy and accurate object framing and centering during different nights, after meridian flipping and many other exciting possibilities.

Using blind solving in PointCraft you can synchronize your mount without need to center any star and to avoid the GoTo alignment procedure.

See PointCraft and Plate-Solving section.

## 12 Object Browser




Opens Object Browser to select an object and populate its coordinates in the GoTo RA/Dec.

If you use **Shift+Click** APT will get the current coordinates from the running Planetarium application rather than opening the Object Browser. See Planetarium section.

## 13 Park / Unpark




Parks the telescope. If the mount is parked the button will become UnPark.

The actions park and unpark should be supported by the mount and by the driver.

If you use **Shift+Click** APT will set the current position as park position.

If you use **Ctrl+Click** APT will move the scope to the Home position.

### 14 Home




Goes to mount's Home position.

The Home feature should be supported by the mount and by the driver.

### 15 Sync




Synchronize the mount with the coordinates entered in GoTo RA/Dec. This is the equivalent to make "One-Star GoTo Alignment" through your hand-controller.

You can use LiveView and Cross to center one of the stars listed in the Stars tab of Object Browser then using Sync button to synchronize the telescope. A message will be printed in the Log panel when command is completed.

Note that you can use Blind solving in PointCraft to synchronize your mount without need to center a star.

**Note: No sync will be made if the Declination is bigger than 85 or lower than -85*. Use regions with Declination in the range from +85 to -85 degrees.***

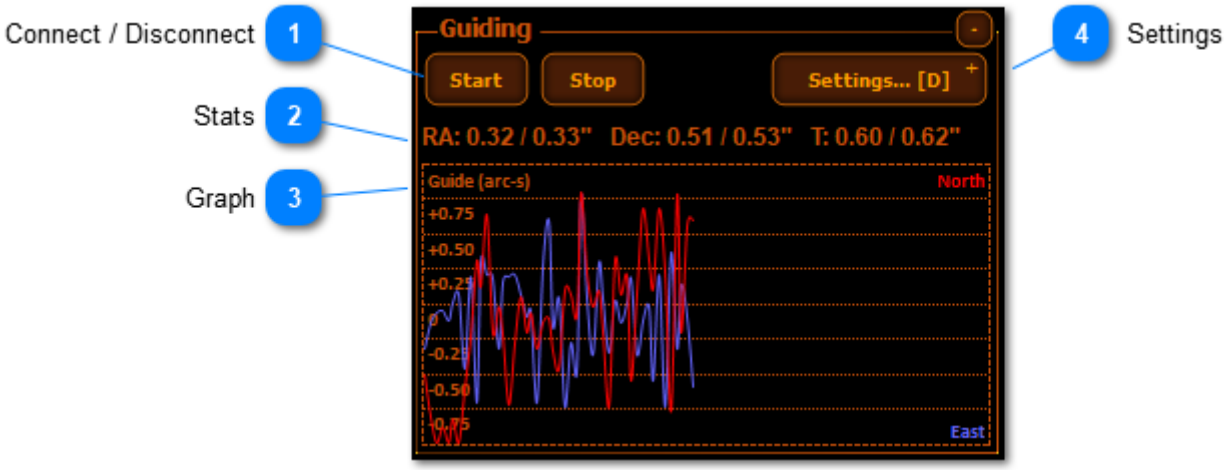
### 16 Track




Enables / Disables the mount tracking.

## Guiding

This section shows the status and gives control over the guiding process. See Dithering and Guiding section for detailed information about the supported guiding applications / devices and the configuration of the connection.




## 1 Connect / Disconnect



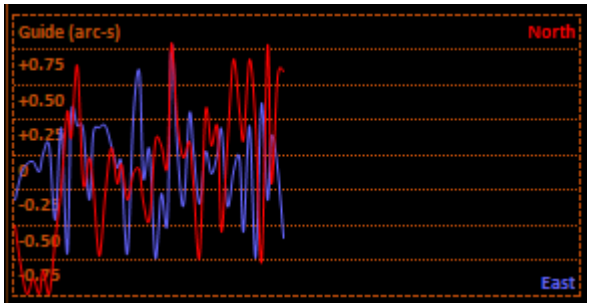

Starts / Stops the guiding. If there is no active connection to the guiding application / device, Start button will make a connection first. **Shift+Click** on Settings button also makes connection.

## 2 Stats



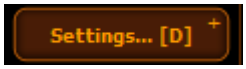

Shows in in real-time detailed information - the RA/Dec corrections (for the applications that provide this information) in pixels and arc-seconds. "T" shows the RMS (root-mean-square error) again in in pixels and arc-seconds.

## 3 Graph




Shows the guiding graph in real-time. For applications like PHD1 and Lin_Guider the graph will be one combined line for both directions. A re-sizable version of this graph is available in Graphs Aid.

## 4 Settings




Opens the Guide Settings dialog box. APT can communicate with various guiding applications and devices. See Dithering and Guiding section.

The text on the button varies:

| | |
|---|---|
| **Settings** | No dithering and Auto-Cancel enabled |
| **Settings [C]** | Dithering disabled, Auto-Cancel enabled |
| **Settings [D]** | Dithering enabled, Auto-Cancel disabled |
| **Settings [D+C]** | Both Dithering and Auto-Cancel enabled |

Dithering is making small mount movements between the imaging exposures. This technique combined with at least 10 exposures and "sigma-clip", pixel rejection (or equivalent) staking method gives very good control over the noise, dark / hot pixels, satellite and airplane tracks.

Auto-Cancel is an APT feature that allows stopping a running exposure if the distance to the guiding star becomes bigger than a defined limit, in order to save imaging time or to save the already gathered data. For example - there is no need to wait 10 minutes if guiding ruined the exposure in the first minute.

Use **Shift+Click** on Settings button to close/reopen connection to the guiding application or device.

## Focusers

This section gives ASCOM and INDIGO / INDI compatible focusers control. APT can control **two focusers** in same time - one for the main imaging scope and second for the guider like motorized Off-Axis-Guiders (OAG). The Auto Focusing features can be used with the first focuser, while the second focuser control could be used to apply different position offset per filter (*this is unique feature, by the time when APT 4.20 is released, no other imaging software had it before!*)

There are two types of focusers Absolute and Relative. The Absolute use servo motor to drive the telescope focuser and can measure every move in steps and to give the exact position of the focuser in every moment. The Relative use DC motor and can't measure the exact position. APT can make emulation and make Relative focuser to look like Absolute. To enable the emulation use the options in Scope & Focuser settings tab.

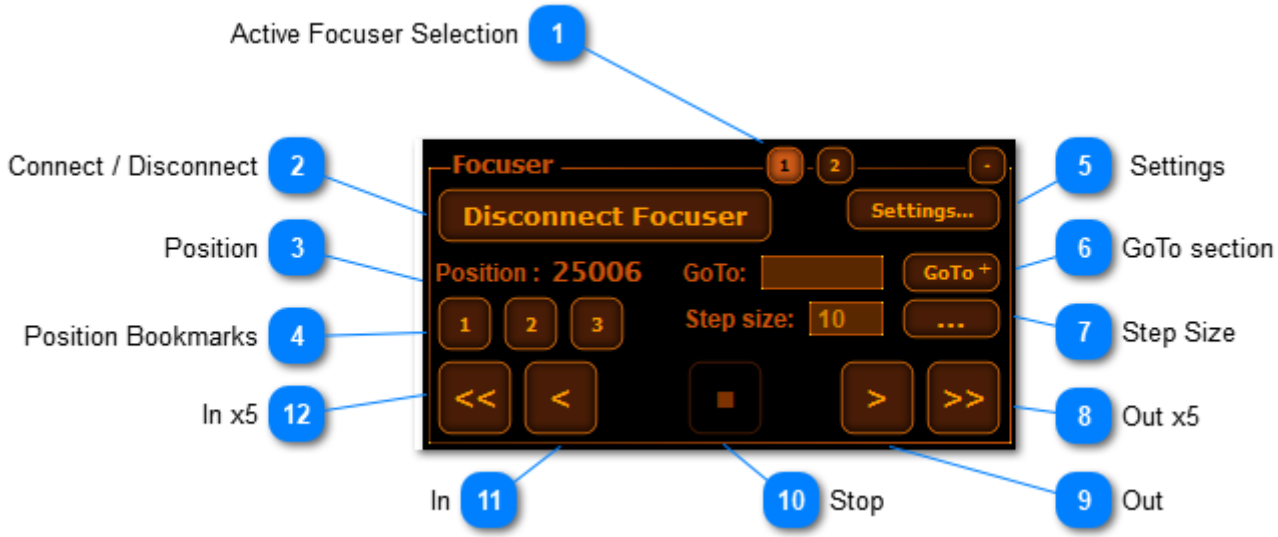
APT is capable to apply temperature focus compensations and focuser backlash compensations. For details on configuring them see Scope & Focuser settings tab. Note that temperature compensations will not be applied when Focusing Aid, Auto Focus Aid or Bahtinov Aid are open.

Some focusers has built-in temperature sensor. Also there are some DIY (Do-It-Yourself) projects based in the Arduino platform that has both temperature and humidity sensors. For more information on how such sensors can be used see the section Temperature /Humidity Sensors.

If you have Meade focuser connected to the AutoStar hand-controller see Meade Specific section.

The focuser connection is used or can be used by the following APT features:

- Auto Focusing Aid
- Filter Wheel - Adjust Focuser
- Imaging plans (Scripts and Commands)

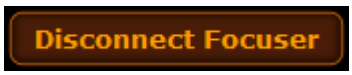



## 1 Active Focuser Selection



Defines which focuser is active in the moment. The control options bellow are applied to the active focuser.

## 2 Connect / Disconnect




When you connect a focuser for the first time you will be asked to select the connection parameters from ASCOM or INDIGO / INDI selector dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

## 3 Position




If the focuser is of type Absolute shows the current position of the focuser. If the focuser is Relative the position is not available, unless emulation is enabled in Scope & Focuser settings tab.

## 4 Position Bookmarks




Allows storing and using of three focuser position values.

To store the current focuser position use **Shift+Click**. To use stored position, just click on the button and the value will be populated into the GoTo field.

**Ctrl+Click** on the bookmark buttons stores the values in GoTo edit box as bookmark.

## 5 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

## 6 GoTo section



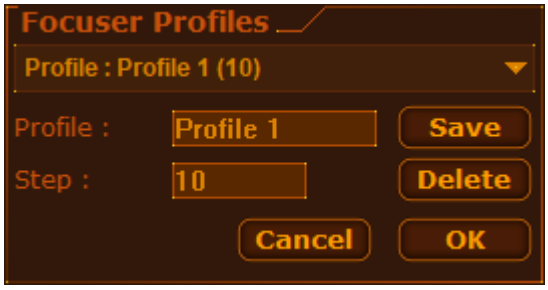

This section allows to move the focuser to particular position. Enter the position (or use the Position Bookmarks) and click on GoTo button. This requires Absolute focuser or enabled positions emulation (Scope & Focuser settings tab).

If position emulation is enabled **Shift+Click** on the Goto button will set the entered GoTo value as current position of the focuser.

## 7 Step Size




Defines how many positions to change on every move step. The button "..." allows creation/selection of different step size profiles. When Step size control is focused you can use arrow up/down keys to scroll through the profiles you have defined.




## 8 Out x5




Move the focuser in outward direction with five times the defined step size.

## 9 Out




Move the focuser in outward direction with the defined step size.

### 10 Stop



Stops the running focuser move.

### 11 In



Move the focuser in inward direction with the defined step size.

### 12 In x5



Move the focuser in inward direction with five times the defined step size.

## Filter Wheel

APT is able to control filter wheels via ASCOM drivers, INDIGO / INDI as well as SBIG filter wheels through their native interfaces. To describe the filter names and offsets in APT rather than in the wheel driver see Filter Wheel settings tab.

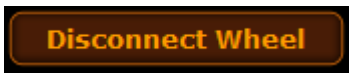
This section gives manual wheel control. Note that imaging plans can be configured to change the filters during the plan execution. See Plan Editor section.

The filter wheel connection is used or can be used by the following APT features:

- Imaging plans
- Imaging plans (Scripts and Commands)
- CCD Flats Aid



## 1 Connect / Disconnect

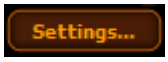



When you connect an **ASCOM / INDIGO / INDI** filter wheel for the first time you will be asked to select the connection parameters from ASCOM or INDIGO / INDI selector dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

To connect **SBIG** filter wheel see Select Camera Type. Note that for SBIG wheel you have to use the Filter Wheel settings tab to describe the installed filters.

To "connect" a manual filter wheel or filter drawer you have to enable the option in the Filter Wheel settings tab.

## 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

## 3 Current Filter




Shows the current filter name.

This information can be also found in the Status section in the Main screen in order to save you tab switching just to see the current filter.

## 4 Go to filter




List box with all installed filters that allows selecting directly the desired filter instead of scrolling. Note that Moravian Instruments filter wheels will make the actual movement before the next exposure.

When manual wheel or drawer is used, it just changes the select filter name after the filter is changed manually.

## 5 Previous / Next




Goes to the Previous / Next filter. Note that Moravian Instruments filter wheels will make the actual movement before the next exposure.

When manual wheel or drawer is used, these buttons just change the select filter name after the filter is changed manually.

### 6 Adjust focuser




When is active (high-lighted) if there are entered focus offset for the filters in Filter Wheel settings tab or in the ASCOM properties and if there is connection to Focuser, then APT will adjust the focuser position on every filter change.

This option could be used even with manual wheel or drawer.

### 7 Applied Offset




Shows the applied focus offset on the last filter change. Needs Adjust focuser to be enabled, connection to a Focuser and defined focus offset.

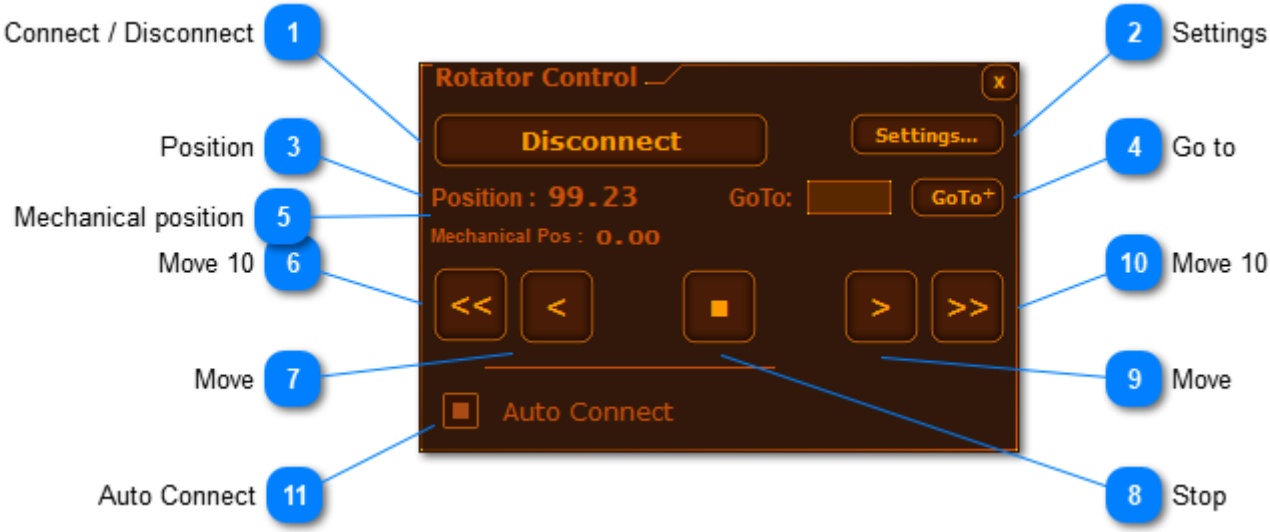
## Rotator

*The Rotator Panel is accessible from Gear tab.*

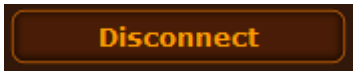
Click on the **Rotator** button to open/close Rotator Panel from where is possible to control ASCOM compatible rotator devices.

When there is active connection there will be asterisk in the Rotator button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

Here is how Rotator Panel looks like:

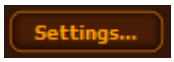



### 1 Connect / Disconnect



When you connect a rotator for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

## 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

## 3 Position




The current position reported by the driver.

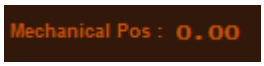
## 4 Go to




Goes to the desired position. Enter the wanted degrees and click on GoTo.

**Note**: Using **Shift+Click** will synchronize rotator position with the entered value (if the ASCOM driver provides the functionality).

## 5 Mechanical position




Shows the mechanical position of the rotator. When you make a synchronization via Sync button in PointCraft or via Shift+Click on GoTo button, the ASCOM driver defines the offset of logical position from the mechanical position.

In the screenshot above the 99.23 is the logical position as the last solved image shows rotation 99.23, but the actual position of the rotator device is 0.

## 6 Move 10




Move the rotator by 10 degrees in one direction. The direction depends on the driver settings.

## 7 Move



Move the rotator by one degree in one direction. The direction depends on the driver settings.

### 8 Stop



Stops the running movement.

### 9 Move



Move the rotator by one degree in the opposite direction. The direction depends on the driver settings.

### 10 Move 10



Move the rotator by 10 degrees in the opposite direction. The direction depends on the driver settings.

### 11 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected rotartor.

## Flat Panel / Cover

*The Flat Panel / Cover is accessible from Gear tab.*

Click on the **Flat Panel / Cover** button to open/close Flat Panel / Cover controlling panel from where is possible to control ASCOM compatible flat panel and/or cover devices. Note that if your flat panel doesn't have ASCOM driver you can check the Extra Devices Panel where some models can be controlled via direct serial communication.

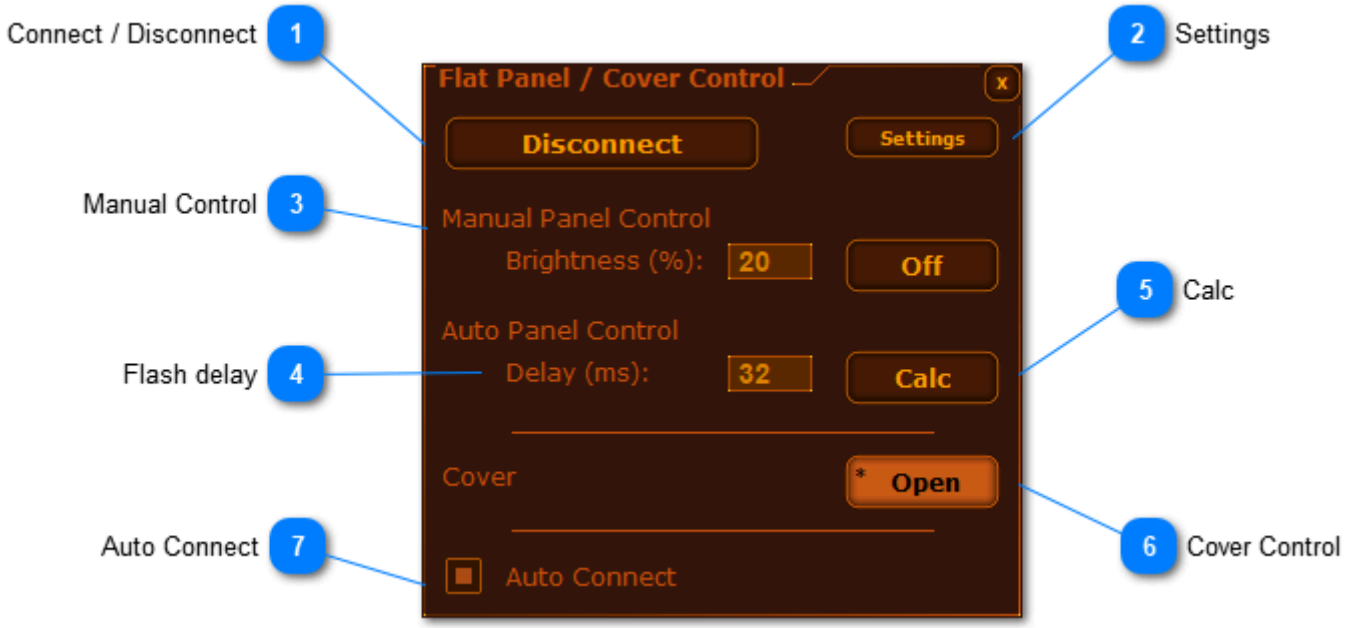
When there is active connection there will be asterisk in the Flat Panel / Cover button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

The panels and the cameras should work in tandem in order to get best results. In one hand the panel need some time to reach the exact brightness. In other hand the most of the cameras has electronic (rarely mechanical) shutter, so if you start exposure when the panel is turned On is possible to gets slightly different amount of light in top and bottom areas of the sensor as it takes time to read the lower pixels which are still exposed to the panel light.

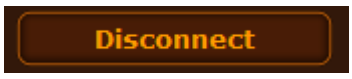
The optimal workflow is to start the exposure, turn the panel On for some time, after that to turn it Off and after that to end the exposure. So far so good, but as it was mentioned the panel needs some time to turn On/Off. Let name it this **delay** as X. When we want to make a flat frame with 5s duration, we have to make it for 5s + 2*X in order to be sure that every sensor pixel will get same amount of light. Because determining the delay could be tricky APT gives way to calculate it depending on the statuses provided by the ASCOM driver. Use the **Calc** button several times to see how the milliseconds vary. If the values are constant you can leave the setting as it is. If they vary or you want to be on the safe side, you can increase the max value you got with small value like 5-10%.

The brightness levels per filter can be defined in Filter Wheel settings tab. If you are using Color/OSC - One Shot Camera, just enter OSC on the first line and the needed brightness. Keep in mind that you can use the Manual Filter Wheel support for manual wheels and filter drawers.

Here is how Flat Panel / Cover looks like:




## 1 Connect / Disconnect



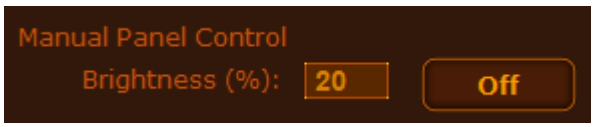

When you connect a Flat Panel / Cover for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

## 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

### 3 Manual Control




This section gives manual control on the flat panel. Allows entering the brightness in the range of 0-100% and to turn On/Off the panel.

APT can automatically control the device during the execution of Flats Imaging Plans - DSLR and CCD/CMOS modes and with CCD Flats Aid

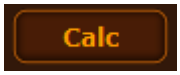
### 4 Flash delay




When a Flats Imaging Plans is executed in DSLR or CCD/CMOS or CCD Flats Aid is used and flat panel is connected, it will be automatically controlled. When panel is automatically connected the brightness levels per filter are defined in Filter Wheel settings tab. If you are using Color/OSC - One Shot Camera, just enter OSC on the first line and the brightness. Keep in mind that you can use the Manual Filter Wheel support for manual wheels and filter drawers.

Defines how many milliseconds are needed to the panel to reach from 0 to stable brightness with the desired percent. This value will be used to calculate the exact exposure duration. See above the notes on how the panels and the cameras work together.

### 5 Calc




Calculates the delay value based on the statuses provided by the ASCOM driver.

### 6 Cover Control




Allows manual control of the cover.

### 7 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected rotartor.

## Ports Hub

*The Ports Hub Panel is accessible from Gear tab.*

Click on the **Ports Hub** button to open/close Ports / Switches Hub Panel from where is possible to control ASCOM compatible Ports / Switches Hub devices or Velleman K8055/K8055N and Whadda WSI8055N boards.

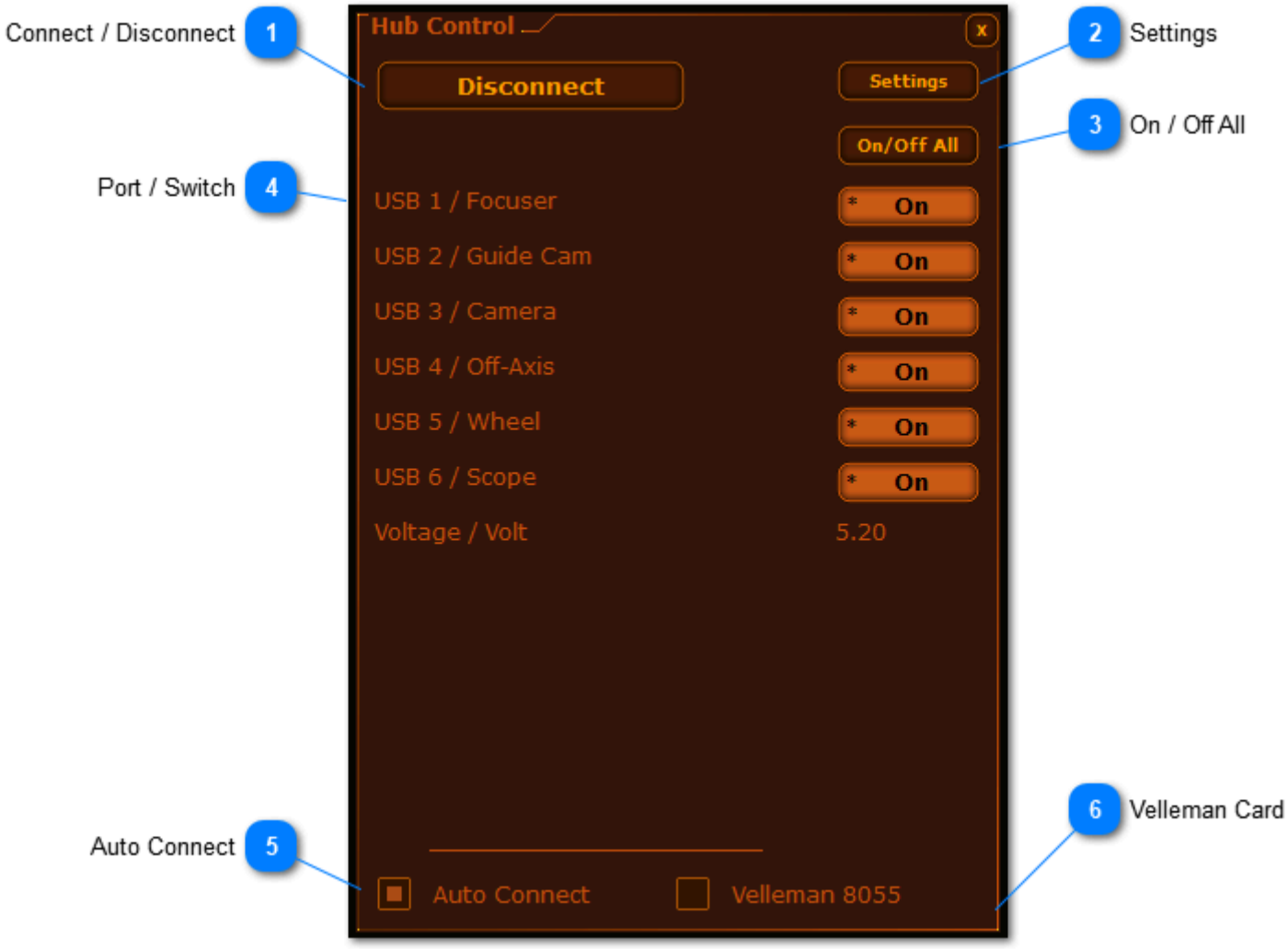
When there is active connection there will be asterisk in the Ports Hub button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

The interface of of this panel is dynamic and depends on the ports and the switches that can be controlled by the driver. There are three types:

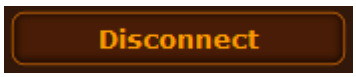
- Ports / Switches with variable values that can be set like dew heater power control
- Ports / Switches than can be set On and Off like USB ports
- Ports / Switches than provide read-only information like power level, temperature and etc.

When an item is from the first time, the tooltip help will shows the maximum and minimum acceptable values as well as the changes step. For example some dew heaters can accept power levels from 0 to 100% and to be changed with step of 10%. If you set 25% it will be rounded to 20%.

Here is how Ports Hub panel looks like:

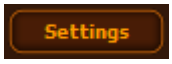


## 1 Connect / Disconnect




When you connect a Ports Hub for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

## 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

## 3 On / Off All




Turns change the status of all ports that accept that to On / Off.

## 4 Port / Switch










Allows control on the port / switch or shows the value of the read-only items.

## 5 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected device.

## 6 Velleman Card




When checked the the Ports/Hub Panel will give control to board models - Velleman K8055/K8055N and Whadda WSI8055N

Here is how the interface look like in such case:




## Observing Conditions

*The Observing Conditions Panel is accessible from Gear tab.*

Click on the **Obs Conditions** button to open/close Observing Conditions Panel from where is possible to monitor/use the data form ASCOM compatible Observing Conditions devices.

When there is active connection there will be asterisk in the Obs Conditions button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

The interface of of this panel is dynamic and depends on the sensors available..

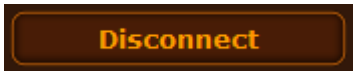
The Observing Conditions can provide data for various features of APT:

- Main screen Temperature / Humidity / Dew Point
- Refocusing by Temperature in Session Craft
- Temperature compensation in Session Craft
- Storing temperature in the images file names
- Storing Temperature / Humidity / Sky quality in Database and FITS / XISF header (for CCD/CMOS cameras)
- Using the Sky quality in the Sky Quality Calculator

Here is how Observing Conditions looks like:




## 1 Connect / Disconnect




When you connect a Observing Conditions for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

### 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

### 3 Sensor Name/Value

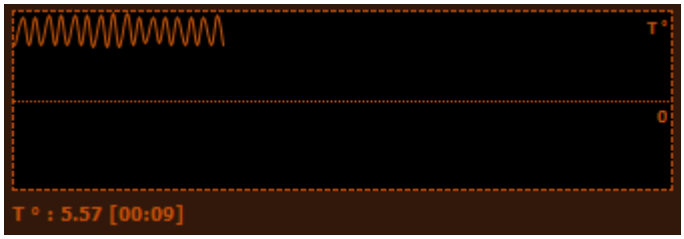



Shows the sensor name and value. Selecting the radio button will show the gathered data graph in the Data Graph section

If there is no other external weather sensors and such are available in the connected device, Temperature, Humidity, DewPoint will be used as data source in the Main Screen and Session Craft temperature triggers ( refocusing and temperature compensation)

If the  is no other external weather sensor and such is available, the Sky Quality value will be populated in Sky Quality Calculator and also will be used for string in the FITS / XISF header and the Database.

### 4 Data Graph




Shows the graph of the data for the selected sensor. Moving the mouse over the graph shows the exact value and the time it has been recorded.

### 5 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected device.

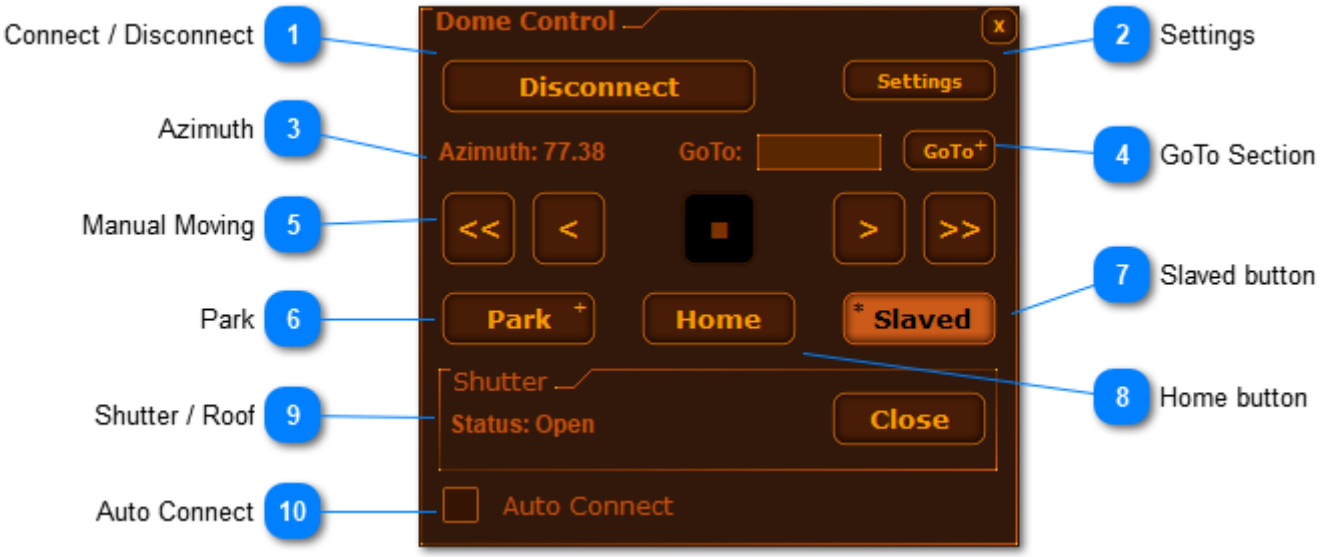
## Dome

*The Dome Panel is accessible from Gear tab.*

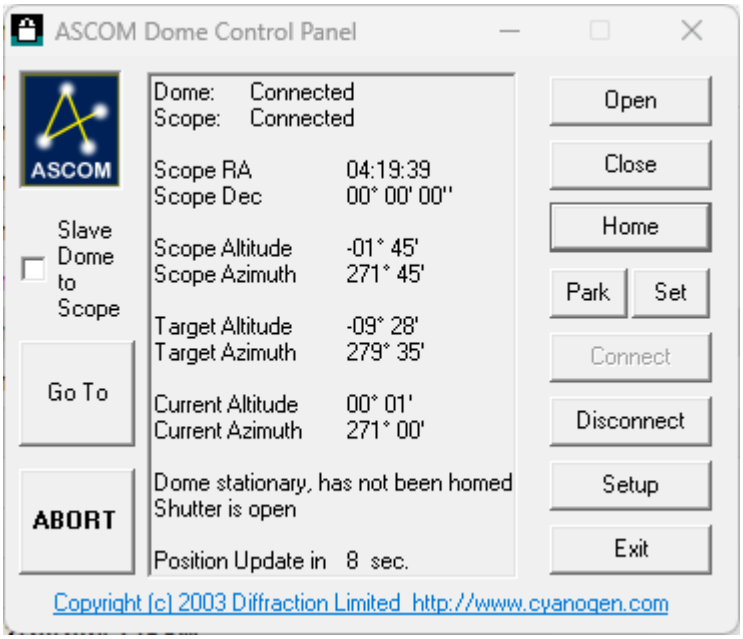
Click on the **Dome** button to open/close Dome Panel from where is possible to control ASCOM compatible Domes or observatories with automated roofs.

When there is active connection there will be asterisk in the Dome button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

Here is how Dome panel looks like:

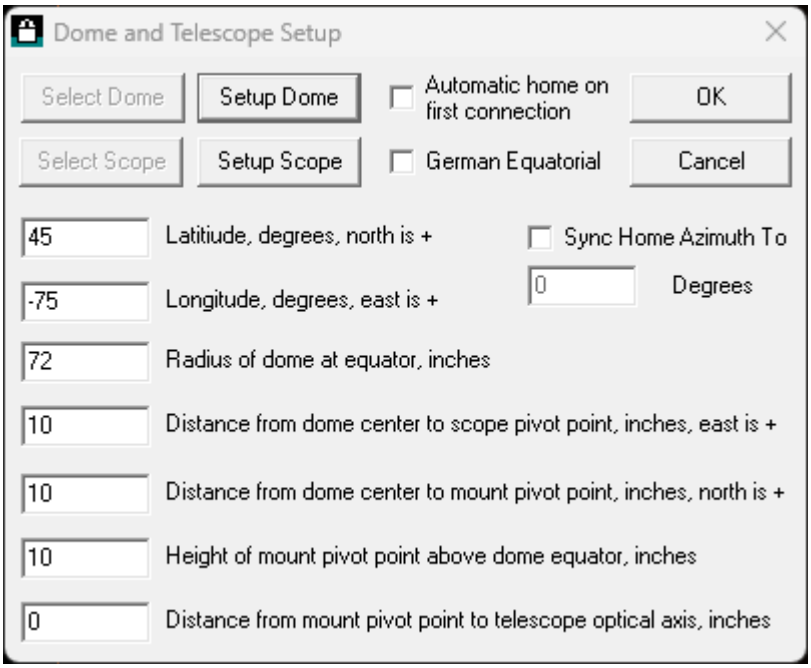



If you have dome you can use the **ASCOM Dome Control** which is part of the ASCOM platform. It will synchronize the telescope and the dome in order to keep the shutter opening to be in front of the telescope.




There is need to follow steps:

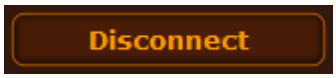
1. Use Shift+Click on Connect button in Dome Panel.
2. Select **ASCOM Dome Control** and click Properties
3. Click on **Setup** button
4. Click **Select Dome** and select the ASCOM driver for your Dome/Obeservarory
5. Click **Select Scope** and select the ASCOM driver for your mount/telescope
6. Enter the following parameters for your location and dome in order the driver to calculate correctly the shutter position




7. In Gear tab use Shift+Click on Connect and select **ASCOM Dome Control** as mount driver. For best results select the same driver in your **planetarium** application and in **PHD2**.

All these step are "one time". In the next imaging session just click on Connect buttons.

### 1 Connect / Disconnect



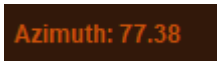

When you connect a Dome/Roof for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

### 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

### 3 Azimuth




Shows the current Azimuth position of the dome.

## 4 GoTo Section




This section allows to move the Dome to particular position. Enter the position and click on GoTo button.

**Note**: Using **Shift+Click** will synchronize dome position with the entered value (if the ASCOM driver provides the functionality).

## 5 Manual Moving




Moves the Dome with fixed step "<" and ">" moves the Dome with one degree, "<<" and ">>" with 10 degrees. The Stop button will abort a running move operation.

## 6 Park




Sends the Dome to the defined Park position.

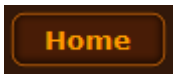
**Note**: Using **Shift+Click** defines the current Azimuth position as park position.

## 7 Slaved button




Enables/Disables the dome slaving to telescope position. When enabled the dome will follow the telescope.

## 8 Home button




Sends the Dome to the defined Home position.

## 9 Shutter / Roof




This is the shutter/roof section. It shows the current status and give possibly to open / close the shutter / roof.

### 10 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected device.

## Safety Monitor

*The Safety Monitor Panel is accessible from Gear tab.*

Click on the **Safety Monitor** button to open/close Safety Monitor Panel from where is possible to use ASCOM compatible Safety Monitoring devices.

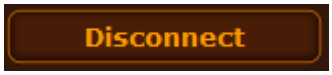
When there is active connection there will be asterisk in the Safety Monitor button name in Gear Tab. Note that closing the panel window does not disconnect the device. You can open and close the panel as many times as you need in order to keep the interface clean without worrying about the connection to the device.

When there is connection to a device that can evaluates what is the danger to keep imaging, in a case of not safe event, Session Craft can trigger a special imaging plan to finish the session in order to keep your setup safe - including parking the scope, closing dome/roof, taking care for the camera, guiding and etc via Script Commands, If there is a "not safe" event, the trigger is with top priority and will override all the other triggers set in Session Craft. If there is such trigger any other SessionCraft activity will be disabled till Reset button is clicked or the option "No Stopping Trigger" is checked before the event.

Here is how Safety Monitor panel looks like:

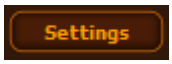



### 1 Connect / Disconnect




When you connect a Safety Monitor for the first time you will be asked to select the connection parameters by the standard ASCOM dialog. APT will remember your selection and when you click again on the “Connect” button it will use the previous settings automatically. If you want to change the connection parameters, use “**Shift+Click**” on the Connect button. Use **Ctrl+Click** to forget the selected connection parameters.

### 2 Settings




Opens the settings dialog of the ASCOM driver. If this action is not supported by the driver, use **Shift+Click** on Connect button and then click Properties in the driver selector dialog box.

### 3 Is Safe




Shows if the current conditions reported by the sensors are safe or not. If the value changes from "Yes" to "No" and there is trigger set in Session Craft, it will be executed.

**Note:** If its happening not during the night (depending on the Location setting), the trigger will not be executed.

### 4 Is Triggered



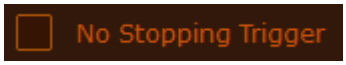

Show if there is report for not safe conditions since connection of the device. If the value is "Yes" you can use the "Reset" button to clear the state and force new monitoring cycle which could be used in Session Craft - Control

### 5 Auto Connect




When checked, on every start APT, it will try to restore the connection to the selected device.

### 6 No Stopping Trigger




When enabled in case of an event reported as not safe SessionCraft, will continue monitor and to execute the other triggers set. If this option is unchecked all future triggers will be ignored till Reset button is used.

## Extra Devices

*The Extra Devices aid is accessible from Gear tab.*

*Related videos:*
*Extra Devices*

This aid is built to give control over specific devices.

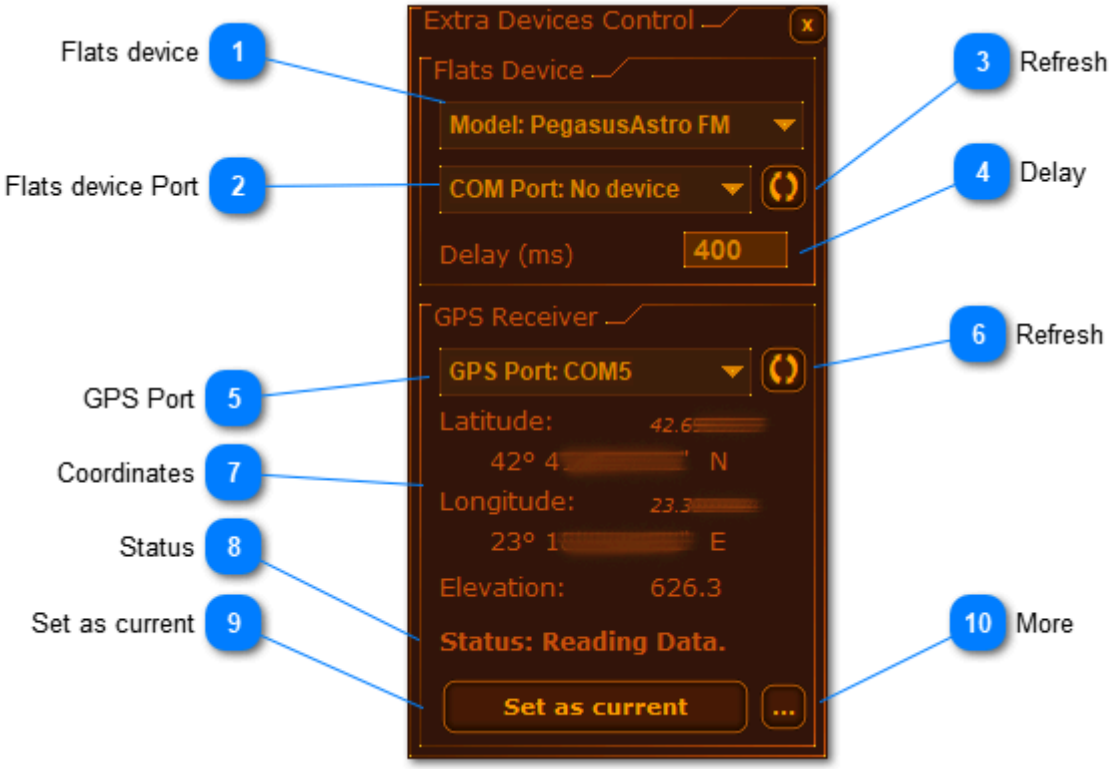
**The first section** allows native connection to several models of flat panels - Lacerta's FBC - Flat Box Controller, Pegasus Astro - FlatMaster, ArteSky - Flat Box USB, GeOptik Flat Field Generator. Alnitak and clones Flat Fielding Devices. These

settings are used by CCD Flats Aid and during Flats Type imaging plan execution (in both DSLR and CCD/CMOS modes) when such device is available.

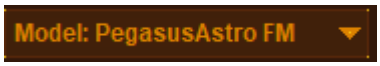
**Note:** The flat panels support in APT was implemented before the definition of the ASCOM standard for these devices, so this section is getting obsolete. If your device has an ASCOM driver it is better to use the Flat Panel / Cover Aid.

The brightness levels per filter can be defined in Filter Wheel settings tab. If you are using Color/OSC - One Shot Camera, just enter OSC on the first line and the needed brightness. Keep in mind that you can use the Manual Filter Wheel support for manual wheels and filter drawers.

**The second section** allows communicating with a GPS dongle or with smartphone (using an app that forwards the location data via Bluetooth). The detected coordinates can be used by the mount, for the Darkness Clock and DSD Calculator




## 1 Flats device




Defines to which device brand to make connection.

## 2 Flats device Port




Defines the COM port on which the flat panel is connected. Once selected APT will make attempt to make connection and will display the result in the Log panel.

## 3 Refresh



Refreshes the connection to flat panel.

## 4 Delay




Lacerta FBC is designed to start the flat panel flash after the exposure start in order to avoid artifacts caused by mechanical shutter or electronic shutter (rolling image reading). This delay defines how many milliseconds are needed for the camera shutter to open/close fully. APT will modify the exposure duration automatically to include that delay before and after the flash. If exposure/flash is set to 1s it will execute 1s and 800ms if the delay is set to 400ms. The total exposure = "Exposure" + 2*Delay. If you want to match perfectly the Dark Flats plan for your Flats Plan generated by the CCD Flats Aid, increase the Dark Flats exposure with 2*delay.

For Pegasus Astro - FlatMaster and Geoptik - Flat Field Generator is used the same logic for panel control as for Lacerta FBC.

ArteSky - Flat Box USB needs some time to stabilize the needed brightness. You can use this setting to give time the brightness to reach the desired level before taking exposure.

For Alnitak and clones is used the same  for panel control logic as for ArteSky - Flat Box USB.

## 5 GPS Port



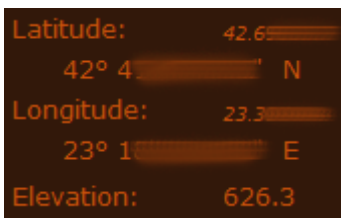

Define the COM port of the GPS dongle. If smartphone is used (with dedicated app that exports the current location via Bluetooth), it will be also visible as COM port. Once selected APT will make attempt to make connection and will display the result in the Log panel.
It is also possible to read the location coordinates from the PrimaLuceLab EAGLE computer GPS.

## 6 Refresh



Refreshes the connection to the GPS dongle or smartphone.

## 7 Coordinates



Shows the detected coordinates. Keep in mind that it can take several minutes the GPS dongle to detect the satellites.

### 8 Status




Shows the connection status.

### 9 Set as current




Once coordinates are available you can set them as current location in Settings Location tab and use them for the mount, for the Darkness Clock and DSD Calculator.

### 10 More




Opens small settings dialog box where you can manage the COM port speed or to enable/disable GPS data logging. Use logging only in case of problem because the log files could become quite big.

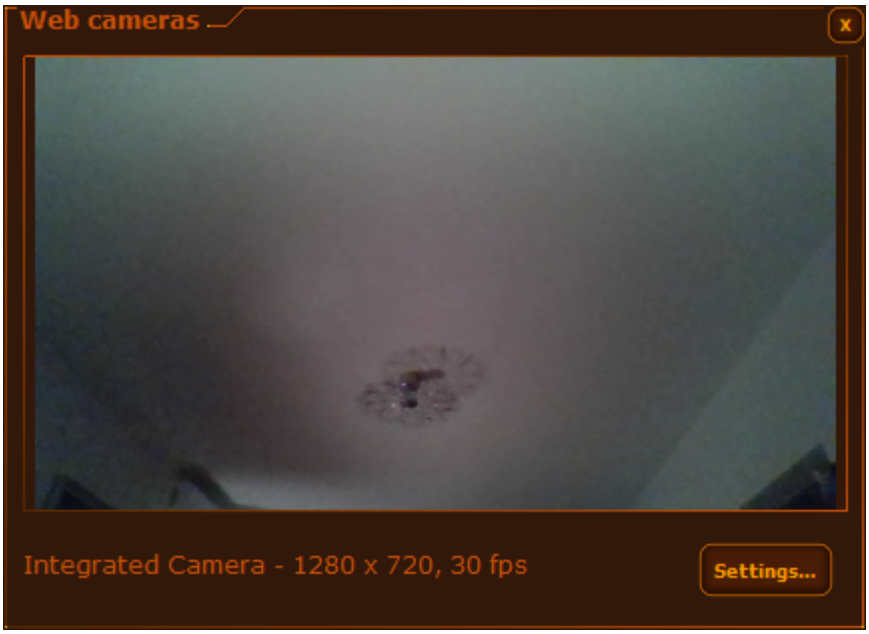
## Web Cameras

*The Web Cameras is accessible from Gear tab*

*Related videos:*
*Reolink IP Camera to PC Setup & Connection to APT*
*Reolink IP Camera to PC Setup & Connection to APT Addendum - A Static IP Address*
*Webcams & IP Cameras*

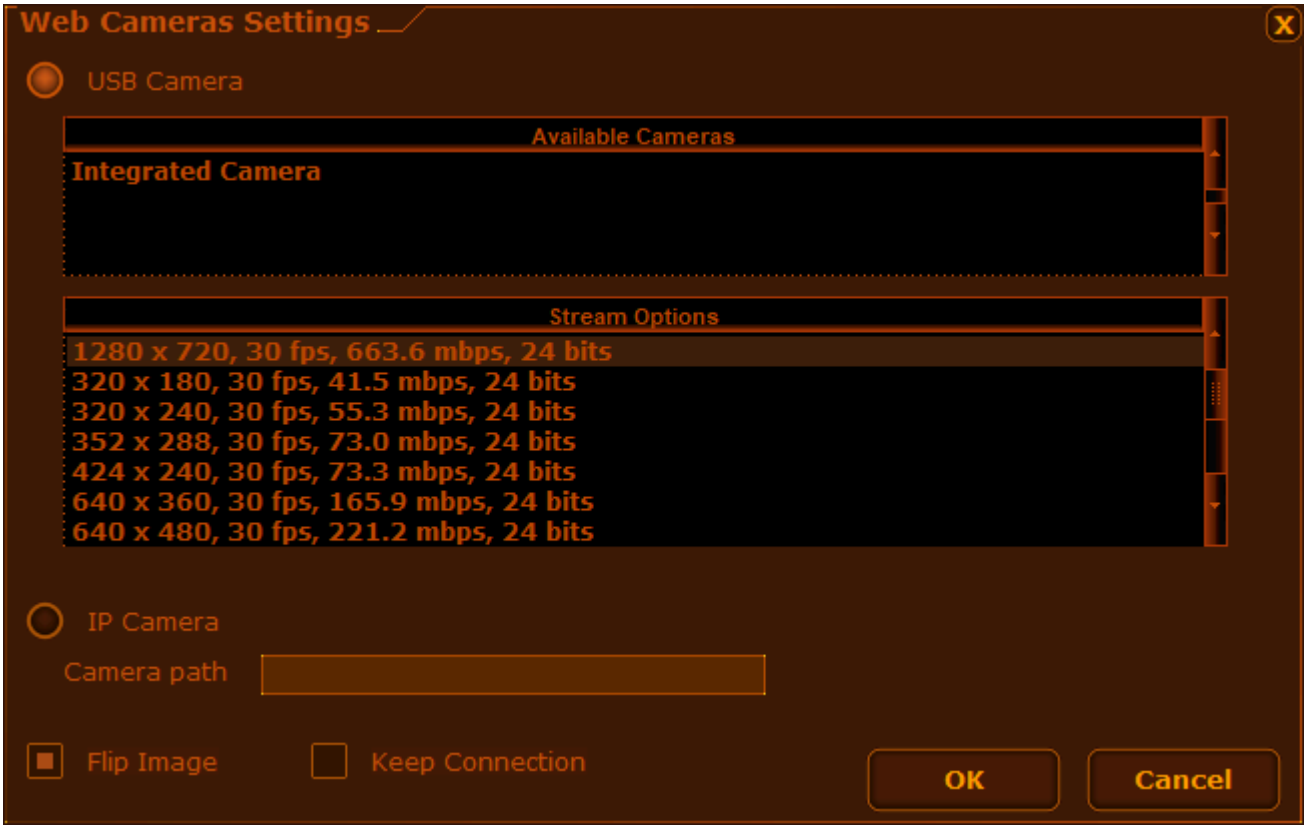
This aid allows connecting to USB or IP Web Camera and monitoring your setup behavior remotely. It will remember the camera and the selected stream option and the windows size/position. So it possible to take a short look on the camera and to close it many times during the night. Double click on the image will switches to double size of the image and back to previous size in case you want to see something in more details.

Here it is how the aid looks in action:




The settings are quite few. The camera you want to use and the stream option you prefer. There is possible to flip the image in order to be right-side. If you want to use IP camera, but don't know the exact address and the parameters you can use the free "ONVIF Device Manager". It will detect the IP of your camera and also to give the exact ULR of the video stream via "Live video" button. The link to "ONVIF Device Manager" is
https://sourceforge.net/projects/onvifdm/

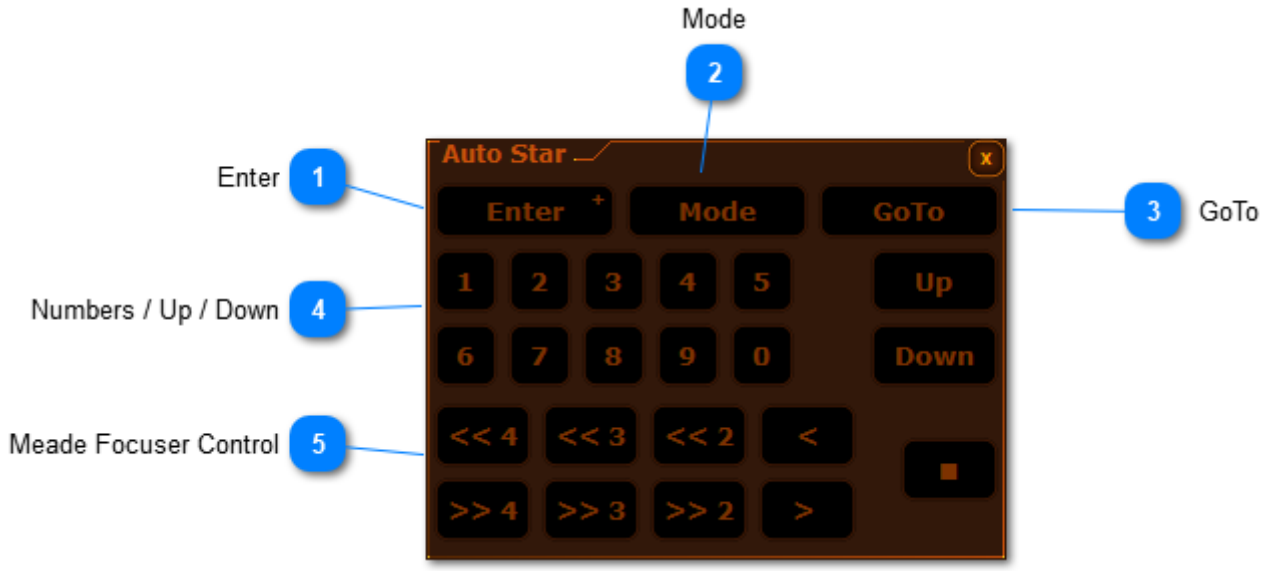
When "Keep Connection" is enabled once a connection is made to the camera it will be kept no matter if the Web Cameras panel is open or closed. This feature is handy when an IP camera is changing the address between the connections.




## AutoStar (Meade Specific)

*The AutoStar is accessible from Gear tab*

This section becomes available when Meade mount with AutoStar hand-controller is connected. It gives way to use the AutoStar features directly from APT.




### 1 Enter




Equal to pressing Enter on the hand-controller.

**Shift+Click** on Enter enables/disable "High Precision mode".
**Ctrl+Click** on Enter is equal to hold the Enter key on the hand-controller.

### 2 Mode




Equal to pressing Mode on the hand-controller.

### 3 GoTo




Equal to pressing GoTo on the hand-controller.

### 4 Numbers / Up / Down




Equal to pressing the corresponding number, Up or Down key on the hand-controller.

### 5 Meade Focuser Control




This section becomes available when:

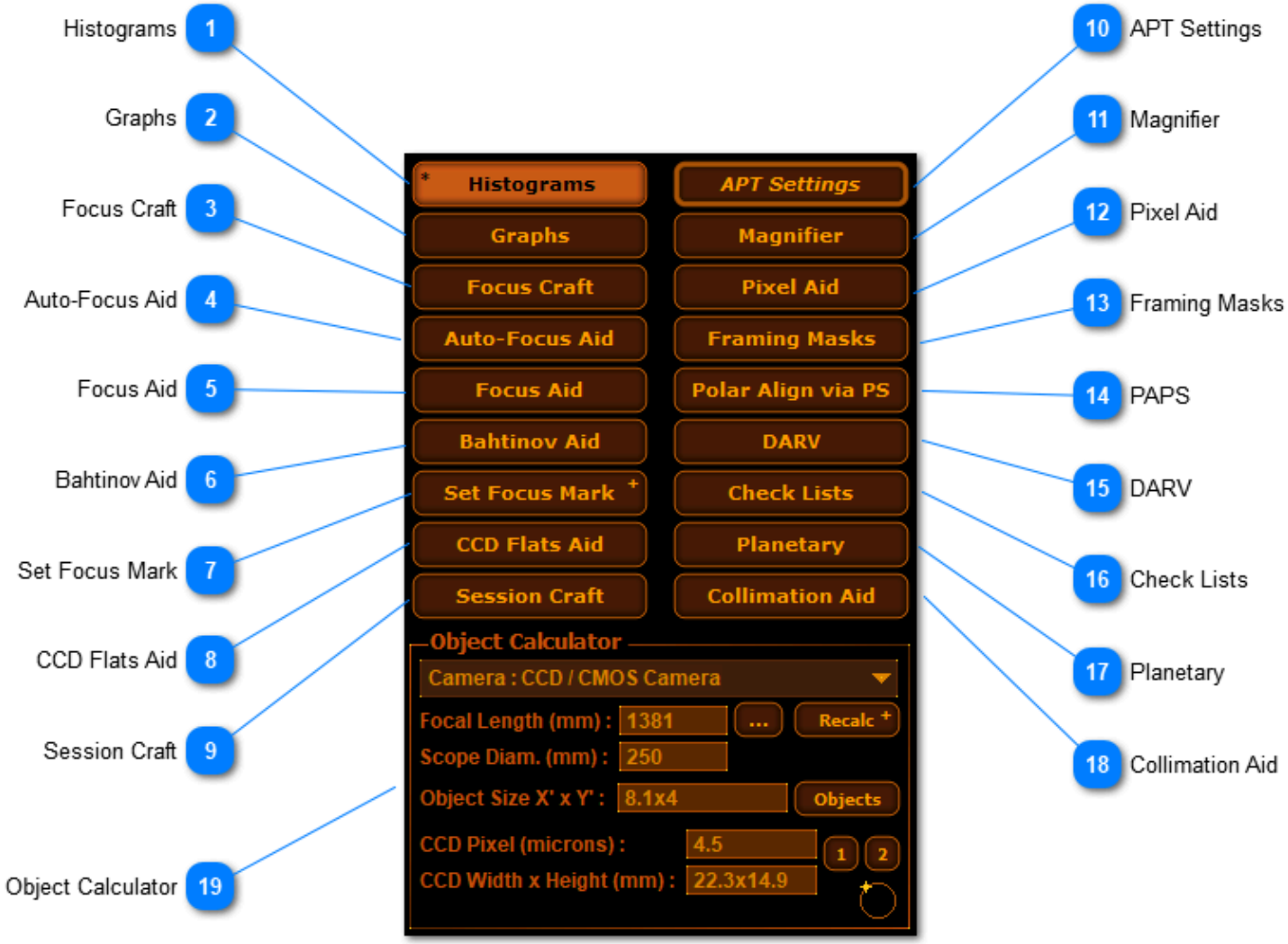
- AutoStar controller is connected
- "Meade Focuser" is enabled in the Scope & Focuser settings tab

It allows controlling the focuser attached to the AutoStar in four speeds and to stop a running focuser move.

## Tools Tab

*Related videos:*
*Tools Tab - 4.60+*
*Tools Tab - 2, Tools Tab*

This tab gives access to many interesting features. Here you can find short note about every one and link to a dedicated section where the feature is described in details.




## 1 Histograms




Opens/Closes the Histogram Aid. It can be used to see if the image is properly exposed or the make Screen Stretch or Levels of the image to see fainter details. This is "on screen" operation and the saved image is not altered.

See Histogram section.

## 2 Graphs




Opens/Closes the Graphs aid. It shows graphs for various data collected during the imaging session like EXIF temperature, CCD/CMOS temperature and etc.

See Graph section.

### 3 Focus Craft




Opens/Closes the Focus Craft Panel. It allows to monitor the focus quality during the session and also is integral part of the automatic focusing.

See FocusCraft section.

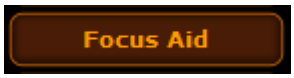
### 4 Auto-Focus Aid




Opens/Closes the Auto-Focus Aid. Using a motorized focuser and Focus Aid the Auto-Focus Aid analyze and tune the focus automatically.

See Auto-Focus Aid section.

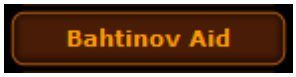
### 5 Focus Aid




Opens/Closes the Focus Aid. This is an aid to achieve the best focus by using FWHM (Full Width Half Maximum) or HFD (Half Flux Diameter) metrics for measuring the focus quality. This aid is also used by the Auto-Focus Aid and EOS Lens Auto-Focus.

See Focusing Aid section.

### 6 Bahtinov Aid




Opens/Closes the Bahtinov Aid. This aid analyzes the spikes made by a Bahtinov mask on sub-pixel level and allows achieving better focus than the one made by eye.

See Bahtinov Aid section.

### 7 Set Focus Mark




Sets a focus mark for the current temperature. The mark is used in order to determine when to notify you that there is need to refocus because of temperature change.

**Shift+Click** on this button prints the last set temperature mark in Log panel.

See External Sensors section.

## 8 CCD Flats Aid




Opens/Closes the CCD Flats Aid. Use this aid to determine the exposure duration needed to get the best flat frames. It can evaluate multiple filters and create automatically Flats type imaging plan.

See CCD Flats Aid section.

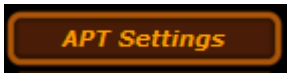
## 9 Session Craft




Opens/Closes the Session Craft Panel. It allows to control the Automated Meridian Flip, to schedule refocusing and plans execution.

See SessionCraft section.

## 10 APT Settings




Opens the Settings dialog box where you can handle most of the APT settings. Some APT features has their local settings which are described the corresponding sections.

See Settings section.

## 11 Magnifier




Opens/Closes the Magnifier aid. It allows making software image zoom.

See Magnifier section.

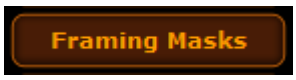
## 12 Pixel Aid




Opens/Closes the Pixel Aid. It allows to inspect the signal in various metrics for a small part of the image (or the whole image).

See Pixel Aid section.

## 13 Framing Masks




Opens/Closes the Framing Masks aid. This is an aid to frame object by same way during different nights or after a meridian flip.  It allows creating a reference mask from an image and to show it over other image with just a few clicks.

It is an alternative to PointCraft when there is no telescope/mount connection.

See Framing Masks section.

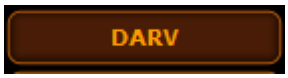
## 14 PAPS




Opens/Closes the Polar Align via Plate Solving - PAPS Panel. It allows to make a polar alignment using the plate solving technology.

See PAPS section.

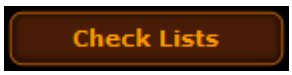
## 15 DARV




Opens/Closes the DARV aid. DARV is **D**rift **A**lignment by **R**obert **V**ice method. DARV Aid helps with the mount movement and exposure control.

See DARV section.

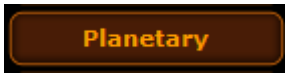
## 16 Check Lists




Opens/Closes the Check Lists Panel. It provides to store and preview checklists of steps and reminders for various aspects of preparation for imaging session or step to follow. Like "Don't forget the USB cables"...

See Check Lists Section.

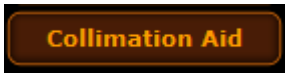
## 17 Planetary




Opens/Closes the Planetary Panel. It provides a way to take planetary images using the EOS LiveView.

See Planetary Panel section.

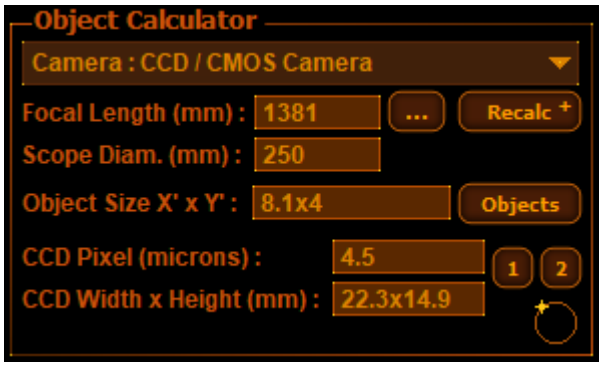
### 18 Collimation Aid




Opens/Closes the Collimation Aid. It helps to make easier collimation.

See Collimation Aid section.

### 19 Object Calculator




This is the built-in APT calculator that allows computing the FOV (Field Of View) size, resolution, CFZ (Critical Focus Zone) and etc.

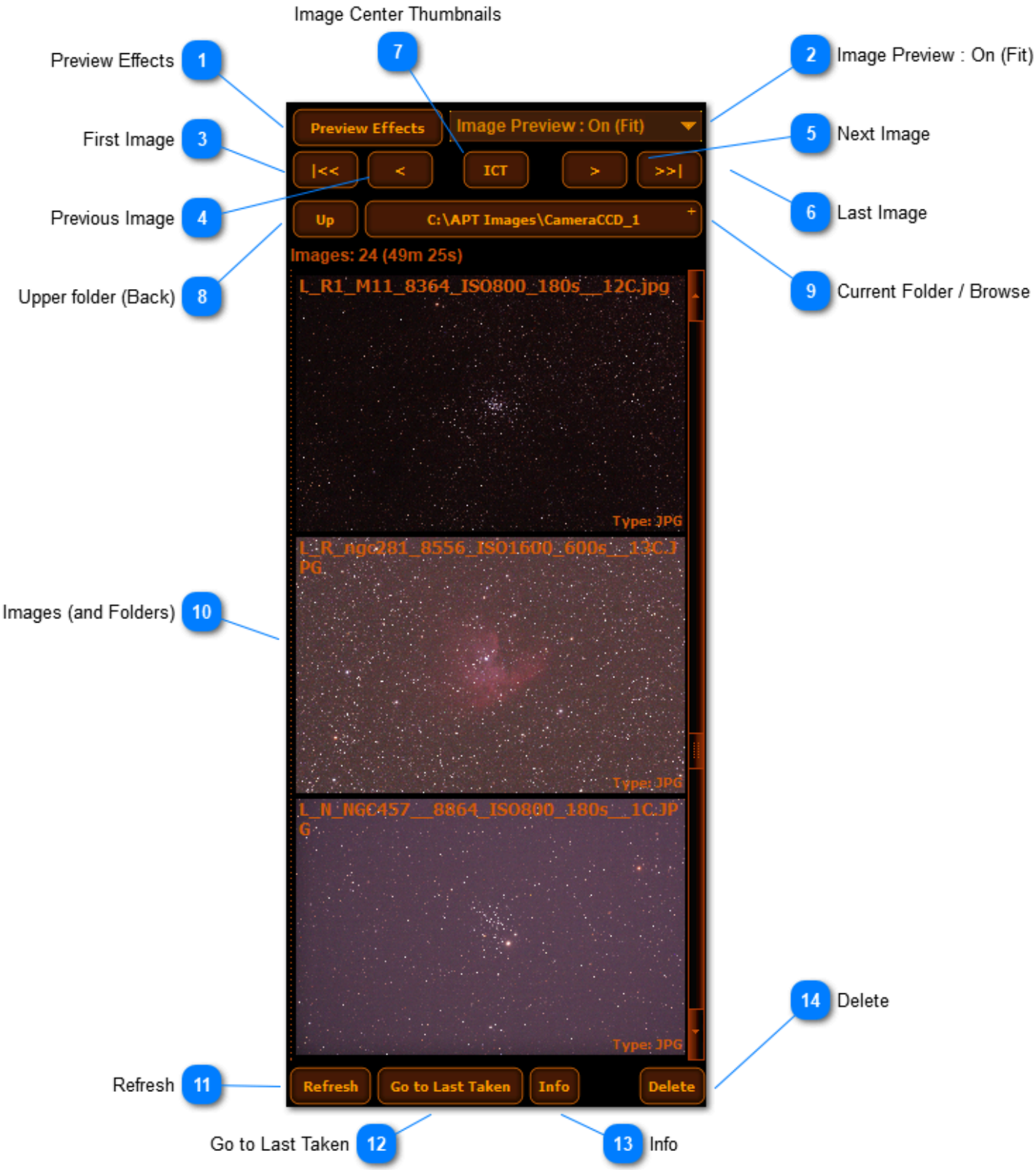
See Object Calculator section.

## Img Tab

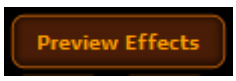
*Related videos:*
*Img Tab - 4.60+*
*Img Tab*

Img Tab is the image browser of APT. It allows fast previewing and deletion of images. It has some features that are related to astro-photography. For example if you image in RAW+L quality mode APT will group the two files (CR2/NEF and JPG) to show one thumbnail. If you use the Delete button it will remove both files at once. When Preview mode is set to 1:1 the scrolled position will remain allowing to inspect same region in series of images.
For the FITS / XISF images is calculated the total exposure time. It may need some time to show the value for folders with many images.

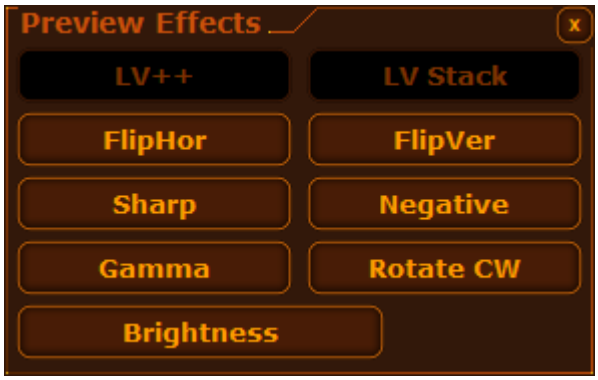
Use **Shift+Click** on the Gear tab button in order to make the tab a floating window. Click on the "x" button or use **Shift+Click** to dock it back.




## 1 Preview Effects




Opens/Close the Preview Effects dialog box which allows applying various effects on the loaded image or LiveView stream. The saved images are not affected. If there is asterisk after "Preview Effect" it means that one or more effects are activated.




| | |
|---|---|
| **LV++** | Tries to intensify the EOS LiveView stream. Note that EOS Histogram has LiveView auto-stretching option that can give better results. In CCD/CMOS mode the LiveView can be intensified by CCD Histogram stretching or auto-stretching |
| **LV Stack** | Stacks number of frames from the EOS LiveView stream. The count is configurable from Advanced settings tab |
| **FlipHor** | Flips the image horizontally |
| **FlipVer** | Flips the image vertically |
| **Sharp** | Applies sharpening filter |
| **Negative** | Makes the image negative |
| **Gamma** | Increases the gamma with +0.25 on every click till +3.00. Double-click disables the effect |
| **Rotate** | Rotates the image with +90 degrees clock-wise on every click. Double-click disables the effect |
| **Brightness** | Increases the image brightness with +25% on every click till +200%. Double-click disables the effect |

Note that performance can get slow (especially on a weak computer) if you are using Preview Effects over big images in combination with Preview Modes "1:1" and "1:1 Scroll"

## 2 Image Preview : On (Fit)




Controls the preview of the loaded image in the "LiveView / Image Preview" panel. It duplicates the functionality of the same control in Camera tab in order to save tab switching.

| | |
|---|---|
| **On (Fit)** | Shows the image in the preview area after every exposure. The image will be scaled to fit in the area |
| **Off** | No preview |
| **On (1:1)** | Shows un-scaled part from the loaded image that fits in the preview area |
| **On (1:1) Scroll** | Shows scrolling buttons to select the image area that you want to see in mode “On (1:1)”. Use the central rectangle to view the center of the image |

To scroll the image smoothly in “On (1:1)” or “On (1:1) Scroll” modes, hold the Shift key and drag with the mouse. You can also use the right mouse button to drag the image.

To switch quickly between “On (Fit)” and “On (1:1)” modes double click on the image. This allows to center the part of the image without scrolling.

If you double click on a scroll arrow, position will be moved to the corresponding border.

### 3 First Image




Loads the first image in the current folder.

### 4 Previous Image




Loads the previous image in the current folder.

### 5 Next Image




Loads the next image in the current folder.

### 6 Last Image

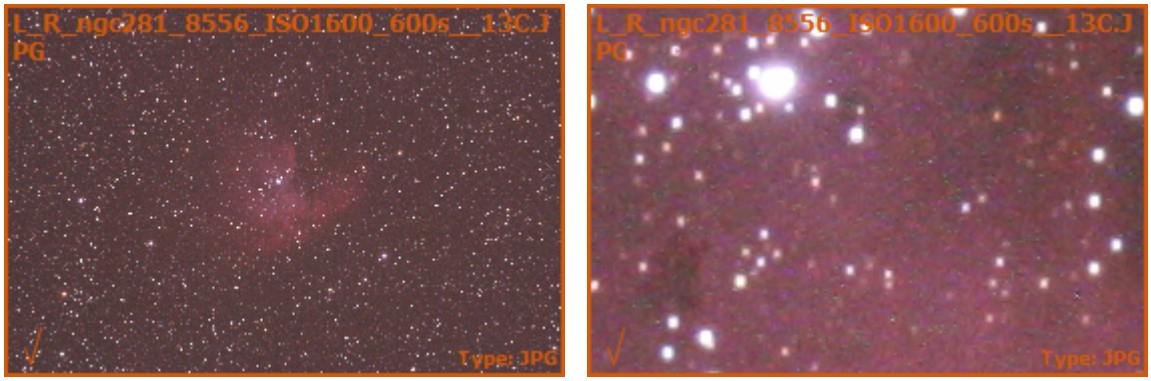



Loads the last image in the current folder.

### 7 Image Center Thumbnails




Enables/disables the Image Center Thumbnails (ICT) mode. The ITC mode shows in the thumbnail the center of the image in 1:1 scale. Is is very handful to evaluate the guiding quality without need to load and scroll the image. The bad images can be deleted easily with the Delete button.




In left is a thumbnail of the whole image, in right is the thumbnail of the image center.

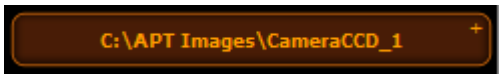
It is possible to toggle both modes for one image only with **right click** on it.

## 8 Upper folder (Back)




Goes to the upper folder - the parent folder of the current one.

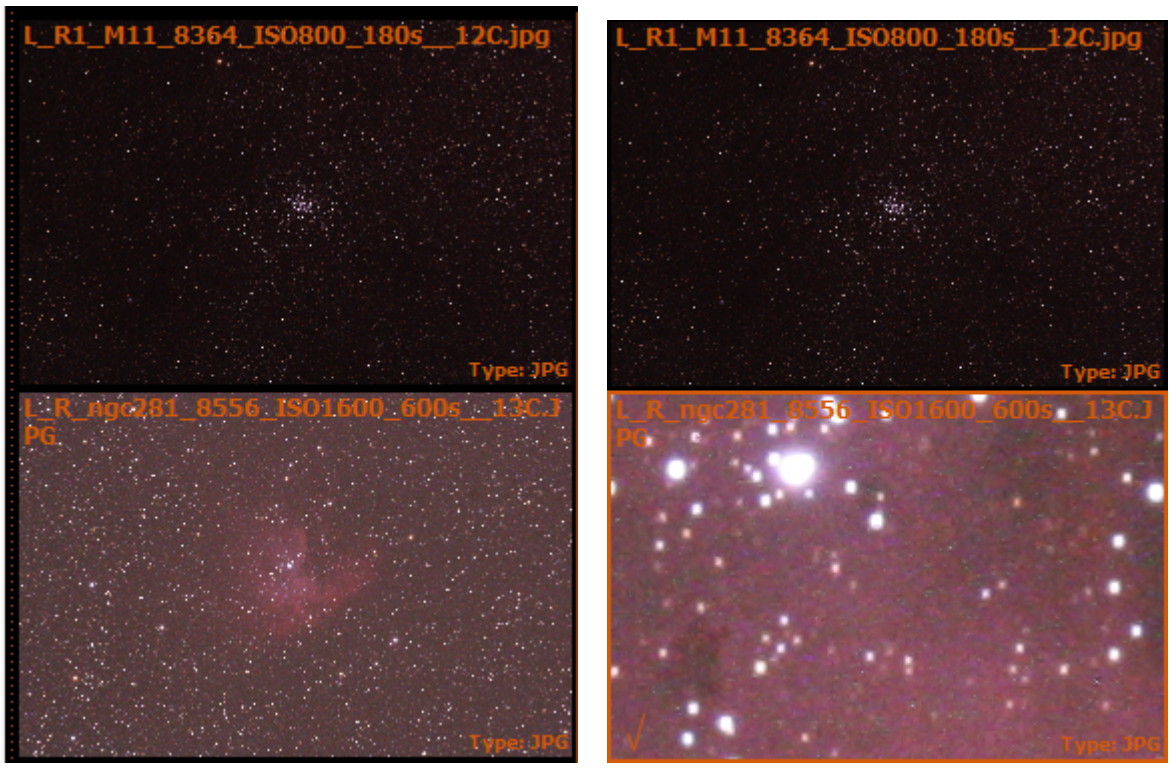
## 9 Current Folder / Browse




Shows the current folder. **Click** on this button to open the folder selection dialog box.

**Shift+Click** on it to open the folder in Windows Explorer.

## 10 Images (and Folders)




List of thumbnails. **Double click** on image thumbnail loads the image in the "LiveView / Image Preview" panel. Click with the right mouse button toggles between full image thumbnail (in left image) and image center thumbnail (right).

**Shift + Double Click** loads the CR2/NEF/FITS/XISF image into the associated application.

**Shift + Ctrl + Double Click** loads the JPG image into the associated application.

**Double click** on folder thumbnail opens the selected folder and makes it current one.

If the setting "Hide folders in Image Browser" in Main settings tab is enabled, the list contains only image thumbnails. If the option is disabled the list will include also thumbnails for the sub-folders of current folder.

Sample folder thumbnail:



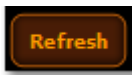

In the lower right corner of image thumbnail are printed image types (files) represented by this thumbnail The possible values are:

| | |
|---|---|
| JPG | One file only in JPG format. |
| CR2 and JPG | Two files - CR2 and JPG formats |
| NEF and JPG | Two files - NEF and JPG formats |
| CR2, TIFF and JPG | Three files - CR2, TIFF* and JPG formats |
| NEF, TIFF and JPG | Three files - NEF, TIFF* and JPG formats |
| FITS / XISF | One file only in FITS / XISF format. |

*TIFF file is generated when the option "Convert CR2/NEF to TIFF" option is enabled in the Advanced settings tab.

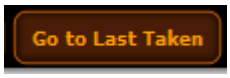
Note that changing the current folder in the Img Tab has not effect on the folder where the images are stored.

## 11 Refresh




Refresh the list of the current folder and re-generates the thumbnails.

## 12 Go to Last Taken

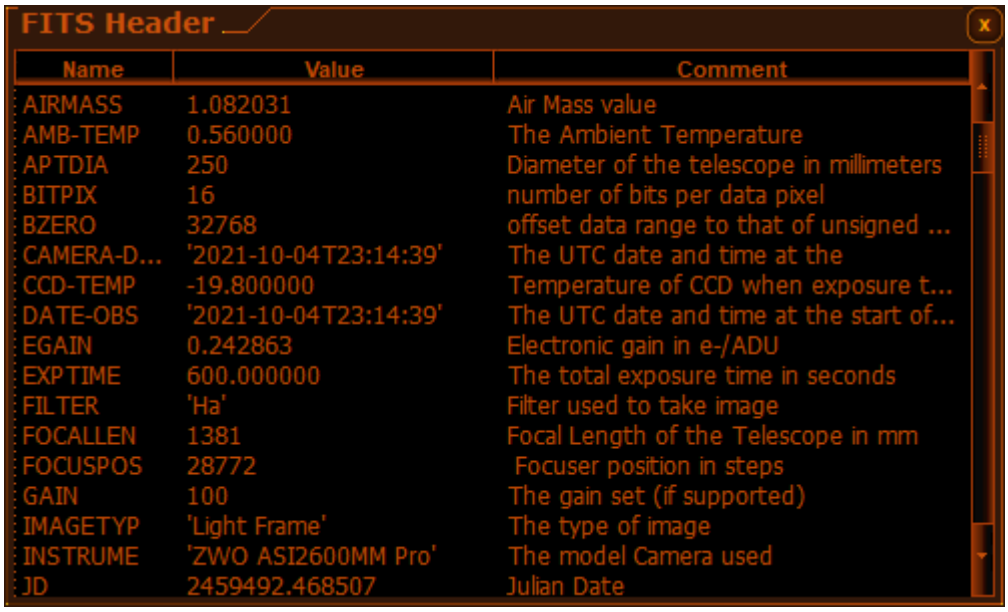



Goes to the folder where is saved the last taken image during the current imaging session (or previous session before new image is taken).

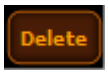
## 13 Info



If the file is in FITS / XISF format opens the FITS / XISF Header viewer. The information in it is updated if other image is loaded. The shortcut for this dialog box is Alt+I.




### 14 Delete




Deletes the selected file (or files if the thumbnail represents more than one). The file(s) are moved in the Recycle Bin, so they can be restored in case you change your mind. You can use also the Del key of the keyboard.

## APT Features

*Related videos:*
*APT In Action: From Polar Alignment to Imaging*

In this section are described almost all APT features. You can use it find information about a feature and how to use it.

There are some major features that are explained in separate sections:

- Dithering and Guiding
- PointCraft and Plate-Solving
- Multi-Camera Operation

### Credits

In order to provided all described APT features are used several external components:

- Canon EOS SDK
- Nikon SDKs
- SBIG SDK
- FreeImage library
- Bahtinov analysis technology by Neils Noordhoek

• NASA FITS/IO library

## LiveView

*LiveView is controlled by the button "LiveView" in the main screen or with Alt+L shortcut.*
*It has different behavior in DSLR and CCD/CMOS modes.*

• **Canon EOS mode**

In EOS mode LiveView is a feature provided by the camera to get real time images. It is affected by settings ISO and Exposure that can be controlled from Camera Tab (DSLR Mode). By default APT will use for LiveView the highest ISO and Exposure settings in order to provide high sensitivity suitable for deep space objects. This feature is named LiveView Automation and can be disabled/enabled from Main Settings Tab.

Using "Zoom +" and "Zoom -" you can increase/decrease the LiveView zoom level to 5x (or 10x if it is clicked two times). For most EOS cameras Zoom x5 is very close to the representation "1:1" - "one pixel from the image, represents one sensor pixel". It is valuable feature for planetary astro-photography.

**Troubleshoot: If the Zoom+ is not working, then go to the camera menu and disable the Face Detection feature (for the newer models use "FlexiZone AF" not "Live AF"). It is not compatible with LiveView zoom.**

**Tips & Tricks:** *To place the zoom window in the center of the image, use Shift+Double click.*

**Tips & Tricks:** *When Zoom x5 or x10 is enabled APT shows small cross to mark the exact center of the camera sensor. It is useful when precise star alignment is needed.*

• **Nikon mode**

In Nikon mode LiveView is a feature provided by the camera to get real time images. It **not** is affected by settings ISO and Exposure that can be controlled from Camera Tab (DSLR Mode). For Nikon cameras you can disable the feature LiveView Automation from Main Settings Tab.

Using "Zoom +" and "Zoom -" you can increase/decrease the LiveView zoom level to from 0% to 100%. For most Nikon Zoom 100% is the representation "1:1" - "one pixel from the image, represents one sensor pixel". However the poor quality of the LiveView stream doesn't allow it usage for planetary astro-photography.

**Tips & Tricks:** *To place the zoom window in the center of the image, use Shift+Double click.*

• **In CCD/CMOS mode**

In CCD/CMOS mode LiveView takes endless series of images that are not stored on the hard disk. The Binning, Gain and Exposure settings can be controlled from the Camera Tab (CCD/CMOS mode). If the feature LiveView Automation is enabled APT will select automatically the biggest supported Binning settings to maximize the sensitivity. This feature can be disabled/enabled from Main Settings Tab.

The CCD/CMOS cameras have no hardware supported Zoom. In order to make a software zoom you can use Tools->Magnifier feature.

The LiveView works in this mode for the cameras connected via ASCOM driver, SBIG, INDIGO/INDI. Sometimes is also referred as "Images LiveView"

• **In native PlayerOne / QHY / ToupTek / ZWO mode (Video LiveView)**

When a native connection is made to a **PlayerOne / QHY / ToupTek based / ZWO** camera, the following dialogue box will be opened on LiveView activation.

i, shorter exposures and possibility to use automatic exposure duration and gain value (depends on the camera model). Un-checking the option "Video LiveView" switches to "Images LiveView" where the exposure parameters are controlled from the Camera Tab (CCD/CMOS mode)

## Histogram

*The Histogram is accessible from Tools tab or with Alt+H shortcut.*

*Related videos:*
*Histogram*

The Histogram Aid is an important and powerful feature that can be used to see if image is properly exposed or to make Screen Stretch or Levels over image to see fainter details. This is "on screen" operation and the saved image is not altered!

The histogram is a graphical representation of the tonal distribution in the image. It shows the number of pixels for each tonal value. The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that have this particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium bright areas and the right hand side represents bright and pure white areas.

You can set one black and one white point. The black point defines the left part of the histogram that you want to exclude (dark areas). The white point defines the right part of the histogram that you want to exclude (bright areas). The range between the black and the white points is the one that is showed on the screen. When this range is smaller than the original one stored in the image the remaining tones are intensified. This action is known as Screen Stretching or Levels filter. When the back point is in the very left and the white point is in the very right, the image is un-stretched and all tones are showed as they are stored in the image.

In order to provide better control and more clean user interface, the Histogram Aid has different look in DSLR and CCD/CMOS modes.

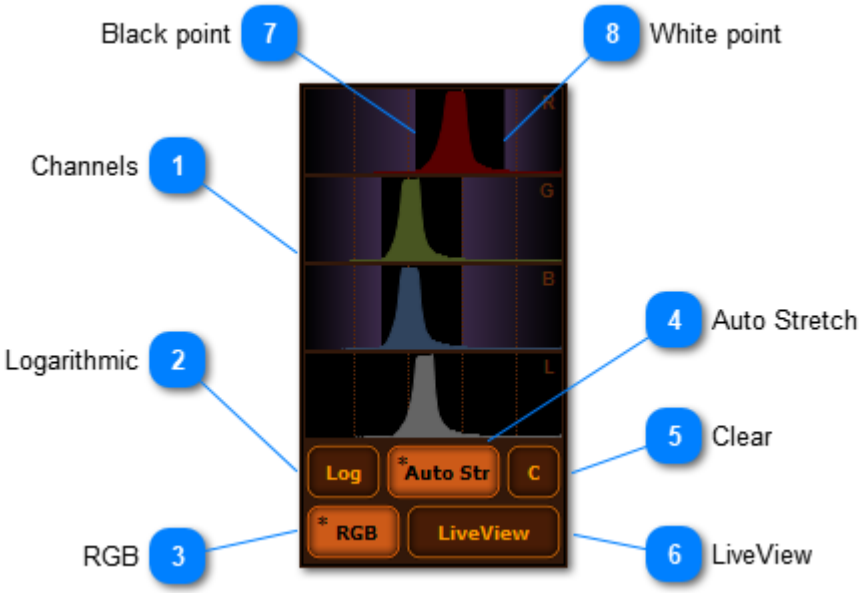
## DSLR Mode

*The Histogram is accessible from Tools tab or with Alt+H shortcut.*

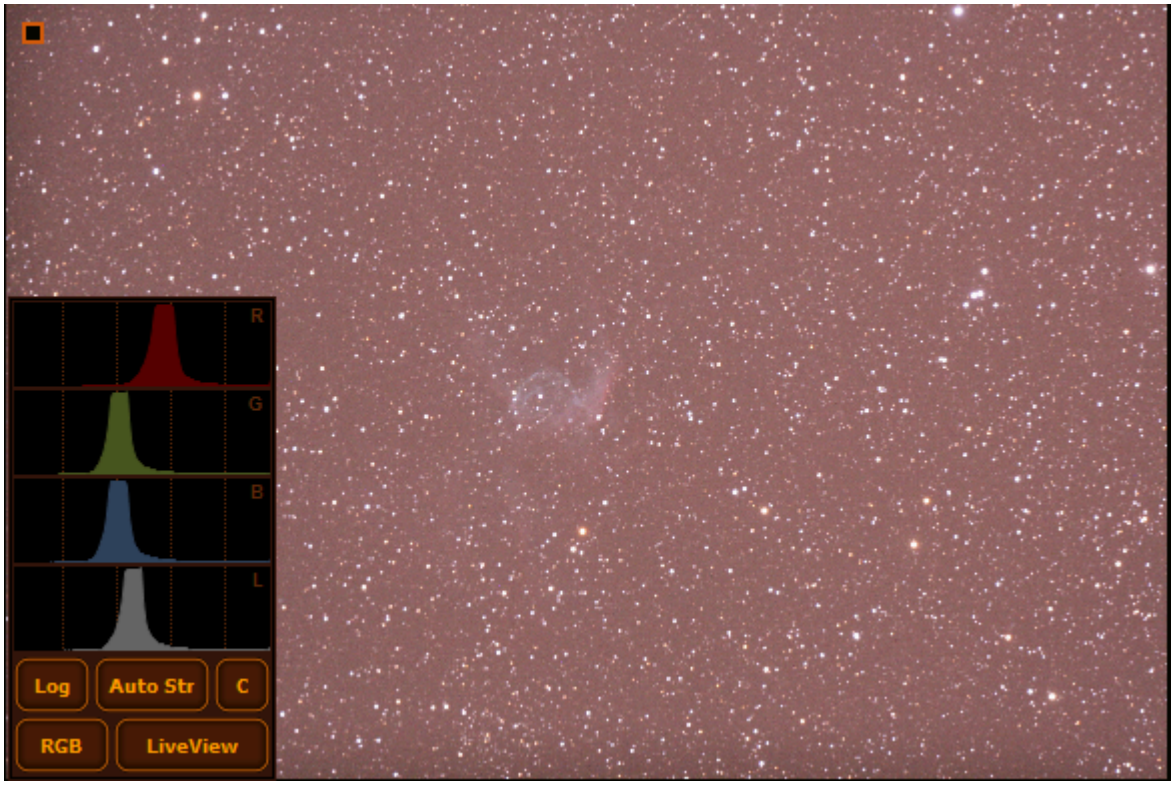
*Related videos:*
*Histogram*

This is how Histogram Aid looks like when APT is in DSLR mode (Canon or Nikon). It shows the histograms of R, G and B channels as well as the combined L (luminance) channel. The histogram area is divided in 5 logical sectors. For astro imaging is good to inspect the all the channels and to select exposure / ISO combination that places the peaks in the second or/and third sector. This gives images that after stacking allow easier post-processing. If the peaks are in the left most sector this means that the image is under exposed. If the peaks are in the last two sectors the image is over exposed. Both case will lead to information lost and less options for post-processing. The right exposure / ISO combination depends on various factors like sky glow, object size, object brightens, sensor sensitivity and etc.

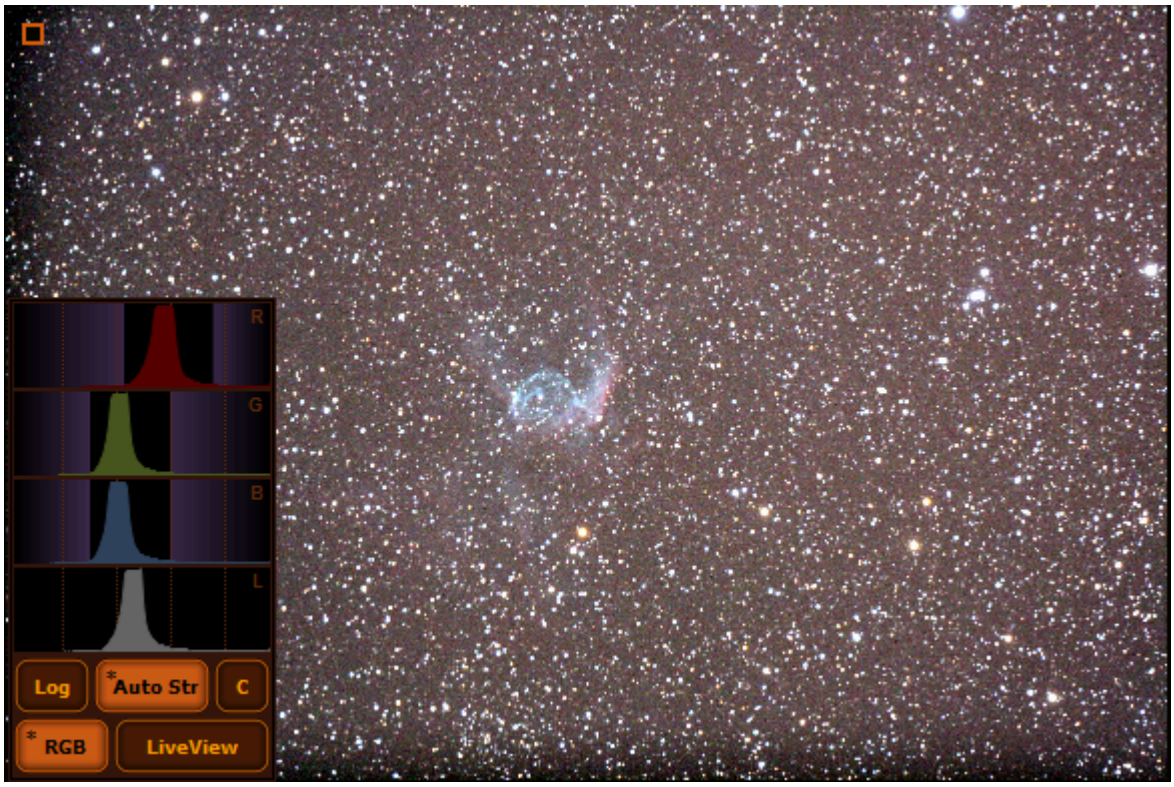
APT allows defining separate black/white points for the different R, G and B channels (by highlighting the RGB button) or for the L channel. The RGB mode is very useful when modified DSLR camera is used because gives possibility to make on-screen color balance and to get idea how the post-processed image will look like. It is recommended to use this mode even to un-modified cameras because it takes the most of the signal per every channel.



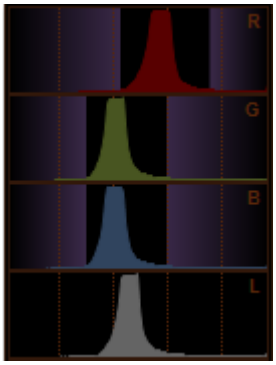

The "Auto Stretching" is a powerful feature. It makes automatic selection of the optimal black and white points (per L or per RGB) and by this boosting the weak signal. Here is an un-stretched image (black point in very left, white point in very right) taken with modified Canon EOS camera.




This is the same image with "Auto Stretching" feature enabled in RGB mode. The stretching is made per each channel separately in order to get the best from every one. As you can see the object can be seen much better and the image has better color balance.




## 1 Channels




Shows the histograms of per R, G and B channels and for the combined L (luminance) channel.

## 2 Logarithmic




When is active (high-lighted) it shows a logarithmic representation of the data.

## 3 RGB




When is active (high-lighted) it allows defining separate black and white points per R, G and B plans. When not is active (high-lighted) the black and white points are only for the L channel.

It also defines if the Auto Stretching works per L or per RGB.

### 4 Auto Stretch




When is active (high-lighted) it makes automatic selection of the black and white points. If the RGB mode is enabled the black/white points are determined per every channel. If RGB mode is disabled black/white points are determined per L channel only.

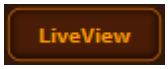
You can control how aggressive the automatic stretching needs to be by the option "DSLR Histogram Auto-Stretch Factor" in Advanced setting tab.

### 5 Clear




Disables the Auto Stretching mode (if it is enabled) and clears all set black/white points.

### 6 LiveView




When is active (high-lighted) the histogram will be calculated for the LiveView stream. Also it applies the Auto Stretching mode or the manually defined black/white points (per L or RGB depending on the RGB mode) on the stream.

Note that it can affect the frames-per-second rate of the LiveView stream when used on slower computer.

### 7 Black point



Shows where the black point is set. When Auto Stretching is disabled you can set the point manually using the following combinations. **Shift+Double Left click** set the black point. **Shift+Double Right click** clears the black point.

### 8 White point



Shows where the white point is set. When Auto Stretching is disabled you can set the point manually using the following combinations. **Double Left click** set the white point. **Double Right click** clears the white point.

## CCD/CMOS Mode

*The Histogram is accessible from Tools tab or with Alt+H shortcut.*

*Related videos:*
*Histogram*

This is how Histogram Aid looks like when APT is in CCD/CMOS mode. Usually the CCD/CMOS sensors have from 12 to 16bits dynamic range which is hard to be displayed on screen especially when we talk about combination of weak object and brights stars. Because of that there is need to make a signal compression and/or signal boost (stretching) in order to see more details from the raw data. The Histogram Aid allows to combine both compression and stretching in order to see most of the faint data without using processing application. The stretching is implemented by two types - by placing black and white points manually or automatic (by calculating good black/white points) or with fully automatic stretching like "Screen Transfer Function" in PixInsight which is analyzing the image for showing most of the weak signal.

In short when **Auto** is enabled there are four options for automatic stretching:

1. Calc 1 - moderate automatic image stretching without black/white points
2. Calc 2 - more aggressive automatic image stretching without black/white points
3. Points L - automatic black/white points calculation based on the most left data peak
4. Points R - automatic black/white points calculation which includes all data peaks

**Note: There is no need to keep the Histogram open in order to apply the stretching on the new images displaying. Also, the state of Auto and Method are saved between the sessions. You can enable Auto with Calc-1 and keep the Histogram Aid closed most of the time, saving screen space. This combination will work very well for the majority of the objects.**

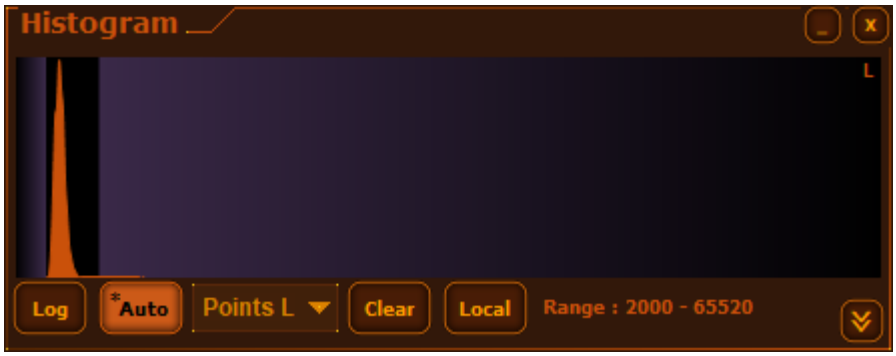
See below for details how to use Histogram Aid in more details.

When you are working with black/white points, there is possibility to apply histogram compression using **Local** mode. When this mode is enabled APT makes one automatic compression by determining the lowest and highest tones in the current image and to work with this limited Range allowing mode detailed stretching. This is similar to defining additional black/white points that bounds the recorded signal and excluding the left and right areas without data.

In the sample below the Range is from 2000 to 65520 which means that there is no pixels with ADU less than 2000 and bigger than 65520, so there are set hidden black/white points at these borders. Also very left point of the graph shows the tine 2000, the very right shows 65520.

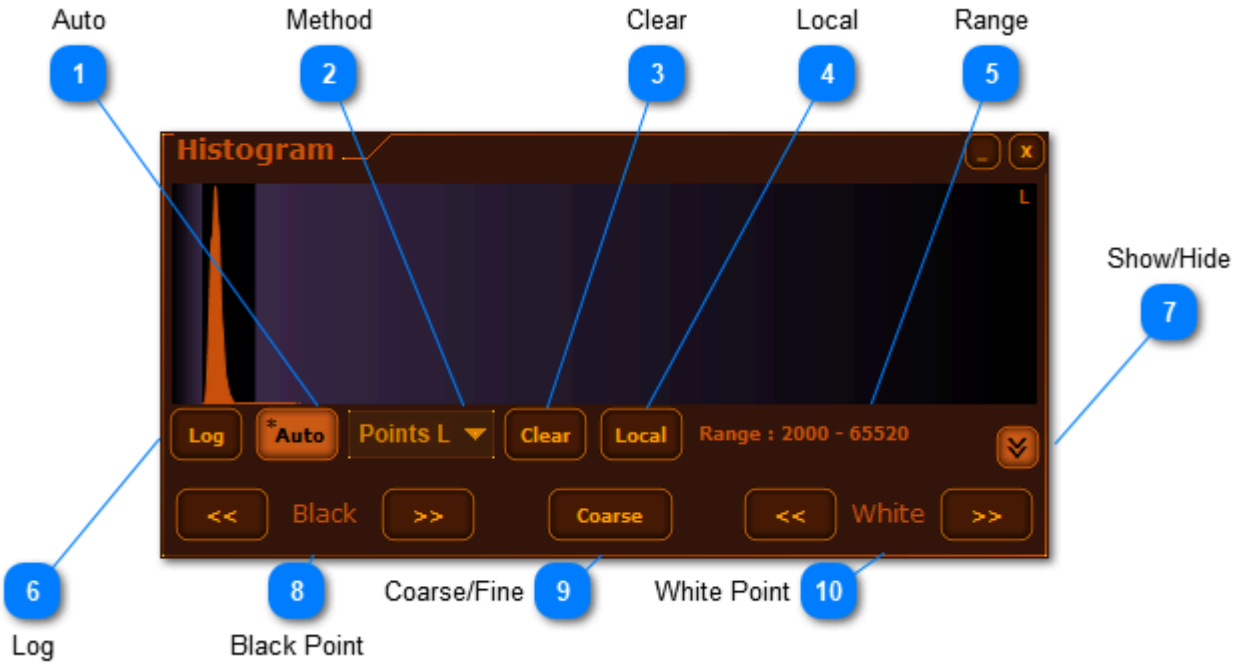



When Local is disabled the histogram shows and works with the whole 0 - 65535 range and here is how the same data look like.




Enabling Local mode works well for bright frames (light, flats, framing), but sometimes lead to different screen representation of "similar" to dark and bias (sometimes flat) frames where the Range is very small. Random hot pixels can change the Range and as result two bias frames can have different brightness on the screen. There are no problems because the stored data is fine and this is only screen representation. Sometimes the automatic stretching works better with enabled Local mode, in other situations stretching on whole range gives better preview. It depends on how faint the object is, exposure, sky conditions and etc.

Follows detailed description of the Histogram features.




The screen below shows how defined black/white point looks like. The dark area is the range between the black and the white point that will be used for manual or automatic screen stretching. When Auto Stretching is disabled you can set the point manually using the following combinations. **Shift+Double Left click** set the black point. **Shift+Double Right click** clears the black point. **Double Left click** set the white point. **Double Right click** clears the white point. Below are described and other way to move the points.

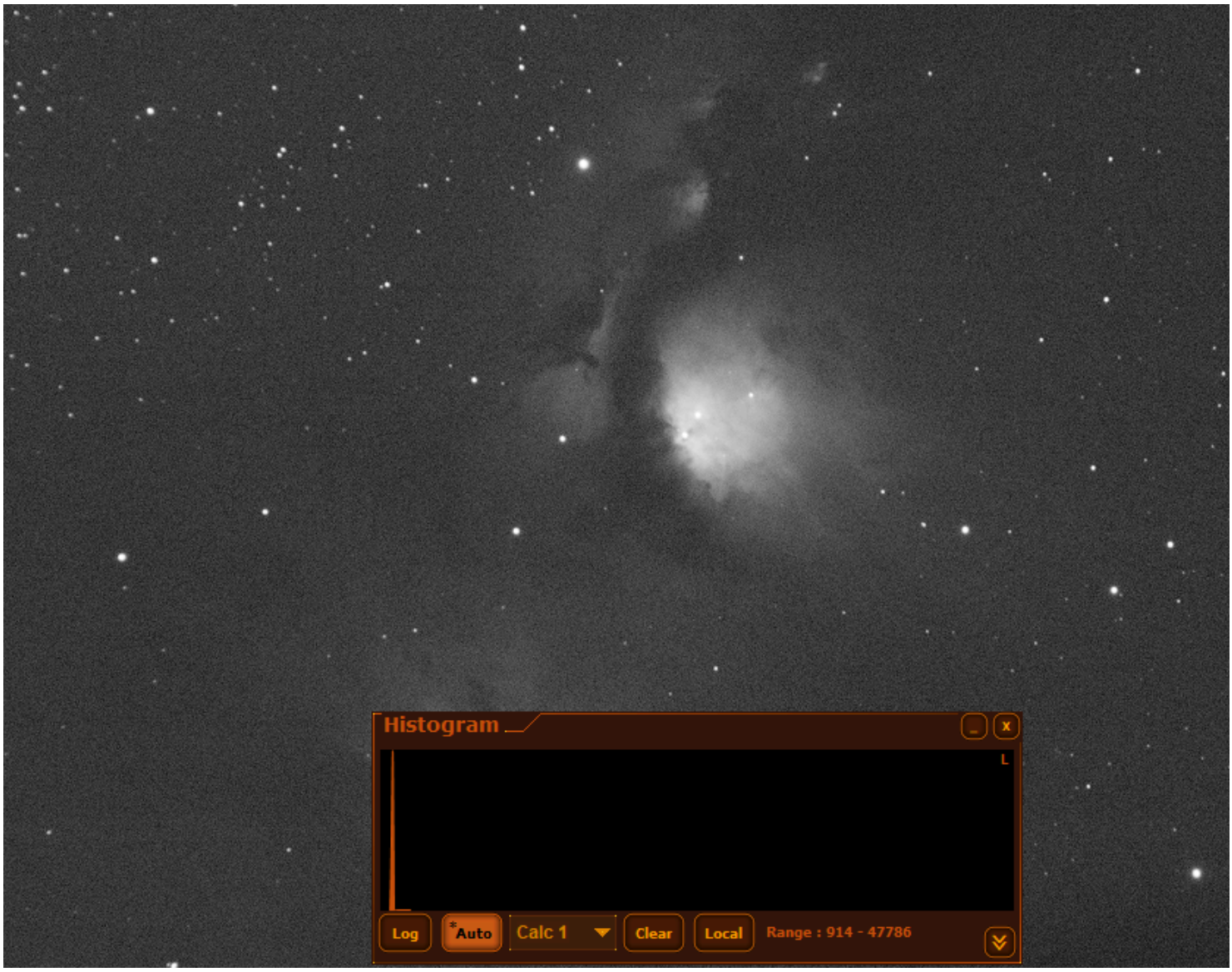



The image stretching is invaluable option when we are working with weak signal (which is 99.9% of the time), saving the time to transfer the image to an image processing application just to see where and if the object is in the Field Of  View - FOV.

Here is a sample of un-stretched image. As you see, only few stars are visible.




This is the same image after applying the Auto with "Calc -1" method. The M78 nebula becomes more than obvious.



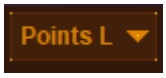

## 1 Auto




Enables/Disables the automatic stretching. When enabled the selected stretching method will be applied on the image preview. Note that it doesn't affect the stored image data.

**Note: There is no need to keep the Histogram panel open for automatic stretching to apply to new images. The settings for both "Auto" and the selected method are saved between sessions.**

## 2 Method




Defines what method to be used for the automatic image preview stretching:

1. Calc 1 - moderate automatic image stretching without black/white points. Works very well in most of the cases

2. Calc 2 - more aggressive automatic image stretching without black/white points. Works when the object is very faint and hard to be seen
3. Points L - automatic black/white points calculation on most left data peak. Works with the most left peak in the histogram where deep sky objects usually live and gives better results when there are many saturated areas in the image.
4. Points R - automatic black/white points calculation which includes all data peaks. Works better when there are several signal peaks that you want to use or just one peak and when there are no many saturated areas.

**Note: There is no need to keep the Histogram panel open for automatic stretching to apply to new images. The settings for both "Auto" and the selected method are saved between sessions.**

### 3 Clear




Disables Auto stretching and clears the set black and white points.

### 4 Local




Switches between the use of the local range and the whole 0 - 65535 ADU range. When Local is enabled the histogram and the stretching will show/use only the Range where there is signal.

### 5 Range




Shows the image signal range.  The weakest and strongest tones stored in the current image.

### 6 Log



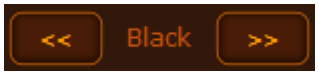

When is active (high-lighted) it shows the logarithmic representation of the data.

### 7 Show/Hide



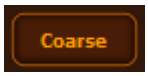
Show/Hides the section for "by step" black/white points moving in manual mode when Auto is disabled.

### 8 Black Point



Moves the black point in left or right with the selected step (Coarse/Fine). Works when Auto is disabled.

### 9 Coarse/Fine




Switches between the Coarse and Fine fine step modes. Works when Auto is disabled.

### 10 White Point




Moves the white point in left or right with the selected step (Coarse/Fine). Works when Auto is disabled.

## Plan Editor

*The Plan Editor is accessible from Camera tab.*

*Related videos:*
*Plan Editor - 2, Plan Editor*

The imaging plan defines a set of exposures that you want APT to take.

In order to provide better control and more clean user interface, the Plan Editor has different look in DSLR and CCD/CMOS modes. Also APT keeps separate sets of plans for the two modes. See Select Camera Type section to see how to change the mode.

A plan which is in running execution can not be changed, there is no problem to edit the others.

## DSLR Mode

*Plan Editor can be opened from Camera tab by using the Edit button or by double click in the table for the current plan.*
*If a plan is loaded the editor will be initialized.*

*Related videos:*
*Plan Editor - 2, Plan Editor*

There are six different plan types that have different properties:

| Type | Short prefix | Long Prefix | Dithering | Note |
|---|---|---|---|---|
| Light | L_ | Light_ | Yes | |
| Light Auto | LA_ | LightAuto | Yes | Uses AV dial mode to determine the exposure. Useful for eclipses imaging. |

| | | | | |
|---|---|---|---|---|
| Dark | D_ | Dark_ | No | |
| Bias | B_ | Bias_ | No | If Advanced Bias/Flats is disabled uses the shortest supported exposure |
| Flat | F_ | Flat_ | No | If Advanced Bias/Flats is disabled uses AV dial mode to determine the exposure; Flat Box Controllers / Panels could be used during plan execution |
| Dark Flat | DF_ | DarkFlat_ | No | |
| Frame/Focus | | | No | Doesn't store images on the disk/card |

What prefix type will be used is selected form Name Parts in Main Settings tab.

**Important Nikon note**: Some of the Nikon models (D5000, D5100, D5200, D5300, D5500, D5600, D90, D80, D60, D40, Df) doesn't allow to use the AV dial mode without attached lens. For these models Light Auto is useless and also for Flats there is need to enable the option Advanced Bias/Flats and enter exposure duration. You can use the Shoot button the Histogram to find the right exposure. The histogram peak should be in the send section from left to right.

If you have a Nikon model that can handle AV mode without lens, in the camera menu go to section Setup -> option "Non-CPU Lenses", enter the focal length and the focal ratio of the telescope, then disable the option Advanced Bias/Flats disable the option Advanced Bias/Flats and let APT to do the automation.




## 1 Plan : Select / Create / Delete All




Here you can select for editing one of the existing plans or create a new one.

To create a new plan select from the list one of the options:

- Add New Light Frames Plan
- Add New Light Auto Frames Plan
- Add New Dark Frames Plan
- Add New Flat Frames Plan
- Add New Bias Frames Plan
- Add New Focusing / Framing Plan
- Add New Dark Flats Plan

This will create the corresponding plan and will give possibility to edit it.

If you want to delete all plans from a type you can use one of the options

- Delete All Light Frames Plan
- Delete All Light Auto Frames Plan
- Delete All Dark Frames Plan
- Delete All Flat Frames Plan
- Delete All Bias Frames Plan
- Delete All Focusing / Framing Plan
- Delete All Dark Flats Plan

Two confirmations are required in order to avoid mistakes. Even after them clicking on Cancel button will keep the plans.

### 2 Plan Name




Allows entering the name you want to use for the selected plan.

### 3 Delete plan



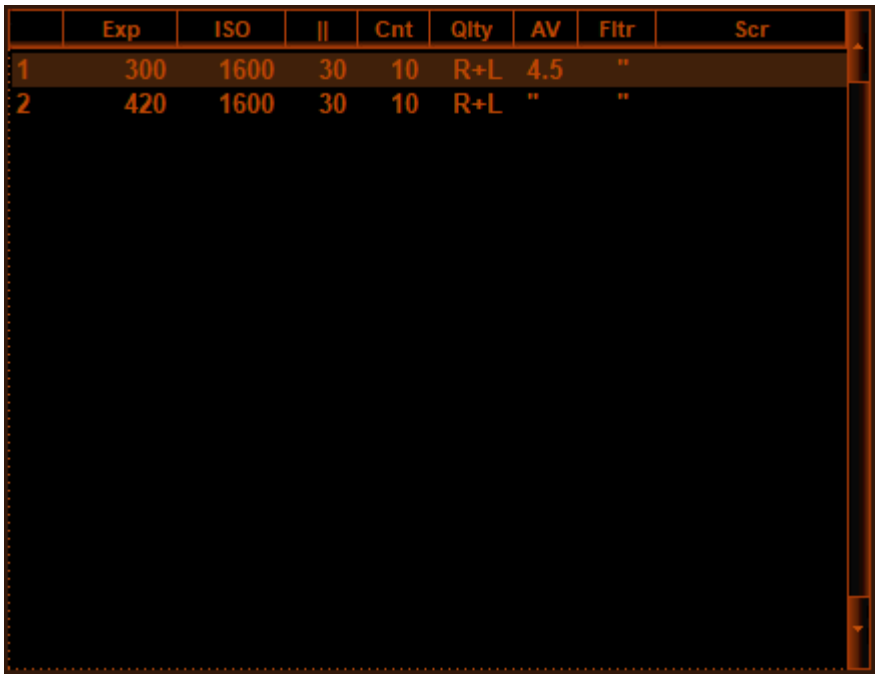

Deletes the currently selected plan.

### 4 Clone plan




Makes a copy of the current plan with possibility to change the type and loads the new one for editing. This is an easy way to create matching light and dark plans.

### 5 Plan List




List of the defined exposures. Click on the line that you want to edit, move or delete. The parameters of the selected line are loaded in "Add / Edit Exposure" section.

The columns are:

- Order
- Exposure duration
- ISO
- Pause duration
- Count of the exposures
- Quality
- Lens aperture (AV)
- Filter

### 6 Down



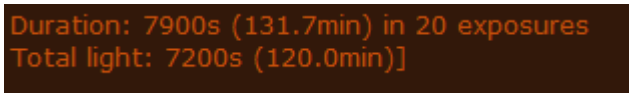

Moves the selected line one position Down.

### 7 Up




Moves the selected line one position Up.

### 8 Plan duration



Shows the expected plan duration. If the current plan is Light type it will show the total light duration that will be gathered.

### 9 Del




Deletes the selected line from the plan.

### 10 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

### 11 Exposure




Defines the duration for every exposure that will be executed by this plan line. Use a duration supported by your camera. The duration is in seconds or fraction of a second.

If you are not sure about the speeds less than a second, make a connection to the camera and check the values available in the Exp list in Camera Tab.

If the exposure duration is 0, the line will make just pause and/or will execute defined Script or Command.

### 12 ISO




Defines what ISO to use for the exposures in this plan line. Use an ISO supported by your camera. If you are not sure, make a connection to the camera and check the values available in the ISO list in Camera Tab.

### 13 Pause




Defines the pause in seconds that have to be made between every exposure from this line of the imaging plan.

**Tips & Tricks** *Longer pauses between exposures reduce the noise in your images.*

### 14 Count




Defines how many images to take by this line of the imaging plan using the defined parameters.

## 15 Quality




Defines the image quality setting to use for the exposures taken by this line of the imaging plan.

| | |
|---|---|
| R+L | Raw + Large JPG |
| L | Large JPG |
| M | Medium JPG |
| S | Small JPG |
| Raw | Raw only |
| *R1L* | *Raw1 + Large JPG* |
| *R2L* | *Raw2 + Large JPG* |
| *S1* | *Small 1 JPG* |
| *S2* | *Small 2 JPG* |

The options in *italic* are not supported by all Canon EOS models and not available for Nikon models!

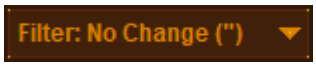
Using quality that doesn't include RAW file, speedups the downloading and is useful for focusing an framing.

## 16 Lens AV




Defines the lens aperture (AV) to use for the exposures taken by this line of the imaging plan. Use the option "No Change" if you don't use EOS lens or don't want to change the aperture.

## 17 Filter

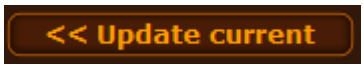



The filter to use for this line of the imaging plan. Use the option "No Change" if you don't use Filter Wheel or don't want to change the filter.

In order to change filters a connection is required to the Filter Wheel during the plan execution.

If the filters are described in Filter Wheel settings tab or if there is active connection to a wheel then this list will show the filter names. In other case the list will contain only position numbers like "Filter 1", "Filter 2"...

## 18 Update current button



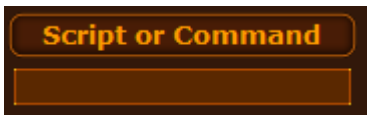

Updates the selected line with the parameters set in section "Add / Edit Exposure".

## 19 Add as new button




Adds a new plan line after the selected one using the parameters set in section "Add / Edit Exposure".

## 20 Script or Command




Allows executing an internal APT command or external script / application. See the Scripts and Commands section.

## 21 Wait script end




When selected APT will wait the external script or application to finish before continuing the execution of the plan. For the internal commands APT always wait the execution to complete.

See the Scripts and Commands section.

## 22 No Dithering




If the current plan is Light Plan, allows disabling the Dithering for this plan only.

## 23 Vertical plan




Allows controlling the plan execution order. When it is unchecked, APT will take all exposures for the first line and then will continue with the next line. When it is checked the execution order will be:

Line1->Exposure1, Line2->Exposure1... LineN->Exposure1
Line1->Exposure2, Line2->Exposure2... LineN->Exposure2
Line1->Exposure3, Line2->Exposure3... LineN->Exposure3
…
Line1->ExposureX, Line1->ExposureX... LineN->ExposureX

The vertical mode is useful if you want to make HDR eclipse images, or when filter wheel is used and you are not sure that weather will permit to gather all channels one after another.

## 24 Import/Export



Export allows to save one or more imaging plans in new file, while Import gives possibility to add saved plans in addition to the current set or overwrite all plans.

## CCD/CMOS Mode

*Plan Editor can be opened from Camera tab by using the Edit button or by double click in the table for the current plan.*
*If a plan is loaded the editor will be initialized.*

*Related videos:*
*Plan Editor - 2, Plan Editor*

There are seven different plan types that have different properties:

| Type | Short prefix | Long Prefix | Dithering | Shutter | Note |
|---|---|---|---|---|---|
| Light | L_ | Light_ | Yes | Opened | |
| Dark | D_ | Dark_ | No | Closed | |
| Bias | B_ | Bias_ | No | Closed | If Advanced Bias/Flats is disabled uses the shortest supported exposure |
| Flat | F_ | Flat_ | No | Opened | Flat Box Controllers / Panels could be used during plan execution |
| Dark Flat | DF_ | DarkFlat_ | No | Closed | |
| Frame/Focus | | | No | Opened | Doesn't store images on the disk |
| Mixed | L_, D_, _F, _DF or B_ | Light_, Dark_, _Flat, _DarkFlat or Bias_ | Yes for Lights | Opened or Closed | Allows creation of one plan that takes light, dark, flat, dark flat and bias frames. Requires mechanical shutter or filter wheel with covered position |

What prefix type will be used is selected from Name Parts in Main Settings tab.
Shutter column shows how the shutter is controlled when there is mechanical shutter available.




## 1 Plan : Select / Create / Delete All




Here you can select for editing one of the existing plans or create a new one.

To create a new plan select from the list one of the options:

- Add New Light Frames Plan
- Add New Dark Frames Plan
- Add New Flat Frames Plan
- Add New Bias Frames Plan
- Add New Focusing / Framing Plan
- Add New Dark Flats Plan
- Add New Mixed Plan

This will create the corresponding plan and will give possibility to edit it.

If you want to delete all plans from a type you can use one of the options

- Delete All Light Frames Plan
- Delete All Dark Frames Plan
- Delete All Flat Frames Plan
- Delete All Bias Frames Plan
- Delete All Focusing / Framing Plan
- Delete All Dark Flats Plan
- Delete All Mixed Frames Plan

Two confirmations are required in order to avoid mistakes. Even after them clicking on Cancel button will keep the plans.

## 2 Plan Name




Allows entering the name you want to use for the selected plan.

## 3 Delete Plan



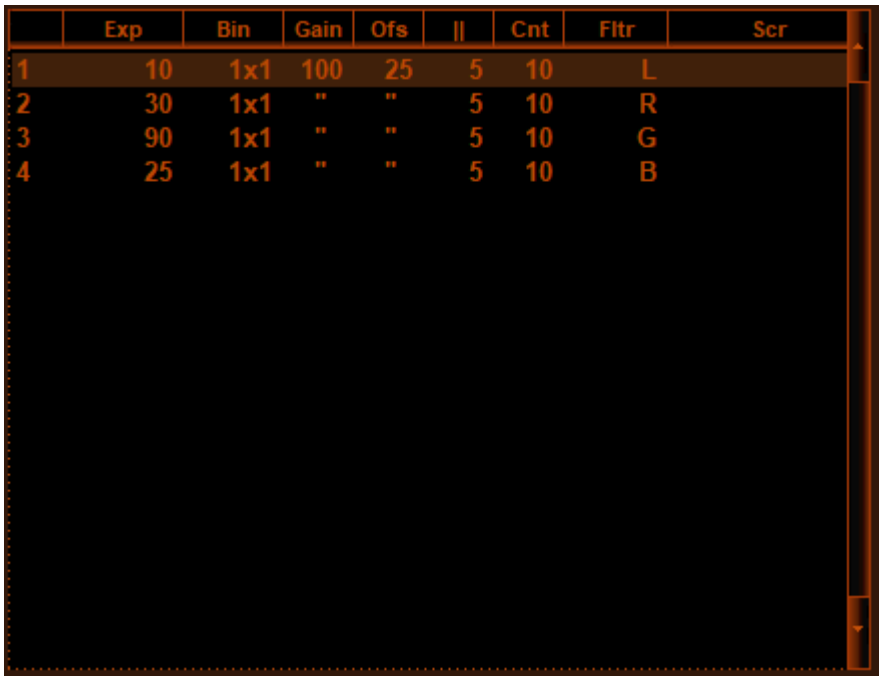

Deletes the currently selected plan.

## 4 Clone As




Makes a copy of the current plan with possibility to change the type and loads the new one for editing. This is an easy way to create matching light and dark plans.

## 5 Plan list




List of the defined exposures. Click on the line that you want to edit, move or delete. The parameters of the selected line are loaded in "Add / Edit Exposure" section.

The columns are:

- Order
- Exposure duration

- Binning
- Pause duration
- Count of the exposures
- Filter

### 6 Down



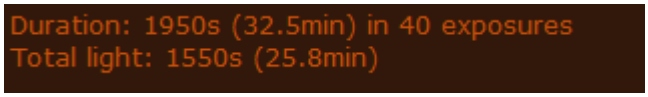

Moves the selected line one position Down.

### 7 Up




Moves the selected line one position Up.

### 8 Plan duration




Shows the expected plan duration. If the current plan is Light type it will show the total light duration that will be gathered.

### 9 Del




Deletes the selected line from the plan.

### 10 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

### 11 Exposure




Defines the duration for every exposure that will be executed by this plan line. Use a duration supported by your camera. The duration is in seconds or fraction of a second.

If the exposure duration is 0, the line will make just pause and/or will execute defined Script or Command.

## 12 Binning




Defines what binning to use for the exposures in this plan line. Use an binning supported by your camera. If you are not sure, make a connection to the camera and check the values available in the Bin list in Camera Tab.

*Tips & Tricks: Most likely you are using symmetric binning - 1x1, 2x2, 3x3, so you can enter only 1, 2 or 3 in the Binning field. APT will fill automatically the other dimension.*

## 13 Gain




Defines what gain to use for the exposures in this plan line. If there are no gain values defined per line will be used value per filter in Filter Wheel settings tab the value. If there is no gain value per filter then will be used the Gain value defined in the Camera Tab.

Note: The option Manage Gain should be enabled in CCD Settings

## 14 Offset/Blacklevel




Defines the offset/blacklevel to be used for the exposure. Leaving empty will not change the offset/blacklevel, will use the one set in Settings in Camera Tab.

## 15 Pause




Defines the pause in seconds that have to be made between every exposure from this imaging plan line.

## 16 Count




Defines how many images to take by this line of the imaging plan using the defined parameters.

## 17 Filter

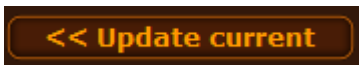



The filter to use for this line of the imaging plan. Use the option "No Change" if you don't use Filter Wheel or don't want to change the filter.

In order to change filters a connection is required to the Filter Wheel during the plan execution.

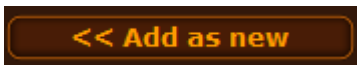
If the filters are described in Filter Wheel settings tab or if there is active connection to a wheel then the list will show the filter names. In other case the list will contain only position numbers like "Filter 1", "Filter 2"...

### 18 Update current button



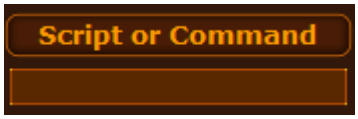

Updates the selected line with the parameters set in "Add / Edit Exposure" section.

### 19 Add as new button



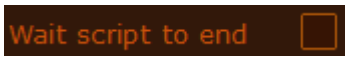

Adds a new plan line after the selected one using the parameters set in "Add / Edit Exposure" section.

### 20 Script or Command




Allows executing an internal APT command or external script / application. See the Scripts and Commands section.

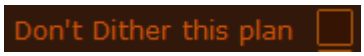
### 21 Wait script end




When selected APT will wait the external script or application to finish before continuing the execution of the plan. For the internal commands APT always wait the execution to complete.

See the Scripts and Commands section.

### 22 No dithering




If the current plan is Light Plan, allows to disable the Dithering for this plan only.

### 23 Vertical plan




Allows controlling the plan execution order. When it is unchecked, APT will take all exposures for the first line and then will continue with the next line. When it is checked the execution order will be:

Line1->Exposure1, Line2->Exposure1... LineN->Exposure1
Line1->Exposure2, Line2->Exposure2... LineN->Exposure2
Line1->Exposure3, Line2->Exposure3... LineN->Exposure3

…
Line1->ExposureX, Line1->ExposureX... LineN->ExposureX

The vertical mode is useful if you want to make HDR eclipse images, or when filter wheel is used and you are not sure that weather will permit to gather all channels one after another.

### 24 Import/Export




Export allows to save one or more imaging plans in new file, while Import gives possibility to add saved plans in addition to the current set or overwrite all plans.

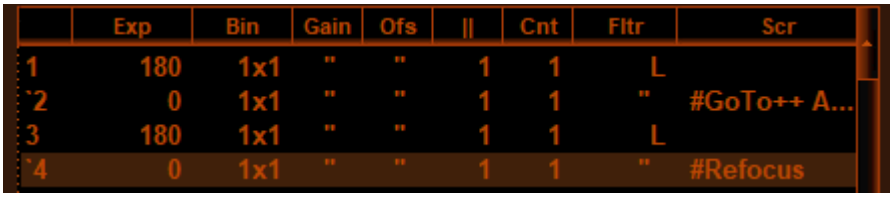
## Scripts and Commands

The Plan editor provides advanced control over the imaging session. It is possible to execute internal APT commands or external scripts and programs after exposure end. Enter the command that you want to be executed in the field “Script”. If you check the box “Wait script to end” the execution of the script/program will be synchronous and APT will not continue with the next exposure until the end of the external operation. Leaving it unchecked APT will execute the command asynchronously and will continue with the plan as soon as the script/program is started. The internal APT commands are executed always synchronously.

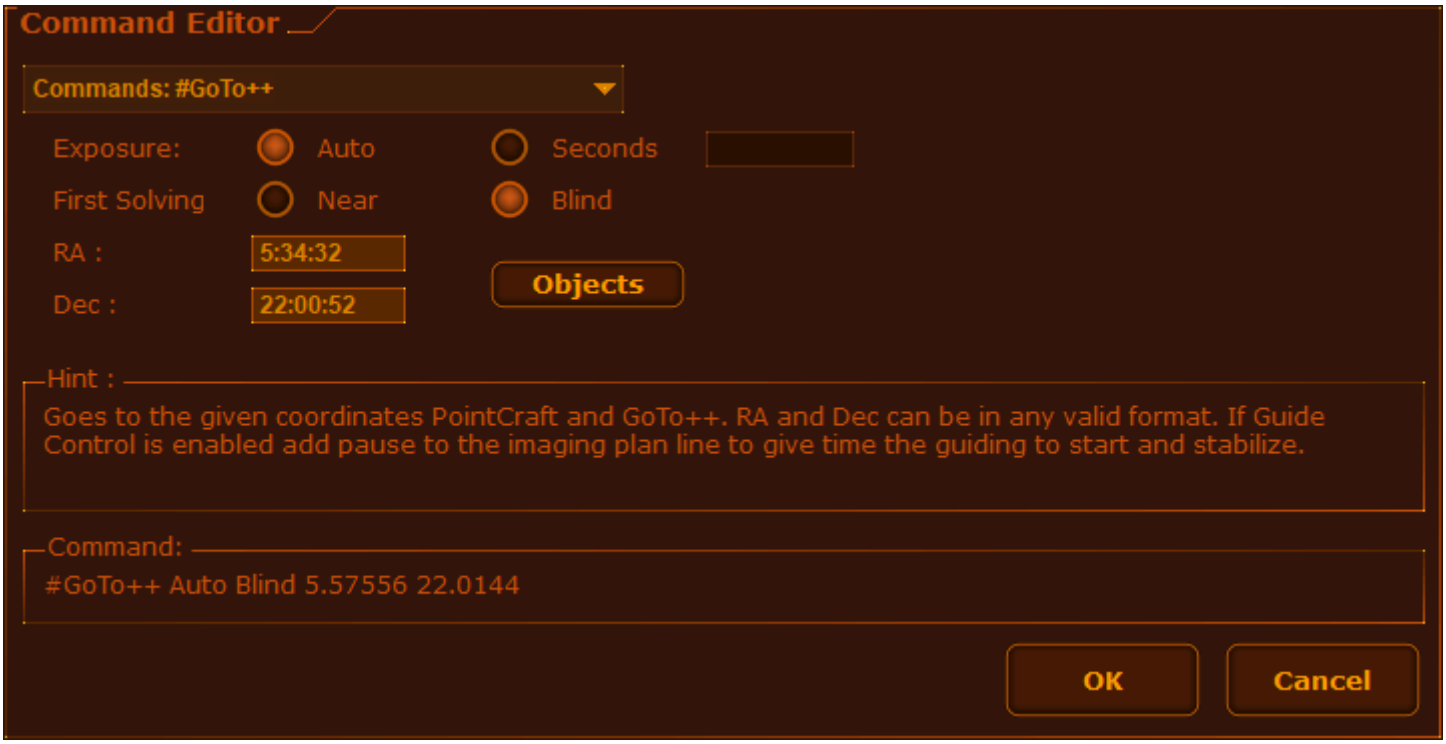
In order easily to see which lines in a imaging plan has advanced behavior, they are marked with apostrophe (') character. You can see this in both Plan Editor and in Camera Tab.

You can combine the scripts/commands with 0s exposures. This allows executing a script/program or command without taking an image for example - to rotate to dome or to close the roof in the plan end.

In this example the lines 2 and 4 are set to execute internal commands without making exposures:




APT has a dedicated editor for Scripts and Commands which saves the need to format manually the required parameters. It also gives a short information about every command. To open this editor click on the button "Script or Command" in Plan Editor. The screenshot below shows a formatted command for GoTo with Ra/Dec populated using the Object Browser.




Here is the list of the supported internal APT commands and their parameters. Note that hash (#) is required in order to determine that you want to execute internal command

• **#CCDGain** - changes the CCD/CMOS Gain to a new integer value.
Syntax: #CCDGain Number

• **#CCDCool -** Cools the CCD/CMOS camera. Without parameter or with Auto uses the settings set in Cooling Aid. XX.X sets the target cooling temperature. The parameter A-XX.X will sets cooling to XX.X below the ambient temperature. Requires a temperature sensor to determine the ambient temperature.
Syntax: #CCDCool XX.X/auto/A-XX.X

• **#CCDPower** - Enables or disables CCD/CMOS camera cooling power
Syntax: #CCDPower On/Off

• **#CCDWarm -** Warms the CCD/CMOS. Without parameter uses the settings set in Warming Aid. XX.X sets the target warming temperature. Auto uses a temperature sensor to set the target. The command is using Warming Offset set in CCD Settings Tab
Syntax: #CCDWarm XX.X/auto

• **#CCDOffset** - changes the CCD/CMOS Offset or Black Level to a new integer value. Works only when native ZWO or AltairAstro connection is used.
Syntax: #CCDOffset Number

• **#ConditionalStop** - stops the execution of the current plan when condition is met. Once the command is used in a plan the condition will be evaluated after every exposure no matter if there other commands are used. If other #ConditionalStop is used then it will become the active condition. There are many parameters that can be used. The Script Editor makes the usage much easier!
Syntax: #ConditionalStop EndDSD PlanName - will stop the plan on Deep Sky Darkness end and will execute the imaging plan with the defined name (if plan name is given)
Syntax: #ConditionalStop EndAN PlanName - will stop the plan on Astro Night end and will execute the imaging plan with the defined name (if plan name is given)

Syntax: #ConditionalStop EndN PlanName - will stop the plan on Night end and will execute the imaging plan with the defined name (if plan name is given)
Syntax: #ConditionalStop Alt XX.XX PlanName - will stop the plan when object's Altitude goes bellow the given number and will execute the imaging plan with the defined name (if plan name is given)
Syntax: #ConditionalStop Time XX:XX PlanName - will stop the plan when the defined time is passed and will execute the imaging plan with the defined name (if plan name is given)
Syntax: #ConditionalStop BeforeMeridian XX PlanName - will stop the plan if the object is less than XX minutes from the meridian passing and will execute the imaging plan with the defined name (if plan name is given)

• **#CoverState** - changes the state of the connected Panel / Cover to opened or closed.
Syntax: #CoverState Opened/Closed

• **#DataTransfer** - Starts the transfer of the queued files in DataCraft.
Syntax: #DataTransfer

• **#DitherN** - changes the "Dither on # of images" value.
Syntax: #**DitherN** Number

• **#DomeHome** - moves the Dome to home position.
Syntax: #DomeHome

• **#DomePark** - moves the Dome to park position.
Syntax: #DomePark

• **#DomeShutterClose** - closes the Dome shutter or the moving roof.
Syntax: #DomeShutterClose

• **#DomeShutterOpen** - opens the Dome shutter or the moving roof.
Syntax: #DomeShutterOpen

• **#DomeSlaved** - enables/disables the Dome slaving to the telescope position.
Syntax: #DomeSlaved On/Off

• **#ExecutePlanAtTime** - Enables or disables ExecutePlanAtTime option in SessionCraft
Syntax: #FocusCraftCalculation On/Off

• **#FocusCraftCalculation** - enables/disables the focus metrics calculation. Controls the Calculate option in FocusCraft
Syntax: #ExecutePlanAtTime On/Off

• **#FocusCraftMethod** - defines what method to use for focus metrics calculation in FocusCraft, The ASTAP parameter enables the "Use ASTAP" option. The InvPower parameter enables the "InvPower Mode" option. HFD parameter uchecks the other to options and forces FocusCraft to use APT internal HFD calculation.
Syntax: #FocusCraftMethod HFD/ASTAP/InvPower

• **#FocuserGoTo** - moves the focuser to given position or the string @1 or @2 or @3 which corresponds to the stored positions in Gear tab
Syntax: #FocuserGoTo Number

• **#FocuserMove** - moves the focuser with the defined step. Negative number is inward move, positive number is outward move
Syntax: #FocuserMove Number

• **#Home** - moves the telescope to the Home position

Syntax: #Home

• **#GoTo++** - Goes to the given coordinates using PointCraft and GoTo++. If Guide Control is enabled will command completion the guiding will be re-engaged. The first parameter defines how many seconds to be the exposures for the GoTo++. Auto will use the exposure defined in the Camera Tab or the default exposure set in PointCraft settings. The second parameter defines what solving to use for the first exposure. If the scope is not aligned you can select Blind solving for the first step of GoTo++, next steps will use Near solving. Follows the RA and Dec which can be in any valid format (XX.X or hh:mm:ss/dd:mm:ss). The parameter FastCheck will use the current image on the screen as first step of the GoTo++ process. It is handy if you use the #GoTo++ for periodically re-centering the target during the image plan. the last take image will be used instead of taking dedicated image. If there are letters after Dec or FastCheck it will be used as Object Name and will be used for file naming, folders and etc. If there is connected Rotator is possible to @Angle as last part of the command to define the desired Field-Of-View Angle.
Syntax: #GoTo++ XX/Auto Blind/Near RA Dec FastCheck ObjectName @Angle

• **#GoTo** - Goes to the given coordinates. RA and Dec can be in any valid format (XX.X or hh:mm:ss/dd:mm:ss). If Guide Control is enabled will command completion the guiding will be re-engaged.
Syntax: #GoTo RA Dec

• **#GoToOffset** - Goes to an offset from current position. The offset is in arc-minutes from current RA/Dec position. If Guide Control is enabled will command completion the guiding will be re-engaged.
Syntax: #GoToOffset RAoffset DecOffsed

• **#GoToAltAz** - Goes to the given Altitude/Azimuth coordinates. Alt and Az are in degrees. If Guide Control is enabled will command completion the guiding will be re-engaged.
Syntax: #GoToAltAz Alt Az

• **#GuideControl** - Stops or starts guiding (works for PHD2 / PHD1 / MGEN2/3 ). When the guiding is starting, define a pause in the imaging plan line to give some time the guiding to stabilize.
Syntax: #GuideControl  Start/Stop

• **#LoadImage** - Loads an image. The parameter is the image full path and file name or the word "Auto". Use "Auto" to load the last take image. If no image is taken in this session yet, will be loaded the last take image from the previous session.
Syntax: #LoadImage PathName/Auto

• **#NextPlan** - Defines plan that the be executed after completion of the current plan. This command just defines next plan, it will not be executed before current plan completion, so there is no problem to use the command in Vertical plans. Note that if there are more than one plan with same name, will be executed the first one found in the plans list.
Syntax: #NextPlan PlanName

• **#PanelState** - changes the state of the connected Flat Panel to On/Off and the panel brightness percent (from 0/% to 100%) when the state is On.
Syntax: #PanelState On/Off XXX

• **#Park** - parks the scope.

• **#Pause** - Makes pause shows defined message and waits for resuming the plan execution.
Syntax: #Pause Message

• **#Refocus** - pauses the execution of the current executes automatic refocusing using Auto Focus Aid and FocusCraft, after that resumes the imaging plan.

• **#RefocusPause** - Enables or disables Refocusing automatic refocusing.
Syntax: #RefocusPause On/Off

• **#RepeatTillAlt** - Defines that the current plans should be executed till the object Altitude becomes lower than the defined limit. If the plan is shorter it will be started from the beginning. If executed this command in the beginning of the plan the logic will be "Execute the plan as long as it is possible, if there is time repeat the lines as much lines as possible". If the command is executed as last line the logic is "Execute the plans once, if there is time repeat the plan as long as possible". The second option ensures that the plan will be executed at least once, the first option ensures that the plan will stop on the defined time no matter if the whole plan is full executed at least once.

Syntax: #RepeatTillAlt XX.X

• **#RepeatTillTime** - Defines that the current plans should be executed till the given time. If the plan is shorter it will be started from the beginning. If executed this command in the beginning of the plan the logic will be "Execute the plan as long as it is possible, if there is time repeat the lines as much lines as possible". If the command is executed as last line the logic is "Execute the plans once, if there is time repeat the plan as long as possible". The second option ensures that the plan will be executed at least once, the first option ensures that the plan will stop on the defined time no matter if the whole plan is full executed at least once.

Syntax: #RepeatTillTime XX:XX:XX

• **#ResetFocusCraft** - Resets the FocusCraft best values and the graph.

• **#ResetImageID** - Resets the image ID counter. It does the same as "Reset Image ID" button.

• **#ROIControl** - defines what ROI - "Region Of Interest" option to use.

Syntax: #ROIControl Off, 1/16, 1/8, 1/4, 1/2

• **#RotatorPos** - Sets the Rotator position to the given angle in degrees.

Syntax: #RotatorPos X.XX

• **#SetObjName** - change the object name. Affects the storage folder name if Object Name is part of the naming.

Syntax: #SetObjName NewName

• **#SolveSync -** Uses PointCraft to make Near or Blind plate-solving and then Sync the mount to the found coordinates. **NOTE: No sync will be made if the declination is bigger than 85 or lower than -85**

Syntax: #SolveSync Near/Blind

• **#SolveGoTo -** Uses PointCraft to make Near or Blind plate-solving and then go to the found coordinates without making synchronization. Useful in combination with #LoadImage command. If Guide Control is enabled will command completion the guiding will be re-engaged.

Syntax: #SolveGoTo Near/Blind

• **#Shutdown** - Without parameter shutdowns the computer. If there is optional parameter makes the one of the desired action.

Syntax: #Shutdown restart/standby/hibernate

• **#StopPlan** - stops the execution of the current plan. If there is parameter "Full" it will cancel the execution of #NextPlan too.

• **#SwitchState** - changes the state port/switch state of the connected Ports Hub to On/Off the XXX is the port number.

Syntax: #SwitchState XXX On/Off

• **#SwitchSet** - changes the port/switch value of the connected Ports Hub. XXX is the port number, X.XX is the port value. If the port is accepting only On/Off the X.XX could be also On/Off words

Syntax: #SwitchSet XXX X.XX

• **#Tracking** - Enables or disables mount tracking

Syntax: #Tracking On/Off

• **#TempCompensationPause**- Enables or disables temperature compensation
Syntax: #TempCompensationPause On/Off

• **#WaitTillTime**- Holds the next exposure till the given local time. If the parameter ResumeIfPassed is used and the give time is passed the execution will be resumed. If there is no such parameter and the time has passed the plan execution will be resumed on the next day.
Syntax: #WaitTillTime XX:XX:XX ResumeIfPassed

• **#UnPark** - unparks the scope.

If the mount is not supporting movements by Alt/Az coordinates APT will convert them to RA/Dec for current time and for the current Location.

**Tips&Tricks** *To make easier the use of #GoTo in combination with Object Browser, use **Shift+Click** on the OK button in the browser. This will store in the clipboard ready to use #GoTo with the coordinates of the selected object.*

In case you want to execute external script or a program there are some parameters that you can send:

%LastFile% - the path and file name of the last saved image
%CurrExp% - the number of the current exposure
%TotalCount% - the total count of exposures to make in a plan
%EDuration% - the expected remaining duration (00X' or 00X")
%ETime% - the expected time when the plan will end
%ISO% - the current ISO
%Gain% - the current gain
%Exp% - the current exposure time
%PCBat% - the PC battery percent
%CamBat% - the Camera battery percent
%CamSpace% - the free space on the camera card
%ExifT% - the temperature reported by EOS Exif or by the CCD/CMOS
%Temp% - the temperature reported by external sensor
%Hum% - the humidity reported by external sensor
%DewP% - the dew point reported by external sensor
%RA% - the right accession reported by telescope
%DEC% - the declination reported by telescope
%Obj% - the entered object name
%FocalLen% - the entered focal length
%FilterPos% - the current position of the filter wheel
%FocusPos% - the current position of the focuser
%ImageY% - the image height
%ImageX% - the image width
%Pixel% - the pixel size
%Lat% - the site Latitude
%Long% - the site Longitude
%SQM% - the Sky Quality value
%ALT% - the altitude reported by telescope
%AZ% - the azimuth reported by telescope
%ATimeDayEnd% - time when Sun sets
%ATimeDayStart%, - time when Sun rises
%ATimeNautStart% - time when Nautical Twilight starts
%ATimeNautEnd% - time when Nautical Twilight ends
%ATimeANStart% - time when Astro Night starts

%ATimeANEnd% - time when Astro Night ends
%CameraNum% - the camera/APT instance number
%CameraName% - the camera name

Example : test.vbs %LastFile% %CurrExp%

This will try to execute the script test.vbs (if there is no path the script has to be located in the APT folder) and will pass path is file name of the last take image as first parameter and the number of the exposure as second one.

**Tips&Tricks** If a pause is defined it will be executed after execution of the command or script.

## Settings

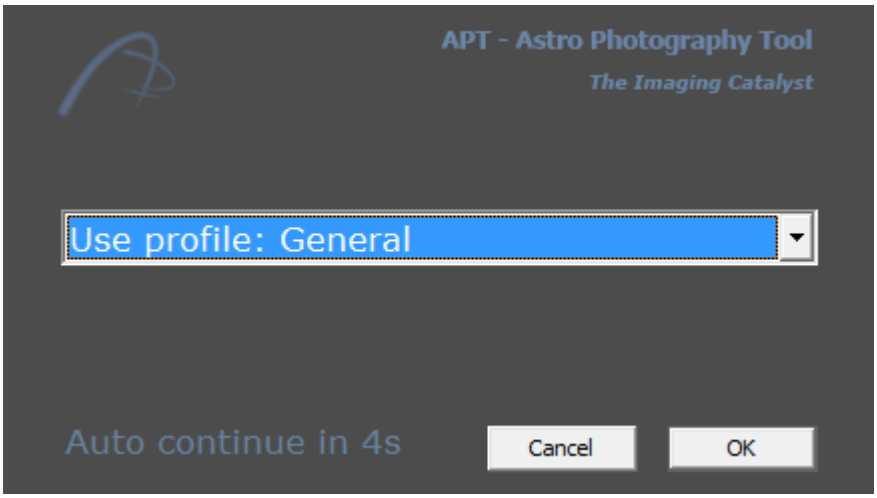
*The APT Settings dialog box is accessible from Tools tab, from Main Screen on border of LogPanel or with Alt+S shortcut.*

*Related videos: Profiles*

The settings are grouped in tabs for easier location.

APT supports the usage of settings profiles. This is helpful when multiple imaging configurations are used - for example different scopes, cameras, filter wheels and combination between them. When there are multiple profiles defined on APT start will be displayed a selector dialog box that gives possibility to select which profile you want to use for the current session. If no action is taken the last used profile will be automatically used after several seconds. This could be controlled by the Profile Selection option in Advanced tab.

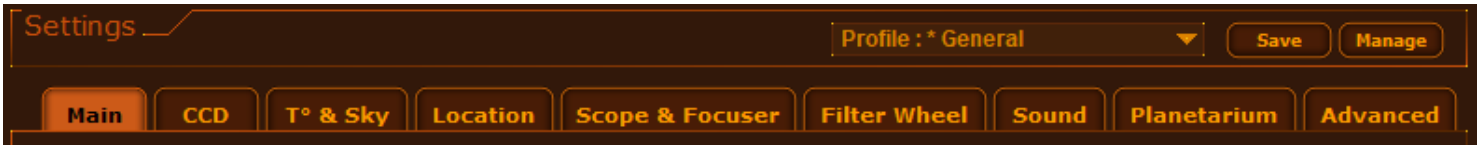
**Note: You have to create separate profiles if you want to use Multiple Cameras in same time !**



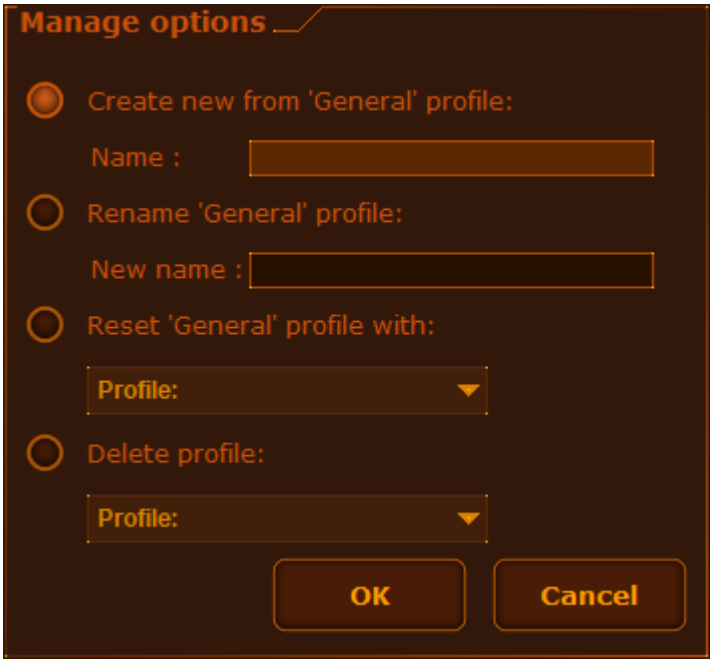

Each profile has its own value for every setting including the Guide settings, PointCraft settings, SessionCraft and etc. The Settings dialog box contains the main part of the APT parameters, so it is possible to manage the values for the different profiles. For the settings out of this dialog box there is need to restart APT and the select the desired profile and tune the values in the corresponding place.

**Tips & Tricks:** *Good approach is to define settings for the setup you use most and use that profile as template for the others.*

The "Profile" combo box selects the profile which you manage in the moment. Clicking on "Save" button will store the changes in the currently selected profile.




The button "Manage" opens the next dialog box:



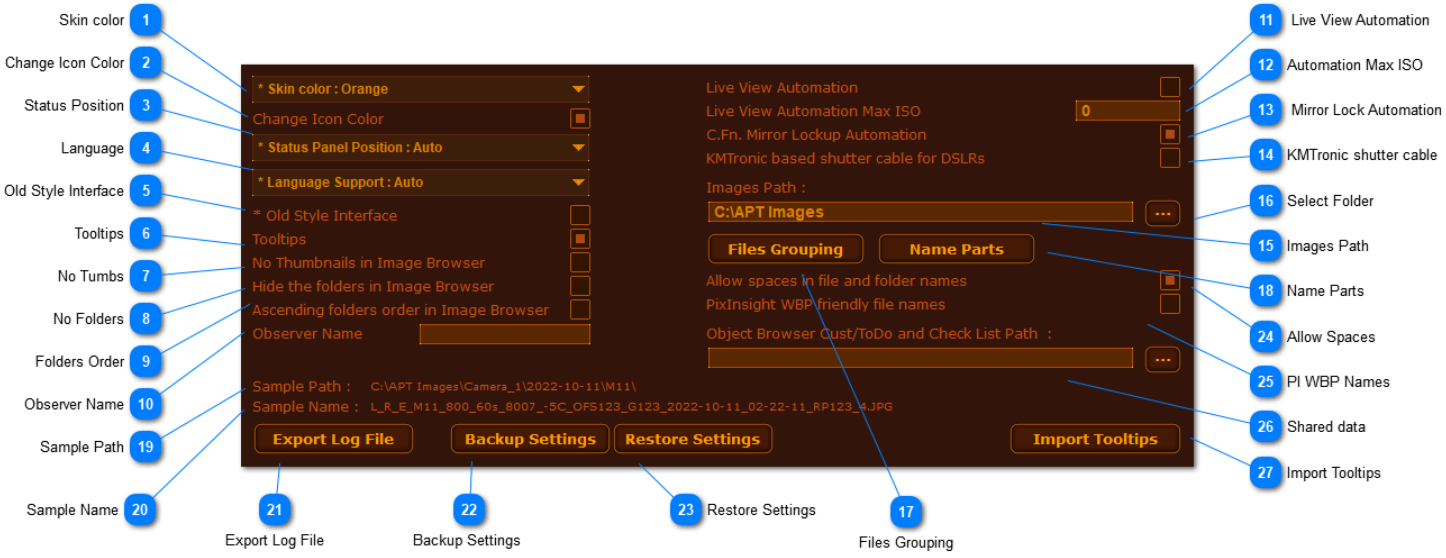

It give possibility to manage your profiles - to create new, rename and delete profile, as well as to copy all settings from one profile to other.

## Main

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Main Tab - 2*
*Main Tab*

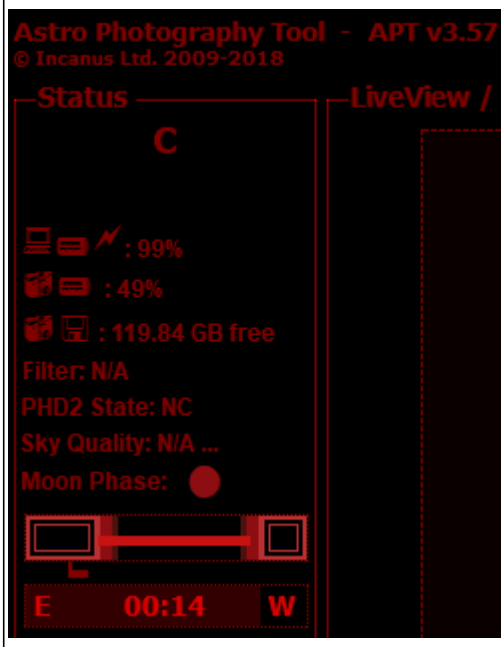
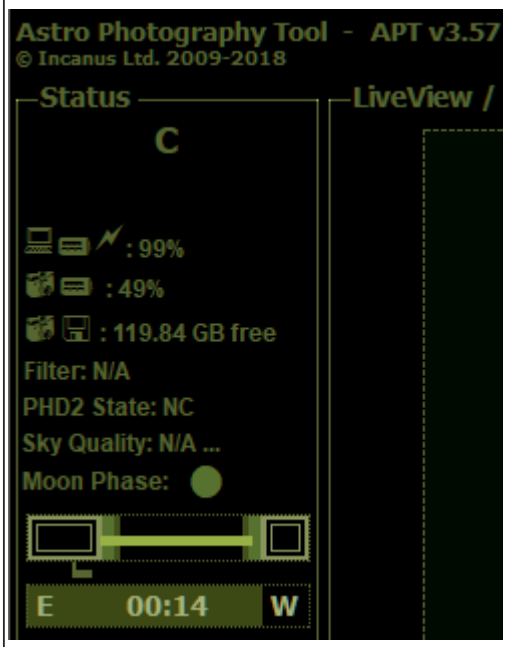
The Main settings tab contains the most general settings related to APT behavior.

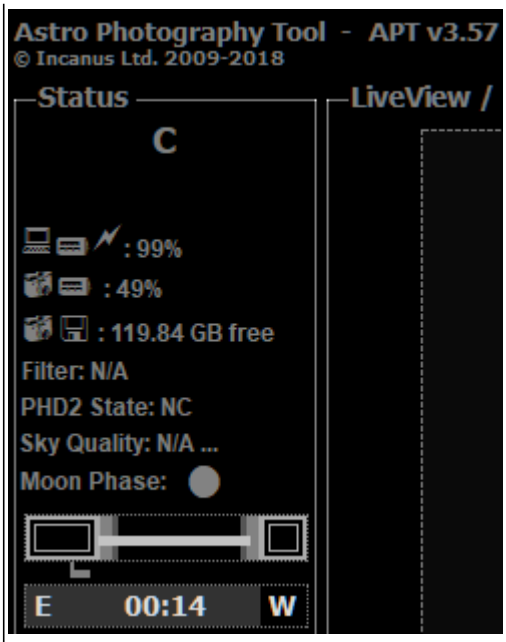
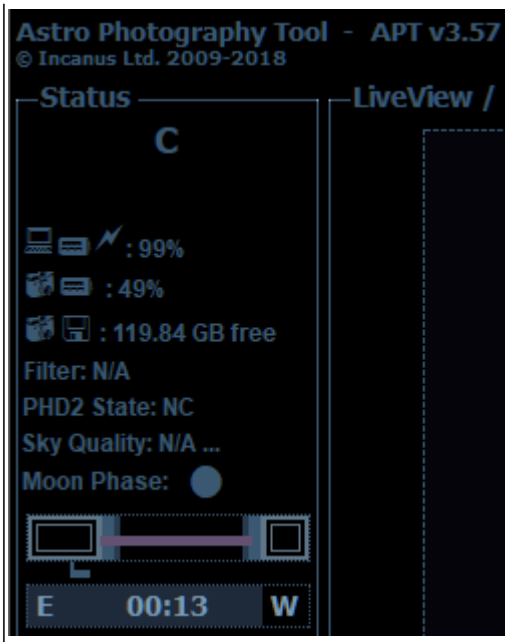
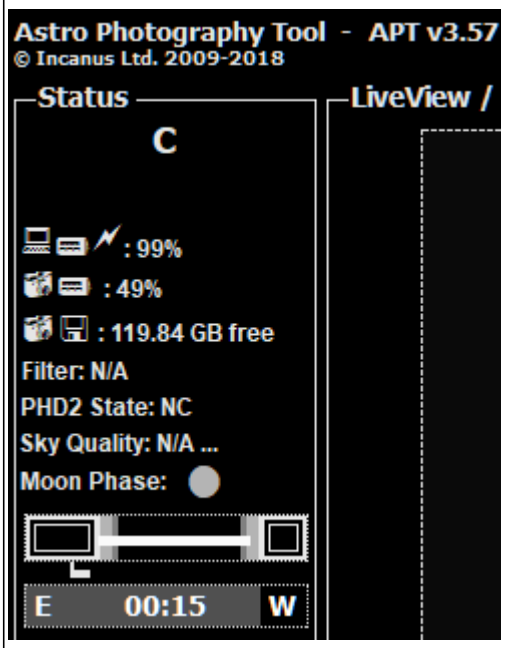
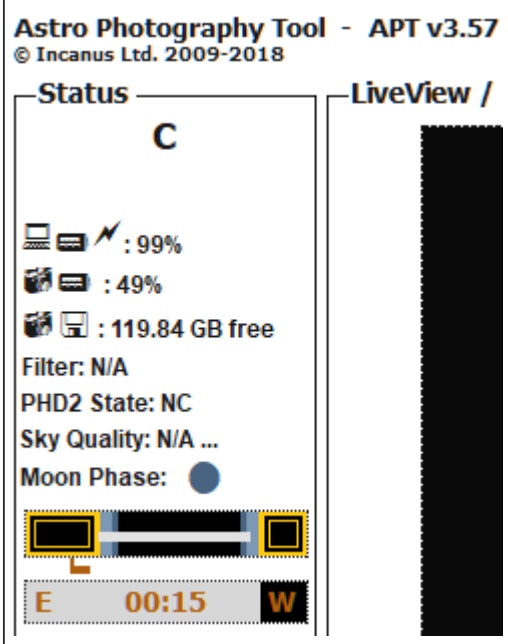


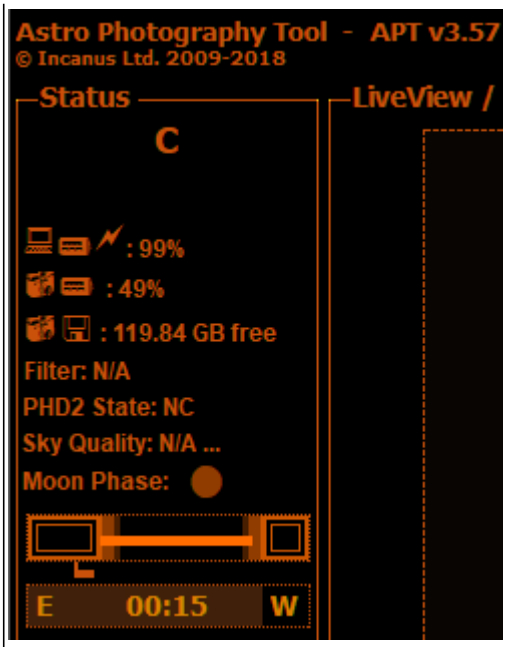

## 1 Skin color




APT has six skins :

| Red | Green |
|---|---|
|  |  |
| Grey | Blue |

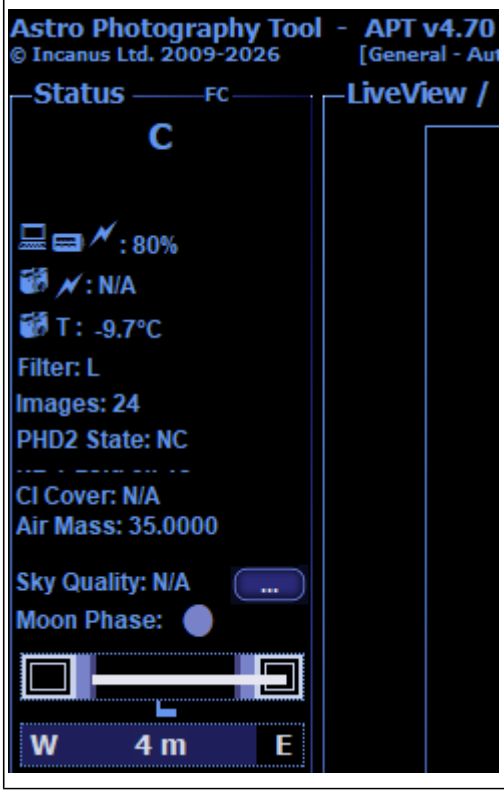
| | |
|---|---|
|  |  |
| Light Grey | White |
|  |  |
| Orange | Purple |







Midnight Blue



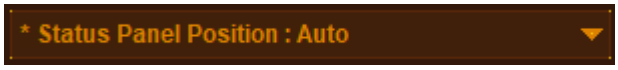

Note that after skin change there is need to restart APT.

## 2 Change Icon Color



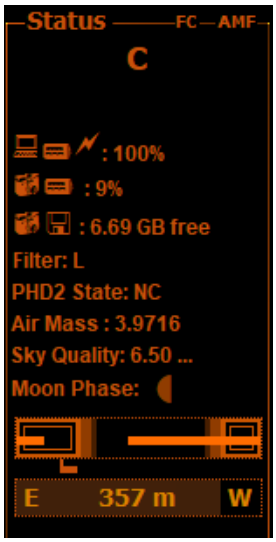

When enabled the icon color in Windows Task Bar will match the color of the select skin. It is useful when you run multiple APT instances as gives easy way to identify the instances in task bar.

## 3 Status Position




Depending on the screen aspect ratio APT can place the Status Panel on different places in order to use the screen place better and show bigger preview image. When Auto option is selected on wide screens the Status is vertical in left of Image Preview like it is in the Main Screen image, On 4:3 screens it is horizontal under Image Preview. The other options defines the desired position no matter the screen ratio.

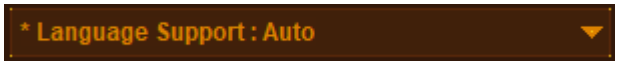
This option can useful when APT is running on one computer and remote connection is made on other with different screen ratio. Or when APT is running mainly in window mode and you want different arragment.







## 4 Language




Defines special language support like Japanese and Chinese. The Auto option lives the letters displaying, folder and filenames handling to Windows.

## 5 Old Style Interface



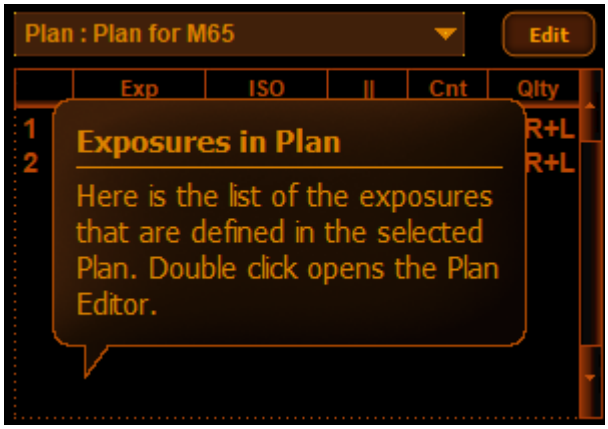

When enabled APT will use the old approach of interface which includes total control over screen that doesn't allow to see taskbar and also use small floating screen when is minimized (see Minimized mode). This mode has some problems under Windows 10.

## 6 Tooltips




Enables/Disables the Tooltips (balloon) help. When enabled you can point a button, list, label and etc. to get a short help.

Sample:




## 7 No Tumbs




When enabled APT will not generate/show thumbnail images in Img Browser Tab.

## 8 No Folders




When enabled APT will show in Img Browser Tab only the names of the image and will hide the folders. When disabled the list will contain both the images and the folder.

## 9 Folders Order




By default the folders in Img Tab are in descending order. Enable this option if you want ascending folders order.

## 10 Observer Name




Defines observer's name that to be stored in the FITS / XISF header.

## 11 Live View Automation



When enabled and LiveView is activated APT sets some parameters in Camera Tab (depends on the APT mode) in order to get maximum sensitivity.

**DSLR mode:**

Sets ISO to maximum (or the defined Automation Max ISO)
Sets Exposure to 30s

**CCD/CMOS mode:**

Sets binning to maximum

When LiveView is stopped the parameters in Camera Tab are restored to their previous values.

Disable this option if you don't want APT to change the Camera Tab settings on LiveView start.

## 12 Automation Max ISO




Defines the maximum ISO to set for LiveView Automation. Some modern DSLRs support extremely high ISO values which are useless for astro needs. Using this option you can limit the ISO. Empty value or 0 defines to use the maximum supported by the camera.

## 13 Mirror Lock Automation




When enabled APT will take care managing the state of Mirror Locking custom function in EOS camera menu.

Note: Magic Lantern takes control over the Mirror Locking function and makes it un-accessible for APT. You will have to uninstall  Magic Lantern or will have to enable/disable Mirror Locking function manually from the camera menu.

## 14 KMTronic shutter cable




Defines that the selected Long Exposure serial/shutter cable is based on the KMtronic USB Relay board. This cable is very easy to be made. Instructions can be found here

## 15 Images Path



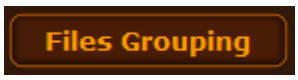

Defines the folder where image files are to be stored. Any existing local or network folder can be used.

## 16 Select Folder



Opens a dialog box that allows selecting an existing Images Path folder.

## 17 Files Grouping




Defines how you want to group the image files.  It opens a dialog box where you can include and exclude the sub-folder to be used to organize image files.

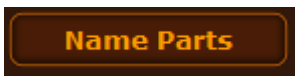



The button "->" includes an item, "<-" excludes an item. Up/Down change the order.

The items marked with * are mandatory.

When you click on OK take a look on "Sample Path" to see how the folder structure will look like.

## 18 Name Parts




Defines what you want to include in the name the image files. It opens a dialog box where you can include and exclude name parts.




The button "->" includes an item, "<-" excludes an item. Up/Down change the order.

The items marked with * are mandatory and at least one item with ** should be used.

When you click on OK take a look on "Sample Name" to see how the image names will look like.

For DSLRs the Image ID is provided by the camera. For CCD/CMOS is sequential number preserved between the sessions. It can be reset from Reset Image ID button in CCD Settings tab

## 19 Sample Path



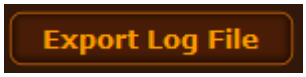

Shows how the folder structure will look like depending on the items selected in Files Grouping dialog box.

## 20 Sample Name



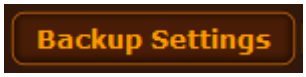

Shows how the image filename will look like depending on the items selected in Name Parts dialog box.

## 21 Export Log File



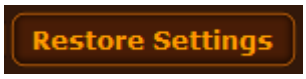

APT logs various information about the program behavior and usage. In case of problem use this button to save the Log file somewhere and then send it to the APT support.

## 22 Backup Settings

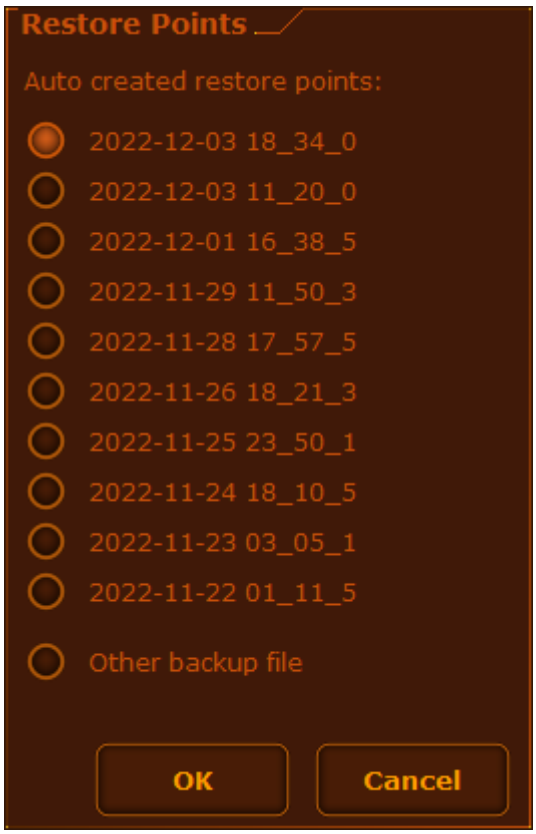



Backups all APT settings. The file can be used to setup identical configuration on other machine or just for backup.

## 23 Restore Settings




Restores the settings previously saved to a file. APT creates restore point every time when it starts and keeps the last 10 restore points. If it happens a problem to be detected during the APT start it automatically will use the last restore point. However you can restore the settings from other point or from a backup file you have made. Here is how the Restore Settings dialog box looks like:




## 24 Allow Spaces




When disabled all spaces in Object Name, Observer Name and etc will be removed from the file and folder names. This makes much easier the files grouping in WBP - Weighted Batch Preprocessing script in PixInsight.

## 25 PI WBP Names



When enabled APT will generate the files names using the pattern Keyword_Values like :

PLANSHORT_L_FILTER_L_IMGID_0221_ISOBIN_Bin1x1_EXP_5s_EXIF__-8C_OFFSET_OFS20_GAIN_G-100.FITS

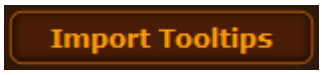
This makes much easier the files grouping in WBP - Weighted Batch Preprocessing script in PixInsight.

### 26 Shared data



Allows defining shared folder for Object Browser Custom and ToDo tabs as well as Check Lists. If you are using APT on multiple computers or are running multiple instances in order to control more than one setup, you can set same folder here and to share same data in all APTs.

### 27 Import Tooltips




Allows easily importing translated to other language tooltips help. Starting from version 3.40, during the installation APT will not overwrite the applied tooltips translations so you have to re-apply them only when there is a new edition of the translated help.

## CCD

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*CCD Tab - 2*
*CCD Tab*

The CCD/CMOS settings tab contains options related to CCD/CMOS mode.

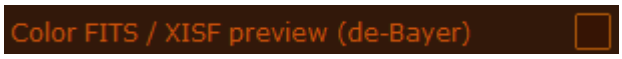


## 1 FITS or XISF




Defines what image format to be used for storing the images from CMOS/CCD cameras. When unchecked the images will be stored in FITS format. When checked, the images will be stored in XISF format.

## 2 Color FITS / XISF Preview




Enables / disables the color FITS / XISF preview in the "LiveView / Image Preview" panel. There is need to select the corresponding Bayer matrix configuration from Bayer Filter list.

Note - this affects only the image preview and is not altering the saved images.

## 3 Bayer Filter




Defines the Bayer matrix configuration to be used by the de-bayering algorithm.

## 4 Store Bayer Pattern



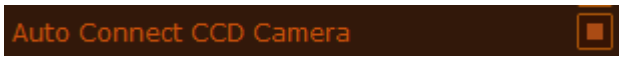

Defines if the select bayer pattern should be stored in the FITS / XISF header. Allows disabling the Color FITS / XISF preview and still to have the pattern stored in the FITS / XISF header.

## 5 Hide Location




If enabled the site location entered in Location Settings tab will not be stored in the FITS / XISF files.

## 6 Auto Connect Camera




When enabled, upon starting APT will try to make a connection to the last used CCD/CMOS camera.

## 7 Higher Compatibility




Enable this option if you have problems in using your CCD/CMOS camera.

## 8 Disable Min Exposure




Disables the usage of the minimal exposure duration value reported by the ASCOM driver or INDIGO / INDI . This is work-around for some cameras which report wrong value that doesn't allow flats making.

## 9 Auto CCD Profile




If enabled, on CCD/CMOS camera connection, APT will read and calculate the pixel size, sensor with and height from the camera driver. The value will be populated in the Tools tab for usage in the Object Calculator, Object Browser and PointCraft.

## 10 Remember binning




If enabled the binning set in the Camera tab will be remembered between the APT sessions.

## 11 Remember Gain




If enabled the Gain value entered in Camera tab will be remembered between the sessions and will be set automatically on camera connection.

## 12 Manage Gain




If enabled the Gain value in Camera tab and per filter values defined in Filter Wheel setting tab will be set in the camera before every taken image. During LiveView or Shoot image will be used the value Camera tab. During plan execution if there are values defined in Filter Wheel setting tab they will be used with higher priority.

If **disabled** the Gain value in Camera tab and per filter values defined in Filter Wheel setting tab will be ignored. The Gain value control is left completely to the camera driver and driver settings.

## 13 Red Channel Color Balance




Defines the how to scale the red channel in order to color balance the color FITS / XISF data. For example 0.5 will divide the red channel values in half. After changing this value you have to reload the current FITS / XISF file to see the effect. The Green channel is constant, so to color balance the images you have to find the suitable for your camera red and blue channel scaling factors.

Value 1.0 means no scaling.

## 14 Blue Channel Color Balance




Defines the how to scale the blue channel in order to color balance the color FITS / XISF data. For example 1.5 will multiply the blue channel values by 1.5. After changing this value you have to reload the current FITS / XISF file to see the effect. The Green channel is constant, so to color balance the images you have to find the suitable for your camera red and blue channel scaling factors.

## 15 Auto Stretch Factor




Defines the factor that is used by the Automatic Histogram stretching in CCD/CMOS Histogram mode. The values are between 0.000 and 1.000. The bigger value means more aggressive stretching. The default value is 0.150

## 16 Binning limit




Defines the maximum usable binning value to be available for LiveView Automation and for imaging. Some cameras support high binning options that are rarely used and by this option you can hide the values that are not used. There is need to reconnect the camera in order changes to be applied.

Leave the value empty to use the full range of supported by the camera binning options.

## 17 Cooling Delta




Defines the acceptable difference between the camera and target temperatures in Cooling/Warming Aids.

Some camera/drivers have difficult times with sub-degree values and require Delta 1.0 or more in order Cooling/ Warming Aids to work correctly. Don't change this value if you don't have problems.

## 18 Stop Initial Cooling




When enabled APT will stop the automatic CCD/CMOS cooling that most cameras make on connection time. This allows using the Cooling Aid in Camera tab to make smooth cooling.

Note that cooler will remain turned ON, but will not make cooling.

## 19 Pause Cooling



When enabled APT will turn off the cooling during image read in order to get clean image. Behavior required by some SBIG cameras.

### 20 Open Cooling Aid




When enabled APT will open the Cooling Aid on camera connection for easier cooling start.

### 21 Use Ext. Sensor



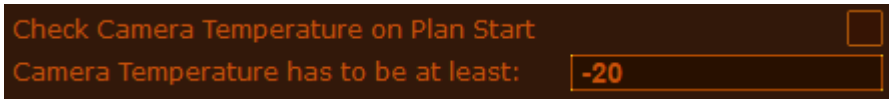

When enabled the Warming Aid will use the focuser temperature reading or the reading from External Sensor to define the target warming temperature.

### 22 Warming Offset




Defines offset from the ambient temperature to be set as target in the Warming Aid. For example, if the ambient is 12C and the offset is 5C the target will be 7C. The modern CMOS cameras never can reach ambient after deep cooling. 5C to 10C offset can't cause any harm to the cooler.

### 23 Check Camera Temperature



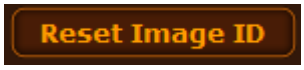

Enables / Disables checking if the camera temperature is above the defined limit on imaging plan start. Helps to avoid imaging with un-cooled camera.

### 24 Camera name




Replaces the camera name reported by the camera driver with the given value. The name will be used in the FITS / XISF header, Filename and Camera tab.

### 25 Reset

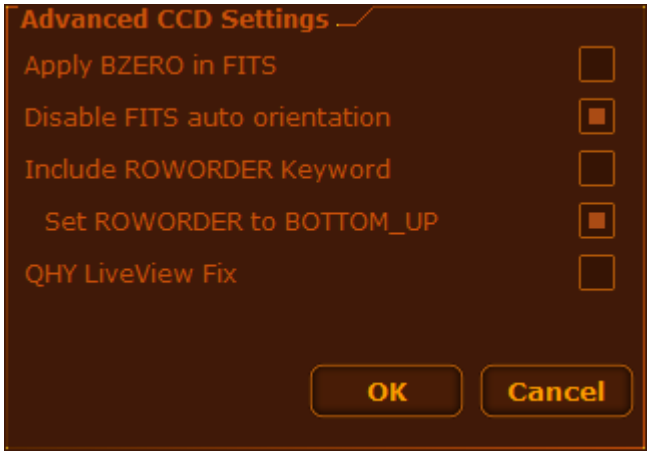



Resets the Image ID counter used in the file names of the images taken with CCD/CMOS cameras.

## 26 Advanced CCD Settings




Opens dialog box with rarely used CCD/CMOS settings.




**Apply BZERO** - In very rare cases is possible to need enabling this option. **Don't enable it without a reason!**

**Disable Auto Orientation** - Disables the auto-orientation of the FITS / XISF files. Some cameras like QHY 10 MkII need this option to be enabled in order APT to save the images correctly.

**ROWORDER Keyword** - When "Include ROWORDER" is enabled APT will store the keyword ROWORDER in the FITS / XISF header. Keep in mind that this keyword is new and some applications like PixInsight has questionable implementation. Sometimes it could be better not to use it. When "BOTTOM_UP" is enabled APT will store that value in the header, when it unchecked APT will store the value TOP_DOWN.

**QHY LiveView Fix** - Enable this option if you are experiencing problems with LiveView using QHY camera.

# Σ - Summary Tab

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Summary Tab - 2*
*Summary Tab*

The Σ - Summary Tab settings tab controls what to show in Σ - Summary Tab and how the tab behaves.




## 1 Auto Redirecting



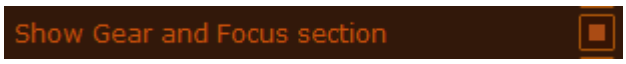

Enables / disables the "Auto-Redirecting" mode of the Σ - Summary Tab. When enabled, pointing a section in Σ - Summary Tab will switch to the corresponding tab and when the mouse is away from the tabs area will switch back to Σ - Summary Tab.

## 2 Camera




Shows/hides the Camera section in Σ - Summary Tab.

## 3 Gear and Focus




Shows/hides the Gear and Focus section in Σ - Summary Tab.

## 4 Last Focusing




Shows/hides the Last Focusing section in Σ - Summary Tab.

## 5 Guiding




Shows/hides the Guiding section in Σ - Summary Tab.

## 6 Tools




Shows/hides the Tools section in Σ - Summary Tab.

## Temperature & Sky

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Temperature & Sky Tab - 2*
*Temperature & Sky Tab*

The Temperature & Sky settings tab contains options related to temperature and sky quality tracking.

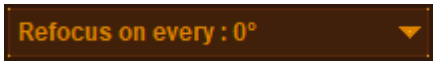



### 1 Temperatures in C/F




Defines how to show the temperature values – in Celsius or Fahrenheit.

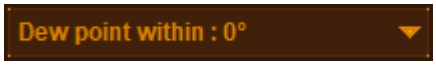
### 2 Refocus Notification




Defines when you want to be notified that there is need to refocus. When your telescope or lens is focused, click on the button Set Focus Mark in Tools Tab to set focus mark on the temperature that focus was achieved. For example if 4° is selected, when APT detects change of 2° (half of the defined value), the temperature reading in top of the APT main screen will start flashing to show that soon there will be need to refocus (in minimized mode there will be flashing “F” letter). When APT detects change of 4°, the temperature will be displayed with bright font and message will be printed in the Log panel than there is need to refocus (in minimized mode there will be non-flashing “F” letter). The value 0° disables this feature. Required is external Temperature / Humidity Sensor.

**Tips & Tricks**. *Don’t forget to click on the “Set Focus Mark” button every time you focused to place the “Focus Mark” on the right temperature reading.*

### 3 Dew point Notification




Defines when you want to be notified for closing the dew point. There is no need to heat your optics when the dew point is not even close. For example if 4° is selected, when APT detects that dew point is on 2° or less from the current temperature, the DewP reading in top of APT main screen will start flashing (in minimized mode there will be flashing “D” letter). When APT detects that temperature dropped under the dew point, the DewP reading will displayed with bright font and message will be printed in the Log panel (in minimized mode there will be non-flashing “D” letter). The value 0° disables this feature. Required is external Temperature / Humidity Sensor that is able to measure the humidity.

**Tips & Tricks.** *To get more accurate readings, place the sensor close the objective, but not on the heating strips.*

*You have to experiment when you have to start the heating. It depends on your heating solution, telescope size and etc.*

### 4 T Calibration




Allows entering a calibration value that to be added or subtracted from sensor readings.

### 5 Humidity Calibration




Allows entering a calibration value that to be added or subtracted from sensor readings.

### 6 Temper(Hum)




Instructs APT to use the readings from the attached Temper or TemperHum sensor. For more information see Temperature / Humidity Sensors.

### 7 USB Dewpoint




Instructs APT to use the readings from the attached USB_Dewpoint sensor. For more information see Temperature / Humidity Sensors.

### 8 No Sensor



Instructs APT that there is no additional external sensor. APT will still use the readings from the ASCOM / INDIGO / INDI compatible focuser if they are available.

For more information see Temperature / Humidity Sensors.

### 9 Sky Quality Tracking




Defines if you want to use the Sky Quality Tracking system in APT. The sky quality tracking can be made automatically by using the Unihedron SQM or compatible devices and manually by observer's estimation of the limiting magnitude or by using the SQM-L manual device. More information about supported devices see Sky Quality Meters

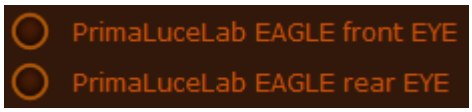
When the Sky Quality Tracking system is enabled you can use Graphs to monitor the value changes through the imaging session, to use the readings as part of the image file name - see Name Parts in Main Settings tab. Also the readings will be stored in the FITS / XISF files.

### 10 MPSAS




Defines MPSAS (magnitudes per square arc second) as default sky quality metrics to use in Status panel, for the value entered in Sky Quality Calculator when SQM-L or manual entry is selected and for storing in FITS / XISF files.

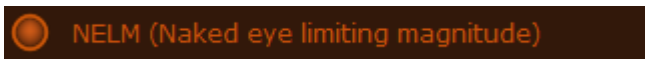
### 11 EAGLE EYE




Defines that you want to use the readings from PrimaLuceLab EAGLE's front or rear Eye.

More information about supported devices see Sky Quality Meters.

### 12 NELM




FITS / XISF
Defines NELM (naked eye limiting magnitude) as default sky quality metrics to use in Status panel, for the value entered in Sky Quality Calculator when SQM-L or manual entry is selected and for storing in FITS / XISF files.

### 13 SQM-L




Defines that you want to use your estimation by eye, SQM-L or compatible device to measure and track the sky quality. After that you have to use the Sky Quality Calculator enter the value you have determined.

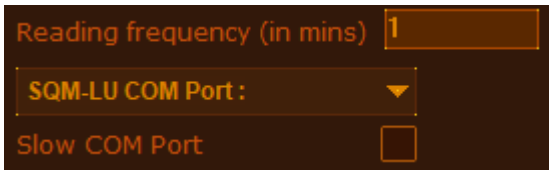
More information about supported devices see Sky Quality Meters.

### 14 SQM-LU




Defines that you want to use SQM-L, SQM-LU-DL or compatible device to measure and track the sky quality.

When this option is selected there is need to define how often to read the sky quality value and to which port is connected the device in the section that will become visible.




If you are using mySQM or other device that needs slower COM port speed, enable the option "Slow COM Port"

More information about supported devices see Sky Quality Meters.

### 15 SQM-LE




Defines that you want to use SQM-LE or compatible device to measure and track the sky quality.

When this option is selected there is need to define how often to read the sky quality value and the IP/Port of the device in the section that will become visible.




More information about supported devices see Sky Quality Meters.

## Location

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Location Tab - 2*
*Location Tab*

The Location settings tab contains the options related to your site coordinates and possibilities to synchronize them. It is important to define the coordinates because they are used by Darkness Clock, Deep Sky Darkness Calculator, the filter of visible objects in Objects Browser and checking if object is above horizon on GoTo.

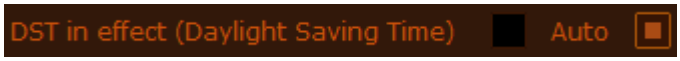



## 1 Hemisphere




The hemisphere you are in.

## 2 DTS




Is daylight time saving currently in effect. If "Auto" is selected APT will manage the "DST" setting using the Windows settings

## 3 Location




List with the stored locations. Supported are up to 20 locations. Select the site you want to use/edit.

## 4 Site Name




The site name.

## 5 Latitude



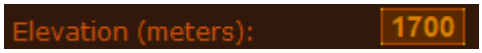

The site Latitude. Accepted is any format. The GPS format of the entered value is displayed in italics.

## 6 Longitude




The site Longitude. Accepted is any format. The GPS format of the entered value is displayed in italics.

## 7 Elevation




The site elevation in meters.

## 8 Time Zone




The site time zone.

## 9 Twilight offset




Defines an offset from the calculated Astro Twilight. This allow to define that astro night starts X minutes earlier and ends X minutes later. By this way the automated imaging cans start earlier and end later. This offset is used by the #ConditionalStop script command, by SessionCraft and by manually scheduled plans via Start options.

## 10 Air Mass Limit




Defines the Air Mass Limits for calculation of **Maximum Imaging Time** and **Imaging Time Left** in Object Browser. The Air Mass value defines how much atmosphere there is between the us and the object. In Zenith the thickness is the smallest possible - one atmosphere (Air Mass 1.0). On horizon the thickness is equal to 35 atmospheres. It is considered that imaging through 2 atmospheres (Air Mass 2.0) or less gives best imaging results. This corresponds to altitude above horizon of 30 degrees or more.

When the desired altitude limit is entered the corresponding air mass value will be displayed.

## 11 Use Nautical Twilight




When enabled the Nautical Twilight will be used instead of Astro Twilight as definition of the astro night. This is useful in the areas with high north/south latitude, with long nautical twilight and possibility to do narrowband imaging. This affects the #ConditionalStop script command, SessionCraft and the manually scheduled plans via Start options.

### 12 No Sync




The current site coordinates will be used only in APT.

### 13 Import




The current site coordinates will be updated with the coordinates provided by the telescope as soon as it is connected.

### 14 Export




The current site coordinates will be used to set the coordinates of the telescope as soon as it is connected.

Note: If you want to export location information to EQMOD/EQASCOM you have to enable the option "Allow Site writes". To open the EQMOD settings panel use either:

*APT > Gear tab > Shift-Click Connect Scope > ASCOM Telescope Chooser > EQMOD ASCOM HEQ5/6 > Properties*

or

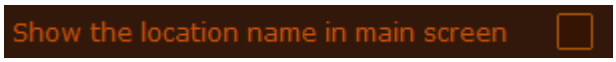
Windows Menu > EQMOD Toolbox > Driver Setup

### 15 Export Time




When enabled will export the current time the PC clock to the ASCOM driver synchronizing telescope time.

### 16 Show Location



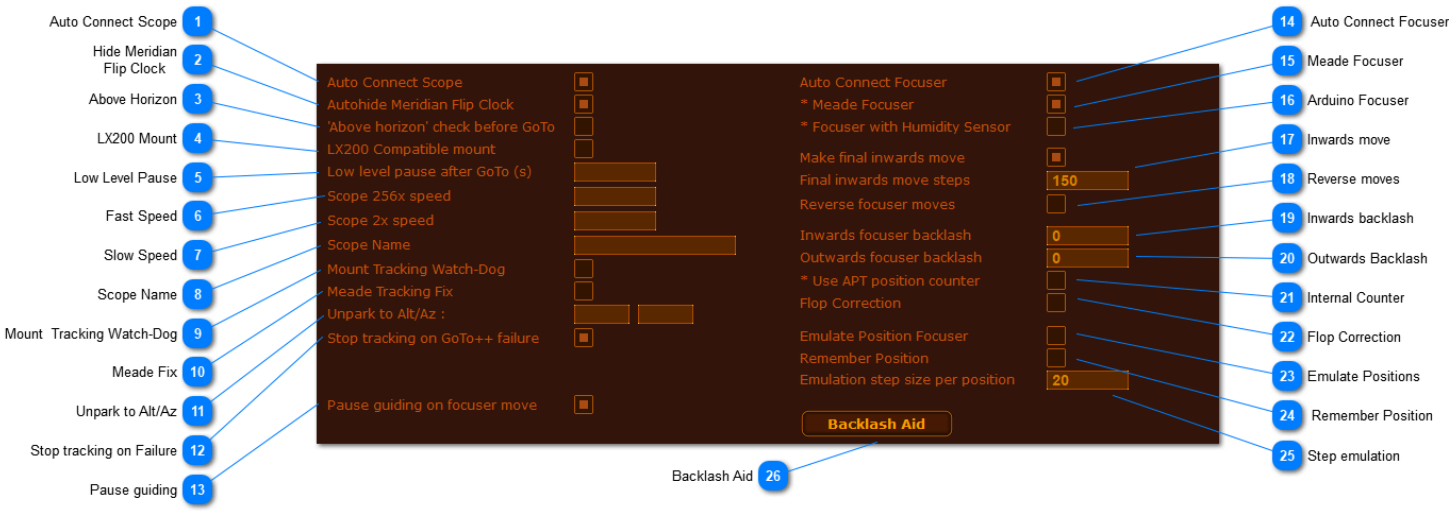

When enabled, will show the selected location name in the top left corner of main screen after the current profile name.

## Scope & Focuser

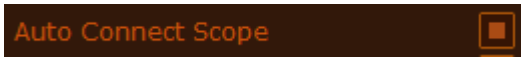
*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Scope & Focuser Tab - 2*

The scope and focuser settings tab contains options related to telescope mount and focuser.




## 1 Auto Connect Scope




When enabled on starting, APT will try to make connection to the last used telescope/mount.

## 2 Hide Meridian Flip Clock




When enabled the Meridian Flip clock will be visible only when there is active connection to telescope in Gear tab

## 3 Above Horizon




When enabled before any GoTo command, APT will make a check if the target coordinates are above horizon. If the object is below horizon you will be asked to confirm the move.

## 4 LX200 Mount




When enabled will force APT to use the LX200 communication protocol over the ASCOM connection.

## 5 Low Level Pause



Defines how many seconds to wait after every mount slew. Some mount drivers reports that the move is completed few seconds before the mount settles completely. This could affect the solving accuracy of PointCraft, SessionCraft and other features. The low level pause will hide this imperfection making the APT features to think that the slew takes a bit longer.

Leaving empty value or 0 will not apply any pause.

### 6 Fast Speed




Defines a fast speed of telescope moving (degrees per second) when N/S/E/W buttons are used in the Gear tab with the 256x option. Leave empty to use the default speed which is 256 times the sidereal speed. Note that some value may not be supported by the mount or by the driver.

### 7 Slow Speed




Defines a slow speed of telescope moving (degrees per second) when N/S/E/W buttons are used in the Gear tab with the 2x option. Leave empty to use the default speed which is 256 times the sidereal speed. Note that some value may not be supported by the mount or by the driver.

### 8 Scope Name




Defines the scope name. It can be used as part of the images files names and will be stored in the FITS / XISF header.

### 9 Mount  Tracking Watch-Dog




When enabled the will APT will monitor and notify for problem with the mount connection.

See the Telescope section in Gear Tab

### 10 Meade Fix




Enable this option if the ASCOM driver for your Meade mount is not able to report if tracking is enabled or not.

### 11 Unpark to Alt/Az



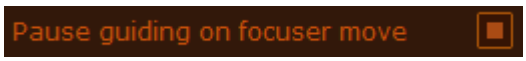
When coordinates are defined on Unpark action (manual or via command) the telescope will be automatically sent to the given Alt/Az. Does nothing if empty.

### 12 Stop tracking on Failure




When enabled if a GoTo++ action (manual or automatic via command / SessionCraft) fails the Tracking will be disabled to avoid setup damages

### 13 Pause guiding




When enabled the guiding will be stopped during any focuser move and will be resumed when the move is completed. It could be useful for systems with Off-Axis-Guider and enabled Make final inwards move option

### 14 Auto Connect Focuser




When enabled on starting, APT will try to make connection to the last used focuser.

### 15 Meade Focuser



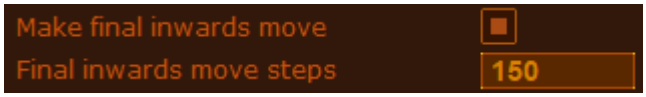

When enabled will show the special section in the Gear tab for using Meade focuser. In this case you don't need to make a connection using "Connect Focuser" button. Requires APT restart.

### 16 Arduino Focuser




Enable this option if you are using an Arduino based focuser which has integrated humidity sensor. Requires APT restart.

### 17 Inwards move




When enabled, every focuser position change will be finished with a move in inwards direction in order to minimize the influence of the backlash or the mirror flopping. To achieve that if the move is outwards, APT makes a bigger move and after that gets back to the desired position from inwards direction. The amount of that move is defined by "Final inwards move steps".

## 18 Reverse moves




When enabled the will send reversed Inward/Outward commands.

## 19 Inwards backlash




Defines now many position steps is the inwards backlash of the focuser that has to be compensated when focuser changes the move direction from outwards to inwards. 0 means no backlash.

## 20 Outwards Backlash




Defines now many position steps is the outwards backlash of the focuser that has to be compensated when focuser changes the move direction inwards from to outwards. 0 means no backlash.

## 21 Internal Counter




Enable this option if you want to hide the backlash compensation moves from the focuser position. In this case APT will use its own position counter and its value will be visible in the Gear tab. When is disabled position value will include the backlash moves.

## 22 Flop Correction




When enabled the inward and/or outward backlash define what moves are needed to compensate the mirror flop of Schmidt-Cassegrain / Maksutov telescopes when focuser changes the move direction.

When inward backlash is entered, the flop correction will make same as Final inward move. If you have outward backlash entered the logic will make final outward move. In case your focuser has a backlash you will have to manage it in the focuser's driver because enabling flop correction will need use the backlash values entered in APT for that correction.

## 23 Emulate Positions




Enable this option if you have focuser that doesn't support positions. APT will emulate positions focuser.

### 24 Remember Position




When enabled APT will remember the emulated position value between the session. It is useful for permanent setup.

### 25 Step emulation




Defines how many steps/pulses will correspond to one emulated focuser position.

### 26 Backlash Aid




Opens the Backlash Aid. It helps to measure the backlash of Crayford / Rack & Pinion focusers.

## Filter Wheel

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

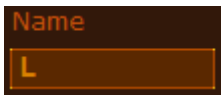
*Related videos:*
*https://www.youtube.com/watch?v=_T7Cg7lDn-M*
*Filter Wheel, APT Settings*
*Setting Up Manual Filter Wheels & Filter Drawers*

The filter wheel settings tab contains options related to filter wheel. Here you can enter the filter names and focus offset for the filters mounted into your wheel. Describing the names here allows APT to show them in the Plan Editor and in the Camera tab (the selected plan table) rather than using the filter position number. This tab is required for **SBIG** and **manual** wheels, but it will be more comfortable for you if you enter the information even if you use ASCOM / INDIGO / INDI compatible wheel.

*Note that if there are values in this tab APT will ignore the values entered in the properties of the ASCOM driver.*

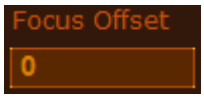



## 1 Filter Name




Defines the filter name you want to use.

## 2 Focus Offset



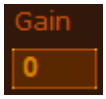

Defines the focus offset that you want to apply when this filter is selected. Not all filters are para-focal, so if you measure the exact difference in the focus between the filters (in steps of your focuser) it can save you the refocusing on every filter change. To use this feature you need Focuser connection and enabled "Adjust Focuser" in Filter Wheel section of Gear tab.

The value 0 means that there is no offset.

If you are using two focusers you can define two offsets separating them with semicolon (;). For example 10;3 means that the R filter has 10 focuser steps offset from L via main focuser and 3 steps via the second focuser allowing the Off-Axis-Guider to remain sharp.

**Note:** The focus offset has not thing with the black level/offset.

## 3 Gain



Defines the gain value that you want to apply when this filter is selected. Empty value means that gain value should not be changed. This value will be used with priority during imaging plan. During LiveView or Shoot image if the Gain value in Camera tab is not empty it will be used with priority.

### 4 AF Exposure




Defines what exposure duration to be used for every filter during the Auto-Focus Aid process. If the value is empty the next option is used. The priority from top to lower is:

- Per Filter in Filter Wheel tab
- Default Exposure in Auto-Focus Aid settings
- Exposure in Camera Tab DSLR Mode / CCD Mode

### 5 PS Exposure




Defines what exposure duration to be used for every filter during the GoTo++ Plate Solving process. If the value is empty the next option is used. The priority from top to lower is:

- Per Filter in Filter Wheel tab
- Default Exposure in PointCraft settings
- Exposure in Camera Tab DSLR Mode / CCD Mode

### 6 Clear All




Clears all values entered in Name and Offset fields.

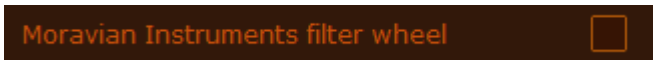
### 7 Brightness




Defines what Flat Panel brightness to be used for every filter when flat panel device is connected Flat Panel / Cover or Extra Devices

If you are using Color/OSC - One Shot Camera, just enter OSC on the first line and the needed brightness.

### 8 Moravian Filter Wheel



Enable this setting if you are using filter wheel made by Moravian Instruments.

### 9 Auto Connect Wheel




When enabled on starting, APT will try to make connection to the last used filter wheel.

### 10 Manual Wheel / Drawer




Allows usage of manual filter wheel or filter drawer. Enable this option, enter the installed filters names (and offsets), then click on Connect Wheel button in the Gear tab. The main purpose of this feature is to add the right filter name prefix in the image filenames for easier processing. It also can be used to adjust the focuser position on filter change using the entered offset.

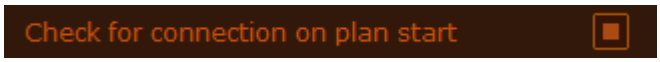
### 11 Pause for Manual change




When this option is enabled, APT will show dialog box every time there is need to change the filer of manual filter wheel or drawer during plan execution. Clicking on OK will resume the imaging.

Note: Give few seconds the guiding to settle after filter change.

### 12 Check for connection



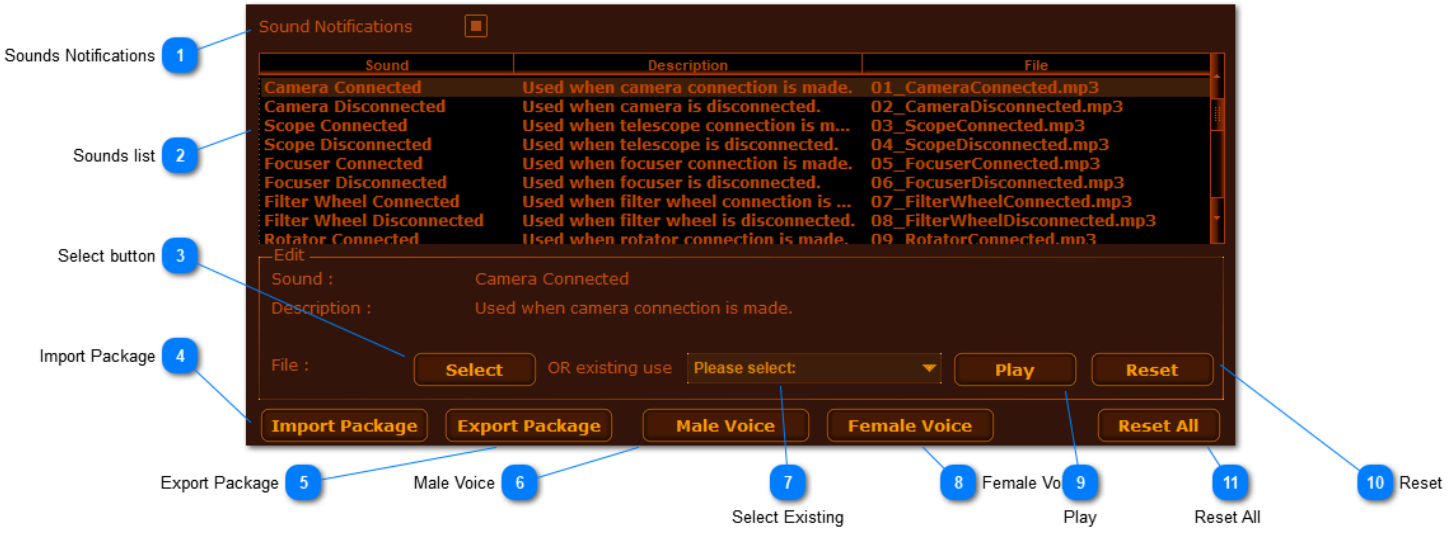

When this option is enabled, on plan start APT will check if that plan is configured to use filters and will warn if there is no active connection to a filter wheel.

## Sound

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Sound Tab - 2, Sound Tab*

The sounds settings tab allows configuring the sounds system of APT. Supported are 36 different events that can use separate sound using WAV or MP3 file. When a sound file is selected APT makes a copy into special folder, so there is no need to keep the source file.

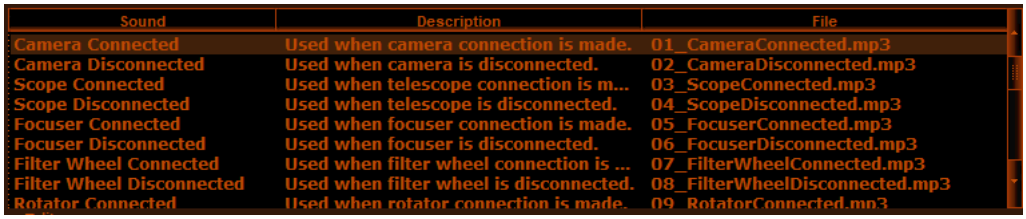



## 1 Sounds Notifications



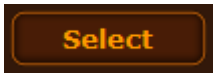

Enables/Disables sound notification for 36 events like device connection/disconnection, plan end and etc.

## 2 Sounds list



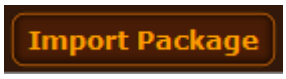

List of all supported events, short description and currently selected sounds. To edit an event select the corresponding line and select a new WAV or MP3 file.

## 3 Select button



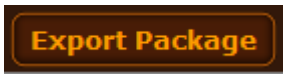

Opens a dialog box to select a WAV or MP3 file for current event.

## 4 Import Package



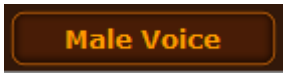

Opens a dialog box for selection of folder where is stored/downloaded the sounds package you want to import. The import will copy all sounds to special APT folder, so there is no need to keep permanently the source folder.

## 5 Export Package




Exports the current sounds settings as sounds package for backup or sharing.

### 6 Male Voice



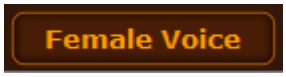

Imports a copy of the predefined male voice sounds package. You can use this copy as base of your own package.

### 7 Select Existing



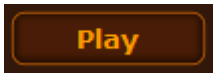

Use this list to attach already selected sound to the current event.

### 8 Female Voice



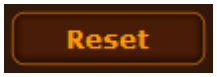

Imports a copy of the predefined female voice sounds package. You can use this copy as base of your own package.

### 9 Play



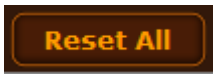

Plays the sound of the currently selected event.

### 10 Reset




Resets the sound of the currently selected event. If the attached sound is not used for other event, it will be deleted from the special APT folder.

### 11 Reset All




Resets the sounds of all events. It also deletes the sound files from the special APT folder.

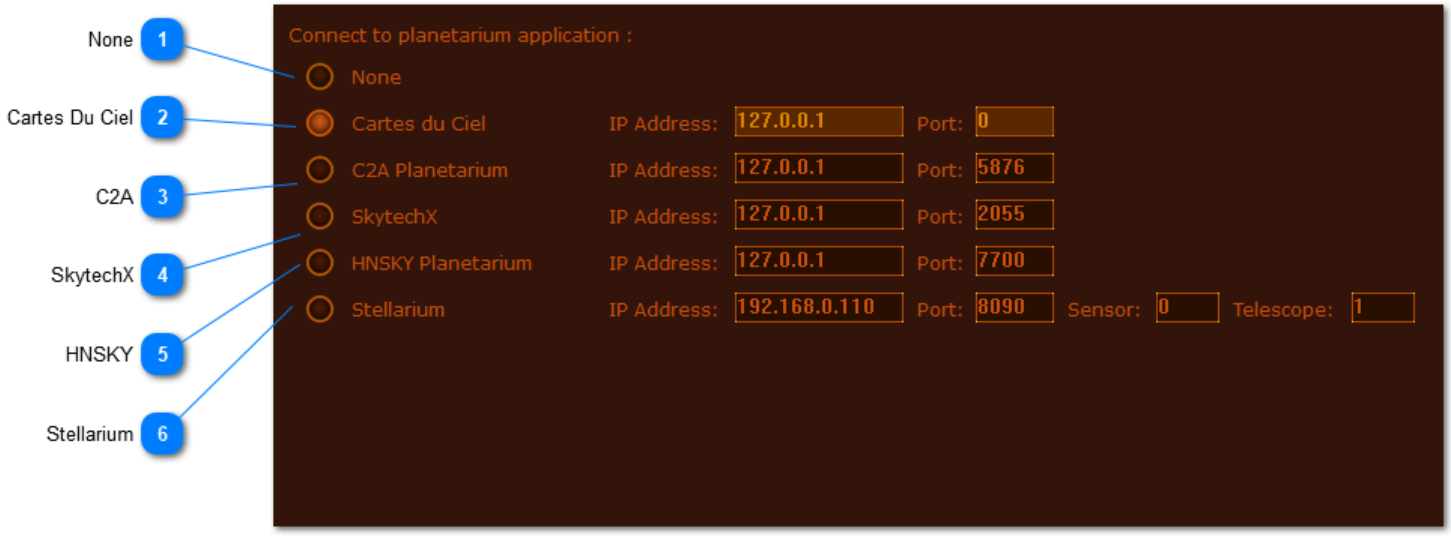
# Planetarium

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Planetarium Tab - 2, APT Settings,*
*Pre-install (Windows) Part 4a - More Stellarium Configuration,*
*Planetarium Tab*

The planetarium settings tab contains the options related to the integration with the planetarium application you use. This integration can be used in PointCraft, Object Browser and Gear Tab.

For more information about the integration with planetarium applications see the Planetarium in APT Features section.




## 1 None




No integration will be used.

## 2 Cartes Du Ciel




Connect to and communicate with Cartes du Ciel - CdC (https://www.ap-i.net/skychart/en/start). If CdC is installed on the local machine enter for IP address 127.0.0.1 and leave the Port to 0. If CdC is on a remote machine set the IP and Port used there.

Before making a connection, go to CdC -> Setup -> All Configuration Options -> General -> Server, enable the options "Use TCP/IP server" and "Keep client connection active". Enable the option CdC -> Setup -> All Configuration Options -> Display -> Finder Rectangle -> Mark the center of the chart.

Also CdC has to be set in Equatorial chart mode from Chart->Chart Coordinates System.

### 3 C2A




Connect to and communicate with Computer Aided Astronomy - C2A (http://www.astrosurf.com/c2a/english/). If C2A is installed on the local machine enter for IP address 127.0.0.1. The default Port is 5876. If C2A is on a remote machine set the IP and Port used there.

### 4 SkytechX




Connect to and communicate with SkytechX (http://skytechx.eu/). If SkytechX is installed on the local machine enter for IP address 127.0.0.1. The default Port is 2055. If SkytechX is on a remote machine set the IP and Port used there.

Before making a connection, go to SkytechX -> File -> Setting -> Server tab, enable the option "Run server on startup" and click on "Start Server".

### 5 HNSKY




Connect to and communicate with Hallo Northern SKY - HNSKY (http://www.hnsky.org/software.htm). If HNSKY is installed on the local machine enter for IP address 127.0.0.1. The default Port is 7700. If HNSKY is on a remote machine set the IP and Port used there.

Before making a connection, go to HNSKY -> File -> Setting -> TCP/IP Server tab and enable the option "Use TCP/IP server".

### 6 Stellarium




Connect to and communicate with Stellarium 0.17 or newer (http://stellarium.org/). If Stellarium is installed on the local machine enter for IP address 127.0.0.1. The default Port is 8090. If Stellarium is on a remote machine set the IP and Port used there.

Before making a connection there is need to make some configurations in Stellarium:

1. In Configurations -> Plugins make sure that "Remote Control" plug-in is configured as "Load at startup" (restart Stellarium after enabling). After that click on "configure" and enable the options "Server enabled" and "Enable automatically on startup"

2. In Configurations -> Plugins make sure that "Oculars" plug-in is configured as "Load at startup" (restart Stellarium after enabling).

3. In "Oculars" configuration go to "Sensors" tab and define a new sensor or edit one of the existing. All the needed data can be found in the Object Calculator (for CCD/CMOS a connection is needed in order to determine the pixels

count). Enter the number of the sensor in the APT settings. The first sensor is 0, the second 1 and so on (the index is zero based).

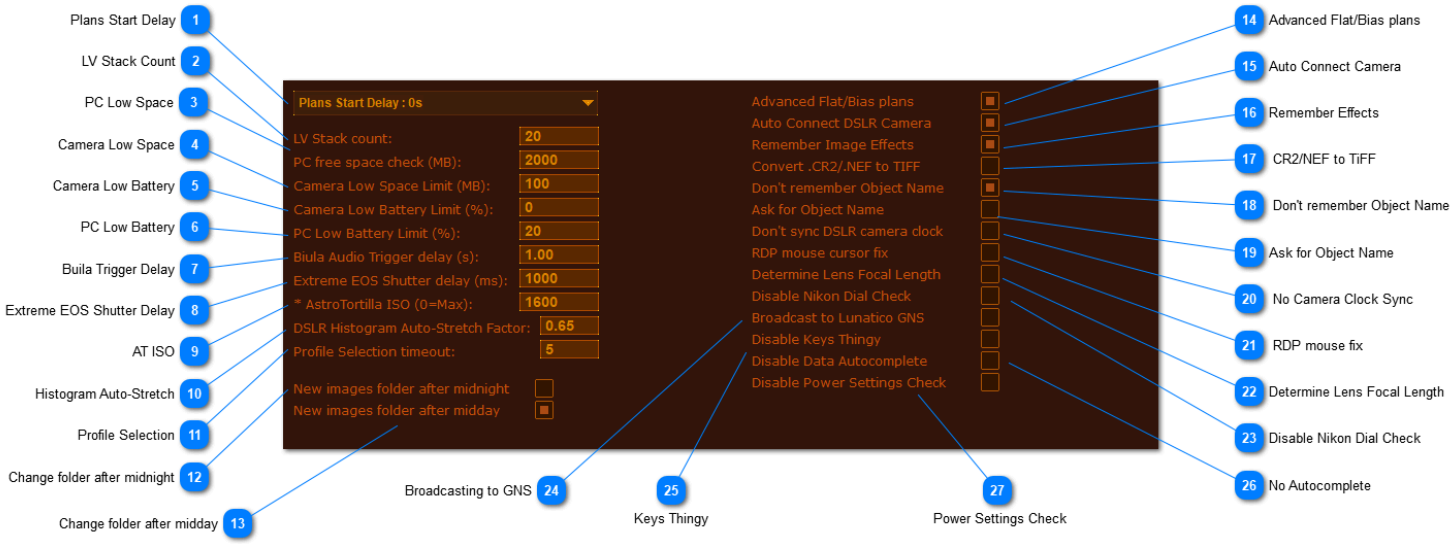
4. In "Oculars" configuration go to "Telescope" tab and define a new sensor or edit one of the existing. Enter the number of the telescope in the APT settings. The first scope is 0, the second 1 and so on (the index is zero based).

## Advanced

*The APT Settings dialog box is accessible from Tools tab or with Alt+S shortcut.*

*Related videos:*
*APT Settings - 4.60+*
*Advanced Tab, APT Settings*

The advanced settings tab contains the options that are not changed very frequently, but in the same time allow to configure important or handy features on APT.




### 1 Plans Start Delay



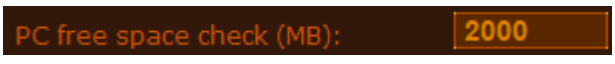

Defines how many seconds to wait after click on the Start button, before plan execution begins.

### 2 LV Stack Count




Defines how many images to be used in LV Stack.

### 3 PC Low Space



Defines the minimum free space than is needed on the PC disk when APT starts. If the free space is lower a notification message will be displayed. Set a value bigger than the average disk space you use per whole night session!

### 4 Camera Low Space



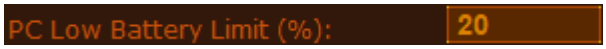

Defines when to notify you about low camera card free space. 0 disables this notification. The notification is flashing icon in the Status panel.

### 5 Camera Low Battery




Defines when to notify you about low Camera battery. 0 disables this notification. The notification is flashing icon in the Status panel.

### 6 PC Low Battery




Defines when to notify you about low PC battery. 0 disables this notification. The notification is flashing icon in the Status panel.

### 7 Buila Trigger Delay




Defines the delay to be used for exposure end when the audio trigger is used. The value depends on the cable implementation. For more information see EOS Shutter Cables.

### 8 Extreme EOS Shutter Delay




Defines the delay needed to store an image on the memory card in Extreme EOS Shutter mode. For more details see Extreme EOS Shutter mode

### 9 AT ISO




Defines what ISO to be used for the images taken through AstroTortilla. 0 means to use the maximum supported value.

### 10 Histogram Auto-Stretch



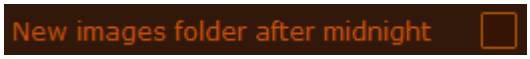
Defines the factor that is used by the Automatic Histogram stretching in EOS Histogram mode. The values are between 0.00 and 1.00. The bigger value means more aggressive stretching. Default value - 0.65.

### 11 Profile Selection



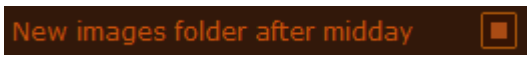

Defines how many second to wait for settings profile selection before continuing with the last selected profile.

### 12 Change folder after midnight




On session start APT creates a folder for the current date and stores all the images in this folder or in sub folders (depending on the selected grouping options). If you want to keep the images strictly separated by date, enable this option to create a new folder after midnight.

### 13 Change folder after midday




If enabled an images storing folder for new date will be created after midday. Helps to separate correctly the images from sequenced nights. For example the nights Fri-Sat, Sat-Sun, Sun-Mon will have overlapping dates mix the images from the previous and next nights. Enabling the option will generate 3 corresponding folders for the nights separated by the midday of Saturday and Sunday.

### 14 Advanced Flat/Bias plans




When selected you will be able to define the duration for exposures in Flat and Bias plans. When it is unchecked, In EOS mode the Flat plans will use the AV dial mode and will leave the camera to select the exposure; Bias plans will use the shortest supported by the camera exposure. In CCD/CMOS mode the Bias plans will use the shortest supported by the camera exposure.

### 15 Auto Connect Camera




When enabled upon starting APT will try to make connection to Canon EOS or Nikon camera (if it is in DSLR mode). Disable this if you want to manage the connection to the camera manually.

### 16 Remember Effects




When enabled APT will keep the selected Preview Effects between the restarts.

## 17 CR2/NEF to TiFF




When enabled APT will make on fly conversion of the EOS raw files into TIFF format. The original file will not be deleted. The TIFF file is without ICC profile and compression.

## 18 Don't remember Object Name




When enabled APT will not store the object name (entered in Camera tab) between the sessions.

## 19 Ask for Object Name




When enabled APT will ask to enter Object Name on every start of an imaging plan. It is useful reminder when object name is part of the file naming or grouping.

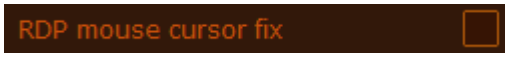
Note: Do not use this option of you use the #NextPlan command or your automation will not work unattended!

## 20 No Camera Clock Sync




When disabled APT will synchronize the Canon EOS or Nikon camera clock with PC clock on camera connection.

## 21 RDP mouse fix




If you have problems with the mouse cursor when you are using Remote Desktop, enable this option.

## 22 Determine Lens Focal Length




When enabled APT will try to determine the focal length of the attached to the Canon EOS or Nikon camera lens. If focal length is found it will be stored in Tools tab Focal Length field for automatic usage from PointCraft and Object Calculator.

Disable it if you are getting false readings when the camera is attached to a telescope.

## 23 Disable Nikon Dial Check




Use this option if your Nikon camera reports wrong dial mode when lens is detached.

### 24 Broadcasting to GNS




Enables/Disables the broadcasting APT status to Linatico's GNS - Good Night System in order to track the events on your smart phone and get alarm if something goes wrong.
**Alerts on:**
Image download failing
Automatic refocusing error
Automated meridian flip error
Camera connection lost
PHD2 star lost

**Messages on:**
Plan start
Exposure auto-canceled
Still waiting image from the camera - 30s

### 25 Keys Thingy




Allows disabling the Keys Thingy.

### 26 No Autocomplete




Allows disabling the edit boxes auto-complete feature. Most of the edit boxes will make automatic data validation 2s after you stop entering characters. If the auto complete is disabled you will have to click somewhere in order the data to be validated and depending on the case applied when there is no OK button.

### 27 Power Settings Check




Allows disabling the USB Power settings check. When the option is unchecked, APT will make a check if selective USB suspend option is enabled. Usually this is causing problems with the devices connection during the unattended imaging sessions and is important to keep all USB devices up and running.

## Darkness Clock

*The Darkness Clock is visible in the Status panel of the Main Screen.*

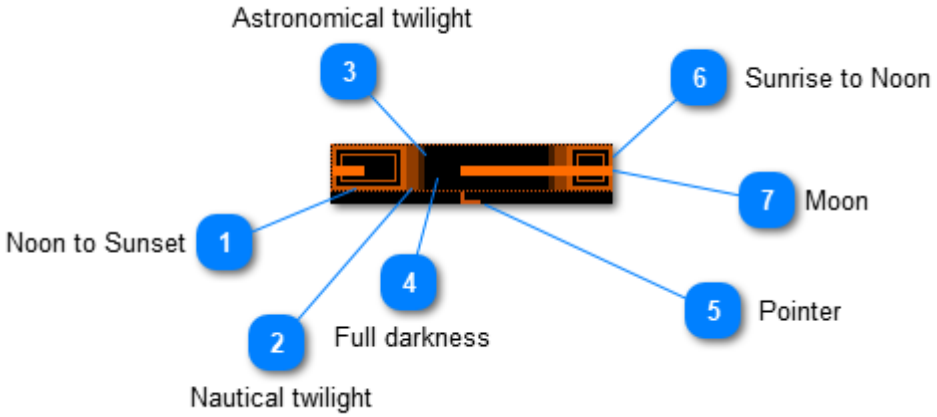
*Related videos:*
*Darkness Clock & DSD Calculator - 4.60+*
*Darkness Clock & DSD Calculator - 2*
*Darkness Clock & DSD Calculator*

The Darkness Clock shows in real time what the “status” of the sky darkness is. It is focused on nights so it starts from the today's noon and ends in the tomorrow's noon in order to show all events during the full night.

Double click on the Darkness Clock opens the Deep Sky Darkness calculator.

**Note:** You have to set your imaging / observing site coordinates in Location Settings in order to get correct times and events.

Take a look on the free (yes, free - no ads or marketing) Androind and iOS versions of the Deep Sky Darkness Calculator - APT Darkness Clock




### 1 Noon to Sunset

This is the time between midday and sunset.

### 2 Nautical twilight

This zone combines the Civil and Nautical twilight.

### 3 Astronomical twilight

This is the Astronomical twilight.

### 4 Full darkness

If there is no Moon this is the time of the full darkness suitable for imaging deep sky objects.

### 5 Pointer

A pointer that shows the current moment. It will start blinking 15 minutes before a zone change.

### 6 Sunrise to Noon

This is the time between sunrise and midday.

### 7 Moon

Shows when the Moon is above the horizon.

## Deep Sky Darkness calculator

*To open the Deep Sky Darkness calculator double click on Darkness Clock located in the Status panel of the Main Screen or with Alt+D shortcut.*

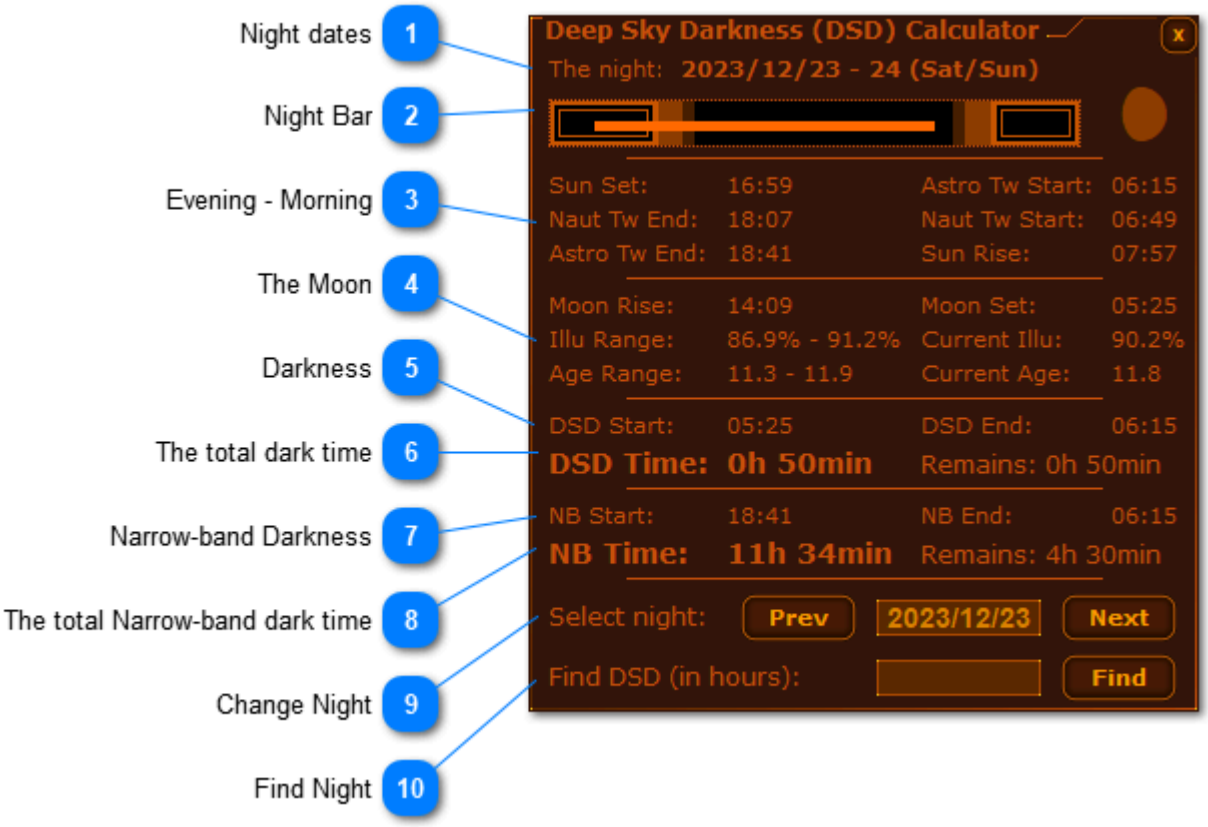
*Related videos:*
*Darkness Clock & DSD Calculator*

The Deep Sky Darkness (DSD) calculator gives possibility to see details for different events in the current or selected night. Maybe the most important feature of imaging night is time of complete darkness that can be used for collecting data for deep sky objects. This calculator is mainly focused on this and calls it - Deep Sky Darkness Time (DSD Time). To have DSD the Moon has to be below the horizon and the astronomical twilight should be already ended or not started yet. The calculator also allows searching for a night with desired DSD Time.

**Note:** You have to set your imaging / observing site coordinates in Location Settings in order to get correct times.

If narrow-band filters are used, it is possible to gather good signal even when the Moon is above the horizon. Narrow-Band (NB) section show how much time can be used for imaging between the evening and morning astronomical twilights.

Take a look on the free (yes, free - no ads or marketing) Androind and iOS versions of the Deep Sky Darkness Calculator - Darkness Clock




## 1 Night dates




The dates of the night that is currently displayed. It can be the current or selected night.

## 2 Night Bar



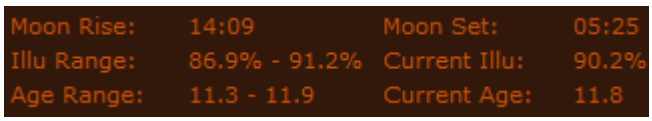
The night bar shows the events in the selected night and the Moon phase. Used is the same events coding as in Darkness Clock.

## 3 Evening - Morning




In the left column are the selected evening events - time of the sunset, the end of the nautical twilight and the end of the astronomical twilight which is the actual start of the night.
In the right column are the selected morning events - the start of the astronomical twilight which is the actual end of the night, the start of the nautical twilight and the time of sunrise.

## 4 The Moon




Here are the Moon events.

- The first line shows the moon rising and setting times in the selected night.
- Illu Range - shows the illumination percent in Moon rise and set moments in the selected night.
- Age Range - shows the age in Moon rise and set moments in the selected night.
- Current Illu - shows the illumination percent in the current moment (uses the computer clock)
- Current Age - shows the age in the current moment (uses the computer clock)

## 5 Darkness




Shows when the when starts/ends the time suitable for imaging of deep sky objects - Deep Sky Darkness (DSD) in the selected night. DSD = No Moon and twilight.

## 6 The total dark time




Shows how long Deep Sky Darkness (DSD) time will be in the selected night. DSD = No Moon and twilight. When the current night is selected will show the remaining time if the night is already started.

## 7 Narrow-band Darkness




Shows when the when starts/ends the time suitable for imaging of deep sky objects using narrow-band filters - Narrow-Band (NB) in the selected night.  NB = No twilight (the Moon is ignored).

## 8 The total Narrow-band dark time




Shows how long Narrow-Band (NB) time will be in the selected night. NB = No twilight (the Moon is ignored). When the current night is selected will show the remaining time if the night is already started.

## 9 Change Night




Allows to change the night which events are loaded. The Prev/Next buttons change the date with one day. You can also enter particular date  and press the Enter key to recalculate.

If you press the Enter key on empty edit box, APT will use the current date.

### 10 Find Night




You can search for the closest night which has Deep Sky Darkness (DSD) Time equal or more to the entered one. The value is in hours and accepts decimal numbers like 6.5

## Object Browser

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*
*APT Object Browser Deep Dive - Its Use, Tips & Tricks*
*Object Browser*

The Object Browser is very powerful tool to find the best targets for imaging before and after the start of the night, as well to review various information about objects. It is also deeply integrated with PointCraft, Object Calculator, Command Editor, Planetarium and planning applications

It is separated in several tabs:

- Deep Sky - two fixed lists of deep sky objects - 545 in the short list and 21 253 in the extended list compiled by Andrew Knight
- Stars - fixed short list 78 alignment stars and 338 in the extended list compiled by Andrew Knight
- Maps - 2 celestial maps
- Custom - user defined or imported objects
- ToDo - a second tab of user defined or imported objects dedicated to keep a shorter list of the planned targets

You can easily search for information in the tabs Deep Sky, Stars and Custom. Just enter the word you are looking for in the top right corner and click on “Search/Next” to find the next line below the current one that contains the searched word. If the cursor is still in the input box then pressing Enter key is same as clicking on “Search/Next”.

There is common behavior for Deep Sky, Custom and ToDo tabs. When an object is selected the following information will be displayed:

**Curr Az** - current azimuth of the object
**Curr Alt** - current altitude of the object
**Rise/Set** - the times when the object is rising and setting
**Transit Time** - the time when the object will pass thought the meridian
**Tranzit Alt** - the altitude above horizon at which the object is passing thought the meridian
**AirML Up/Down** - the times when the object goes above and under the defined Air Mass Limit
**Max Imaging Time (MIT)** - the total time for the current / coming night when the object will be above the defined Air Mass Limit
**Imaging Time Left (ITL)** - the time in the current night left when the object will be above the defined Air Mass Limit

When the **Visibility filter** is enabled the objects in the list will be limited to match to the selected criteria. There are the flowing options:

**Visible Tonight** - shows all objects what will go above the horizon during the current / coming night

**Imageable Tonight** - shows all objects what will go above the defined Air Mass Limit during the current / coming night
**Current Alt X+** - shows all objects which altitude in the moment is higher than the selected value

The option **"Type filter"** allows limiting the list by the object type like showing only globular clusters.

The objects list column **Size (px)** contains the calculated size in pixels for your camera/telescope setup. It will be populated when camera and focal length are defined in the Object Calculator.

The objects list columns: **C.Alt** (Current Altitude), **AML Up** (the time when the object goes above the defined Air Mass Limit), **Tr.T** (Transit Time), **MIT** (Max Imaging Time), **ITL** (Imaging Time Left) are populated only when **Visibility filter** is enabled in order to optimize the calculations speed.

**Note**: All calculations related to object position on the sky and the night events require to enter your observing site coordinates in Location settings tab!

Double click with left mouse button on an object or selecting a row and click on OK button has different behavior in the following cases:

• If the Object browser is opened from Gear tab or from Object Calculator the object coordinates will loaded in the Gear tab - GoTo Ra/Dec, if the object has defined size it will be populated in the Object Calculator and calculation will be executed. Also the object name will be populated in the Camera tab and depending on the Name Parts / File Grouping set in Main settings tab, this name can be used for the images naming/storing.

• If Object browser is opened from PointCraft, the object coordinates will be populated in Approximate RA/Dec or in GoTo++ Ra/Dec

• If Object browser is opened from Command Editor the object coordinates will be populated in RA/Dec fields of #GoTo command

See the tabs description for more information about the corresponding features.




## Deep Sky

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*
*APT Object Browser Deep Dive - Its Use, Tips & Tricks*
*Object Browser - 2, Object Browser*

The Deep Sky tab contains information about 545 deep sky objects - the Messier Catalog, Herschel 400 Catalog, and most of Caldwell and Hidden Treasures catalogs.

Selecting an object will display information like Name, Constellation, Magnitude, Size and interesting facts about it. The last column -

The main sources for interesting facts about the Messier objects are “http://wikipedia.org” and “http://seds.org/messier”/. The facts for the other objects and all audio recordings are compiled and recorded by Jeff Seivert.

To install the audio extension, download the desired package from the Download page of the APT’s site and install it. The button "**Play**" in Object Browser will be available for all objects with audio information.

**Note:** See the Object Browser section for information about information about the **Object Details**, **Type filter**, **Visibility filter**, and object list columns.

Enabling the option **"Show the extended list"** will show 21 253 objects in the list. (Great thanks to Andrew Knight for compiling it!). Note that on slow computers it cloud take some time to load especially if next option is also enabled.

- **Show** button shows the selected object in the planetarium application.

- **Add Trigger** button opens the Add Trigger dialog box in SessionCraft and populates the object name as tag name, object name and the coordinates. If the object is not above defined air mass limit the AML Up time will be prepopulated. If the object is above the air mass limit the current time will be set as trigger starting time.

- **DB Search** button opens the Database Browser with using the object name as prepopulated search criteria. By default the search criteria is build to look for different forms of the name. **Shift+Click** creates search criteria for the exact object name.

- **Add in ToDo** button adds the selected object in the ToDo tab. **Shift+Click** will adds the selected object in the Custom tab.

- **In AstroBin** button opens your web browser and looks for images of the selected object in AstroBin using wildcards. **Shift +Click** will search for exact name.

- **In Telescopius** button opens your web browser and looks for images of the selected object in Telescopius. **Shift+Click** opens the Telescopius Mosaics tool, when a mosaic is created, use Download CSV. After that you can import it in Custom / ToDo tabs.

To change the list order click on the column you want to define the order.

**Tips&Tricks** ***Shift+Click*** *on OK button will but in the clipboard the command #GoTo with the RA/Dec of the selected object.*




## Stars

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*

The Stars tab contains short list of the 78 most popular alignment starts and 338 in the extended list compiled by Andrew Knight. In the Hint column there is short information on how to find the star in the sky. If you select a star and switch to Maps tab, APT will automatically select the map that contains the star.

You can use these stars to make GoTo aliment. Here is the procedure.

- Make connection to the mount
- Select a star from the list
- Use the Cross and LiveView to center the star
- Click Sync in Gear tab

The option "**Show only the visible stars**" determines which stars from the list are visible in the current moment. In order the calculation to be correct you have to enter your observing site coordinates in Location settings tab.

Show button shows the selected object in the planetarium application.

To change the list order click on the column you want to define the order.

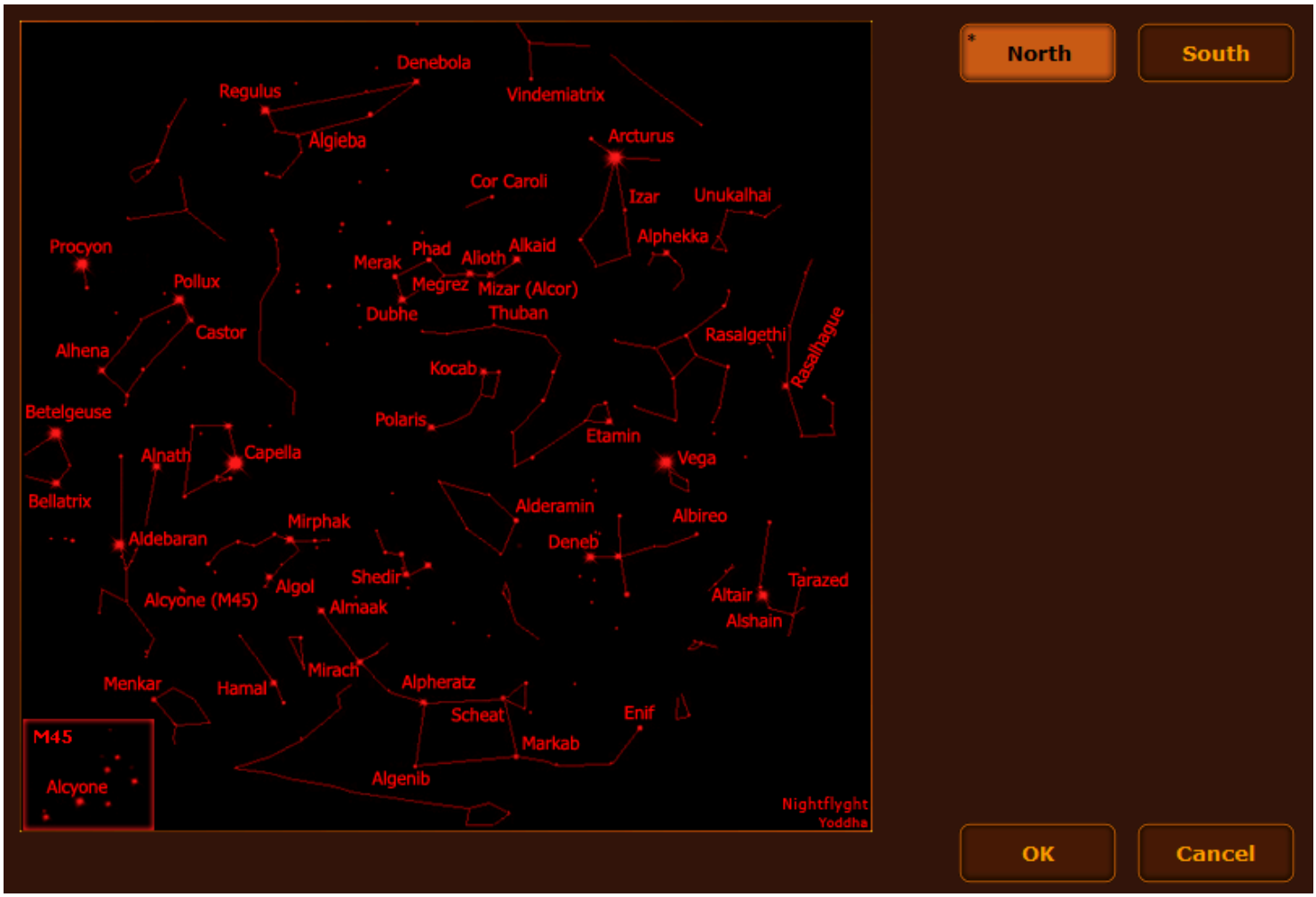



## Maps

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*
APT Object Browser Deep Dive - Its Use, Tips & Tricks

The Maps tab contains two maps with the constellations in both celestial hemispheres and the names of all stars listed in the Stars tab. To switch the maps use the buttons North/South or select a star from Stars tab.




## Custom

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*
*APT Object Browser Deep Dive - Its Use, Tips & Tricks*
*Object Browser - 2, Object Browser*

The Custom tab gives possibility to enter additional objects as well as importing objects saved by other users or exported by other applications. Here the columns are similar to these in Deep Sky tab.

**Note:** See the Object Browser section for information about information about the **Object Details**, **Type filter**, **Visibility filter**, and object list columns.

To change the list order click on the column you want to define the order.

The interface is intuitive, but let give some hints and information:

- You can use **Shift+Click** or **Ctrl+Click** to select multiple lines for deletion.

- **Show** button shows the selected object in the planetarium application.

- "**Add in ToDo**" button adds the selected object in the ToDo tab.

- **Add Trigger** button opens the Add Trigger dialog box in SessionCraft and populates the object name as tag name, object name and the coordinates. If the object is not above defined air mass limit the AML Up time will be prepopulated. If the object is above the air mass limit the current time will be set as trigger starting time.

- **DB Search** button opens the Database Browser with using the object name as prepopulated search criteria. By default the search criteria is build to look for different forms of the name. **Shift+Click** creates search criteria for the exact object name.

- **In AstroBin** button opens your web browser and looks for images of the selected object in AstroBin using wildcards. **Shift +Click** will search for exact name.

- **In Telescopius** button opens your web browser and looks for images of the selected object in Telescopius. **Shift+Click** opens the Telescopius Mosaics tool, when a mosaic is created, use Download CSV. After that you can **Import** it here or in the ToDo tab.

- If Camera Angle field is populated and there is connection to a Rotator, on OK the value will be populated in the Gear tab.

- The **Export** button saves all the objects in a file that can be used as backup or to share with friends.

- The **Import** button can be used to import objects saved in several file formats:

  • APT Native format - data exported by other APT users or from the following applications:

    1. Mosaic plans created by Asimoplan (mosaic planning software - www.asimoplan.com). Each panel of the mosaic creates a separate object. When using Asimoplan select the “Application Specific” page in the “Export Frame Coordinates” window and check the “Astro Photography Tool – APT” check box before clicking the “Export” button. Once imported each frame's object contains that frame's central RA and Dec coordinates. Double-clicking any listed frame transfers those coordinates to the Gear tab or in PointCraft GoTo++ where they can be used to slew the connected telescope into position for imaging.

    2. Lists from AstroPlanner (http://www.astroplanner.net/). In AstroPlanner go to “File” menu then “Export” and select “APT Object List...” option.

    3. Lists from Deep-Sky Planner (http://www.knightware.biz/) In Deep-Sky Planner go to “File” menu then “Export” and select “Export APT...” option.

    4. For Object lists shared by APT users check the following topic in APT forum - http://aptforum.com/phpbb/viewtopic.php?f=19&t=147

  • Telescopius/DSO-Browser format - data downloaded from the site www.telescopius.com / www.dso-browser.com

  • Lists in .COS and .C2A formats saved from Computer Aided Astronomy- C2A (http://www.astrosurf.com/c2a/english/).

  • Observing and objects lists from Cartes du Ciel - CdC (https://www.ap-i.net/skychart/en/start)

  • Frames lists from Cartes du Ciel - CdC (https://www.ap-i.net/skychart/en/start). This allows creating mosaics frames, for more information see http://aptforum.com/phpbb/viewtopic.php?f=17&t=1958

  • Direct import of multiple frames / mosaic from Hallo Northern SKY - HNSKY (http://www.hnsky.org/software.htm)

• Direct import of mosaic frames from  Cartes du Ciel - CdC (https://www.ap-i.net/skychart/en/start) while the Mosaic tool is open

**Tips&Tricks** ***Shift+Click*** *on OK button will but in the clipboard the command #GoTo with the RA/Dec of the selected object.*




When "Add New" or "Edit" is clicked the section "Object Details" becomes like the one on the next screenshot.

Here are some useful features:

• If you have used the Store button in PointCraft, the RA, Dec and Camera angle fields will be populated with the results from the last plate-solving.

• If you are creating a new object and there is connection to the telescope, you can use the button "Get Scope Ra/Dec" to populate the Ra/Dec with the current telescope position.

• If there is connection to your planetarium application,  you can use the button "Catch RA/Dec/Angle" to populate the Ra/Dec (and if it is possible the Angle) from the planetarium.



## ToDo

*The Object Browser is accessible from Tools tab, with Alt+O shortcut and from PointCraft.*

*Related videos:*
*APT Object Browser Deep Dive - Its Use, Tips & Tricks*
*Object Browser - 2, Object Browser*

The ToDo tab gives possibility to define second list of objects different from the one in Custom tab. It was built as place to the objects planned for imaging in the next sessions.

The look and the behavior is the same as Custom tab, so please refer it for details.

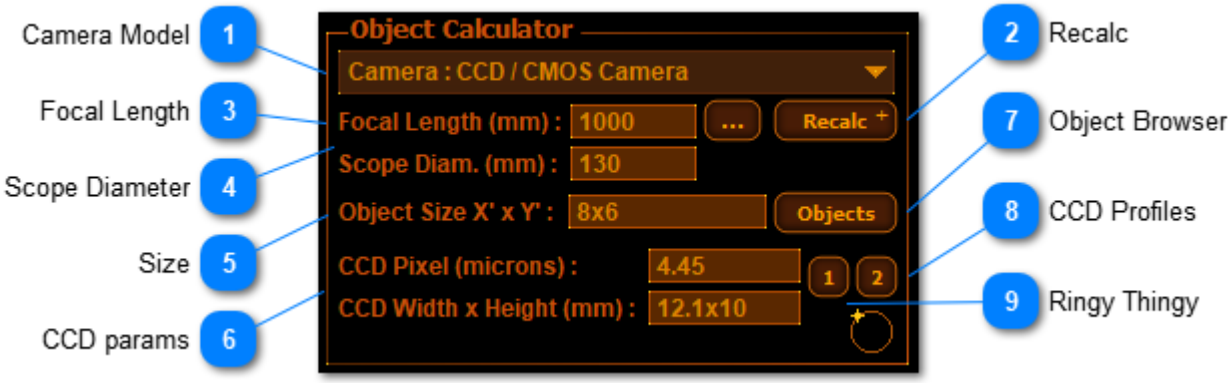
## Object Calculator

*The Object Calculator is accessible from Tools tab.*

*Related videos:*
*Object Calculator*

The Object Calculator is combination of built-in data bases and formulae that allow computing various parameters of your imaging setup (like FOV, CFZ, size, resolution etc.) without need to enter "hard to find data". It also can help to export the FOV size to your Planetarium application for easier target selection and frame orientation (see Planetarium section).

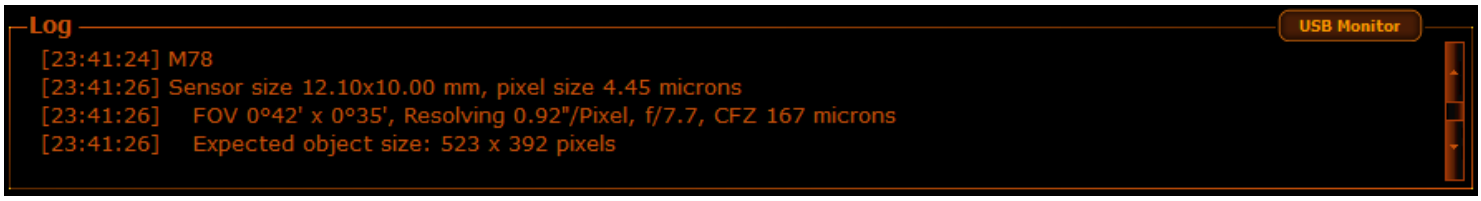
APT contains one database with all Canon EOS and Nikon models and their specifications. Also it has database with many deep sky objects in the Object Browser. Combining them it is possible to see what is you Field-Of-View (FOV) size, the size of an object in pixels or to see how big the object will be into your frame!



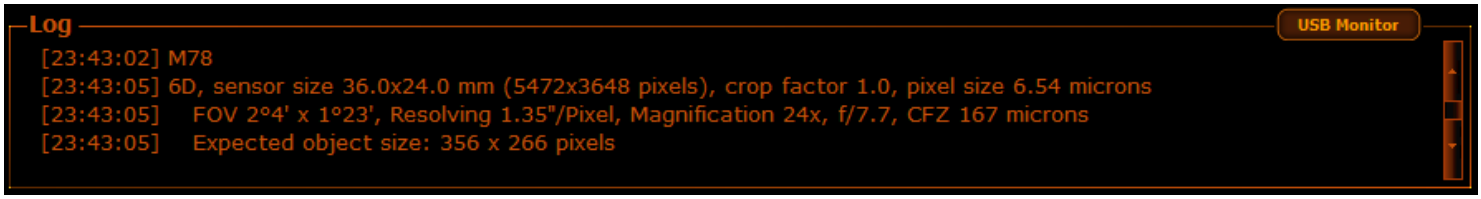

On camera connection APT will automatically select the Canon EOS or Nikon model (or the option "CCD/CMOS Camera") in the list box "Camera". Also you can select any model if you want to make a comparison. The other value you have to enter (for CCD/CMOS there is need to enter the sensor and pixel size one time only) is the telescope or lens focal length.

Click on Recalc button will make the calculations and print the results (and the sensor properties) in the Log panel. If you select an object from the Object Browser, or if you enter object size in arc-minutes, there will be information about the expected size in pixels too.

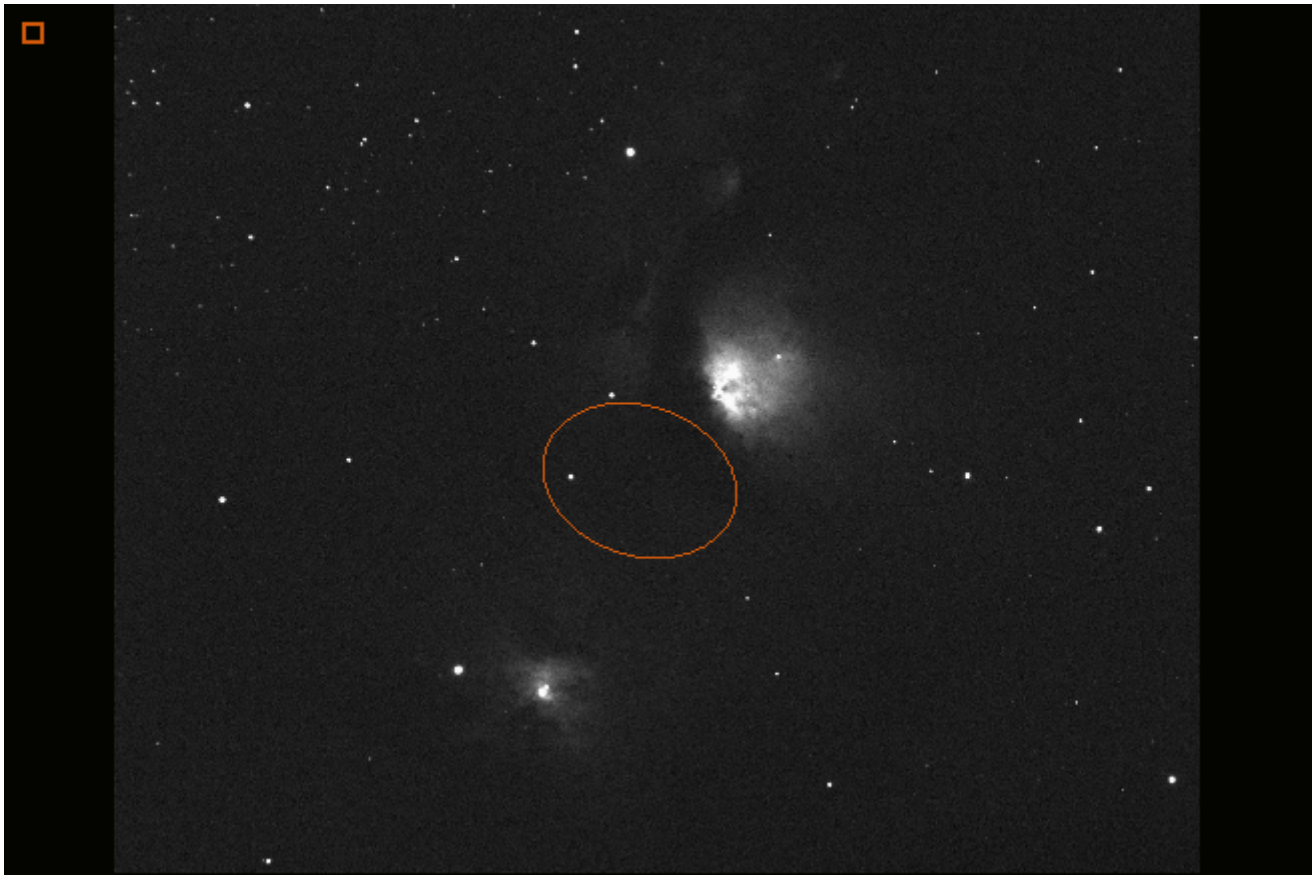
Here is sample with selected M78 (from the Object Browser) for QHY22 CCD camera and focal length 1000mm:




And the same calculation for EOS 6D:




Also in the main screen Preview Area you will see how big the object will be into your image:



## 1 Camera Model




The list of all Canon EOS and Nikon models plus possibility to select a CCD/CMOS. The Canon EOS/Nikon model or the CCD/CMOS option is automatically selected when connection is established.

## 2 Recalc




Makes new calculation with the current camera model, focal length and object size.

If you use the **Shift+Click** on the Recalc button (or Alt+W shortcut), APT will collect information about the FOV size, the current telescope coordinates (if connected), the rotator position (if connected) and then to send it to the connected Planetarium application to show you where the telescope is pointed in a bigger context. If there is no telescope or rotator connection it will still show the FOV size.

## 3 Focal Length




Enter the focal length of your telescope or lens to use for calculating the Field Of View (FOV) and the resolution arc-second per pixel. If you are using Canon/Nikon lens, APT will read the current lens focal length after each exposure and will update this value automatically.

The button "..." allows creation/selection of different profiles. When Focal Length control is focused you can use arrow up/down keyboard keys to scroll through the profiles you have defined.




## 4 Scope Diameter




Enter the diameter of your telescope or lens to use for calculating the Critical Focus Zone (CFZ). Requires the Focal Length to be populated too.

## 5 Size



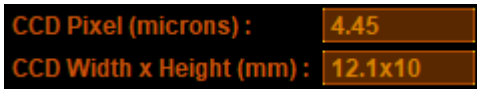

Enter the Object Size that you want to use for the calculations. The values are in arc-minutes. You can enter something like 10x5 for oval object or just 11 for circular object.

If you enter 12.5x7 it will draw an ellipse tilted by the diagonal "lower left - upper right". If you enter 7x12.5 it will draw the same ellipse, but tilted by the diagonal "upper left - lower right". In order to see the object outline, you have to select a camera model, enter focal length, object size and to click on “Recalc” button. If you change any parameter, click again on the “Recalc” button to recalculate and re-draw the object.

To hide the outline use the Target button in the Main screen.

If you want quickly to change the ellipse orientation double click in the edit box and APT will switch from 7x12.5 to 12.5x7.

### 6 CCD params




These are the CCD/CMOS camera parameters used to calculate the Field Of View (FOV) and the resolution arc-second per pixel. They are need only when you use CCD/CMOS camera.

### 7 Object Browser




Opens the Object Browser in order to select an object. On object selection it size will be automatically populated in the Object Size field.

### 8 CCD Profiles




CCD Profiles allow to store the parameters for two CCD/CMOS cameras and later to switch fast between them. To store a profile, enter the CCD/CMOS parameters, hold the Shift key and click on the buttons "1" or "2". To load a profile just click on the desired button. Profile loading also makes automatically the calculations made the Recalc button.

### 9 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## Planetarium

*Related videos:*
*Pre-Install (Windows) Part 4 - Stellarium (making connections)*,
*Pre-install (Windows) Part 4a - More Stellarium Configuration*,
*Planetarium*

APT is able to communicate with growing number of planetarium applications. Currently supported are Cartes du Ciel (CdC), Computer Aided Astronomy (C2A), SkytechX, Hallo Northern SKY (HNSKY) and Stellarium. See the Planetarium settings tab section for information on how to make connection to the applications.

The integration is in two ways. APT is able export information to planetarium in order to see an object in larger context. This allows seeing what other objects are nearby and helps to define image framing by optimal way. It is also possible to import data from planetarium - useful if you want to save a framed target for future use, to help near solving, to make GoTo++ (GoTo with image confirmation) or regular GoTo when the planetarium is not connected to the mount. The import features can be very useful when scope without direct support in Stellarium is connected, using APT as ASCOM bridge/proxy for Stellarium.

**Note:** *You have to start the planetarium application in order APT to be able to connect it it.*

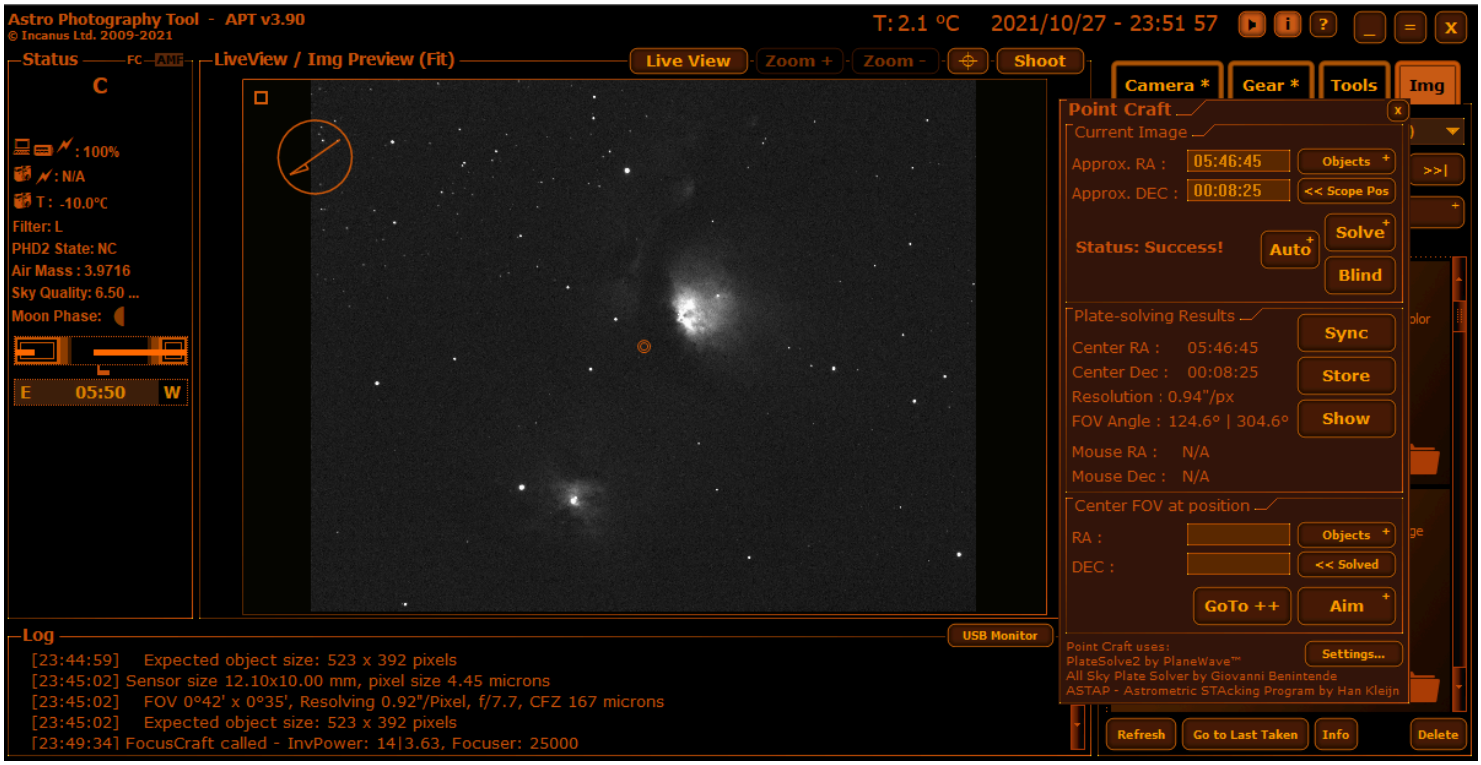
Export can be made:

- In PointCraft when there is a solved image. Use Show button to see the Field-Of-View (FOV) from the current image in planetarium.
- In DeepSky, Stars, Custom, ToDo tabs of Object Browser. Use Show button to see the saved object in planetarium using the FOV size defined by Object Calculator.
- In Object Calculator in Tools tab. Use **Shift+Click** on the Recalc button (or Alt+W shortcut). APT collects the current telescope coordinates (if connected), the rotator position (if connected) and the current FOV defined by the Object Browser to see in planetarium where the telescope is pointed. If there is no telescope or rotator connection it will still show the FOV size.

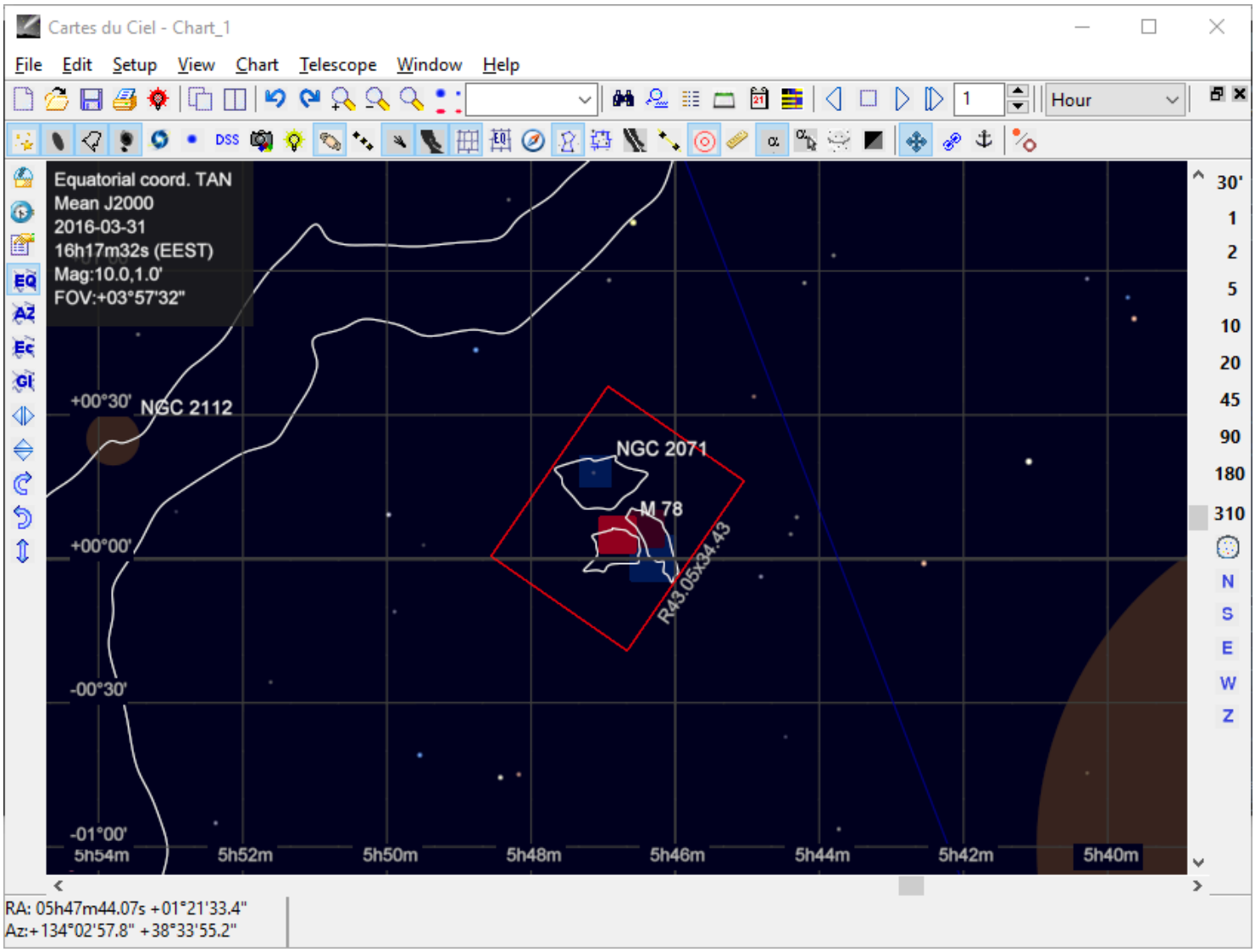
Import can be made:

- In PointCraft use **Shift+Click** on Objects to load the current FOV coordinates from the planetarium in Approx Ra/Dec. Useful to use the planetarium to set the approximate coordinates for near Solving.
- In PointCraft use **Shift+Click** on Objects to load the current FOV coordinates from the planetarium in GoTo++ Ra/Dec. Useful to use the planetarium for framing and then to get the coordinates for GoTo++.
- In Gear tab use **Shift+Click** on Objects to load the current FOV coordinates from the planetarium in GoTo Ra/Dec. Useful to use the planetarium for framing and then to get the coordinates for regular GoTo.
- In Custom tab of Object Browser. When an object is added or edited, use the button Catch RA/Dec/Angle to populate the RA, Dec and Angle (if supported by the planetarium)
- Also when CdC is used the selected Object Name will be imported in APT (Camera Tab and In Custom tab of Object Browser)

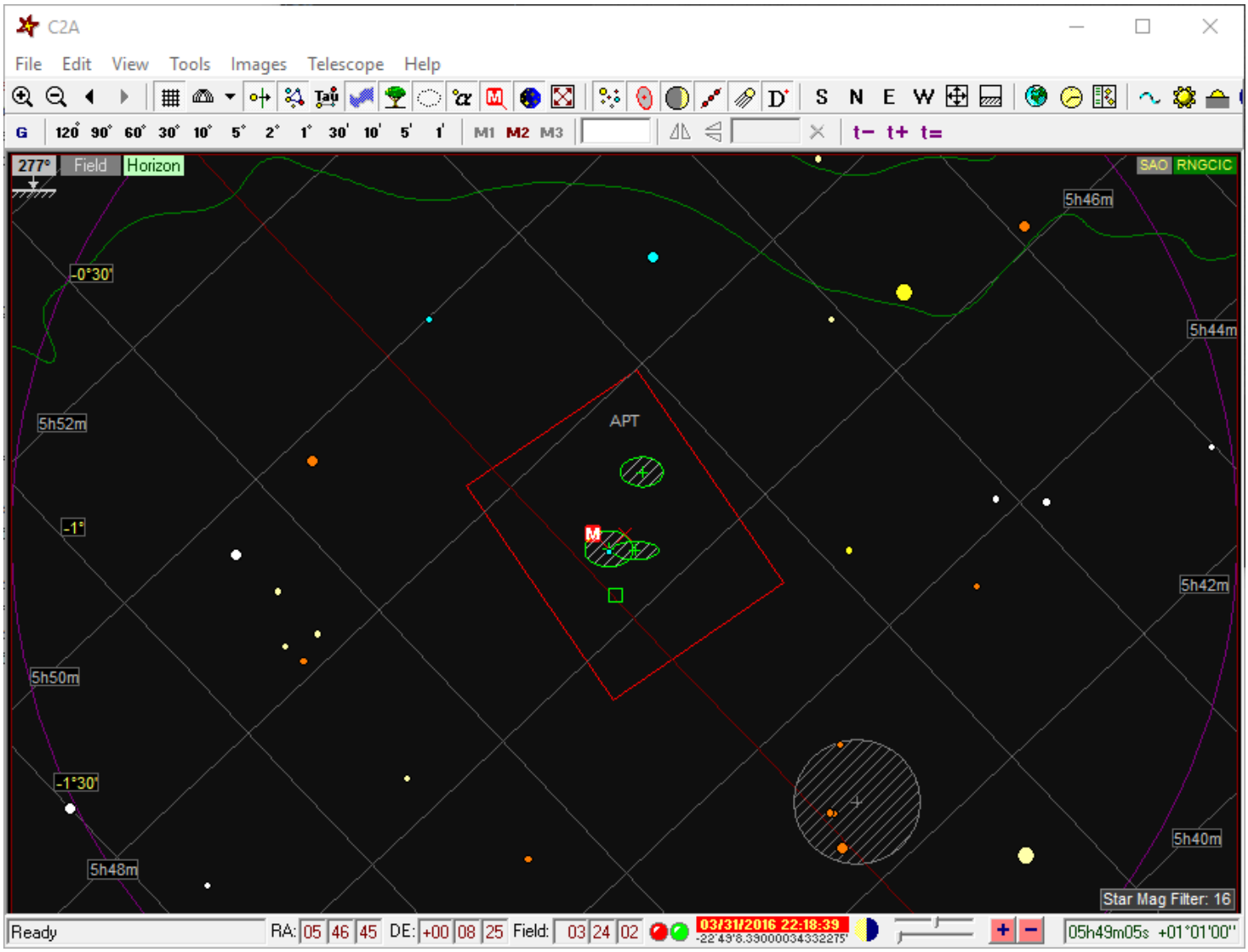
Here is a solved image of M78. The data for the detected FOV is sent to the planetariums below.



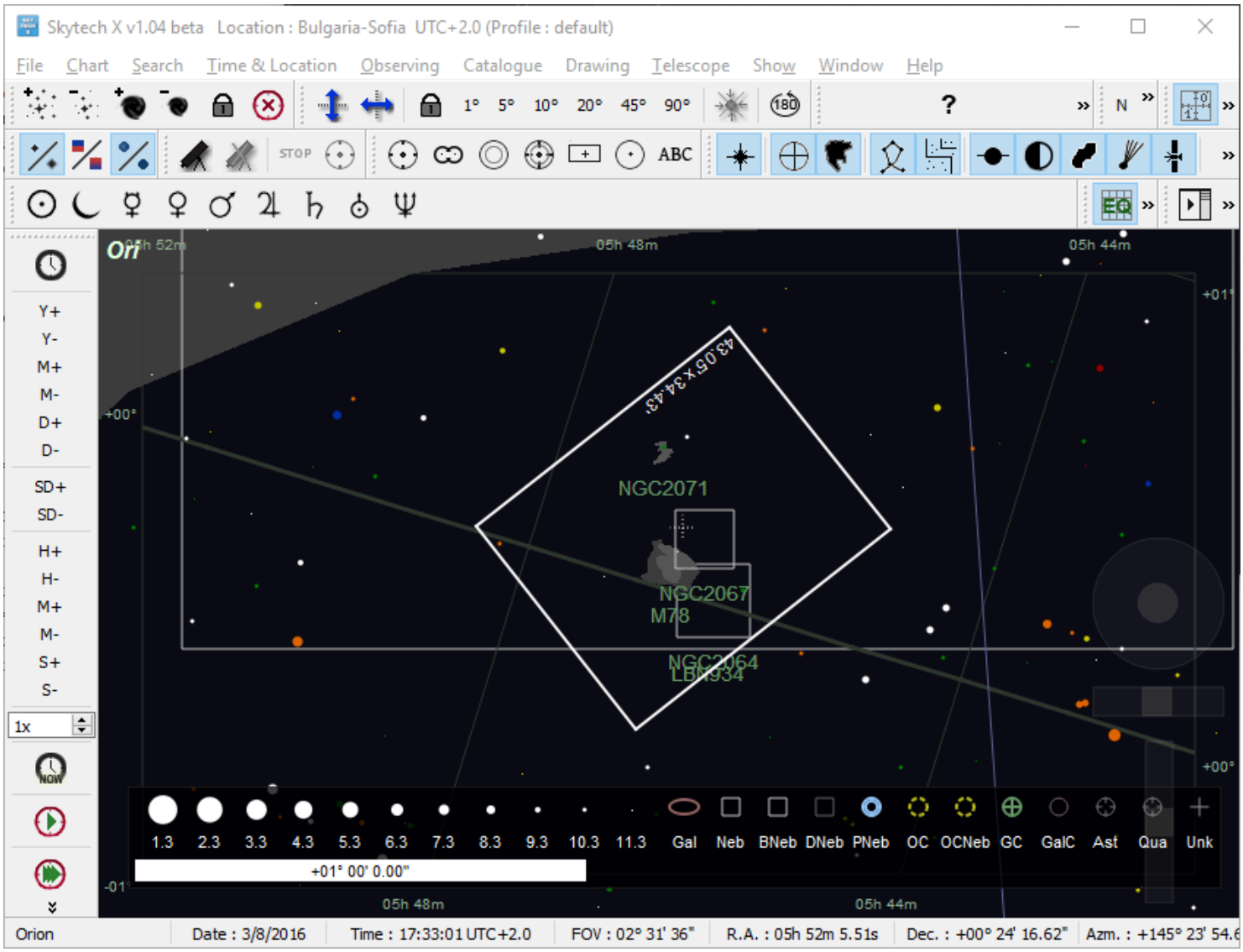
This is how Show button interacts with Cartes du Ciel. See the configuration notes. You can use CdC to create a mosaics frames and then import them for usage in the Object Browser. For more information for to create the frames see - http://aptforum.com/phpbb/viewtopic.php?f=17&t=1958




This is how Show button interacts with Computer Aided Astronomy (C2A).

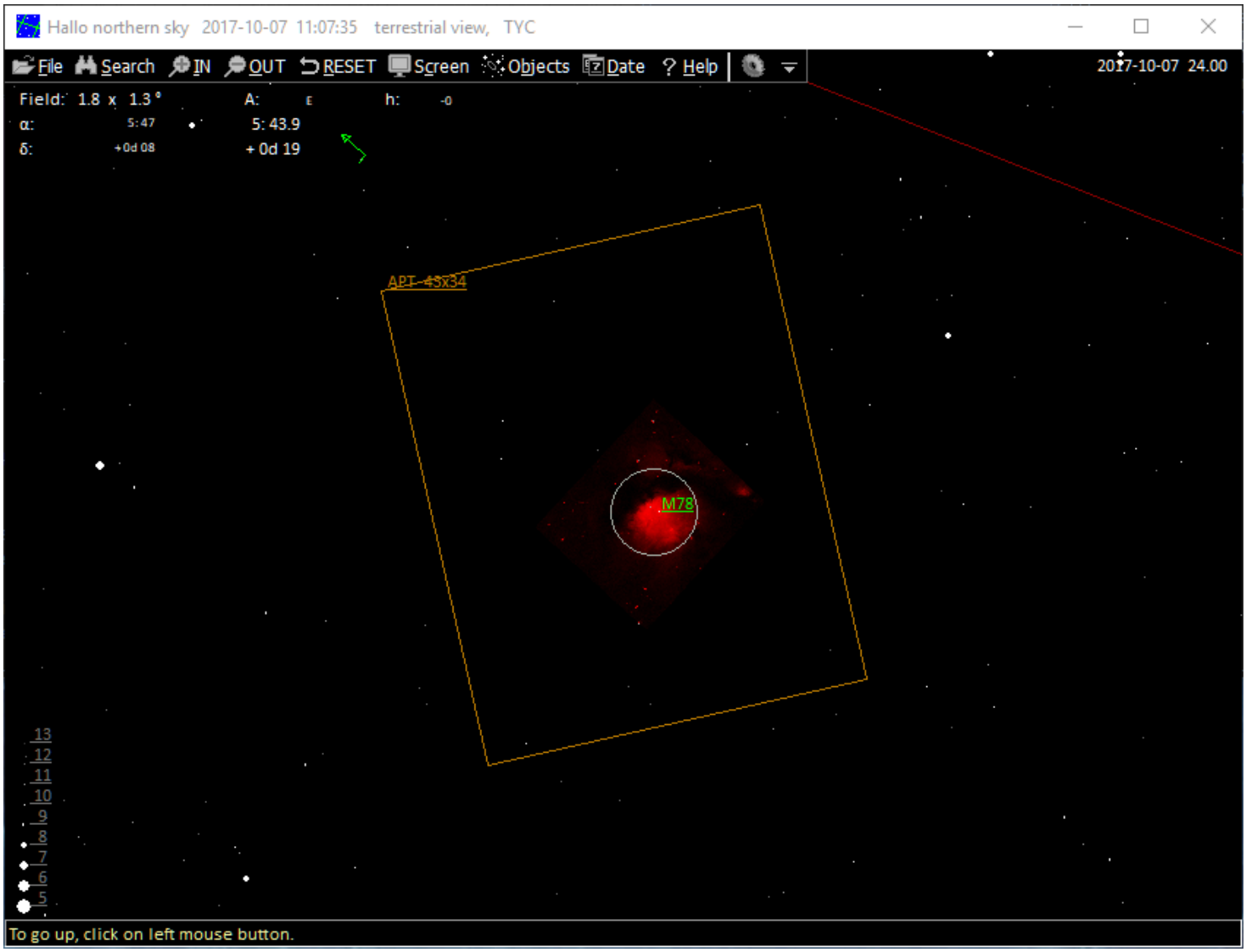



This is how Show button interacts with Skytech X. See the configuration notes.

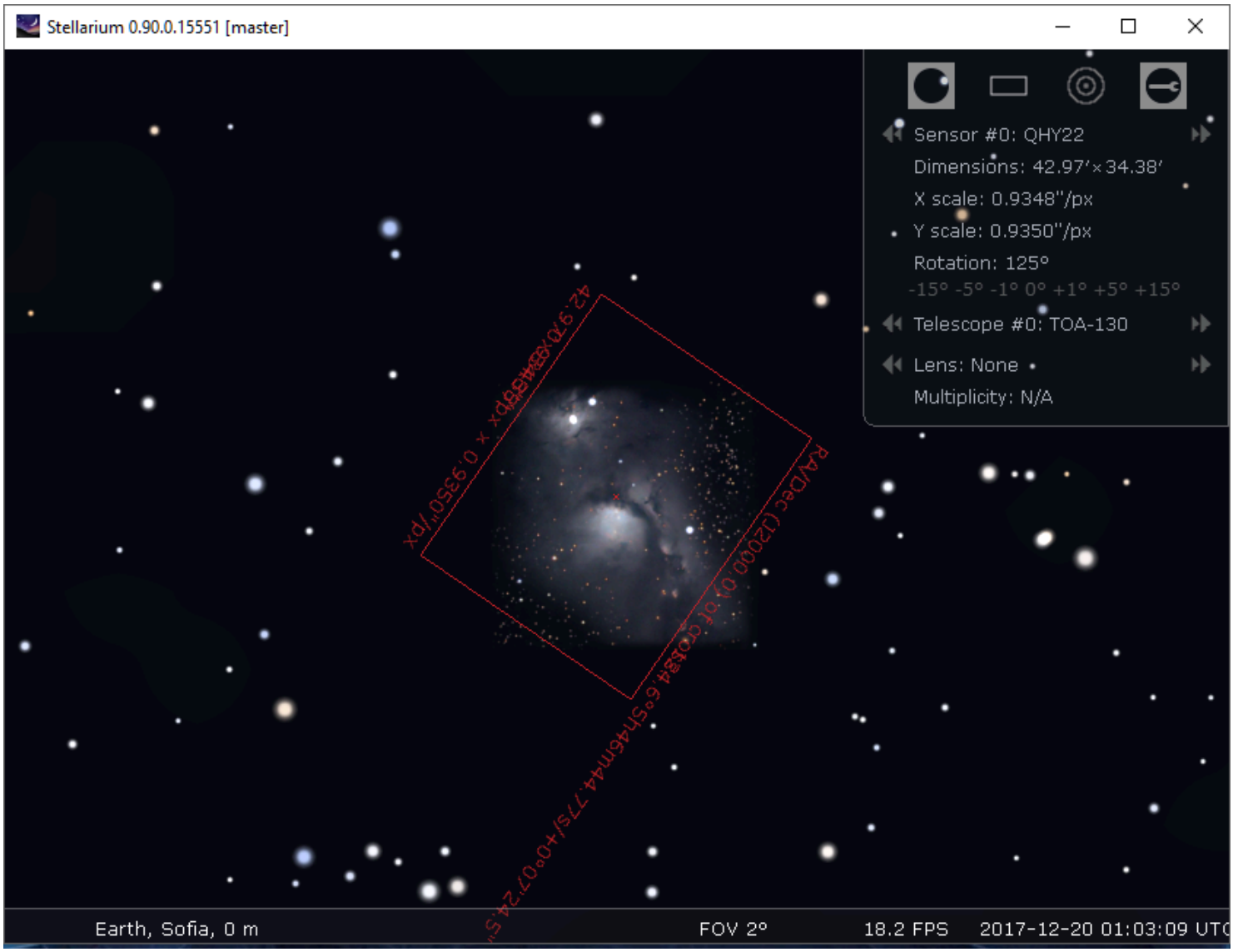



This is how Show button interacts with Hallo Northern SKY (HNSKY). See the configuration notes. Han Kleijn, the author of HNSKY have recorded two very interesting clips demonstrating some interesting features including creation of mosaic and storing the frames in APT

Clip 1 - https://www.youtube.com/watch?v=b1GW1neM3zk&feature=youtu.be
Clip 2 - https://www.youtube.com/watch?v=gj6QUQX1sPc&feature=youtu.be




This is how Show button interacts with Stellarium. See the configuration notes. **The coordinates import features can be very useful when scope without direct support in Stellarium is connected, using APT as ASCOM bridge/proxy for Stellarium**.




## Meridian Flip Clock

*The Meridian Flip Clock is visible in the Main APT screen.*

*Related videos:*
*Meridian Flip Clock*

The Meridian Flip Clock gives an easy way to monitor the important event for most telescope mounts - the passing through the celestial meridian. Usually this affects mount tracking because of the gear engagement change. For other setups it is important to monitor the meridian closing because in some positions the telescope can hit the tripod or pier.

In order to show data the Meridian Flip Clock needs a connection to the mount and also the tracking to be engaged. If there is no mount or it is not tracking the clock looks like:




In some steps during automated meridian flip process the tracking is disabled, but the object position is known so the Meridian Flip Clock will continue to show accurate calculations of the meridian passing moment.

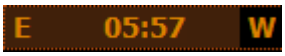
If the option "Auto-hide Meridian Flip Clock" in Scope & Focuser settings tab is enabled, the clock be invisible when there is no mount connection.

Few theory notes. The celestial meridian is a whole circle, not only the visible part from horizon to horizon. Every object is crossing the meridian two times per 24h - once in the highest position (point A) and once in the lowest position (point B) of it path. For the objects near to the celestial poles is possible both the highest and lowest positions to be above the horizon. Point A defines the transition from the Easter celestial hemisphere to the Western hemisphere. Point B from Western to Eastern.

The Meridian Flip Clock shows the time and the minutes **to next meridian crossing** which can be Point A or B. As soon as object is in Point A it has exactly 720 minutes (12h) to reach Point B. The amount of time is same from Point B to Point A.

Both sides of the clock shows E or W. The left side shows in which celestial hemisphere the object is in the moment. The numbers between the two letters show the minutes to next meridian passing the exact time of this moment. The next two pictures show that the scope is pointing to an object in the Easter celestial hemisphere:

Shows the exact time of the meridian flip




Shows the minutes till the meridian flip




In 19:30 the W will be in left E in right showing that scope is pointing in the Western celestial hemisphere, the minutes will be 720 (12h), the time will be 7:30. This shows when next meridian crossing (in Point B) will happen.

## Focusing Aid

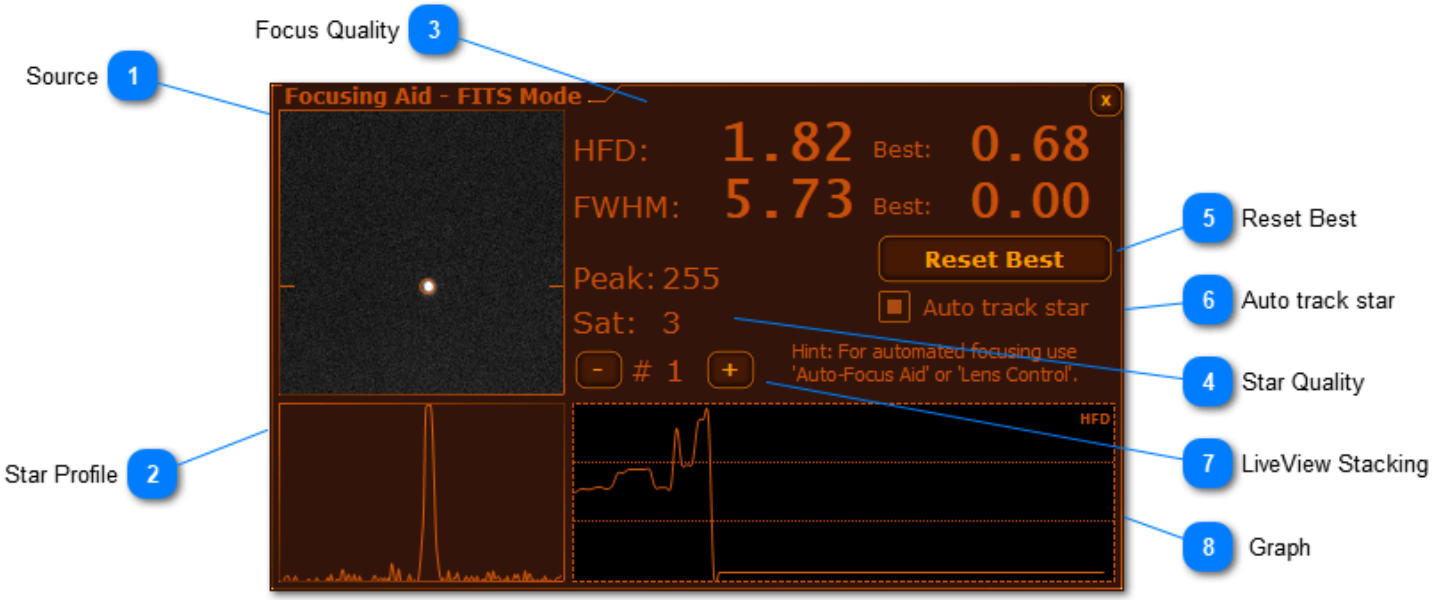
*The Focusing Aid is accessible from Tools tab or with Alt+F shortcut.*

*Related videos:*
*Focusing Aid*
*Focusing A to Z*

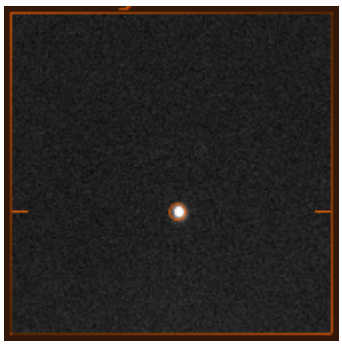
Focusing Aid allows achieving perfect focus using the HFD (Half Flux Diameter) and/or FWHM (Full Width Half Maximum) metrics to measure the focus quality. The lowest value is the best one. It is advisable to relay on HFD instead of FWHM, because the first is more stable against the atmosphere turbulence. HFD works with the whole star area while FWHM works only with the line of the star profile.

**Note:** In CCD Mode you have to switch to 1:1 Preview Mode in order to use the raw FITS / XISF data for calculation of HFD/ FWHM. Using the raw data gives much more accurate focus quality measurements that the values calculated on screen data. In DSLR mode also switch to 1:1 Preview Mode.

The Focusing Aid use the common aid behavior in APT- dragging the window and placing the Source frame over the image part that you want to use.

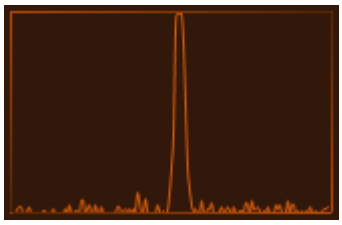



## 1 Source



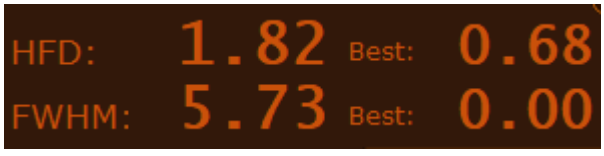
It is a "transparent" window that shows the image under the Focusing Aid and defines what is the source to be used in the Aid. It automatically detects the brightest star in the frame and analyze it.

## 2 Star Profile



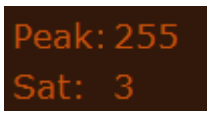
Shows the star profile.

## 3 Focus Quality



In left are the FWHM and HFD values for the current image. In right are the best measured values since last reset. The best values are reset if Reset Best button is used.

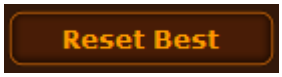
### 4 Star Quality




Peak shows the brightest pixels value in the selected stars (8bits value). Sat means saturation and shows how many pixels has the brightest value.

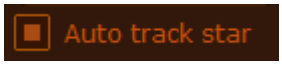
For focusing is good to use stars with saturation 1-2 and peak bigger than 40.

### 5 Reset Best




Reset the best values for FWHM, HFD and clears the graph.

### 6 Auto track star




When enabled moving the Focus Aid window will be moved in ordet to center the focusing star it there is movement during the focusing.

### 7 LiveView Stacking




Used in EOS mode when LiveView is activated. Defines how many images from the LiveView stream to stack before the star quality analysis. Bigger value reduces the influence of the atmosphere turbulence and the image noise, but requires giving time after focus change before you can see the actual effect - stacking leads to less "live" image.

### 8 Graph




Shows graph of the FWHM or HFD value changes. It is valuable to see if you are tuning the focus in the right direction or if the focus point is passed. Lowering graph means that you are moving in the right direction.

Double click on the graph to switch between FWHM or HFD metrics.

# Auto Focusing Aid

*The Auto Focusing Aid is accessible from Tools tab or with Alt+A shortcut.*

*Related videos:*
*Auto Focus Aid*
*Focusing A to Z*

The automated focusing requires some initial preparation and measurements in order to provide best results. Please read this section before you start using it.

The new Auto Focusing Aid that comes with APT 3.88 and later is combined effort of **Stephen King**, **Benjamin Schulz**, **Jim Hunt**, **Ivaylo** and **Maria Stoynovs**. Stephen suggested the method of hyperbola fit for finding the exact focus point by exploring a range of data points and made the "prove of concept" tests. Benjamin wrote a computation library that takes care for the mathematics of the hyperbola fit. The exact algorithms for gathering the data points backlash calculation, filter offsets calculation are made and cleared after great amount of brain-storming, simulations and tests made by this team, but also with many other APT friends. Great thanks to everyone involved for investing so much time and efforts into this project!

The Benjamin's computation library is with open source and is available at https://github.com/bschulz81/hyperbolicfitdll. The sources are also available in the "Sources" subfolder of the folder where APT is installed.

**How it works in short** - the auto-focsing takes a number of shots, changing the focuser position between them. For each shot is measured the **HFD - Half Flux Diameter** or **FWHM - Full Width Half Maximum** or **InvPower**. Computed is the hyperbola curve that fits best the Position vs HFD / FWHM / InvPower pairs. The minimum of this hyperbola is point with good focus - part of the Critical Focus Zone. This method named U-curve is considered to be more effective than the classical V-curve.

**Hardware requirements -** Focuser with stepper motor and ASCOM / INDIGO / INDI driver (or enable emulation of position focuser, see Scope & Focuser settings tab)

**1. Critical Focus Zone**

Everyone of us has seen diagrams of optical systems where the light beams are crossing in the focus point which is critical for good astrophotography or visual observation. However in reality it is not one point, but zone where the light is still focused. This zone is named **Critical Focus Zone** or **CFZ**. How big this zone depends on how "fast" the telescope is. Slower scopes (those with bigger F ratio - the Focal Length divided by Diameter) have bigger CFZ, the faster scopes (these with small F ratio) have smaller CFZ. The scope focuser moves in steps and usually there are several positions where sensor is in the CFZ. This means stars will be equally focused on several positions which makes the focusing much easier task than searching for one exact position.

Here comes a very important thing in the focusing procedure. If we move the focuser by with step much bigger than CFZ we will skip the focus zone and will not be sure where exactly its. In other hand if we move with step much smaller than the CFZ we will get very small changes in the HFD / FWHM / InvPower readings and usually these changes will be affected by the atmosphere turbulence. So it is important to move with a step big enough to give noticeable/measurable difference in the HFD / FWHM / InvPower and in same time not too big so be able to find where HFD / FWHM / InvPower stops to get smaller and starts to get bigger again. Various sources suggest that the optimal step size is 1.5-2 times the CFZ.

APT gives way to calculate the CFZ measured in microns. Just enter your focal length and scope diameter in Tools Tab, click on Recalc button and the Log Panel will see the CFZ size.




This value is in measured in microns, so we have to convert it to focuser steps by determining how many microns the focuser is moved per one step of the motor. If your scope has external focuser you can measure it easily. Here is description how to measure the microns per step. If you have internal focuser like Schmidt-Cassegrain you will have to experiment a bit. According to the empirical data we have collected during the tests we have found the value of 4 **microns per step** if good value or at least is good starting point. Once we have the "microns per step" we are ready to use the Auto Focus Aid - click on the Auto button in the settings and enter the value when asked. APT will determine the Focuser Move Step that should work fine (see the notes below).

If you want to calculate manually the Focuser Move Step, convert the CFZ from microns to steps by dividing by "microns per step". For the scope used for our example we have 86 microns and 3.1 microns per step, so we have 86 / 3.1 = 27.7 or our CFZ is ~28 focuser steps. The Focuser Move Step which is good to use is 42 to 56.

**The "rule of thumb":** During the years we have polished a simple empirical way to find a good Focuser Move Step. Start with the default step calculated by Auto button. Run auto focus with good initial focus by visual estimation. If you see jumping dots increase the step. If you see something like W shape lower the step. Repeat the process starting again with good focus till you get good U shape.

**2. Backlash**

Every mechanical device is not perfect. When you move the focuser in one direction and then get back with same step it will not be in the staring point because there is some play in the parts - this the backlash. You have to make a bit bigger second move in order to compensate the backlash.

There are three approaches to handle the backlash

- To measure how many steps it is and apply correction
- To use the "overshoot method" - Here is tutorial made by Benjamin https://aptforum.com/phpbb/viewtopic.php?f=28&t=4602 how to use only the Final Inward Move
- Combination of both

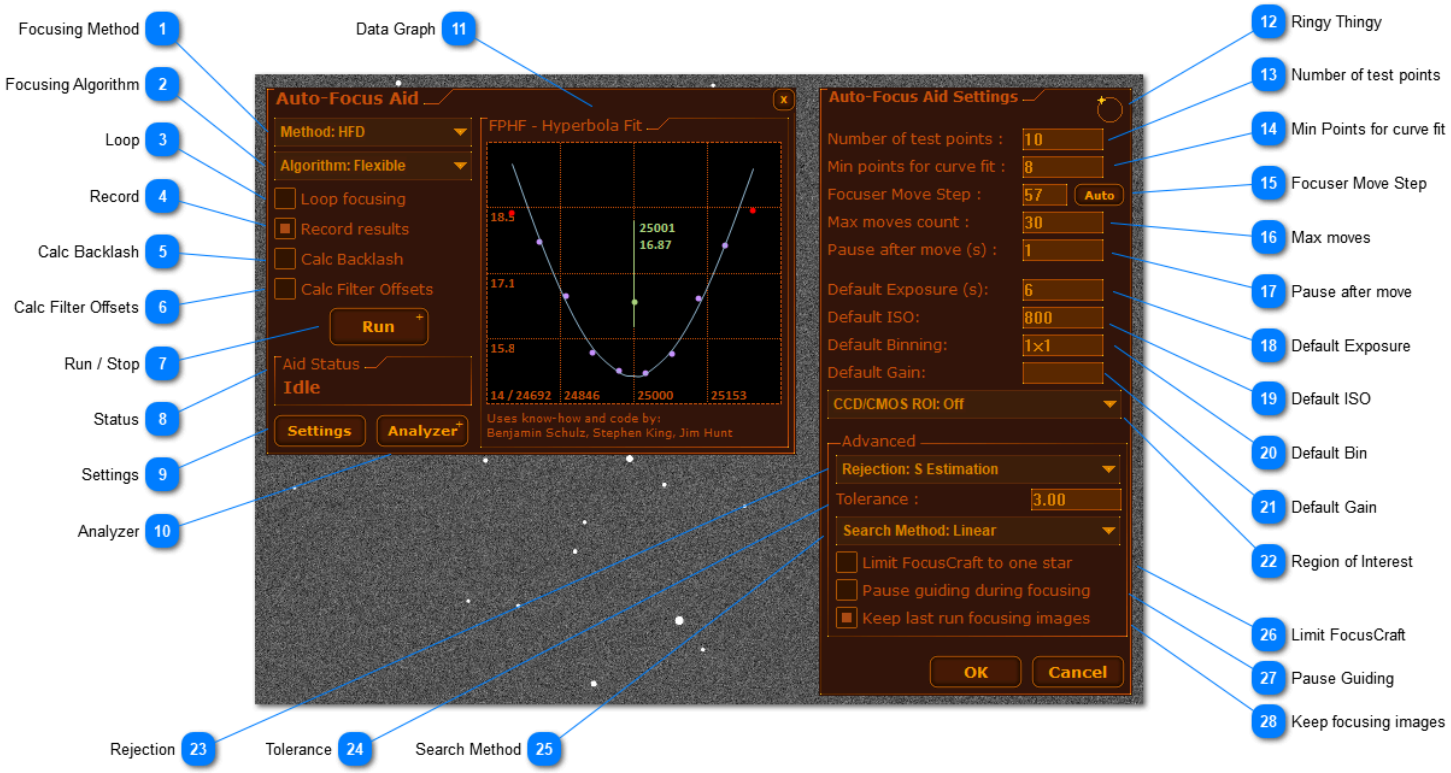
Here are some ideas how to Measure the Backlash. Once you have the backlash value you can enter in the focuser driver properties or in Scope & Focuser settings tab. To use the overshoot enable the Final Inward Move in Scope & Focuser settings tab. Many are using the combination of backlash and overshoot, however only overshoot can gives good results too.

**3. Setup**

Use the button Settings to open the dialog box and tune the options related to auto-focusing (see the description below). Usually the only setting that has to be changed is the Focuser Move Step. *It is important to set short exposure when InvPower is used!*

**4. Focus**

The Auto Focus Aid needs a source of HFD / FWHM / InvPower values. You can use FocusCraft and Focusing Aid. If you are using Focusing Aid switch to 1:1 Preview mode (double click on the star you want to use). Focus by eye as good as you can or go to know focuser position which is close to the best focus point and click on the button Run.




## 1 Focusing Method




Defines which metrics to use for Auto-Focusing - HFD (Half Flux Diameter) or FWHM (Full Width Half Maximum) or InvPower (Fourier method). HFD tends to give better results when the stars are detected. When focusing is made via InvPower there is no star detection.

Note: **InvPower is sensible to saturated stars in the focusing images. Usually the focusing exposures of 1s or even less give better results than long exposures. If you see small bump in the lowest part of the U curve this means that there are saturated stars.**

This setting is also used by the EOS Lens auto-focusing.

## 2 Focusing Algorithm




Defines what algorithm to use for automatic focusing:

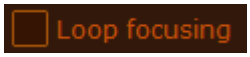
- **One Pass** tries to find the best focus taking defined number of exposures. If there is need it will take additional data points.

- **Flexible** (default) is based on **One Pass**. If additional data points were used Auto-Focus Aid will make second pass starting from the focus point found in the first pass. It can give a bit better result than **One Pass**, but can take double time.

- **Middle Of Two** is based on **One Pass**. It makes one pass and calculates the focus position. After that makes second pass starting from the focus point found in the first pass. As result will use the focuser position which is the average of the positions found in the two passes.

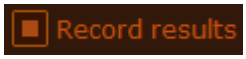
- **Better Of Two** is based on **One Pass**. It makes one pass and calculates the focus position. After that makes second pass starting from the focus point found in the first pass. The result will be the focuser position which has lower HFD/FWHM.

### 3 Loop



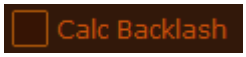

When enabled the Auto-focusing will make continuing focusing till it is manually stopped. Use this option if you want to collect data and study how the focus changes with the temperature changes.

### 4 Record




When enabled, will store the results of all successful focusing runs in log file. Later it can be exported via the Analyzer button and to be inspected and analyzed in MS Excel or other application.

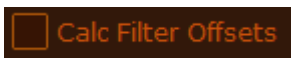
### 5 Calc Backlash




When enabled, on Run will try to measure the focuser backlash. Before you start measuring the focuser's backlash make sure that you have disabled all features that can cause unwanted motor movements. Disable the backlash compensation, temperature compensation, final inward move in Scope & Focuser settings tab. Also the backlash compensation in the ASCOM / INDIGO / INDI driver settings.

Make sure that the scope is well tempered. Use night with stable atmosphere and star or area well above the horizon.

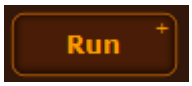
### 6 Calc Filter Offsets




When enabled will auto focus with all filters and will calculate focuser position offset per every filter. The offsets can be used to adjust the focuser position on filter change without need to refocus. Before starting move the filter wheel to the filter which you want to use as base. It is better to use Ha, SII or R filter as base. At the end the calculated offset will be reported and you can apply the values in the Filter Wheel settings tab automatically

Calculate the offsets when the system is well cooled, on sky area close to zenith and in a night with stable atmosphere!

### 7 Run / Stop




Starts/Stops the auto focusing process.

**Shift+Click** will make new hyperbola fit calculation using the data from the last pass. It is useful to see the effect changing the **Min points for curve fit**, **Rejection** or **Tolerance** settings without taking new set of images. After the calculation will be given  an option to move to the new focus position and take new confirmation image to see if the HFD / FWHM / InvPower is getting better.

## 8 Status



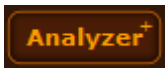

Shows the current status of Auto-Focusing Aid.

## 9 Settings




Opens the settings dialog box.

## 10 Analyzer

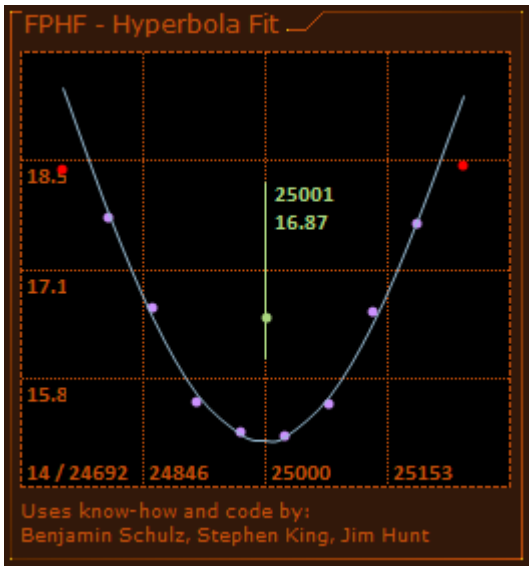



Exports the logged focusing results file that to be opened with MS Excel or similar application.

**Shift+Click** copies detailed data for last focusing into the clipboard. It can be sent to APT team for inspection.

**Ctrl+Click** imports from the clipboard focusing data that can be used for calculation of focus point. Useful if you want to try the shared from other users or your old data from the main APT log file (the lines with "AF (FPHF) Positions:" and " AF (FPHF) Values:")

## 11 Data Graph




Shows the gathered focus points. The horizontal is the focuser position, the vertical is the measured HFD/FWHM. Moving the mouse pointer over the dots you can see the position and the HFD/FWHM values.

Several colors forms are used to display various data:

- dots are used to display the data from the first pass
- small rings used to display data from the second pass
- small squares are used to display data ignored via backlash detection

- purple dots / rings are the data used for hyperbola fit
- red dots / rings are the ignored post ions not for hyperbola fit
- green line is the position of the hyperbola minimum
- green dot is the HFD / FWHM / InvPower value measured in the hyperbola minimum.

- blue curve is the hyperbola from the first pass
- yellow curve is the hyperbola from the first pass

**Note:** If you see dots jumping almost randomly this could mean that the Focuser Move Step is too small. If you see flat bottom in several points it could mean that the Focuser Move Step is too big.

## 12 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 13 Number of test points




Defines the number of the positions where to measure the HFD/FWHM. Before each measurement the position is changed with number of steps defined by Focuser Move Step. If you change this paramter, make sure to click on "Auto" button to re-calculate the Focuser Move Step.

Default value: 12, min: 7.

## 14 Min Points for curve fit




The focusing algorithm could reject some points which differ from nearby points and from the expectations in order get better result. If Min points for curve fit is equal to Number of test points the rejection is disabled and all points will be used, no matter what. Usually Min points for curve fit is Number of test points minus 2 to 4.

If there are rejected points they will be marked with red in the graph.

Default value: 8, min: 6.

## 15 Focuser Move Step




Defines how many focuser steps to make between the HFD / FWHM / InvPower measurements. This is very important value and depends on the Number of test points and on CFZ - Critical Focus Zone. Use the button Auto to get suggestion for the step size.

Default value: 35. It should work for well with 12 Number of test points for most f/5.5 scopes.

The button Auto calculates the Focuser Move Step based on Number of test points, the CFZ - Critical Focus Zone of the telescope and the microns moved by one step of the focuser motor.

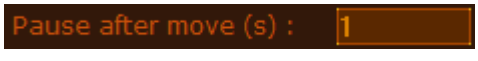
**Note:** If you see dots jumping almost randomly this could mean that the Focuser Move Step is too small. If you see flat bottom in several points it could mean that the Focuser Move Step is too big.

## 16 Max moves



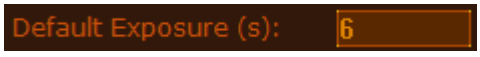

Defines the upper limit of the focuser moves that to make in trying to find the focus. When reached the aid will report and error and stop.

## 17 Pause after move




Defines how many second to wait after focuser move is finished before taking another image. The default value is 1.

## 18 Default Exposure



Defines the default exposure for auto-focusing. When set to 0s or empty will use the exposure set in the Camera tab. Also is possible to define exposure per filer in Filter Wheel tab of Settings. The priority from top to lower is:

- Per Filter in Filter Wheel tab
- Default Exposure in Auto-Focus Aid settings
- Exposure in Camera Tab DSLR Mode / CCD Mode

## 19 Default ISO




Defines the default ISO for auto-focusing. When is empty will use the value set in the Camera tab.

## 20 Default Bin




Defines the default Bin for auto-focusing. When is empty will use the value set in the Camera tab.

## 21 Default Gain




Defines the default Gain for auto-focusing. When is empty will use the gain set per filter or the value set in the Camera tab.

## 22 Region of Interest




Allows speeding-up the image download by reading part of the sensor pixels. For example selecting 1/4 will read one quarter of the sensor around its center.

## 23 Rejection




Defines what rejection method to use if Min points for curve fit is smaller then Number of test points and allows points rejection. The empirical tests shows that **S Estimation** gives best results.

## 24 Tolerance




The Rejection methods could be configured how tolerant to be to the data points when are tested if they belong to the hyperbola curve or not. The different rejection methods has different default values which will be set on method selection.

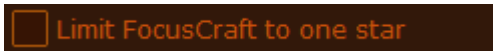
Default tolerance for **S Estimation** is 3.0

### 25 Search Method



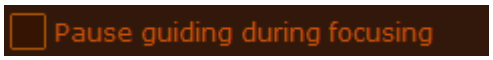

Defines how to search the hyperbola fit by Linear or Median regression. The empirical tests shows that Linear is faster and is giving almost identical results as Median.

### 26 Limit FocusCraft



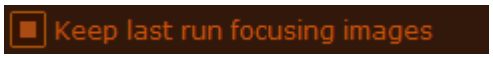

If you see that test points jump too much in the graph you can try to limit FocusCraft to work only with the brightest star.

### 27 Pause Guiding




When enabled, the guiding will be stopped on focusing start and will be resumed after that. This is useful option when Off-Axis Guider is used.

### 28 Keep focusing images




When enabled APT will keep the focusing images from the last re-focusing in the TemporaryStorage sub-folder located in the Images Path.

## Measure the "Microns Per Step"

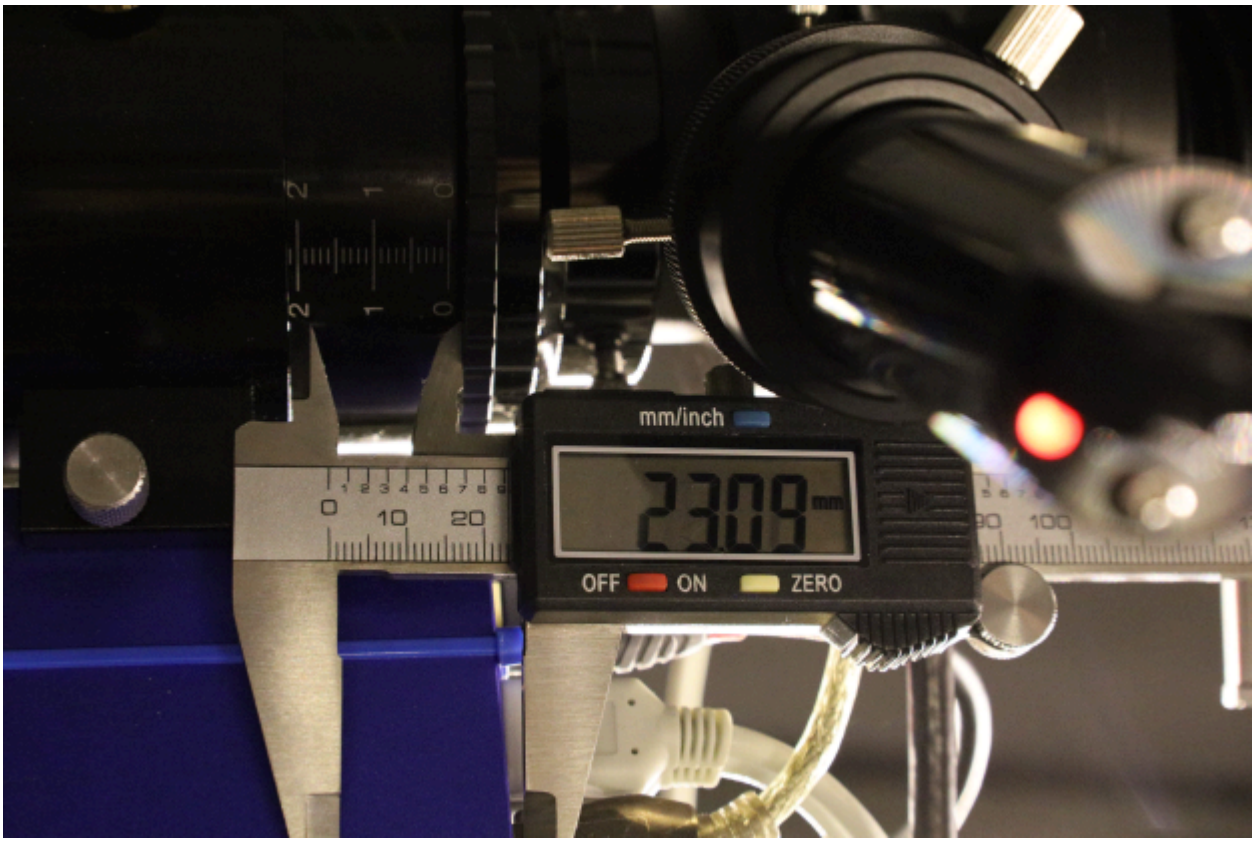
*Related videos:*
*Measure the focus motor "Microns Per Step"*

If you have an external focuser there is simple way to measure the approximate "Microns Per Step" value which gives how many microns the focuser will move for one step of the motor.

Here are the steps:

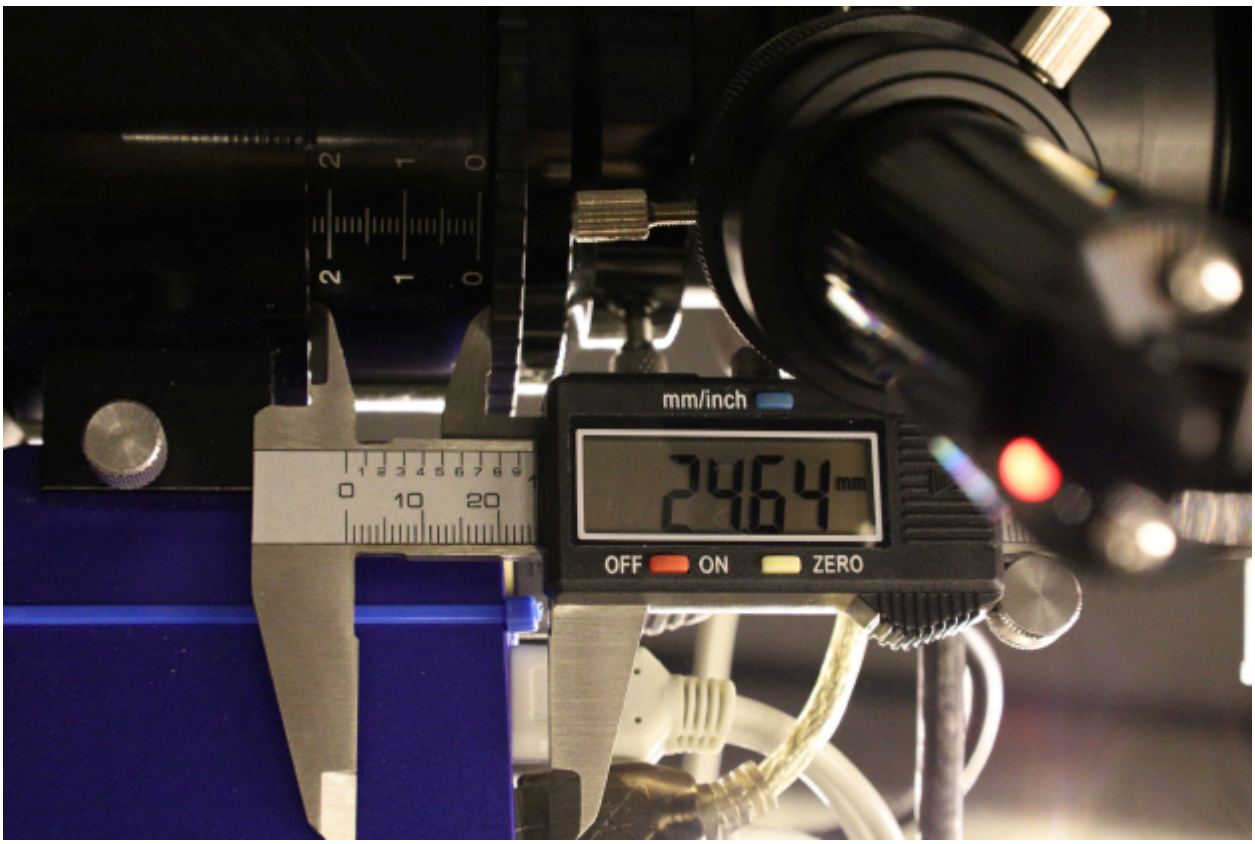
1. From Gear Tab, Focuser section start to move the focuser in "Out" direction till you see that focuser is moving.

2. Measure the position P1 like on the image:




3. Enter Step Size 500 and click on ">" button to make movement of 500 steps in "Out" direction

4. Measure the position P2 like on the image:



5. The formula K = (P2 - P1)/500 gives how many millimeters are moved per one focuser step (if you have used other Step Size in point 3, replace 500 with the used value). So we have K = (24.64-23.09)/500 = 0.0031. To convert to microns multiply by 1000 and we get 3.1 microns per step.

The full formula is **M = ((P2 - P1)/500)*1000**.

**Note:** It is important to work in Out direction **only** as the backlash will be compensated and you can use slight force over the caliper to measure P1 and P2 more precisely without worrying about focuser play.

## Measure the Backlash

*Related videos:*
*Manual Backlash Measurement with Bahtinov Aid*

Before you start measuring the focuser's backlash make sure that you have disabled all features that can cause unwanted motor movements. Disable the backlash compensation, temperature compensation, final inward move in Scope & Focuser settings tab. Also the backlash compensation in the ASCOM / INDIGO / INDI driver settings.

Here are some ideas how to measure the backlash.

**I. Via Auto Focusing Aid**

Make sure that you have determined the right Focuser Move Step. Focus by eye as good as you can, select the option Calc Backlash and click on Run button. The result will be printed in the Log Panel. Make sure that the scope is well tempered. Use night with stable atmosphere and star or area well above the horizon.

**II. Via manual measurement**

1. Focus via Bahtinov Aid. Make sure that you are moving with very small steps and in same direction. Let take that you are moving in "Out" direction. Records the focuser position P1 where the focus is best.
2. Move in "Out" direction with big step - 1000 (or even more if you think that you have big backlash)
3. Move in "In" direction with same step - 1000
4. Start moving with very small step in "In" direction till you reach the best focus. Record the focuser position P2
5. The backlash is B = P2 - P1.

It is very important that you **don't change** the direction in the points 1,2. After that you have to start moving **only** in opposite direction for points 3,4. Here again is very advisable to make sure that the scope is well tempered, to use night with stable atmosphere and star well above the horizon.

Similar measurement could be made using FocusCraft and Focusing Aid but is harder as there is no easy to see confirmation which is the best focus point.

**III. Via Backlash Aid**

The Backlash Aid has some experimental approaches to measure the backlash. The feedback for them is a "mixed" bag - they work for some users and doesn't for other. However they can give at least idea for the magnitude of the backlash.

## Bahtinov Aid

*The Bahtinov Aid is accessible from Tools tab or with Alt+B shortcut.*

*Related videos:*
*Bahtinov Aid - 2,*
*Focusing A to Z*

The Bahtinov Aid uses licensed technology developed by Neils Noordhoek - the very same technology built into the famous Bahtinov Grabber. It allows achieving precise focus using a Bahtinov mask making **sub-pixel** analysis of the spikes.

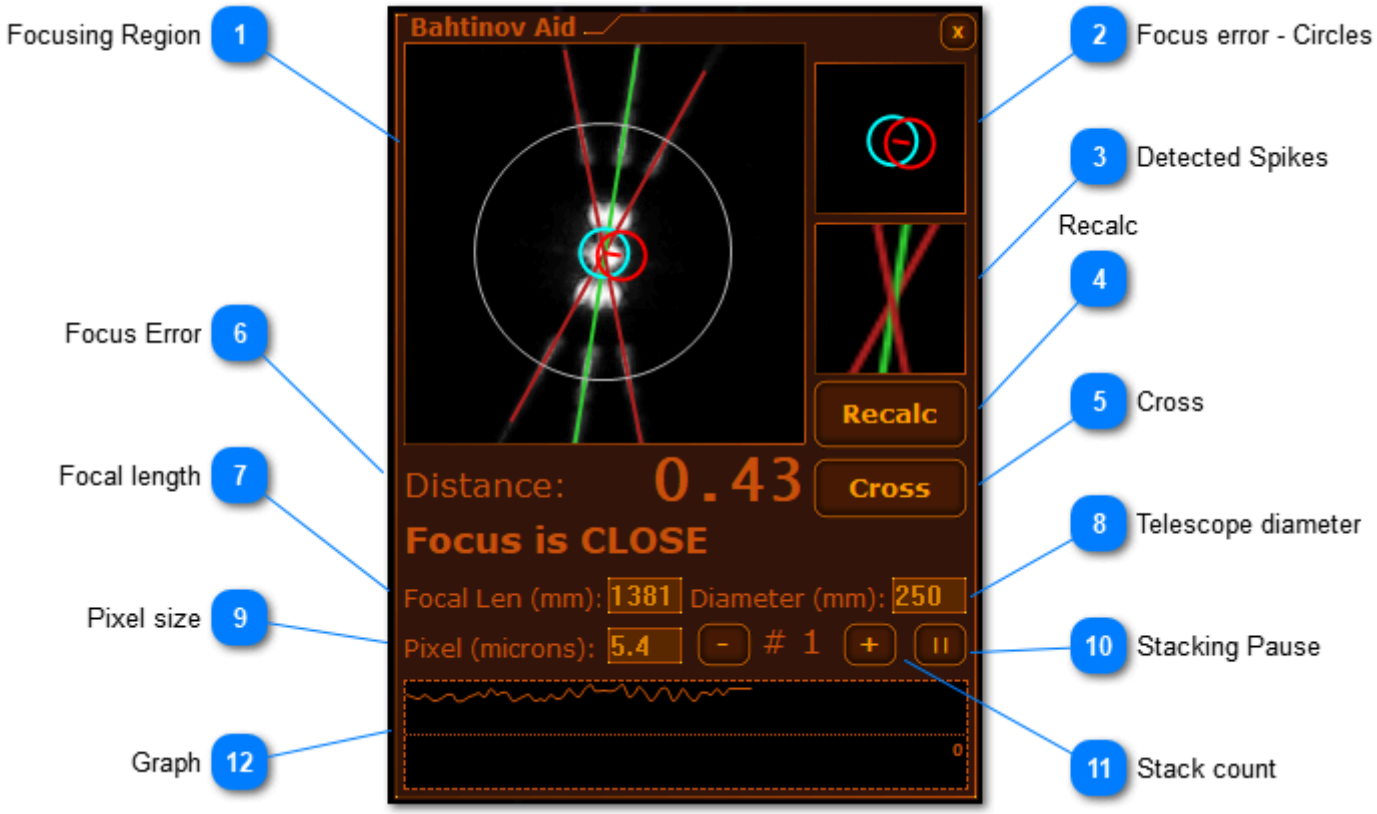
In order to get accurate calculations you have to enter the pixel size (for DSLRs it is automatically determined), the focal length and aperture of the telescope. Drag the panel over the preview area to frame the star that you want to use. Use the Cross mode to center the star in “Focusing Region”. After that click on Recalc button. You will see two graphical interpretations of the results “Lines” – the usual Bahtinov pattern and “Circles”. To make the focus perfect join the two circles. Also you can see the focus error/distance in pixels. Try to get the lowest possible reading. Usually the atmosphere turbulence is makes the distance to jump all the time. Empirically is found that when there is good focus, without changing the focuser position, the aid starts to give equal values, but with different signs (for example -0.12 then +0.12). In the bottom of the aid you can see a graph of the values since the last reset (recalc).

In the Canon EOS LiveView mode is recommended to use x5 Zoom to get pixel resolution close to 1:1, in Nikon use zoom 100% or bit less to fit the spikes. This will give more accurate calculation of the focus error. Also for DSLR LiveView you can use a stacking algorithm in order to lower the influence of the atmosphere turbulence which makes the measurements more accurate, so after every focus change wait a second or two. You can control the number of the stacked images with the + / - buttons. When you are focusing with images you can increase the exposure to get more stable readings.

If the star is very bright, the spikes will be very big and in some cases the Bahtinov Aid will not detect them correctly. You have control by several ways:

- For both DSLR and CCD/CMOS modes use the Histogram move the black point to make the image darker
- If you use EOS camera, lower the ISO and/or the exposure
- If you use CCD/CMOS camera, lower the exposure

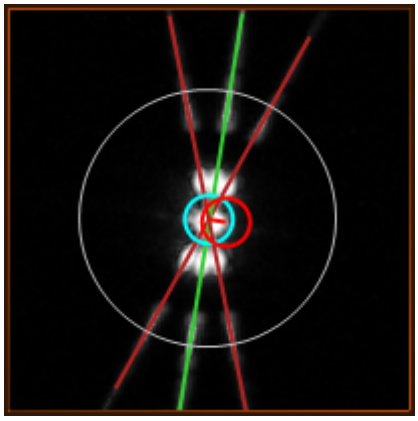
After focusing is complete it is good to double check the focus using a short exposure.




Here is a screenshot of Bahtinov Aid when Cross mode is activated. Place the cross in the center of the star and click on Recalc to make spikes detection again.

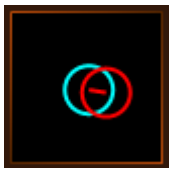



## 1 Focusing Region



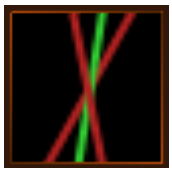
It is a "transparent" window that shows the image under the Bahtinov Aid and defines what is the source to be used in the Aid

## 2 Focus error - Circles



Shows the error as distance between the centers of two circles. Join the circles to get perfect focus.

## 3 Detected Spikes



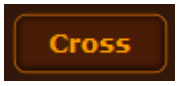
Shows the position of the detected spikes.

### 4 Recalc




Forces the Bahtinov Aid to make a new spikes detection. Sometimes the aid make false detection. If this happens use the Cross mode, center the star again and click Recalc.

### 5 Cross




Enables the Cross mode. Shows a small cross in the Focusing Region in order to achieve better centering of the star.

See the screenshot above.

### 6 Focus Error



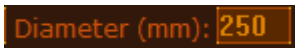

Shows the focus error in pixels and with text interpretation.

### 7 Focal length




Defines the telescope focal length. If there is value in the Object Calculator it will be automatically used. This values is needed for accurate sub-pixel calculation of focus error.

### 8 Telescope diameter




Defines the telescope diameter. This values is needed for accurate sub-pixel calculation of focus error.

### 9 Pixel size




Defines the pixel size of the camera sensor. If there is value in the Object Calculator it will be automatically used. This values is needed for accurate sub-pixel calculation of focus error.

For DSLR cameras this parameter is populated automatically using the internal database for all Canon EOS and Nikon models.

### 10 Stacking Pause



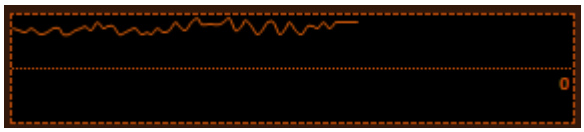
Pauses/Resumes the DSLR LiveView stream stacking.

### 11 Stack count




Defines how many frames from the DSLR LiveView stream to stack. Bigger value lowers more influence of the atmosphere turbulence, but needs more time to build an image and to show the effect from the focus tuning.

### 12 Graph



Shows graph of the values changes. The Recalc button resets it.

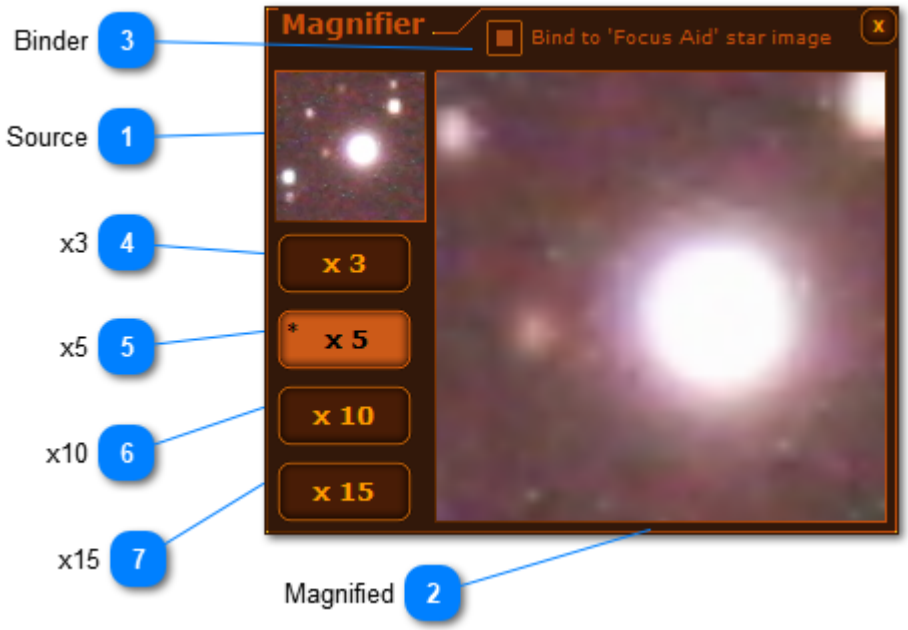
## Magnifier

*The Magnifier Aid is accessible from Tools tab or with Alt+M shortcut.*

*Related videos: Magnifier*

Magnifier Aid allows applying software zoom over an image part. It also can work in combination with Focusing Aid in order to inspect closer the star used for focusing. Some imagers investigate the aberrations in stars during the focusing.

The Magnifier Aid use the common aid behavior in APT- dragging the window and placing the Source frame over the image part that you want to use.




## 1 Source



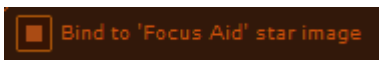
It is a "transparent" window that shows the image under the Magnifier Aid and defines what is the source to be used in the Aid.

## 2 Magnified



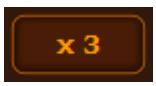
Shows the image in the Source magnified by the selected factor.

## 3 Binder




When selected the Source will be automatically populated with image in Focusing Aid Source frame. If Focus Aid is not available Magnifier acts like this option is disabled.

## 4 x3



Makes x3 software magnification/zoom.

5 **x5**




Makes x5 software magnification/zoom.

6 **x10**




Makes x10 software magnification/zoom.

7 **x15**




Makes x15 software magnification/zoom.

## Framing Masks

*The Framing Masks Panel is accessible from Tools tab or with Alt+K shortcut.*

*Related videos: Framing Masks*

Framing Masks Aid helps in framing object by same way during different nights or after a meridian flip. It is an alternative to PointCraft when there is no telescope/mount connection.

To create a new mask, select "Add New Mask" from the Mask list box, give a name of the mask. After that click with the left mouse button on few stars in the image that you can easily locate to put markers (second click in the same place removes the maker).

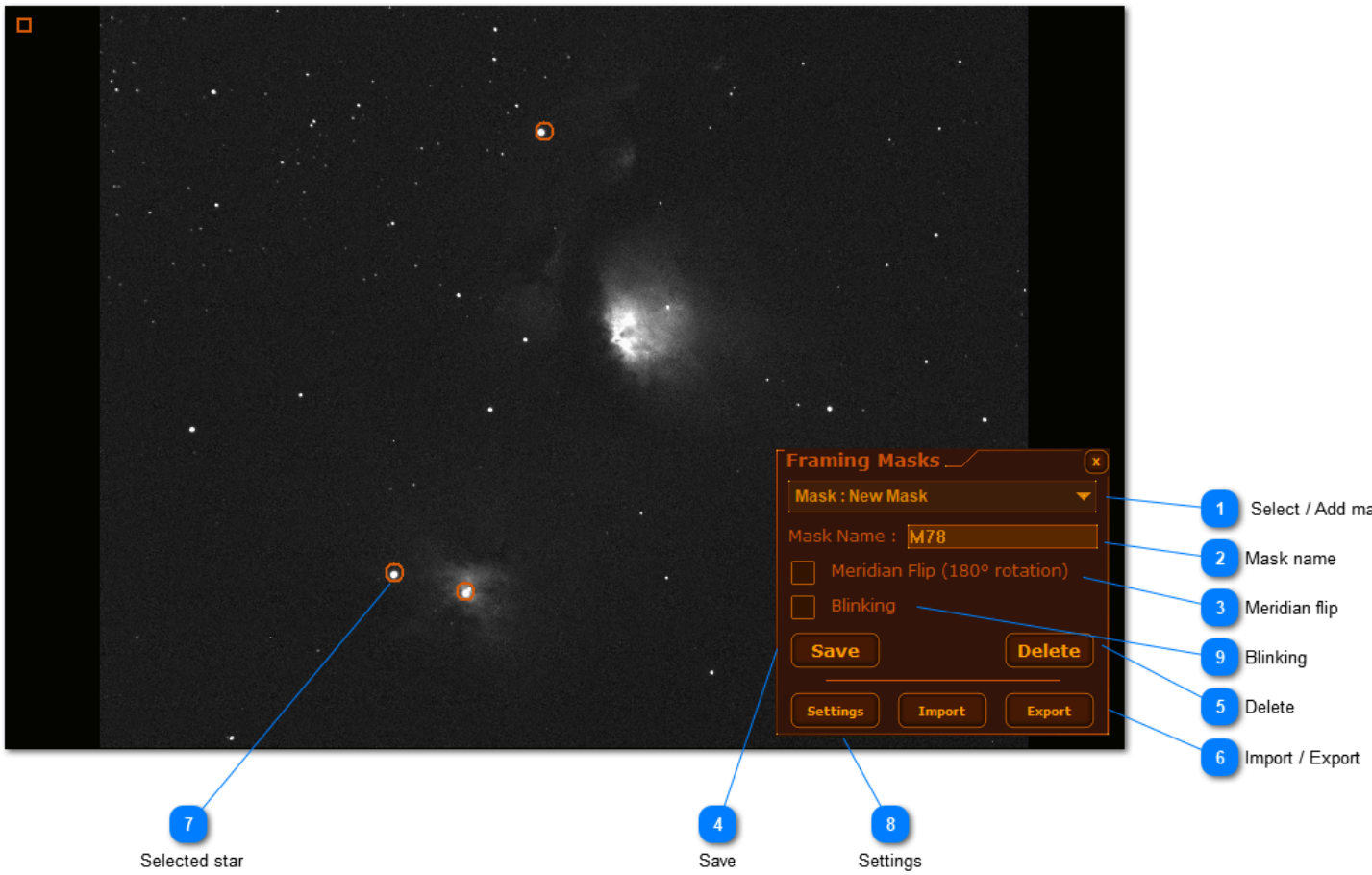
Later you can select the same mask from the list and to see the marker positions, then move the mount and rotate focuser till the reference stars match to the markers pattern. To see the new position you can enable the LiveView or to start a Frame/ Focus imaging plan.

If the mask is created when the object was from the other side of the meridian, select the "Meridian Flip" option and APT will orient the markers in way that corresponds to the current object position. Don't be afraid that image will be rotated, your stacking program will handle this without any problems.

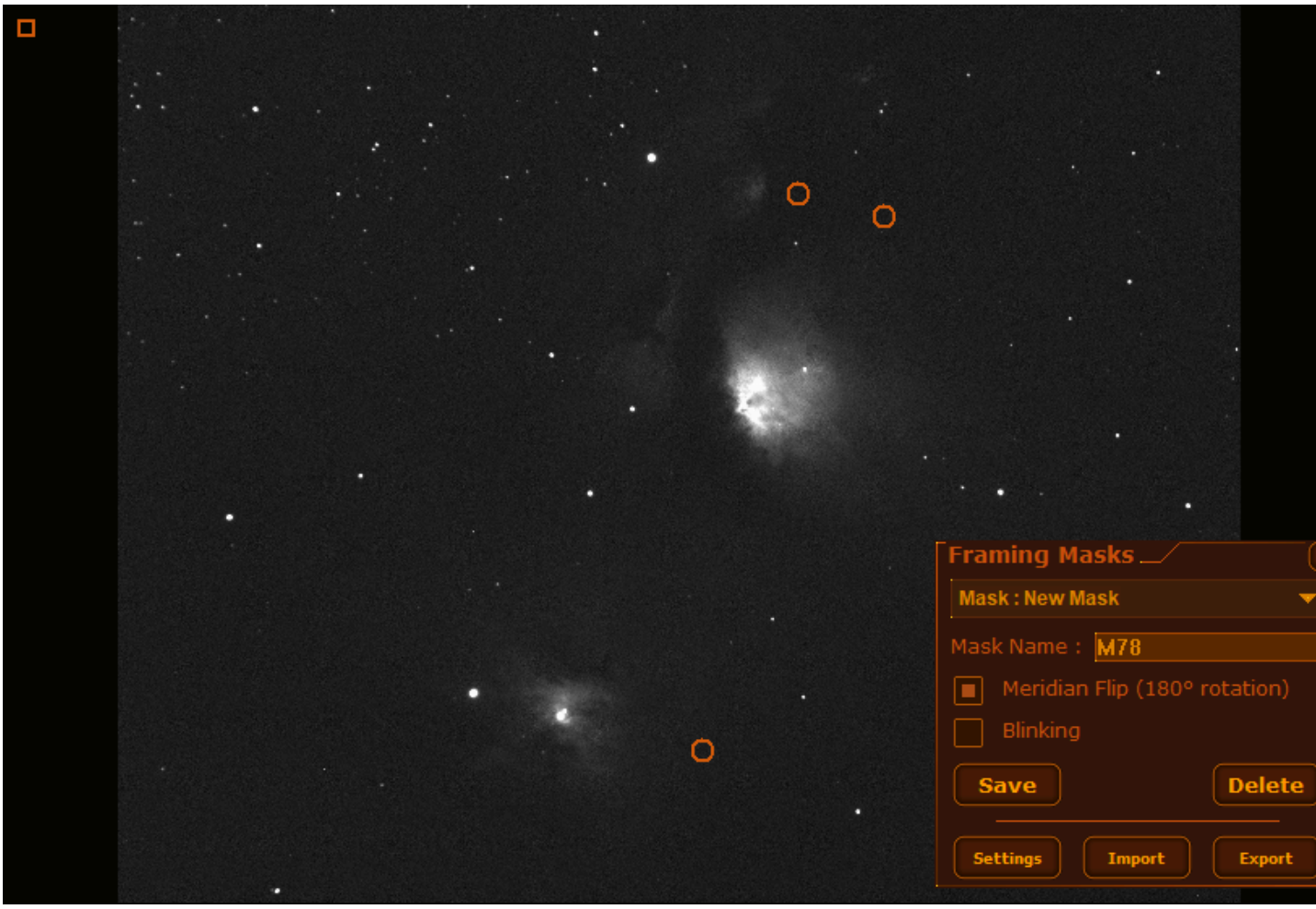
It is possible the create a mask using image from previous imaging session in order to frame the object by the same way. To do that use the image browser - Img Tab to load the image and mark the stars you want to use as markers.

To hide a mask, just close the aid.

Here is Framing Masks Aid in action.




This is how the mask is displayed with Meridian Flip is activated. It places the marks on the place where they are in the flipped image.




### 1 Select / Add mask




List with the saved masks. To create a new mask select the option "Add New Mask".

### 2 Mask name



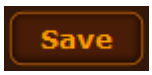

Defines the mask name.

### 3 Meridian flip



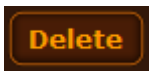

Enables mask orientation for the position of the object when it is from the opposite site of the celestial meridian.

### 4 Save



Saves the markers and the mask name.

### 5 Delete




Deletes the current mask.

### 6 Import / Export



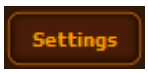

Imports / Export one or more framing masks.

### 7 Selected star



This is a marker placed over a reference star.

### 8 Settings

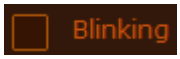



Opens the Framing masks Settings dialog box to define the radius, thickness and color of the markers. It is possible to use the Ringy Thingy to change the values.

If the color is empty the default skin color will be used.




### 9 Blinking



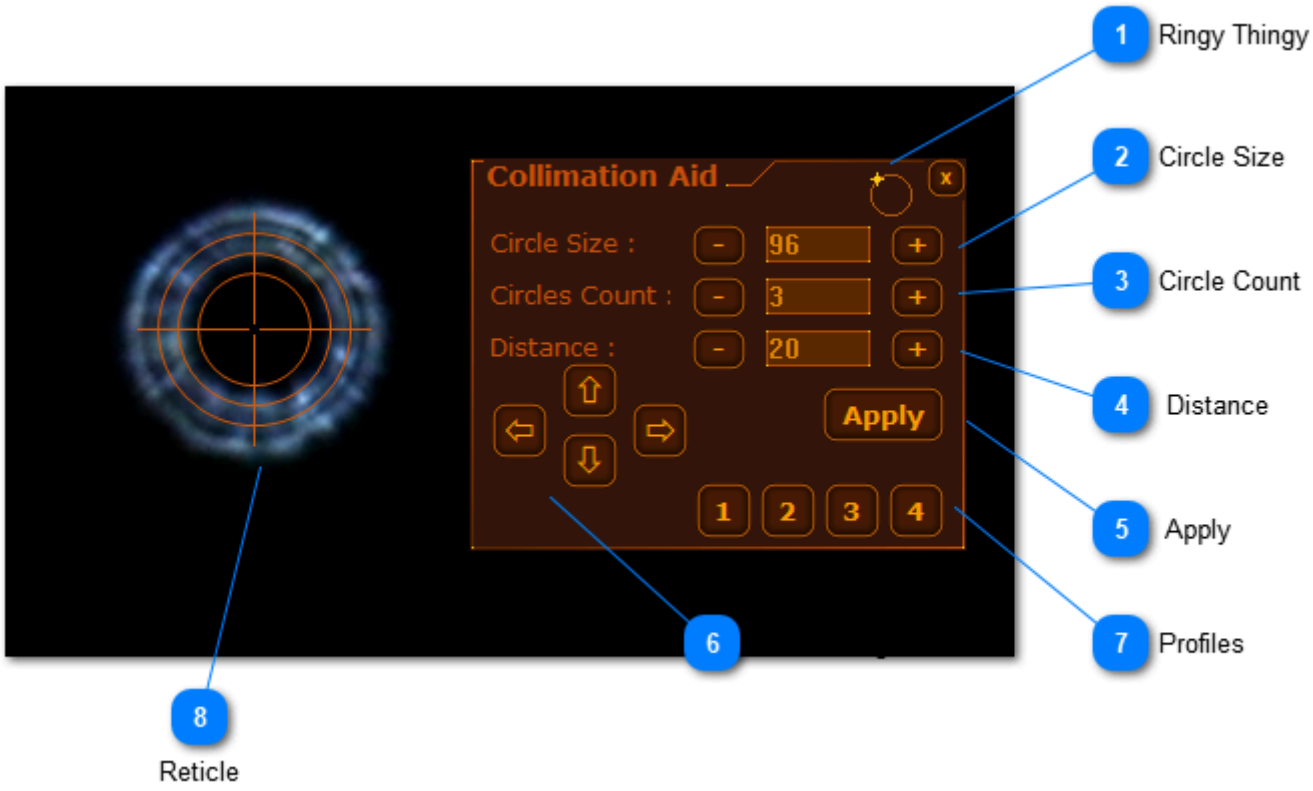

When enabled the marks will blink in order to be easier to see the stars when they are near the mark border.

# Collimation Aid

*The Collimation Aid is accessible from Tools tab.*

The Collimation Aid is used to create and place a reticle over LiveView or image in order to inspect and tune the telescope collimation. Define the pattern for the reticle and simply drag it to the place of the diffraction rings. The using the fine moving buttons you can adjust the position with pixel resolution.

The aid allows store up to four predefined reticles.




## 1 Ringy Thingy



Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 2 Circle Size




Defines the diameter of the most outer circle.

## 3 Circle Count



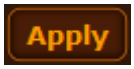

Defines the count of the inner circles.

## 4 Distance




Defines the distance between the circles starting from the most outer circle.

## 5 Apply



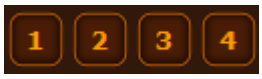

Applies the entered reticle changes in the size, count and distance. Use it when you have changed the values without the +/- buttons.

## 6 Fine moving



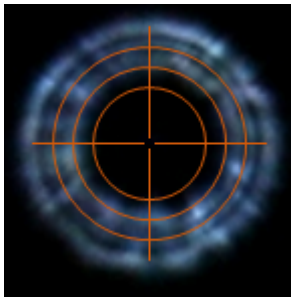
Moves the reticle with one pixel step in the desired direction.

## 7 Profiles




Use **Shift+Click** to save the current size, count and distance on the wanted position. To load saved profile just click on a number.

## 8 Reticle



This is how the reticle looks applied over an image.

# Crosshair

*The Crosshair mode can be activated form the Target button in the main APT screen or with Alt+T shortcut.*

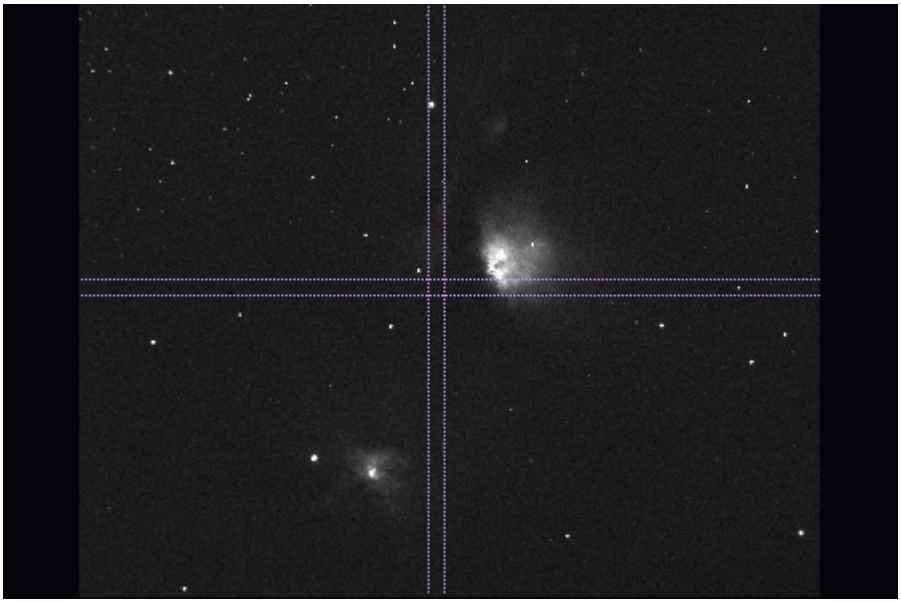
*Related videos:*
*Crosshair*

Combined with LiveView or taken image the Crosshair mode can help in alignment tasks like: Drift Alignment, GoTo Alignment, Precise mode checks for Meade mounts and everything that needs a benchmark.

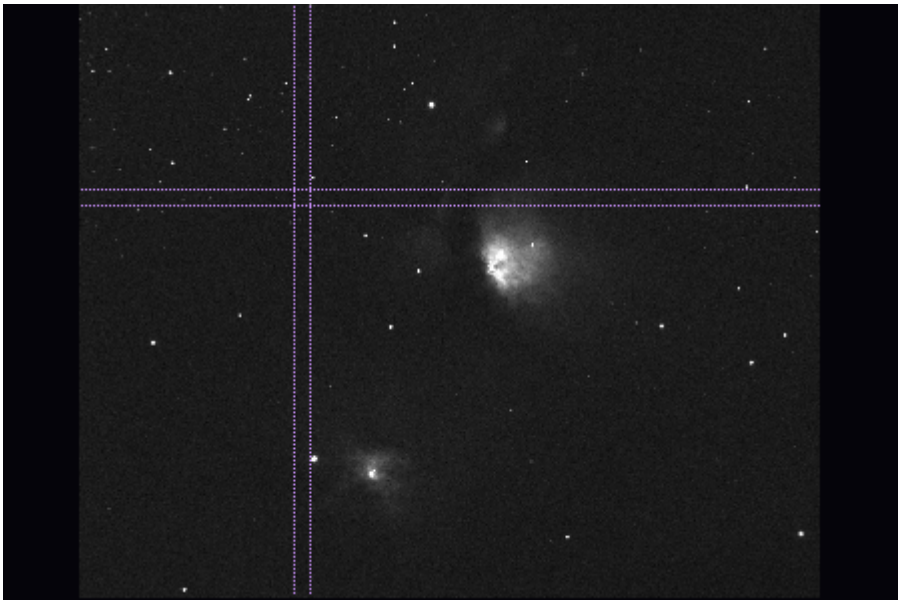
Here are some key combination that gives more control over the Crosshair:

- Hold the **Shift + Left Mouse Button** and move mouse to change the place of the cross center.
- Hold the **Control + Left Mouse Button** and move the mouse horizontally to rotate the cross.
- **Shift** or **Control + Double Click** with the left mouse button will restore the initial centered cross position.

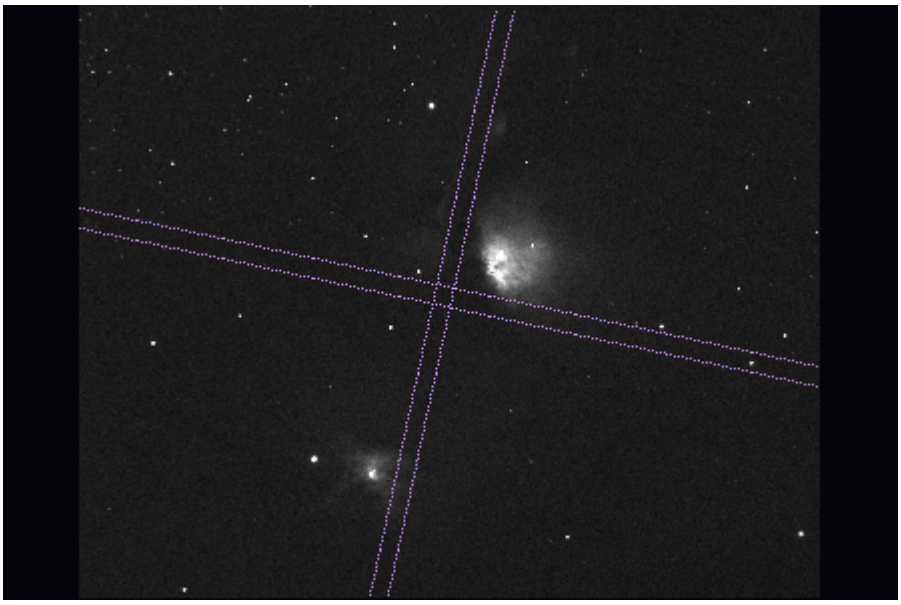
Centered cross:



Moved cross:



Rotated cross:

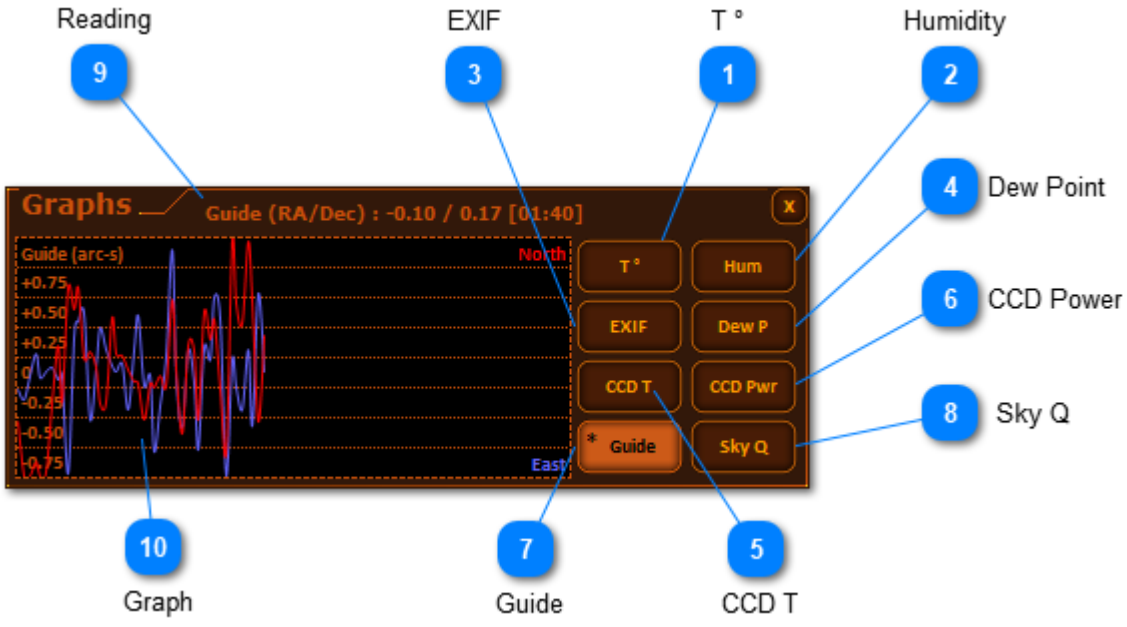


## Graphs

*The Graphs Aid is accessible from Tools tab or with Alt+G shortcut.*

*Related videos:*
*Graphs*

Graphs Aid displays various data collected during the current imaging session - since the APT start. You can switch to different graphs by clicking the corresponding button. If you are using double click in the graph section APT will cycle through the graphs. Hold the Control key and double click in the visualization area to reset the collected data for the selected graph.

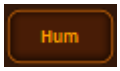


## 1 T °




Shows graph of the ambient temperature data collected through External Sensors during the imaging session.

## 2 Humidity




Shows graph of the humidity data collected through External Sensors during the imaging session.

## 3 EXIF



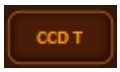

Shows graph of the EOS sensor temperature values stored in the EXIF section in Raw files taken during this session.

## 4 Dew Point



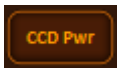

Shows graph of the dew point data collected through External Sensors during the imaging session.

## 5 CCD T




Shows graph of the CCD/CMOS sensor temperature changes during the imaging session.

## 6 CCD Power



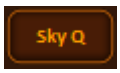

Shows graph of the CCD/CMOS cooling power loading changes during the imaging session.

## 7 Guide



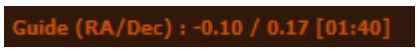

Shows graph of the distance to the guiding star reported by the connected guiding program/device.

### 8 Sky Q



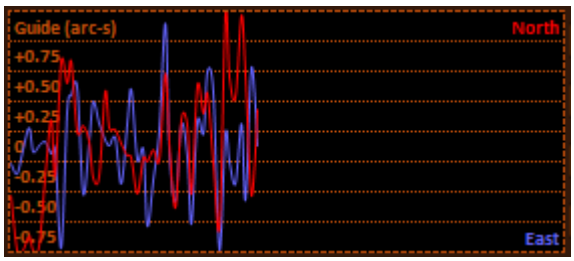

Shows graph of the sky quality data collected by the Sky Quality Meters during the imaging session.

### 9 Reading




When the mouse pointer is out of the graph section, this shows the last logged value/ time for the current data type. If you place the mouse in the graph then the reading displays the value / time that correspond to this point of the graph.

### 10 Graph




The graph that corresponds to the logged data.

## EOS Lens Control and Auto-Focus

*The Lens Control is accessible from Gear tab.*

*Related videos:*
*EOS Lens Control & Auto Focus*

APT can control Canon compatible lens when they are attached to Digic III or latter camera. Lens "Auto Focus" (**AF**) must be set to ON and you have to be in LiveView mode. **Don't forget to set your lens in manual focus (MF) mode before plan execution!**

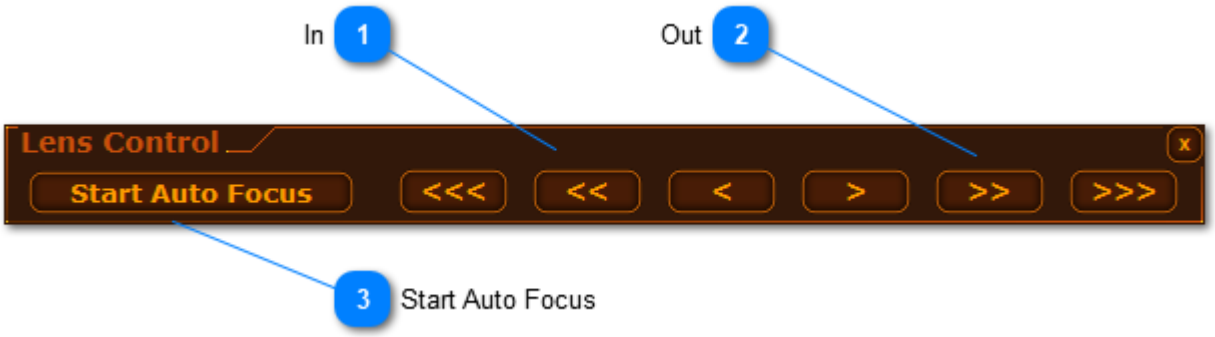
**Note:** ***Some lens could be still controlled in MF mode. Give a try with ours to see it works. Start the LiveView and use the buttons <<< and >>> to see if the the lens supports control in MF mode.***

APT has its own automatic lens focusing that uses the Focusing Aid and FWHM (Full Width Half Maximum) or HFD (Half Flux Diameter) metrics to achieve better focus than the camera built-in automatic focusing which is not optimized for astro photography. The selection between FWHM and HFD is made from the Auto Focusing Aid panel. In the next few versions the Lens Auto-Focus will be fully integrated with Auto Focusing Aid.

To use Lens Auto-Focus, Turn ON the Lens control, turn ON Focusing Aid panel, make a rough focusing using the lens drive buttons and frame a star in the Focusing Aid panel. After that click on the “Start Auto Focus” button. The precision of the focusing depends on the precision of your lens drive. If you are not satisfied by the focus precision you can run auto focusing for second time or to try with manual control of the lens. It is recommended to use the LiveView Zoom x5 option.

Here is the usual scenario:

1. Set the lens in **AF** mode
2. Start LiveView, Focus Aid and Lens Control
3. Frame a bright star with saturation 1 or 2
4. Make rough focus
5. Start Auto focus
6. Set the lens in **MF** mode




### 1 In




Drives the lens in "In" direction with three different step sizes. "<" is the smallest supported by the lens, "<<<" is the biggest supported.

### 2 Out




Drives the lens in "Out" direction with three different step sizes. ">" is the smallest supported by the lens, ">>>" is the biggest supported.

### 3 Start Auto Focus




Starts the APT lens focusing using FWHM (Full Width Half Maximum) or HFD (Half Flux Diameter) metrics.

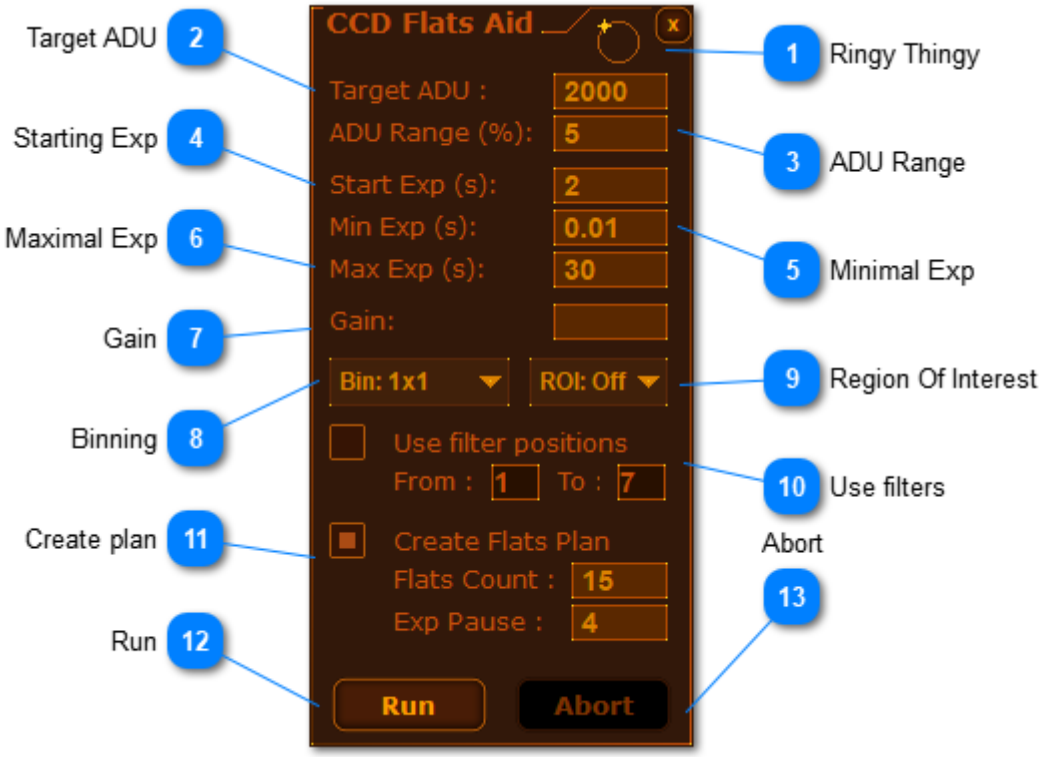
## CCD Flats Aid

*The CCD Flats Aid is accessible from Tools tab.*

*Related videos:*
*CCD Flats Aid, CCD Flats Aid & Flats Devices*

CCD Flats Aid is made to help determining the right exposure time when making flat frames with CCD/CMOS camera. As the name shows currently it is not working with DSLRs - in most cases you can use the AV dial mode to make good flat frames with DSLR.

This aid provides some advanced features like evaluating several filters at once and automatically creating an imaging plan with separate line per filter with the found exposure duration. Built-in is logic that minimize the count of the used exposures during the search of the optimal duration.




**Tips&Tricks** *If you usually taking the flats in similar conditions you can evaluate the created plans and make the range Min/Max exposure smaller. This will speedup the search process and will lead to fewer count of test exposures. For Min Exp select few seconds smaller than the smallest value you have got for all filters. For Max Exp enter few seconds more than the longest exposure you got for all filters.*

## 1 Ringy Thingy



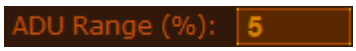
Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

## 2 Target ADU



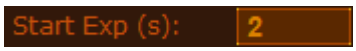

Defines the desired ADU value that you want to reach in order to consider that exposure duration is fine. Usually it is value around 20,000 for 16bits cameras. For 14 bits vlaue 5000-6000 should be fine. Keep in mind that Target ADU depends on the gain. You may need to lower the value if the gain is too big.

### 3 ADU Range




Defines the tolerance range of the ADU value that is acceptable.

### 4 Starting Exp




Defines the starting exposure duration in seconds.

### 5 Minimal Exp




Defines the shortest exposure that you want to try.

### 6 Maximal Exp




Defines the longest exposure that you want to try.

### 7 Gain




Defines the gain value to use for determining the flats exposure. If there is a value here it is used as top priority. If it is empty, gain per filter is second, the gain set in Camera Tab last.

### 8 Binning




Defines the binning that have to be used.

### 9 Region Of Interest



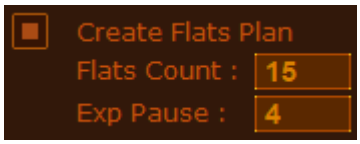

Defines if you want to Region On Interest. This option will use the center of the CCD/CMOS sensor and speed-ups the image downloading. Could be valuable options if you are making sky-flats and imaging time is limited.

### 10 Use filters



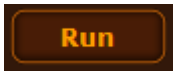

Defines if you want to determine the exposure time for multiple filters and which filter wheel positions to use.

### 11 Create plan




Defines if you want automatically to create an Flats type imaging plan with the found exposure time(s). It is very handy option if you use filters. Some flat panels require a longer pause between the exposures, so if there is need increase the "Exp Pause" field.

### 12 Run




Starts the determining of the exposure time(s).

### 13 Abort




Stops the running process.

## Pixel Aid

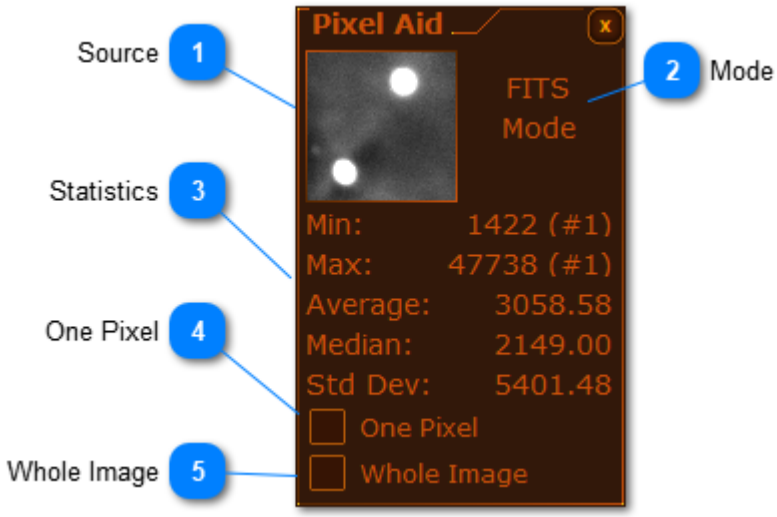
*The Pixel Aid is accessible from Tools tab or with Alt+X shortcut.*

*Related videos: Pixel Aid*

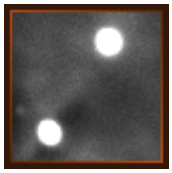
Pixel Aid allows seeing various statistics for a part of the image (or the whole image), like Median, Standard Deviation and etc. It works in two modes - Bitmap or FITS.

- FITS mode requires loaded FITS / XISF file and the Preview Mode to be “On 1:1”. The data is in ADU.
- Bitmap mode is used for the other image types or when Preview Mode is other. In this mode the statistics is calculated for the screen black & white data.

The Pixel Aid use the common aid behavior in APT- dragging the window and placing the Source frame over the image part that you want to use.




## 1 Source



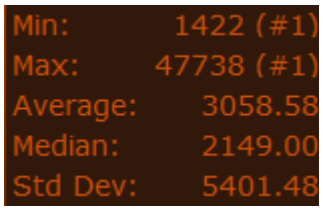
It is a "transparent" window that shows the image under the Pixel Aid and defines what is the source to be used in the Aid.

## 2 Mode




The current mode.

## 3 Statistics




The calculated statistics for the data in the Source.

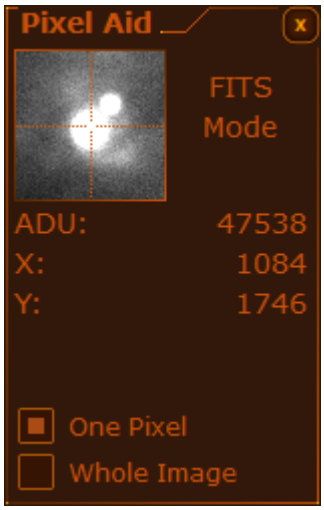
In brackets after the values Min/Max is the number for the pixels with this ADU level. When Whole Image option is enabled the number will be in whole image context, when unchecked displayed is only the number of the pixels in the framed area.

## 4 One Pixel




Has effect only in FITS mode. When selected Pixel Aid shows the ADU value one pixel rather than calculating statistical data for Source image. In this mode there is a cross to show the inspected pixel.

Here is how  Pixel Aid looks in this mode.




5 **Whole Image**




Has effect only in FITS mode. When selected Pixel Aid shows the calculated statistical data for the whole image.

## DARV

*The DARV panel is accessible from Tools tab.*

*Related videos:*
*DARV*

DARV stands for '**D**rift **A**lignment by **R**obert **V**ice method'. The essential idea of the method is to make one long exposure during the mount is moved on East and then back to West (or in reverse in the southern hemisphere) if the polar alignment is perfect the result will be a flat line, in other case the track in the image will have the shape of the letter V. So you have to make corrections till the track becomes a line.



The scenario is easy to follow:

0. Level the mount and make initial polar alignment
1. Locate a star in the South close to Declination 0 (Alt/Az and GoTo could be used to move the scope via APT)
2. Run DARV (Align Azimuth button) and wait for routine to complete.
3. If the track is not line adjust the Azimuth (left/right).
4. If you see V shaped track, repeat the steps 2 and 3 till you get a line.
5. Locate a star in the Eastern or Western horizon and close to Declination 0 (Alt/Az and GoTo could be used to move the scope via APT)
6. Run DARV (Align Altitude button) and wait for routine to complete.
7. If the track is not line adjust the Altitude (up/down).
8. If you see V shaped track, repeat the steps 6 and 7 till you get line.

This tool is made to take care for exposure and telescope move, so it requires Camera and Telescope connection.



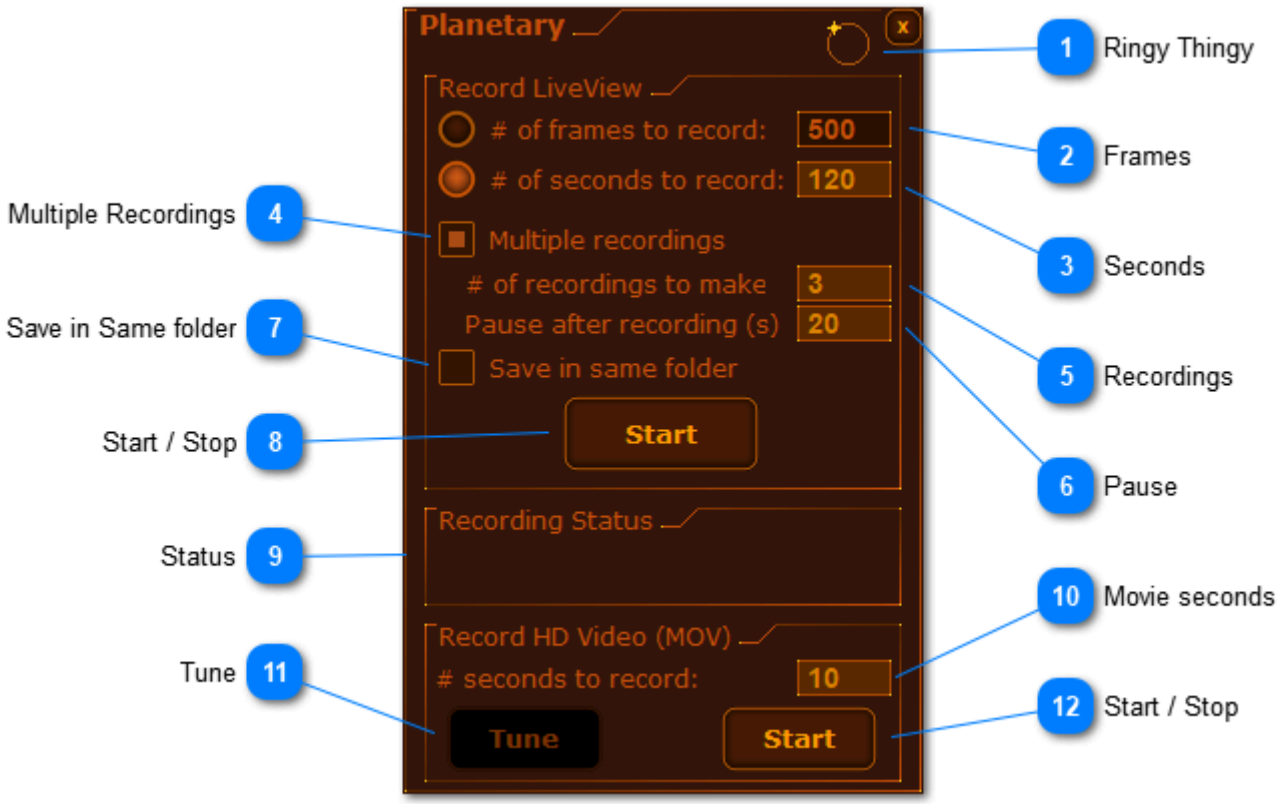

The duration of the drift depends on the focal length of your telescope or lens. Longer it is shorter drift time has to be used.

More information about Robert Vice method can be found here:
http://www.cloudynights.com/page/articles/cat/articles/darv-drift-alignment-by-robert-vice-r2760

## Planetary Panel

*The Planetary panel is accessible from Tools tab.*

The Planetary panel is useful for planetary, Moon, Sun and etc. imaging where the needed frames per second speed is bigger. Also it saves your shutter from making too many cycles, vibrations and etc. Supported are two modes - DSLR LiveView and EOS HD Video.




The LiveView mode allows you to capture the DSLR LiveView stream as series of JPG files and to store it on the PC hard disk. These JPG files can be easily be used in Registax or similar processing application without modifications. In the panel you can define how many images you want to capture. The most of the EOS cameras gives best image when x5 Zoom is used. For more information see article "1:1 Pixel Resolution" by Jerry Lodriguss.

If you are wondering why APT saves JPG files instead of AVI, there is simple reason. The DSLR cameras provide a stream of JPG images, this the "raw" material from the LiveView. APT stores it in the original form and gives to you the option to process it by the way you like. The AVI building can affect the quality and in addition it is time (and power) consuming operation. Everybody prefer to gather more data than to make processing in the field.

**Tips&Tricks** *To get bigger frame rate on slower computer, before start recording make the APT window smaller.*

**Tips&Tricks** *The Object Name entered in Camera Tab will be used in the filenames.*

The second mode HD Video (available for some EOS models) allows to start/stop the HD Video recording of your Digic IV camera (if it has such feature). After the video is recorded APT will transfer the MOV file to PC's hard disk, if Image Destination is set to "PC" or "Cam+PC" in the Camera tab. Because of limitations set by Canon, it is not possible to use this mode unless you have T-ring with focus confirmation or attached lens.

Note that the MOV video file has to be converted before it can be used in Registax. There are several freeware options to make that. Few samples:

- Pazera Free MOV to AVI Converter
  http://www.pazera-software.com/products/mov-to-avi-converter

• FFMPeg
http://ffmpeg.org/

• Media File Converter
http://www.erightsoft.com/SUPER.html

Warning: While you installing this program, pay special attention to things that are checked or unchecked. By default it is configured to install some type of internet tool bar or something like that. Make sure you deactivate anything that you do not want to be installed.

You can follow these steps when you use that program:

Choose AVI as the Output Container.
Choose RAW Uncompressed as the Video Codex
Disable AUDIO for Audio Codex or check the Disable box in the Audio specification box below that.
Choose NO CHANGE for Video Scale Size
Choose 30 or 60 Frame/Sec
Choose the highest Bitrate kbps for best quality.
Choose Hi Quality for additional Options

Jerry Lodriguss has published a great book related to planetary imaging named "A Guide to DSLR Planetary Imaging" that covers every aspect of this type of photography starting from data acquisition to processing. There is special chapter dedicated to APT. The address Jerry's site is www.astropix.com

### 1 Ringy Thingy



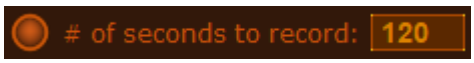
Ringy Thingy is an innovative way to edit numeric values using only mouse or touch pad. See details and animation how to use it in the Application Interface notes.

### 2 Frames



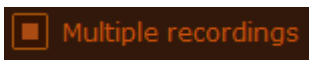

Defines how many frames from the EOS LiveView stream you want to record.

### 3 Seconds



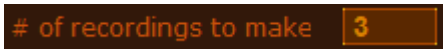

Defines how many seconds to record images from the Live View stream.

### 4 Multiple Recordings




Allows automation of the planetary recordings by defining the number of the images sets to be recorded and the pause between each recording.

## 5 Recordings



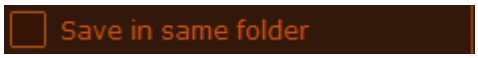

Defines how many recordings to make.

## 6 Pause



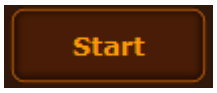

Defines what pause to make between the recordings. This pause helps the camera sensor to cool-down and to avoid the camera blocking.

## 7 Save in Same folder



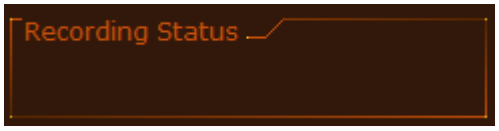

When enabled one folder will be created and used for all recorded LiveView images till the panel is closed.

## 8 Start / Stop



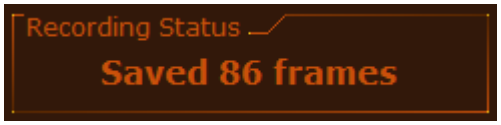

Starts/Stops the LiveView recording.

## 9 Status




Shows the status of the Planetary panel. When there is running recording it shows the saved frames or recorded seconds.

Sample from LiveView recording:




## 10 Movie seconds




Defines how long to be the video recording.

### 11 Tune




Reserved for future use (when Canon provide the needed support).

### 12 Start / Stop




Starts/Stops video recording.

## External Sensors

APT can use different types of external sensors. They are divided in three types - Temperature, Temperature / Humidity and Sky Quality.

See the sections Temperature / Humidity Sensors and Sky Quality Meters for links about the hardware. Switch between Celsius and Fahrenheit is possible from Temperature& Sky settings tab.

Here is description how you can use the different types.

**Temperature**

These are dedicated temperature sensors (different Temper models) or these built-in in the most focusers. In order to use dedicated sensor you have to select the Temper option in Temperature& Sky settings tab, then restart APT. The focuser sensor is detected automatically on connection time. If there is available sensor in the top of main screen you will see the temperature reading ("T") between the APT name and the date, like in the flowing screen shot.




Here are the features that can use the temperature sensor:

- Temperature graph
- Temperature use for name parts
- Temperature use with script
- Refocus notifications on temperature change (see below)

**Temperature / Humidity**

These are dedicated devices - different TemperHum models, USB_DewPoint or special focuser models. To use TemperHum or USB_DewPoint, select the corresponding brand option in Temperature& Sky settings tab, then restart APT. The focuser sensors are detected automatically on connection time. If there are available sensors in the top of main screen you will see reading for temperature ("T"), humidity ("Hum") and dew point ("DewP") between the APT name and the date, like in the flowing screen shot.




Here are the features that can use the temperature & humidity sensors:

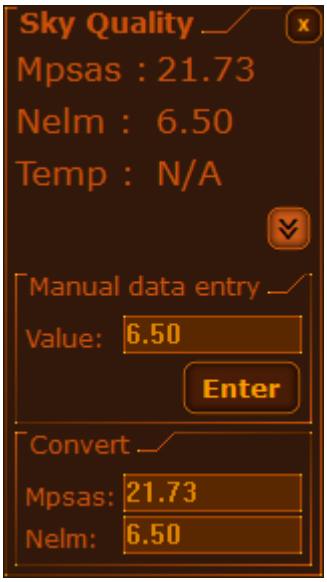
- Temperature, Humidity, Dew point graphs
- Temperature, Humidity use for name parts
- Temperature, Humidity, Dew point use with script and commands
- Refocus notifications on temperature change (see below)
- Dew point notifications (see below)

**Sky Quality**

These are Unihedron and compatible devices, as well as the front/rear EYE sensors of PrimaLuceLab EAGLE computer. In order to use such sensor you have to enable sky tracking and to select the model in Temperature& Sky settings tab, then restart APT. In the Status panel located in Main screen you will see the current value.




Double click on the label opens the Sky Quality Calculator. There you can enter manual values or convert between Mpsas and Nelm.




Here are the features that can use the sky quality sensors:

- Sky quality graph
- Sky quality use for name parts
- Sky quality use with script
- automatically stored in FITS / XISF file header

**Refocus notifications**

APT can be configured to remind you that there is need to refocus the telescope/lens because of temperature change. First set the limit in from "Refocus on every" option in Temperature& Sky settings tab. After that every time when your telescope or lens is focused, click on the button Set Focus Mark in Tools Tab to set focus mark on the temperature that focus was achieved. When the temperature is changed by half of the defined limit the "T" reading visible in the main screen will star flashing. When the temperature change is bigger than the limit, the reading will be printed on bright background and message will be printed in the Log panel.

For example if the limit is set to 2°, "T" will start flashing when temperature is changed by 1° and will be on bright background when changed with 2° or more.

Once you refocus use the button Set Focus Mark in Tools Tab in order to start the monitoring for the new focus position. **Shift +Click** on Set Focus Mark in Tools Tab will print the last set mark in the Log panel.

**Dew point notifications**

APT can be also configured to remind you ahead that dew point is closing and you have to turn on your heating solution. Set the limit in from "Dew point within " option in Temperature& Sky settings tab. When the dew point closes to half of the defined limit the "DewP" reading visible in the main screen will star flashing. If the dew point is passed the printed on bright background and message will be printed in the Log panel.

For example if the limit is set to 6°, "DewP" will start flashing when dew point is in 3° or less and will be on bright background when "T" is lower than "DewP".

## Minimized mode

**The minimized mode is currently abandoned option**. To use it you have to select the option "Old Style Interface" in the Main settings tab. Note that this option is not compatible with Windows 10.

When APT is minimized small floating window will become visible, you can drag and place where it is comfortable with you. In this floating window the same messages will be shown as in the status monitor in the main APT screen. This allows seeing what is the APT status during you use your guiding or other tools. Also you can see the number of the taken images and the total number in the current plan. If you want to restore APT window, double click with the left mouse button on the floating window, or use right mouse button over the APT icon in task bar and select “Restore”

The status window will be expanded automatically when the preview option in the main the Camera Tab is ON and will display the center of the image in the main window. With right mouse button click you can hide/show the small preview area.

## Check Lists

*The Check Lists aid is accessible from Tools tab.*

*Related videos:*
*Check Lists*

In the astro photography there are two things that have strong influence - bad weather and lack of free time in the clear nights. They can lead to long periods without imaging sessions... In other hand imaging process goes in hand with unpacking/packing, setup, cables, different software applications and various other steps to follow. It is easy to forget something or the right order after long row of cloudy new moons. Check Lists aid is designed as way to store and refer your lists of steps avoiding the need to keep everything into your head.




## 1 Check lists set




The set of the defined Check Lists. To add a new list, just select the option "Add New List".

## 2 Check list name



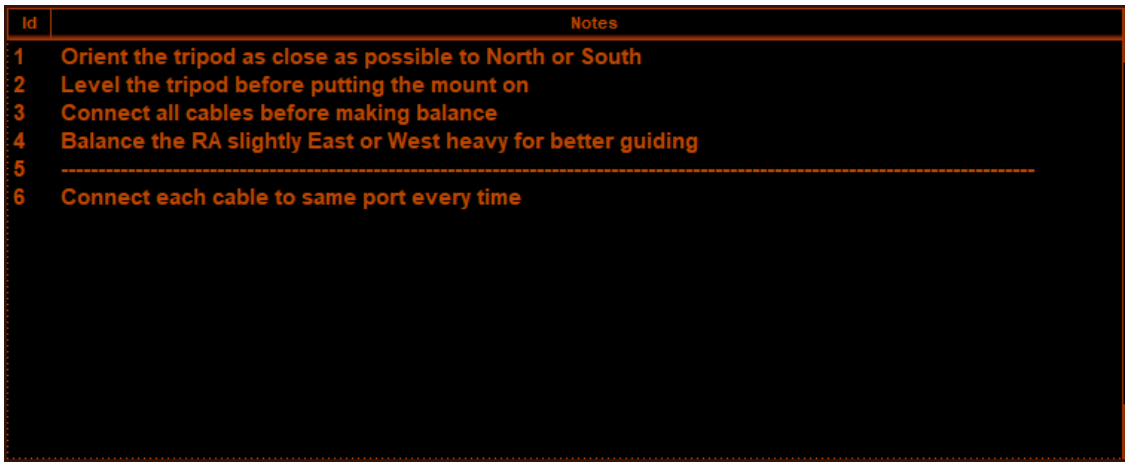

The name of the current list.

## 3 Delete List




Deletes the currently selected list.

## 4 Check list content




The current list of notes / steps. You can define the order of the step using the Up/Down buttons.

5 **Del**



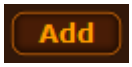

Deletes the current note.

6 **Down**




Moves the selected note one position down.

7 **Add**



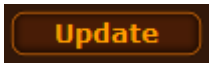

Adds a new note.

8 **Up**




Moves the selected note one position up.

9 **Update**



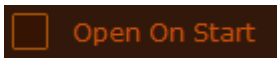

Updates / saves the text of the current note.

### 10 Note text




The text of the currently selected note.

### 11 Open On Start




When enabled, will open the Check Lists aid on APT start.

## Backlash Aid

*The Backlash Aid is accessible from Settings->Scope & Focuser tab.*

Backlash Aid is an experimental tool for measuring the backlash of Crayford / Rack & Pinion focusers. It implements and interesting idea given by my friend George Novtekov.

Here is the algorithm workflow:

- Get current focuser position and measure the length of the visible focuser tube
- Move the focuser with round 1/3 of the tube length
- Go to new position and measure the length of the visible focuser tube
- Calculate how many millimeters/inches correspond to one focuser position
- Make a good number of focuser moves in both directions in order to make the backlash easier to be measured
- Measure the length of the visible focuser tube
- Calculate the backlash value and direction

Backlash aid makes the algorithm easy for execution. Follow these steps:

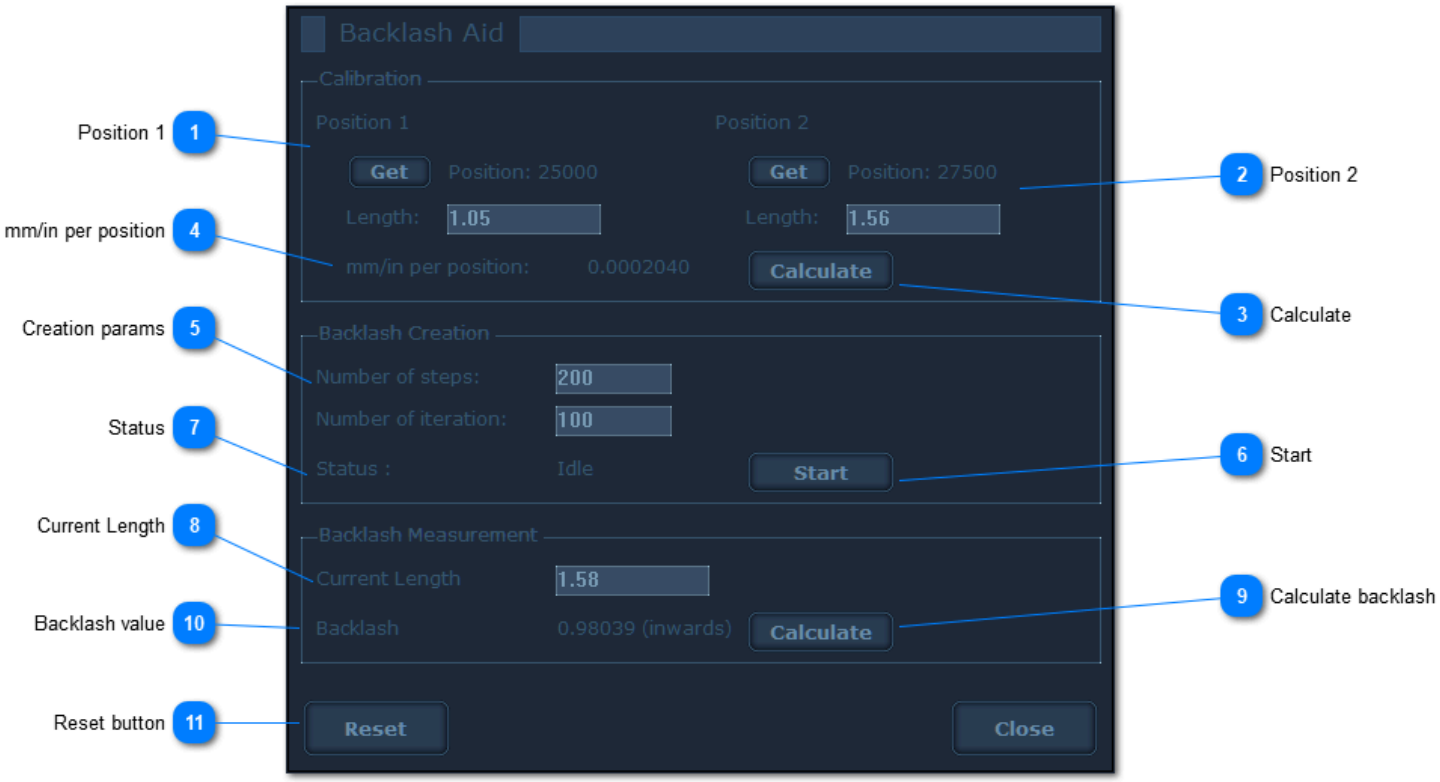
1. Position the focuser in 1/3 of the focuser tube length using Gear tab and click on Position 1 Get button to save the position
2. Carefully measure the visible part of the focuser tube and enter it in Position 1 section
3. Move the focuser with 1/3 of the focuser tube length using Gear tab and click on Position 2 Get button to save the position
4. Carefully measure the visible part of the focuser tube and enter it in Position 2 section
5. Click on Calculate to get the millimeters/inches correspond to one focuser position
6. Enter the number of steps and the number of iterations to make in order to generate backlash and click on Start to begin the moving sequence
7. Carefully measure the visible part of the focuser tube and enter it in the Current Length field
8. Click on Calculate to get the backlash value and direction.

**Notes**: For measuring the tube length use gauge, micrometer or fine ruler. Make the measurement without applying any force on the focuser. More precise the measurement are, more precise the backlash calculation will be. There is no need to use large number of the steps for the backlash creation, use a value that gives visible move of the focuser. Use good number of iterations - 50 or even 100 in order to generate easier to measure influence of the backlash.

Make sure that the scope/focuser is not horizontal. Also make sure that it is loaded with the usual load - camera, filter wheel and etc.

The calculated backlash can be positive (inwards) or negative (outwards), however when you use the value in the Scope & Focuser settings tab, enter the value without sign. For example if calculated value is -1 you have to enter 1 in the outwards field.

Don't forget to share your feedback in the dedicated topic of APT forum - [http://aptforum.com/phpbb/viewtopic.php?f=22&t=1087](http://aptforum.com/phpbb/viewtopic.php?f=22&t=1087)




## 1 Position 1



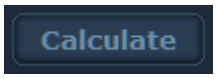

Click on Get to save the current focuser position as first reference point. Measure and enter the length of the visible focuser tube.

## 2 Position 2




Click on Get to save the current focuser position as second reference point. Measure and enter the length of the visible focuser tube.

## 3 Calculate



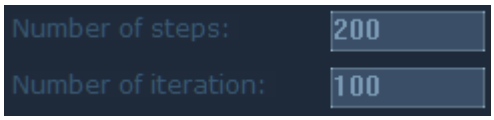

Calculates the mm/in per one position change

### 4 mm/in per position



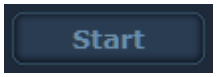

Shows the calculated  mm/in per one position change.

### 5 Creation params




Defines how many steps to make in both inward and outward direction in order to create backlash. These moves will be repeated for the defined number of iterations.

### 6 Start




Starts the moving sequence.

### 7 Status



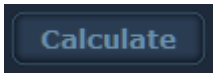

Shows how many iterations are executed.

### 8 Current Length




Measure and enter the visible tube length after the moving sequence.

### 9 Calculate backlash



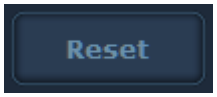

Calculates the backlash value.

### 10 Backlash value




Shows the calculated backlash value.

### 11 Reset button




Resets all values in the Aid.

## Extreme EOS Shutter mode

Some events can be very demanding requirements for imaging frame rate, for example eclipses, transits, occultations and etc. To cover these needs APT provides the "Extreme EOS Shutter mode" (EESM) when Canon EOS cameras are used. Currently this mode is not supported for Nikon cameras.

The "Extreme EOS Shutter mode" uses serial or DSUSB cable to shoot images as fast as possible and allows to boost the imaging frame rate from 1 image on every 2s to 1-2 images per second (depends on the camera and memory card speed).

To enable EESM there is need to set some settings - the Image Destination in the Camera tab has to be **Camera only**, Image Preview has to be **Disabled** and serial cable or DSUSB has to be used as Long Exp Control. The idea is to store the images on the camera card and do not waste time to transfer them to the computer for previewing. The Serial/DSUSB cable provides much faster way to start exposure than the USB communication (limitation of the Canon's communication library).

To get most of EESM make sure that the sounds are disabled, in the plan editor the option "Don't Dither This plan" is better to be checked. Also make sure that image display is disabled from the camera menu.

Having all that set you have to determine how fast your "camera + card" combo is. Make a plan with 20 exposures (RAW only image quality is suggested to save space and time) with duration equal to the shortest you will use and pause set to 0s. Point the camera to some light (darker images are smaller than bright one and take less time to be saved). Repeat the following test.

1. Clear the card
2. Execute the plan
3. check if you have 20 images in the card
4. if you have 20 images lower the value Extreme EOS Shutter delay in Advanced settings tab. Repeat from point 1
5. if you have less than 20 image increase the value Extreme EOS Shutter delay. Repeat from point 1

In the end you will know what is the minimum delay that can be used. Now build the Imaging Plan with all exposures you are planning to execute during the event and make the same test above. The changing of ISO and/or Exposure settings require time, so most likely you will need a bit longer delay, so you will have to determine the right one.

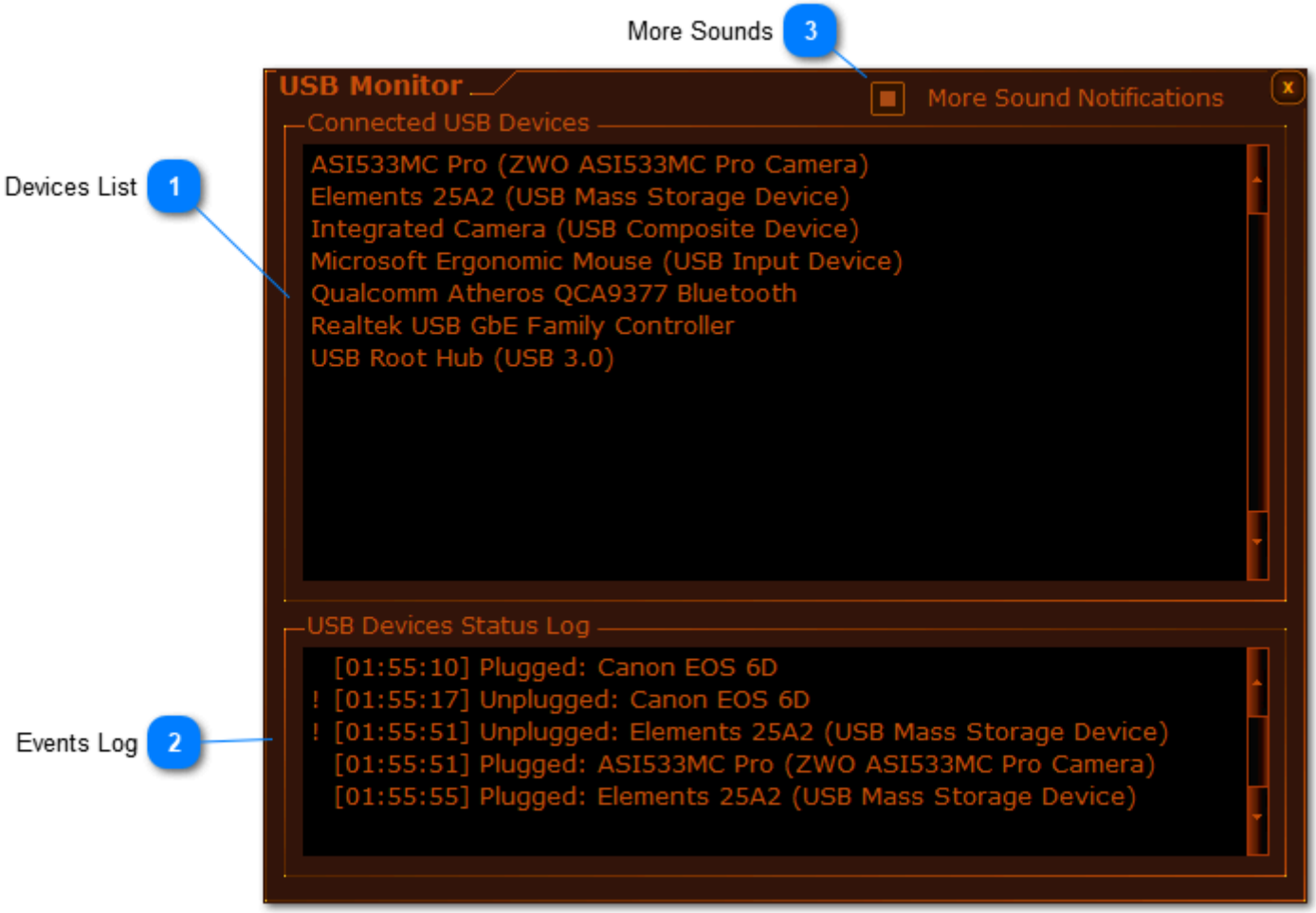
Now you are ready extreme imaging of the event.. You can combine your plan with execution scheduling.

## USB Monitor

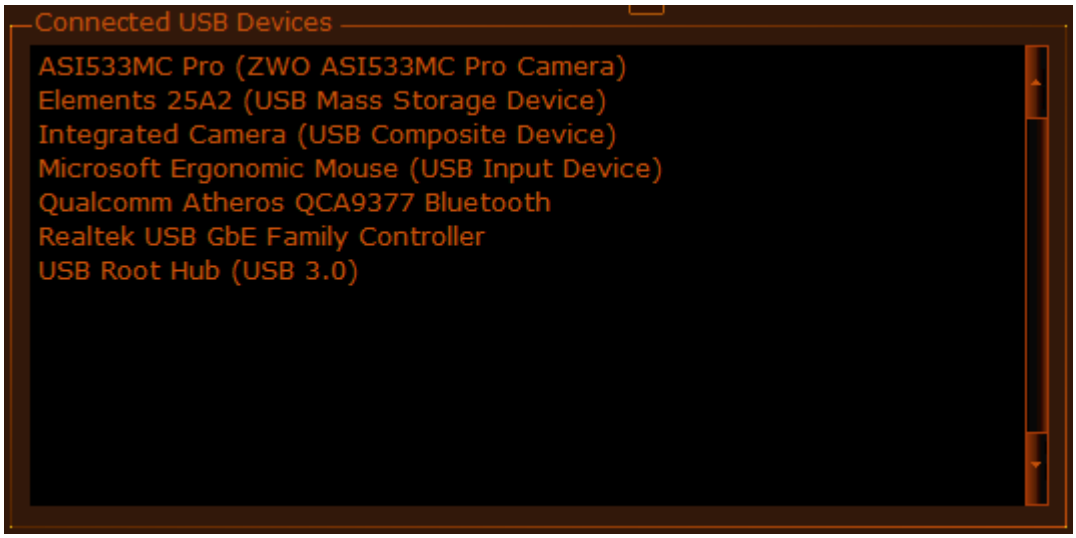
*The USB Monitor is accessible from Main Screen or with F10 key.*

*Related videos:*
240

We all have heard the "unplug" and or "plug" Windows sound during the night wondering which connection was lost... The USB Monitor comes to keep eye on the connected USB devices and also to show log on the events happening in the course of the night. It is running all the time no matter if its window is open. The USB events are displayed in the Log Panel, but if you want to see filtered information or to seem the devices that are discovered click on the USB Monitor button in the top right corner of the Log Panel.

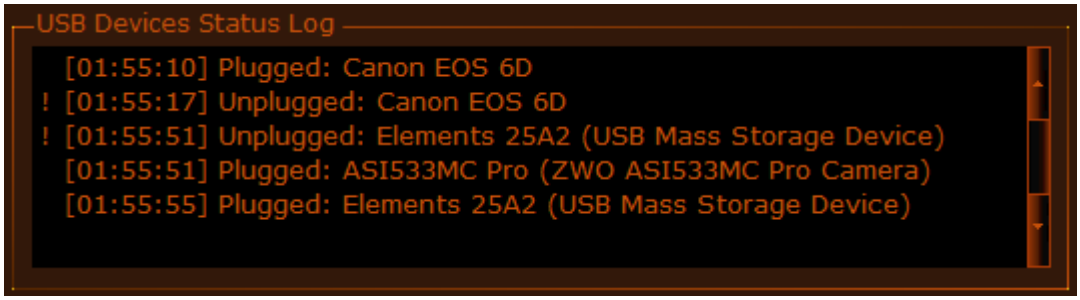



### 1 Devices List



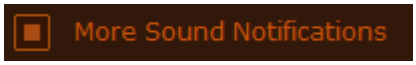

List of the most USB devices. Some internal parts of of the computer are also USB devices, so the USB Monitor tries to show only the devices of interest. If more deep device troubleshooting is needed the Windows Devices Manager will be always there.

## 2 Events Log




A log of the connection and disconnection events detected since the APT start. It can be use to check what happened when you heard "the USB sound", is the camera detected and etc. without digging into the Windows tools with bright white background.

## 3 More Sounds




When USB device is connected or disconnected, Windows play a specific sound. APT has additional sound notification which states what event happened. However when there is problem with an USB hub and many devices are disconnected or connected at once it could be annoying to hear same notification multiple times.

Disabling this option will leave only the Windows notifications.

# Polar Align via PS - PAPS

*PAPS is accessible from Tools tab*

*Related videos:*

**P**olar **A**lign via **P**late **S**olving - PAPS depends on plate solving so you have to configure and make working PointCarft. It is implementation of the 3-point polar alignment available in many mounts (and other applications), but powered and automated by plate solving. PAPS is using code and mathematical problem solution made by Rumen Bogdanovski, who made it for the INDIGO and AIN Imager projects - he was very kind to allow using his code to do the calculations in APT! Essential part of the process is that the 3 check points should be away from the celestial pole. The best places are near the celestial equator. The plate solving has best accuracy there.

PAPS can work in two modes Automatic and Manual. In automatic, connection to mount is needed. When you start the PAPS process it will take images on 3 check positions, calculate the polar axis error and will start looping taking images, calculating the error allowing you to do corrections with the Alt/Az knobs of the mount. The needed Alt correction is marked as Up/Down. The Azimuth correction is CW/CCW for "clockwise" and "counter clockwise" - these directions are same no matter from which side of the mount you are. With the default settings PAPS will take one initial image to make blind solving and synchronization in order to go to the 3 check points accurately.

In manual PAPS mode you can use the tool without connection to the mount (like tracker). Point the mount to the starting position and click Start. PAPS will take an image and solve it. After that move the mount manually only by RA and click on "Measure P2" button. Repeat it for the third point and after that PAPS will become again in looping mode to allow you tweaking the Alt/Az. Keep in mind that the first 3 solvings are in blind mode and will take more time as PointCarft doesn't know the position as you are moving the mount manually.

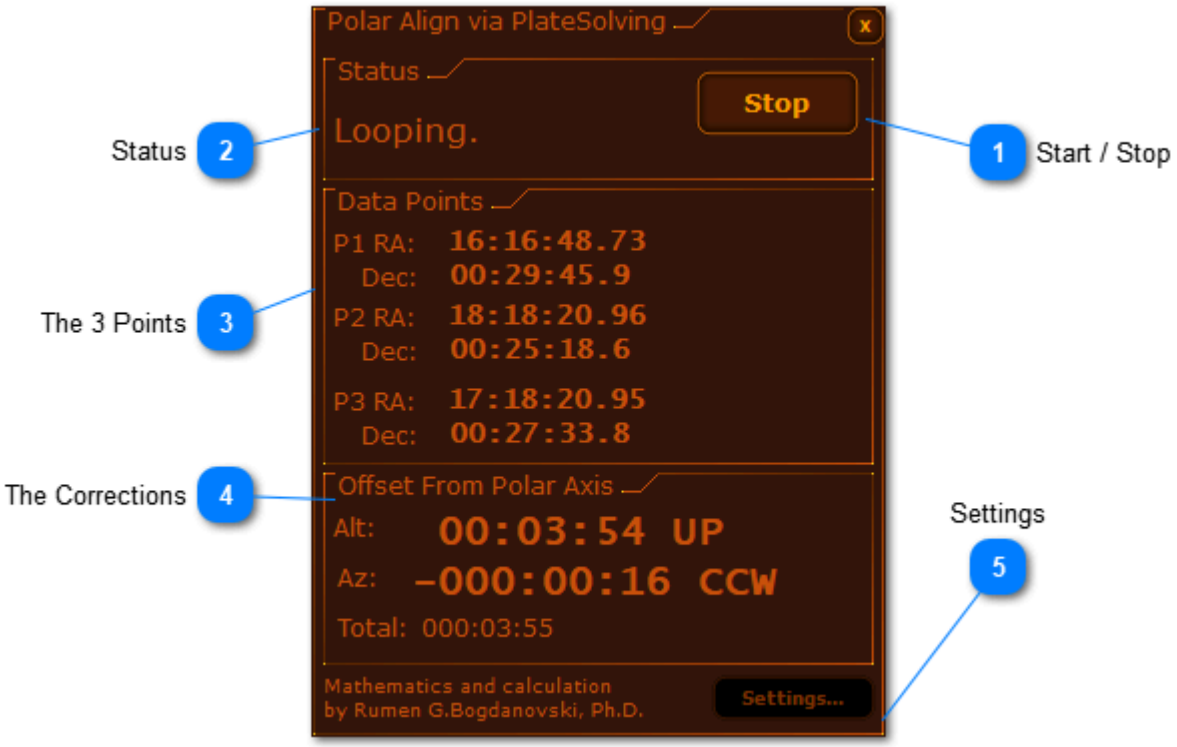
In the both modes there is pause (configurable, 10s by default) between the exposure / solving for calculating the alignment errors. In the last 5s of the pause you will hear a beep in order to know when the next exposure will start.

The requirements PAPS to work are:

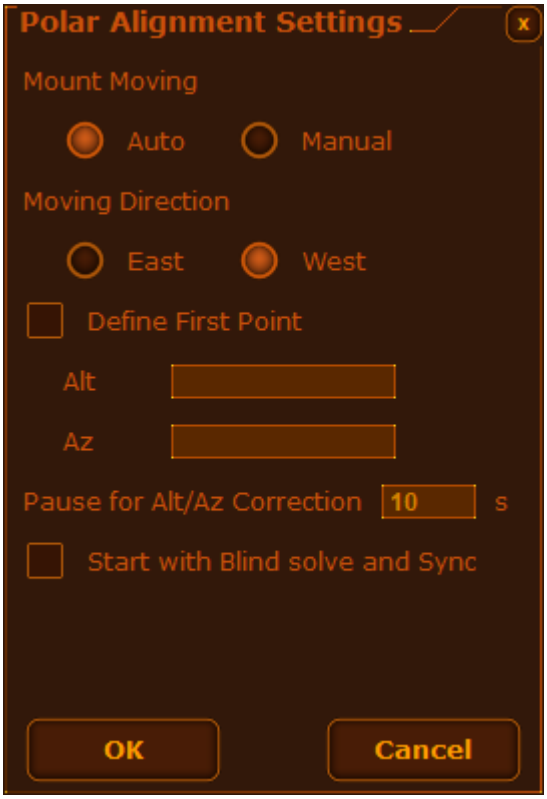
1. To have PointCarft configured for near and blind solving
2. To have your location set in the Location tab in Settings (not needed in Manual PAPS mode)
3 **To make an initial polar alignment as best as you can via polar scope or other method before starting PAPS!**

**Important note: Don't get too pedantic, even an error of 10-15 arc minutes is not something dramatic and the guiding will be more than happy with it.**

After every polar axis error calculation is made, the data will be stored in file named APT_PAPS_Camera_*.log, located in Documents\APT_Data folder**.** This feature allows mounts with motorized Alt/Az movement to do automatic corrections. In such case consider to define bigger "Pause for Alt/Az Corrections" in the settings.




Here is the information about the PAPS settings.




**Mount Moving** - Defines if PAPS will move the mount or you will do it manually.

**Moving Direction** - If "Mount Moving" is automatic, defines in what direction East or West to move the mount in order to take the 3 check points. Both are fine, but gives you an option if you have obstructions in the view.

**Define First Point** - Allows to define the Alt/Az coordinates of the first point if you don't want or can't use the automatic points selection.

**Pause for Alt/Az Corrections** - Defines how long time to leave for making the correction with the mount Alt/Az knobs. Increase the default value 10s if your setup needs more time to settle or is hard to adjust.

**Start with Blind solve and Sync** - When enabled PAPS will start with taking one initial image, blind solving it and synchronizing the mount to be sure that the 3 check points will be navigated correctly.

### 1 Start / Stop




Start / Stops the process. In Automatic mode PAPS will drive the mount. In Manual mode you have to place the mount at the first point before the start.

### 2 Status



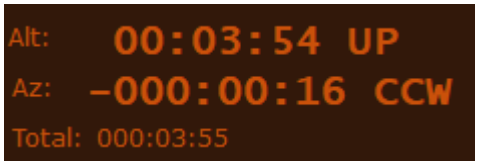

Shows the PAPS status.

### 3 The 3 Points




Shows the plate solved coordinates of the 3 points used to calculate the polar alignment error.

### 4 The Corrections




Shows the polar alignment error and what correction should be made. The Altitude directions are Up and Down. The Azimuth corrections are CW and CCW - "clockwise" and "counter clockwise" - the directions are same no matter from which side of the mount you are.

### 5 Settings



Opens the Settings dialog box.

## Dithering and Guiding

*The Guiding settings are accessible from Settings button in Guide section of Gear tab or with F7 Key.*

*Related videos:*
*Dithering & Guiding*
*Pre-Install (Windows) Part 3 - PHD2 Guiding*

APT can communicate with various guiding programs and devices in order to monitor and control the guiding. Important purpose of this communication is to provide dithering.

**Dithering** are gentle random changes of the telescope position between the exposures. By this the celestial objects are placed on slightly different positions on every image while the sensor defects like hot/cold pixels, dust signs or banding noise remains on constant or almost constant places. During the images stacking the stars are detected and all frames are aligned by the found star positions - this means that the objects become constant and while defects become random. All major stacking applications for image post-processing provide methods based on "sigma clipping" / "kappa-sigma clipping" pixel rejection. These methods exclude the random data and preserve the constant signal. As a result in the stacked image there will be much less defects and noise. More images you use in the stack more noise and defects will be removed. In order the sigma clipping to be effective there is need to use at least 6 light frames.

The author's personal opinion is that good amount of images (10 or more) makes dark frames unnecessary. Making darks is quite time consuming and very tricky process, especially for DSLRs where the imaging sensor temperature is not accurately controlled. Also (again personal opinion) darks applying results in loosing the very faint details in the final image.

No matter if you are applying darks or not, dithering is powerful technology is it is highly recommended to use it. The time needed to make dithering depends on the mount and the desired distance, but in most cases it takes less than a minute - quite small price for the benefits it gives.

Usually the dithering is made by your guiding program/device and there is no need to make dedicated connection to the telescope in APT if you don't want to use other features that require mount control.

**APT Dithering** (Direct Dithering) is special feature made to provide dithering when there is no guiding because your mount is high-end (ASA, 10Micron and etc.) or when you are using **short focal length lens or telescope**. APT Dithering uses a mount connection to make the needed random position changes between the exposures.

**APT Pulse Dithering** is other special feature made to provide dithering using pulse guiding commands for self guided mounts like Meade StarLock, self guiding solutions or mounts like SkyWatcher StarAdventure, AstroTrac and etc. In this cas e the Dithering Distance defines the maximum pulse duration in milliseconds. The value is multiplied by 100. For example Dithering Distance = 5 means up to 500ms pulse.

APT has powerful **Dithering System** that is able to synchronize exposures and dithering even in multi-camera imaging setups. See Multi-camera Dithering / Synchronization section.

Supported are the following guiding solutions:

- PHD Guiding (http://www.stark-labs.com/phdguiding.html)
- PHD2 Guiding (http://openphdguiding.org/)
- MegaGuide (http://www.astrogeeks.com/Bliss/MetaGuide/)
- Lacerta MGen v2 self-guider solution
- Lacerta MGen v3 self-guider solution

- Lin_Guider (https://sourceforge.net/projects/linguider/)
- AstroArt (http://www.msb-astroart.com/)

Lin_Guider is a Linux based guiding application which can be used on Raspberry Pi or other Linux devices for building small self-guiding solutions.
PHD and PHD2 has common roots, but now are different projects. Everything in the text below that is related to PHD is related to PHD2 too.

When **MGen3** connection is made, APT acts like server which can be used by other applications (like virtual handset) to connect to the device in same time.

There are several requirements for the **MGen2** usage with APT:

- The MGen firmware has to be version 2.04 or newer. If it older than 2.04 here is a link for updating:
  http://www.teleskop-austria.at/information/ccd-standalone-hu/pdf/Lacerta_MGEN_FW204.zip
- There is need to install the D2XX drivers that take care for the USB to MGen communication from here:
  http://www.ftdichip.com/Drivers/D2XX.htm
- There is need to enable the “Application Mode” from MGen menus.

Other interesting feature is named "**Auto Cancel Exposure**" (supported for PHD, Lin_Guider and MGen2/3). APT monitors the reported distance to the guiding star and if it becomes bigger than a defined limit the running exposure will be stopped before trails to become visible in the image, or to save imaging time for other exposure. Canceled exposure will not be counted as finished in plan execution and another will be started on its place.

Follows detailed settings description.

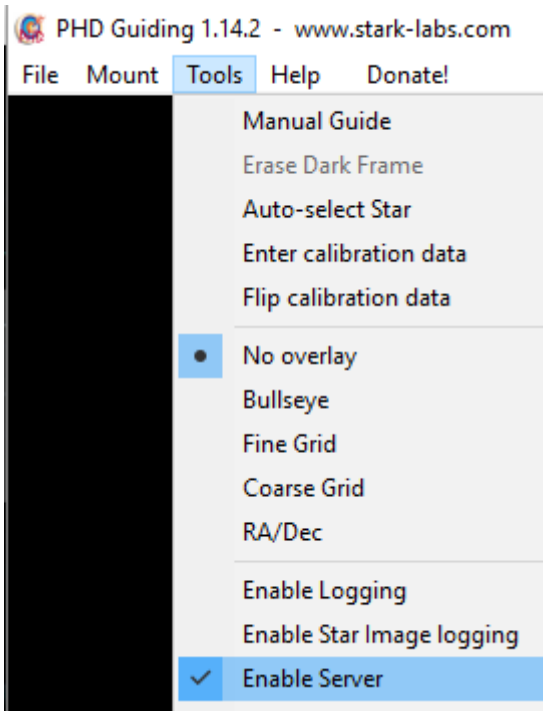



## 1 Guiding Program / Device




Defines the guiding solution that have to be used, or APT if there is no guiding.

When PHD is used there is need to set it in server mode. Select from menu in PHD 'Tools'->'Enable Server'. For PHD2 this option is enabled by default, but check it for sure.




## 2 Auto Dithering




Enables/Disables the dithering.

## 3 Dithering Distance




Defines how big to be the move. This is the upper limit. By definition dithering is random by direction and by distance move.

For PHD(2) if the distance is too small you can use the Brain button (Advanced Parameters) to enter "Dither scale". For each value, here is how much the dither size would be on the guiding chip (assuming you keep dither scale = 1.0):

For PHD1 the logic is:

| Value | Guide Camera Pixels |
|---|---|
| 1 | 0.5 |
| 2 | 1 |
| 3 | 2 |
| 4 | 3 |
| 5 | 5 |

For PHD2 the distance is in guide camera pixels (Value 1, means 1 pixel of the guiding camera, Value 2, means 2 pixels of the guiding camera, etc). An easy to use calculator what is the best value for your setup can be found here

For APT Dithering (Direct Dithering) the value defines the max distance in pixels of the imaging camera (Value 1, means 1 pixel of the imaging camera, Value 2, means 2 pixels of the imaging camera, etc).

For APT Pulse Dithering the value * 100 gives the max guiding pulse in milliseconds to execute.

*Supported by PHD, PHD2, MGen2/3, Lin_Guider, APT Dithering (Direct Dithering), APT Pulse Dithering.*

### 4 MGen Mode




Defines the dithering mode for the MGen2/3 device.

### 5 Stability




Defines the acceptable distance from the guiding start that to be considered as dithering end. For PHD, Lin_Guider the distance is in pixels from 0.00 to 2.55, for PHD2 there is only lower limit 0.00.

PHD and Lin_Guider doesn't report when the action is completed, so APT monitors the distance and when it gets back to normal decides that dithering is completed.

*Supported by PHD, PHD2, Lin_Guider*

### 6 Settle Time




Defines how many seconds to wait after dithering completion. This gives time guiding/tracking to settle down.

*Supported by PHD, PHD2, MGen2/3, Lin_Guider, APT Dithering (Direct Dithering), APT Pulse Dithering.*

### 7 Timeout




Defines the maximum time for waiting the dithering process to finish. After that time APT will continue with the next exposure. 0s means that there is no time limit to complete the dithering.

When MetaGuide or AstroArt is used this defines when to resume with next exposure.

### 8 Dither Interval



Defines how many images to take before making dithering. Values 0 or 1 means to make dithering after every image.

### 9 Dither Delay




Defines how many seconds to wait before sending the Dithering command. Usually there is no need to define such pause.

### 10 Auto Cancel Exposure




Enables/disables the Auto Canceling. Auto Canceling allows canceling exposure when the distance from the guiding star becomes greater than a defined value.

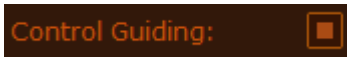
*Supported by PHD, PHD2, MGen2/3, Lin_Guider*

### 11 Auto Cancel Distance




Defines the maximum acceptable distance from the guiding star. Distance above this limit will force exposure cancellation. For PHD and Lin_Guider the values are in pixels form 0.00 to 2.55. For PHD2 there are no value limitations.

### 12 Control Guiding




When enabled APT will stop the guiding in **PHD**, **PHD2** or **MGen2/3** before making a GoTo, GoTo++ or #GoTo command and will try to resume the guiding after move is completed. This option has to be enabled for Automated Meridian Flip.

For **PHD2** when guiding is starting a new guiding star will be auto selected. PHD2 decides itself if there is need to do a calibration. Make sure to apply darks to avoid hot pixel selection.

For **PHD** when guiding is starting a new guiding star will be auto selected. APT can't get feedback from PHD when the guiding is started, so give some time the guiding to start and settle. Make sure to apply darks to avoid hot pixel selection. We suggest migrating from PHD to PHD2.

For **MGEN2/3** a new star is searched using the exposure/gain from the previous guiding. When the guiding star is selected, APT will start a calibration and after its end the actual guiding will be started.

### 13 After GoTo delay



Used when Guiding Control is enabled. Defines how many seconds to wait after mount movement is completed, before sending command for guiding star selection. This delay gives possibility guiding to get image clear of movement trails. Use delay that is 4-5 times the guiding exposure.

### 14 Guiding Resume Delay




Used when Guiding Control is enabled. After mount movement is completed, APT will send command for guiding star selection (defined by "After GoTo delay" ), then will wait N seconds (defined here) in order star selection to complete and tracking to settle before resuming the guiding. Increase this value if the mount needs more time after GoTo command.

### 15 Auto Start PHD2




When enabled during the start APT will check if PHD2 is running and if not, will start it automatically.

No matter if this option is enabled or not, when APT makes connection to PHD2 it will send a command to make connection to all devices in the last used profile in PHD2.

### 16 Remote IP




Defines the IP address of the computer that is used for guiding. This feature is useful if you use separate computer for guiding or self-guiding solution. The default value is 127.0.0.1 which means that same computer is used for imaging and for guiding.

*Supported by PHD, PHD2, Lin_Guider*

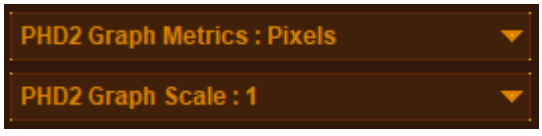
### 17 Remote Port




Defines which TCP/IP port to be used. This feature is useful if you want to control two or more guiding setups with one computer or self-guiding solution. The default value for **PHD1 is 4300**, for **PHD2 is 4400**, for Lin_Guider is 5656.

*Supported by PHD, PHD2, Lin_Guider*

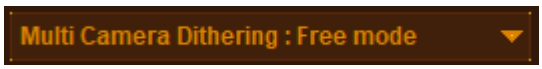
### 18 PHD2 Graph




Gives control over the PHD2 graph in Guiding section of Gear tab and Guide graph in Graphs Aid. The PHD2 Graph Metrics option allows selection how of graph to be scaled - in guide camera pixels or arc-seconds. The

PHD2 Graph Scale defines the graph scale, for example 1 will set the graph to show the +/- 1 arc-seconds range. Bigger guiding errors will be off the graph.

### 19 Multi Camera Dithering




Defines is the role of this APT instance in server-client architecture. If you use only one camera there is no matter what is selected.

See Multi-camera Dithering / Synchronization section.

### 20 Multi Camera Sync




Defines synchronization mode in server-client architecture. If you use only one camera there is no matter what is selected.

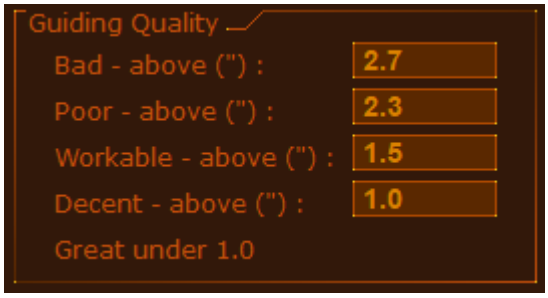
See Multi-camera Dithering / Synchronization section.

### 21 Ping Timeout




Defines how long the server to wait before decides that a client is stopped. Increase this value if you are loosing connection between the server and a client.

### 22 Guiding Quality




APT measures the guiding RMS value during every exposure and allow to rank your images based on the limits defined here as Great / Decent / Workable / Poor / Bad. The rank can be included in the file name.

Both the rank and the RMS values are stored in the database and are available as search criteria.

For **PHD2** the values are in arc-seconds for **MGEN2/3** the values are in pixels.

## Multi-camera Dithering / Synchronizing

*The Guiding settings are accessible from Settings button in Guide section of Gear tab or with F7 shortcut.*

*Related videos:*
*Multiple Imaging Cameras*

APT has powerful Dithering System that allows using dithering in a setup with multiple cameras. When your setup contains two or more cameras there is need APT to synchronize the moment when dithering will be made in order to be sure that none of the cameras is taking an exposure in that moment.

This is a short summary of the workflow:

**Configuration (one time only)**

- In the main APT instance open Guiding and Dithering. After that select "Server Mode" from Multi-Camera Dithering list box
- If there is need tune dithering parameters
- In the other APT instances open Guiding and Dithering. After that select "Client Mode" from Multi-Camera Dithering list box

**Regular use**

- Connect the cameras in all APT instances
- Start the plans in the client APT instances
- Start the plan in the server APT instance
- The Dithering System will synchronize all exposures and dithering

Here is a detailed explanation.

See Multi-Camera Operation for more information on how to use more than one camera at the same time.

Once you have started the different APT instances you have to setup a Client/Server configuration. In the instance that controls the main camera use click on the Settings button in Guide section of Gear tab (or use F7 shortcut) to open the dithering settings dialog and select from the list Multi-Camera Dithering the option “Server Mode”. After that from the list Multi-Camera Sync select the synchronization mode. Available are two modes – “Strict” and “Loose”. In the first mode all clients and the server will make an exposure and then will wait the server to make dithering before continuing with the next exposure. In “Loose” mode, if a client APT is taking shorter exposures than the server and if there is enough time then, the client will start new exposure. For example if the server is taking 10 minutes exposure the client has time to make several 2 minutes exposures without waiting the dithering action.

The server defines the all parameters for the dithering like program, distance, timeout and etc.

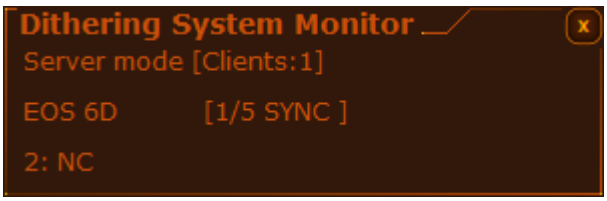
Once server is configured, next are the clients. In the other APT instances select from Multi-Camera Dithering the option “Client mode”. With this configuration is finished. There is no limitation for the number of the clients, but the server can be only one.

The most common workflow is to connect the cameras in all APT instances and to select the plans that will be executed. After that to start the **clients first** and the **server last**. This order allows the Dithering System to synchronize the exposures from the first one.

If the server is started first then all clients be put in SYNC state till server finish the exposure that is in progress.

The clients <-> server connections and the server <-> guiding program connection are checked and initialized (if there is need) on every plan start. So you don't need to take any additional actions.

**Tips&Tricks** *If you want to monitor closer the work of the Dithering System use* ***Ctrl+Click*** *on Settings button in Guide section of Gear tab (or F8 shortcut) to open the Dithering System Monitor. There you can see the status of the system in current APT instance. The server monitor can show the status of up to 10 clients.*




**Tips&Tricks** *If you don't need dithering you can still use the Dithering System to synchronize the exposures by disabling the Auto-Dithering.*

## PointCraft and Plate-Solving

*The PointCraft is accessible from Gear tab or with Alt+P shortcut.*

*Related videos:*
*Using Point Craft With Stored Images*
*Point Craft & Plate Solving*
*APT In Action: From Polar Alignment to Imaging*
*Pre-Install (Windows) Part 2 - Plate Solving*

**Plate-solving** is a image analysis that detects the stars and then tries to identify them using catalogs of know stars. If the analysis is successful it is possible to calculate the Right Accession (RA) and Declination (Dec) of the image center which tells where exactly is pointing the telescope, image orientation, resolution and etc. Plate-solving is the engine of many scientific studies for example comet, asteroid hunting and orbit analysis.

Nowadays we are lucky to have access to many advanced techniques and devices that in the past were available only for the biggest professional observatories. Plate-solving is one these techniques that makes imaging much productive, accurate and pleasant. There are two types of solving - **Near** and **Blind**. The first one needs to know approximately where "you are" and solving will tell you exactly where "you are", it is very fast because you already know context . For the second one you don't need know where "you are" and solving will find the position without knowing the starting position, it is slower because there is need to match star patterns from all over the sky.

**PointCraft** can be considered as set of APT features powered by plate-solving technology. The actual solving is made by external programs then their results are used by APT.

The key features of PointCraft are:

- Solve an image.
- Synchronize the telescope coordinates with the image coordinates.
- Store the found RA/DEC for use after meridian flip or in other imaging session.
- Make the perfect framing using Aim mode - determine the coordinates of every point in an image by a mouse click and use them for GoTo or GoTo++.
- Make GoTo moves with position confirmation using GoTo++.
- To see the Field-Of-View (FOV) of the image into your Planetarium application in order to see what is just around the corner.

This is PointCraft aid looks like:




Supported are three solving applications. Each has their advantages, so it is recommended to install the three of them in order to have the full set of options on the field. ASTAP is the most modern solution and unless you find problem you can use only this application. ASPS is based on Astrometry.net which is classics so it is good to have it in case there is problem to blind solve a particular image. Giovanni Benintende has made the installation and the configuration very easy. PS2 and PS3 are great applications too, however it could have problems with solving on computers with non US/UK numeric format, also can have difficult times when short focal length lens is used.

- **Astrometric STAcking Program** (ASTAP) made by Han Kleijn. Can be used for fast near solving - requires approximate coordinates and also can be used for blind solving.
- **PlateSolve2** (PS2) made by PlaneWave Instruments. Makes fast near solving - requires approximate coordinates.
- **PlateSolve3** (PS3) made by PlaneWave Instruments. Can be used for fast near solving - requires approximate coordinates and also can be used for blind solving.
- **All Sky Plate Solver** (ASPS) made by Giovanni Benintende (uses local server of Astrometry.net). Makes blind solving - can take a bit more time to find the solution.

ASTAP, PS2, PS3 and ASPS are not included in the APT installation, so you have to download them separately. Make sure to make this step when you have access to good/cheap internet connection.

**ASTAP Installation:**

- Download and install/unzip ASTAP from http://www.hnsky.org/astap.htm
- Download and install one of the available star databases D50 or D20
- In PointCraft Settings select the folder where ASTAP is installed

**PS2 Installation:**

- Download PlateSolve2 version 2.28 from https://planewave.com/download/platesolve2/

• Download the UCAC3 catalog from https://planewave.com/download/ucac3-catalog/
• Extract the both ZIP files where you like (**under Windows 10 it is better not to be in the "C:\Program Files" and "C:\Program Files (x86)" folders**)
• Start PS2. From “File->Configure Catalog Directories” select the folder where the UCAC3 catalog is.
• In PointCraft Settings select the folder where PS2 is installed

**PS3 Installation:**

• Download PlateSolve3 version 3.82 from https://planewave.com/files/platesolve3/ or version 3.80 from GoogleDrive or DropBox link
• Download UCAC4 catalog from https://planewave.com/files/platesolve3/PS3-UCAC4-Catalog.zip
• Download Gaia catalog from https://planewave.com/files/platesolve3/PS3-GAIA-Catalog.zip
• Extract the three ZIP files where you like (**under Windows 10 it is better not to be in the "C:\Program Files" and "C:\Program Files (x86)" folders**)
• Rename the PlateSolve.cfg (or delete it)
• Start PS3.81+. From “File->Configure Catalog Directory” For the UCAC4 catalog select the folder where PS3-UCAC4-Catalog.zip is extracted and for the GaiaDR2 catalog select the folder where PS3-GAIA-Catalog.zip is extracted.
• or Start PS3.80. From “File->Configure Catalog Directories” For the UCAC4 catalog select the Kepler directory and for the GaiaDR2 catalog select the UD Catalog directory. From "View->Parameters" make sure that all "Matching Algorithms" are selected.
• In PointCraft Settings select the folder where PS3 is installed

**ASPS Installation:**

• Download 'All Sky Plate Solver' installer from http://www.astrogb.com/astrogb/All_Sky_Plate_Solver.html
• Start the installer. It will download and setup a local Astrometry.net server. No complicated configurations!
• After that it will open the index files downloader which will get only the data you need
• If you are using DSLR select your model from Camera list and all need data for the ASPS index wizard will be displayed in the Log panel
• In PointCraft Settings select the folder where ASPS is installed

You need at least one of ASTAP, PS2, PS3 or ASPS. After their installation go to PointCaft Settings to select the application folders.

Some notes about the installations:

• If usually you are starting APT using "Run As Administrator" option, then start PS2/PS3 with the same option when you configure the catalog folder
• If you want to share the Astrometry.Net index files between ASPS and AstroTortilla check this topic in the APT forum - http://aptforum.com/phpbb/viewtopic.php?f=24&t=619

The next topics are explaining the PointCraft features in details.

## PointCraft

*The PointCraft is accessible from Gear tab or with Alt+P shortcut.*

**PointCraft** is set of APT features powered by the plate-solving technology. Before the detailed information lets give some usage scenarios in order to show what it is possible to do. Aim mode and GoTo++ are described better in dedicated section - Aim and GoTo++

**1. Telescope alignment (Near solving)**

• Click on Objects in 'Current Image' section and pickup a star from Object Browser - Stars tab
• Center the selected start in the finder
• Use the Shoot button to take an image

• Click on Solve
• Wait solving to finish
• Click on Sync button and you are ready to go for a target

**2. Telescope alignment (Blind solving)**

• Use the Shoot button to take an image
• Click on Blind
• Wait solving to finish
• Click on Sync button and you are ready to go for a target

**Note:** ***Don't make Sync on regions near the celestial poles. In this area all or almost all celestial meridians are in the FOV, and the solving is detecting the RA with great error. Sometimes it could be so big that the next GoTo be in almost random part of the sky by RA. Use regions with Declination in the range from +85 to -85 degrees. In order to avoid that APT will not make Sync if the declination is bigger than 85 or lower than -85.***

**Tips & Tricks:** If you are using **EQMOD** check this very useful article written by **Jim Hunt** - https://aptforum.com/phpbb/viewtopic.php?f=19&t=5101

**3. Frame an object**

• Go to the object
• Take an image with exposure that can show its position
• Solve the image
• Click on Aim button
• Click in the image to define the point that you want to be in the image center
• Click on GoTo++ button or on GoTo button in Gear tab
• If GoTo++ is used after completion you can Store the framing for future use (after meridian flip or in other night)

**4. Go to saved position**

• Use Object Browser (the Objects button the “Center FOV at position” section) to populate the GoTo++ RA/Dec coordinates with a saved object.
• Click on GoTo++ button

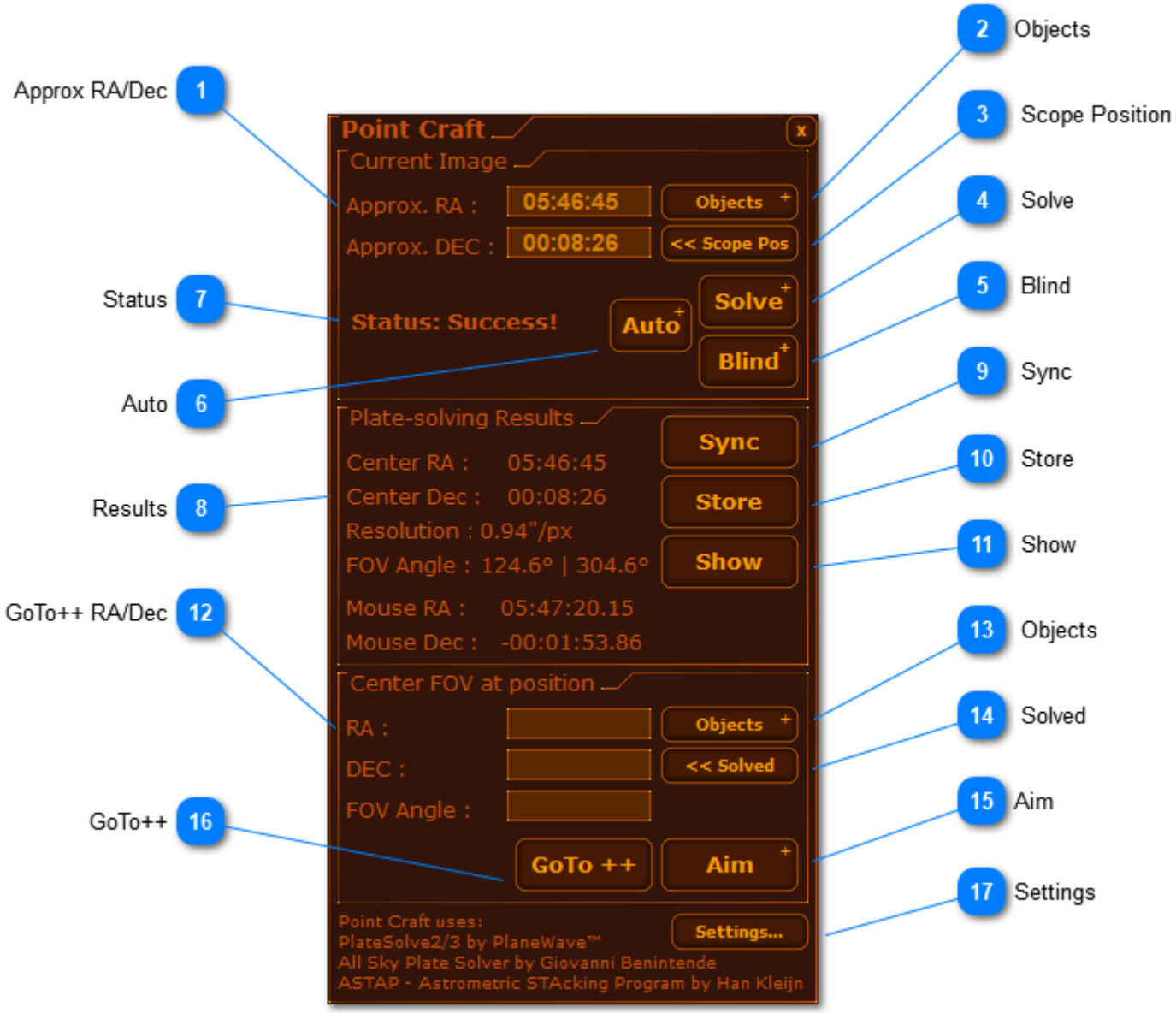
**5. Use an old image**

• Load an old image with the Image browser - Img Tab (if it is FITS / XISF with stored coordinates Approx Ra/Dec will be populated)
• Solve the image (Solve button needs Approx Ra/Dec)
• Click on Solved button
• Click on GoTo++ button or on GoTo button in Gear tab

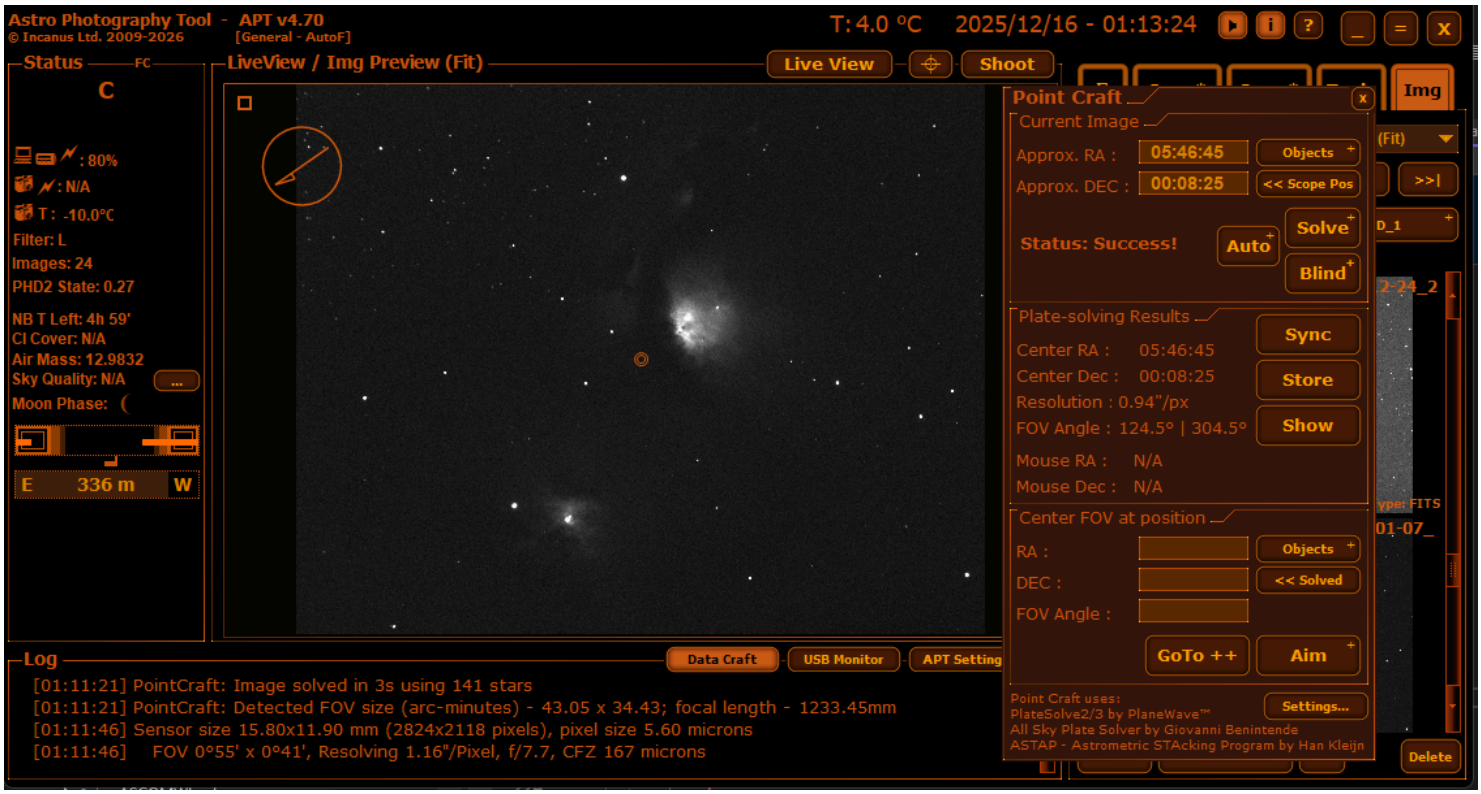
The scenario possibilities for framing and GoTo++ can be extended by the Planetarium applications integration. The Planetarium gives you way to see what is the image context and to change your framing in order to include nearby objects that currently are out of the image borders.

The PointCraft dialog box is separated in three sections described in details by the text below:

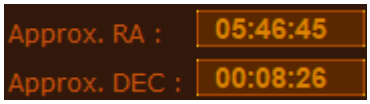
• Current Image - defines the input data and shows the solving status
• Plate-solving results - shows the result an gives options to use them
• Center FOV - defines the position you want to put in the center of the Field-Of-View




Here is how looks a solved image. The center and north position are marked in the image. The coordinates and the other data are populated in the Results section.




## 1 Approx RA/Dec




Contains the approximate coordinates of the current image. They are needed when Solve button is used. If Blind is used you can leave them empty.

Accepted is any RA/Dec format. You can use the Objects and Scope Pos buttons to populate them.

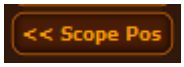
## 2 Objects




Opens the Object Browser in order to populate the Approx Ra/Dec by selecting an object.

**Shift+Click** takes the current FOV coordinates from the Planetarium application.

## 3 Scope Position




Populates Approx Ra/Dec with the coordinates of the connected telescope.

## 4 Solve




Makes near solving by using the selected Near Solver.

This feature needs populated Approx Ra/Dec. The Object Calculator section also has to be populated in order the pass correct the FOV (Field-Of-View) size to the selected Near Solver. Note that if you are using Canon lens, APT will read the current lens focal length after each exposure and will update the focal length field in Object Calculator providing the value for usage in PointCraft.

If you want to use custom FOV use **Shift+Click** on Solve button, enter the size in arc-minutes and click Go to start the solving.




In case of problems with near solving check the following topic in the APT forum. It contains discussion on the PS2 settings that have effect on the solving.

http://aptforum.com/phpbb/viewtopic.php?f=24&t=474

## 5 Blind




Makes blind solving by using the selected Blind Solver. The Object Calculator section has to be populated in order the pass correct focal length and pixel size to the solver.

In case of problems with blind solving check the following topic in the APT forum. It contains discussion on the ASPS settings that have effect on the solving.

http://aptforum.com/phpbb/viewtopic.php?f=24&t=618

**Tips & Tricks:** When you use ASTAP or PS3 as blind solving application, you can use **Shift+Click** on Blind button to execute **Completely Blind** solving. It will solve the image and will determine the focal length of your setup. The only thing that it required is the pixel size. Select the DSLR model or enter the pixel size in the Object Calculator section. Use **Completely Blind** solving if you Near or Blind solving fails because the FOV is not correct.

## 6 Auto




Makes the following sequence of actions: Shoot -> Get Scope Pos -> Solve -> Sync

If there is no defined exposure duration in PointCraft Settings, then is used the one in Camera tab.

If only one solving application it installed it will be used. If there are solving application for both Near and Blind solving, the solving method is defined by the selected method in the setting, PointCraft can use Near Solving, Blind Solving or to ask which to use on every Auto usage.

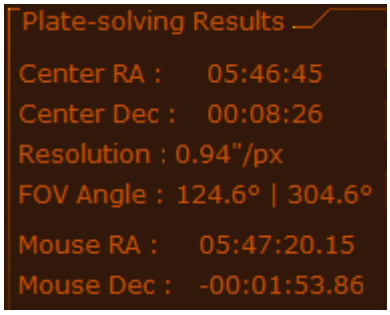
You can use **Ctrl+Click** on Auto button to force Near solving and **Shift+Click** for Blind solving overriding the selected method in the setting for the current execution of the procedure.

## 7 Status




Shows the status of the current solving process.

## 8 Results

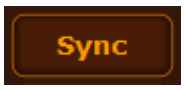



Shows the results from the last solving:

- RA/Dec of the image center (marked in the image with two small circles)
- Image resolution - in arc-seconds per image pixel
- Angle - the frame rotation from celestial North. There are two values. The one detected in the image and the the corresponding angle from the other side of the meridian. Any of these can be used in multi-night sessions in order to rotate the camera properly and avoid data loss.

When you click and hold the left mouse button and then move the RA/Dec coordinates under the mouse pointer will be displayed in the fields Mouse RA/Dec.

## 9 Sync



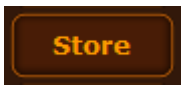

Synchronizes the connected telescope with the solved coordinates of the image center. This is the equivalent of "One star GoTo alignment" provided by most telescope handsets.

If there is connected Rotator it will be also synchronized with the FOV Angled found by the solving.

A message will be printed in the Log panel when command is completed.

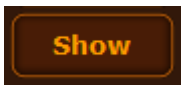
**Note: No sync will be made if the Declination is bigger than 85 or lower than -85**.

## 10 Store




Opens the Custom tab of Object Browser in "Add new" mode then populates the found RA, Dec and angle from the last solving. You can enter additional data like name, type, etc. and save the position for future use - after meridian flip or in other imaging session.

## 11 Show




Shows the FOV detected by the last solving into your Planetarium application. Gives a view to the celestial context of the displayed image.

## 12 GoTo++ RA/Dec




Defines the coordinates to be used for GoTo++. This is a GoTo with image solving confirmation of the position. If there is connected Rotator is possible to define the desired FOV Angle. Leaving the FOV Angle field empty will not alter the Rotator angle.

Works nice in combination with Aim mode. Both described in Aim and GoTo++ section.

## 13 Objects




Opens the Object Browser in order to load the GoTo++ Ra/Dec coordinates with an object - for example saved by Store button position of previous framing.

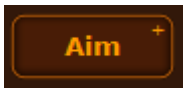
**Shift+Click** takes the current FOV coordinates from the Planetarium application.

## 14 Solved




Populates the GoTo++ Ra/Dec and Ra/Dec in Gear Tab with the coordinates from the last solved image. Useful when you have solved an old image loaded with the Image Browser - Img Tab.

## 15 Aim




When enabled allows finding the celestial coordinates of any point in the solved image. Click with the left mouse button in the image visible in the LiveView / Preview panel and the coordinates will be populated into both GoTo++ RA/Dec and regular GoTo Ra/Dec in Gear tab.

Works nice in combination with GoTo++. Both described in Aim and GoTo++ section.

### 16 GoTo++

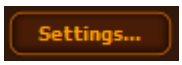



Starts a GoTo++ sequence. This is a GoTo with image confirmation of the position.

For the confirmation images, if there is no defined exposure duration in PointCraft Settings, is used the one in Camera tab.

See Aim and GoTo++ section.

### 17 Settings




Opens the settings related it PointCraft.

See the PointCraft Settings section.

## Settings

*The PointCraft Settings is accessible from Settings button in PointCraft dialog box.*

These is the PointCraft Settings dialog box which defines parameters used only by PointCraft.

It is accessible from the PointCraft window.




## 1 ASTAP Settings




Defines the path to Astrometric STAking Program (ASTAP) application. Use the "..." button to open the folder selection dialog box. The download button navigates the web page for ASTAP downloading.

ASTAP can be used for both Near and Blind solving. Also it can be used for measuring HFD in Focus Craft, by selecting Use ASTAP in the Settings.

Check the instructions how to install ASTAP here.

## 2 PS2 Settings




Defines the path to PlateSlove2 (PS2) application. Use the "..." button to open the folder selection dialog box. The download button navigates the web page for PS2 downloading.

PS2 can be used only for Near solving.

Check the instructions how to install PS2 here.

## 3 PS3 Settings




Defines the path to PlateSlove3 (PS3) application. Use the "..." button to open the folder selection dialog box. The download button navigates the web page for PS3 downloading.

PS3 can be used for both Near and Blind solving.

Check the instructions how to install PS3 here.

## 4 ASPS Path




Defines the path to All Sky Plate Solver (ASPS) application. Use the "..." button to open the folder selection dialog box. The download button navigates the web page for ASPS downloading.

ASPS can be used for both Near and Blind solving, but Near solving is slower than the other option.

Check the instructions how to install ASPS here.

## 5 Near Solver




Defines which solver to use for Near Solving - ASTAP, PS2, PS3 or ASPS.

## 6 Blind Solver




Defines which solver to use for Blind Solving - ASTAP, PS3 or ASPS.

## 7 Solving Timeout



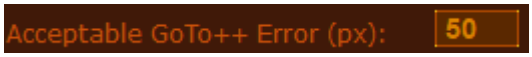

Defines how long to wait ASTAP, PS2 or ASPS for solving results.

## 8 GoTo++ Attempts




Defines how many times the GoTo++ will try to center the desired target.

## 9 GoTo++ Error




Defines how many pixels are an acceptable error for GoTo++.

## 10 GoTo++ Pause




Defines how many seconds to wait after GoTo++ before taking the next image for position confirmation. Some mounts can require time to settle down after a movement.

## 11 Relative GoTo++




When **enabled** the GoTo++ will use the current telescope position and the calculated position error to find the coordinates for the next attempt to center the desired coordinates. It is recommended to enable this option.

When **disabled** the GoTo++ will make direct attempt to center the desired coordinates. Disable this option if your telescope is able to make very precise movements. When this option is disabled it is recommended to uncheck the "No Auto Sync" option too.

## 12 DSLR crop




Enable this option only if ASTAP or PS2 can't solve an image taken with Canon EOS or Nikon camera because of wrong FOV size.

## 13 No Sync




When both, this option and Relative GoTo++ are unchecked PointCraft will send Sync command on every step of GoTo++.

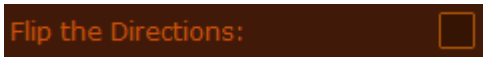
If your telescope is using internal pointing model, unexpected Sync commands can be unwanted, so use this option to be sure that model will not be altered during GoTo++.

## 14 Fast Rotation



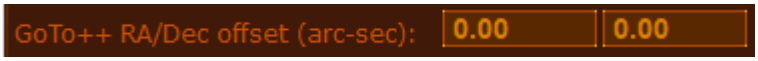

When enabled and there is Target Field-Of-View angle defines for a GoTo++, will be used the closer to the current position angle - the defined angle or meridian flipped one.

## 15 Flip Directions




Enable this option only if Aim mode calculates wrong coordinated or GoTo++ make moves in opposite direction.

## 16 GoTo++ Offset



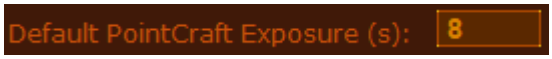

Defines what offset to apply when GoTo++ is executed. It is useful when you use view finder or other scope for pointing the main scope but there is misalignment between the two instruments. For example using finder with camera to point visual telescope.

## 17 Solving Method for Auto




Defines what solving method to use when Auto button is used. 'Always Ask' gives possibility to select the method on every use of Auto. It is also possible force using Near or Blind solving without asking.

## 18 Default Exposure




Defines how long to be the imaging exposure for GoTo++, Auto, and Automated Meridian Flip. There are several options to control the exposure. Here is the priority (top is first)

- Per Filter in Filter Wheel tab
- Default Exposure in PointCraft settings
- Exposure in Camera Tab DSLR Mode / CCD Mode

## 19 Default Filter




Defines what filter to use for GoTo++. The previous filter wheel position will be restored when GoTo++ finish.

Leave it blank if you don't want GoTo++ to change the filter.

## 20 Default Binning




Defines what Binning to use for GoTo++. The previous value will be restored when GoTo++ finish.

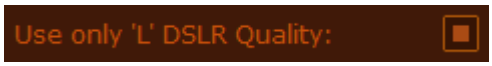
Leave it blank if you don't want GoTo++ to change the binning.

### 21 Default Gain



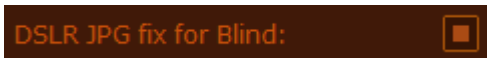

Defines the gain value to use to use for GoTo++. If there is a value here it is used as top priority. If it is empty, gain per filter is second, the gain set in Camera Tab last.

### 22 Image Quality



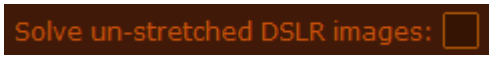

When enabled, GoTo++ and Auto will use 'L' quality type no matter what is set in the Camera tab. This option is used only for DSLR cameras.

### 23 DSLR JPG fix




Enable this option if you want to blind solve JPG files in S1, M, S quality formats.

### 24 Use un-stretched images




When enabled PointCraft will solve the un-stretched version of current image. This option has effect only in DSLR mode. Histogram stretching can make DSLR images harder or impossible to be solved.

### 25 Default ISO




Defines what ISO to use for GoTo++. The previous value will be restored when GoTo++ finish.

Leave it blank if you don't want GoTo++ to change the ISO.

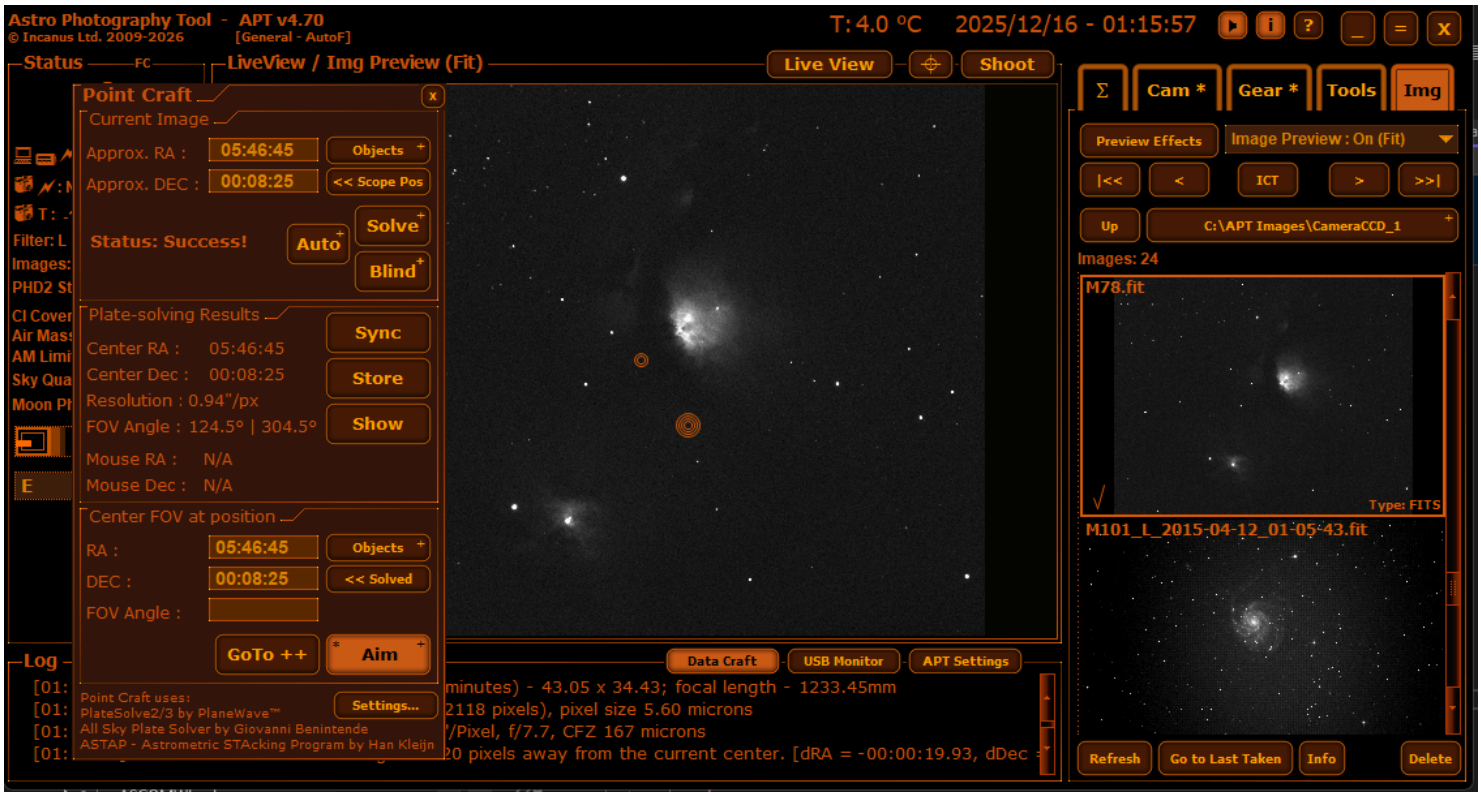
## Aim and GoTo++

*The PointCraft is accessible from Gear tab or with Alt+P shortcut.*

When the image on screen is solved you can use the Aim button to activate the Aim mode. It allows determining the celestial coordinates of every point in the current image. Just click in the image with the left mouse button and PointCraft will calculate the RA/Dec of the point (and will mark it with four small circles). The main purpose of the Aim mode is to define the point that you want to be the center of your image. This is very easy way to frame the target object. Using the GoTo++ or regular GoTo, APT will move the telescope to the desired position.

Every time you select a point the coordinates are populated in the 'Center FOV at Position" section (RA/Dec fields) for usage with GoTo++ and also in Gear tab (GoTo Ra/Dec) for usage with regular GoTo.

Here is a screenshot of activated Aim mode and the calculated coordinates of the selected point (marked with four circles).




The **GoTo++** is PointCraft feature that makes GoTo with image confirmation of the position. It can makes several iterations of the following automatic steps:

- Make a GoTo
- Take an image (the exposure is defined in PointCraft Settings or in Camera tab)
- Solve the image
- Evaluate the error

If the error (the distance between the desired and the image coordinates) is smaller than the one defined in PointCraft Settings the GoTo++ is considered as successful. If found error is bigger a new attempt is made till the limit defined in PointCraft Settings is reached.

**Note:** *If there is defined FOV Angle and there is connected Rotator, the camera will be rotated to the desired angle as a first step of the GoTo++ procedure.*

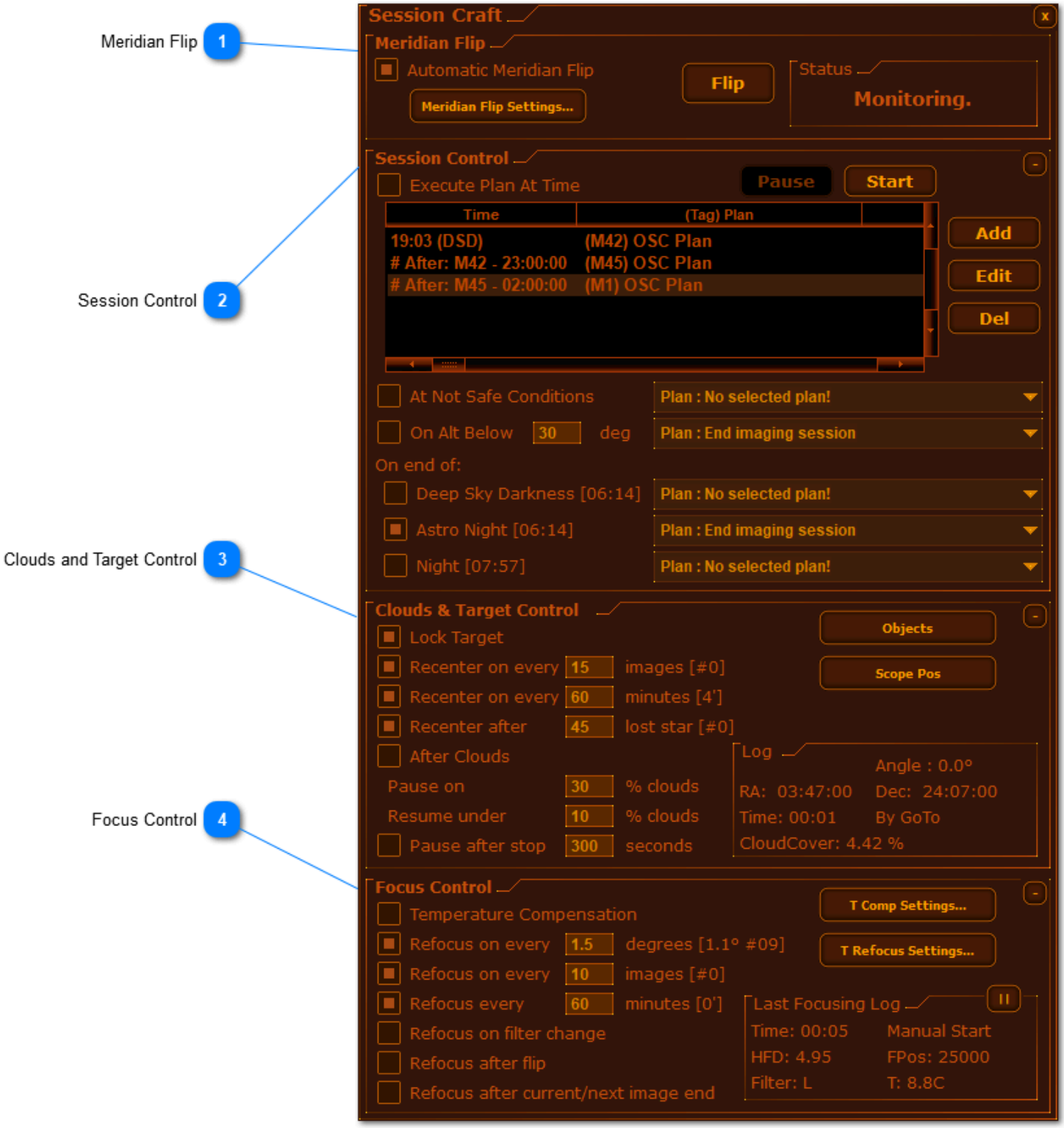
## SessionCraft - Meridian Flip, Control and Refocusing

*The SessionCraft is accessible from Tools tab or with F9 key.*

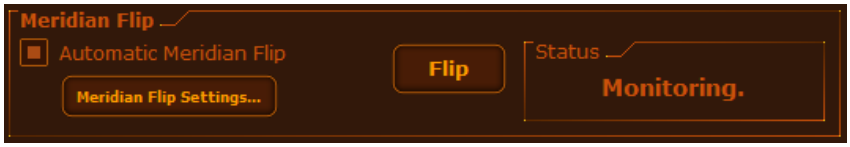
*Related videos:*
*Session Craft, An Overview*

Session Craft is designed to monitor various events (triggers) and to control imaging session. It works even when the window is closed. There three main sections (everyone described in details in corresponding pages):

1. Meridian Flip - which monitors and take care for making automated meridian flip.
2. Session Control - it monitors for various events (triggers) and can execute defined imaging plans. The triggers provide full control what, when how long to image. However the plans still can contain script commands for object changes, scope parking, camera warming and etc.
3. Clouds & Target Control - it allows locking target, re-centering on various events, as well as pausing and restoring the imaging when clouds are detected
4. Focus Control - it monitors for various events (triggers) and can start automatic refocusing (DSLR support is coming soon)

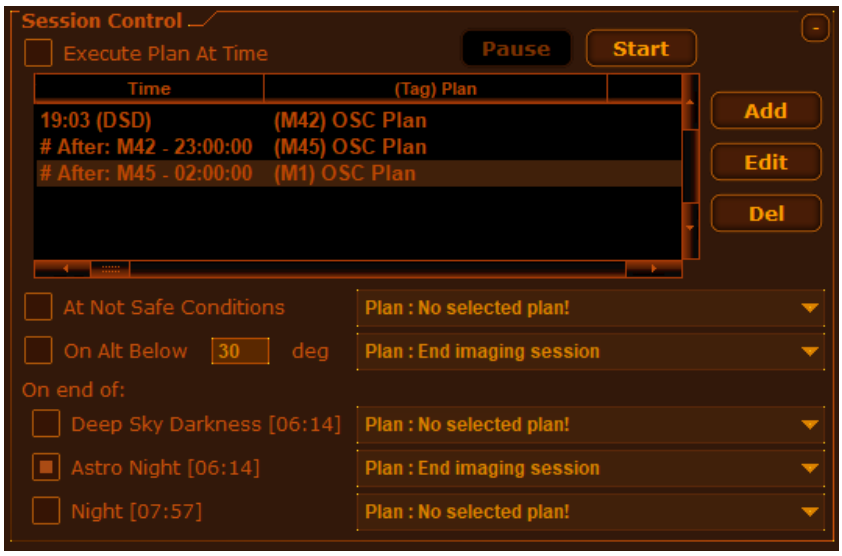



## 1 Meridian Flip



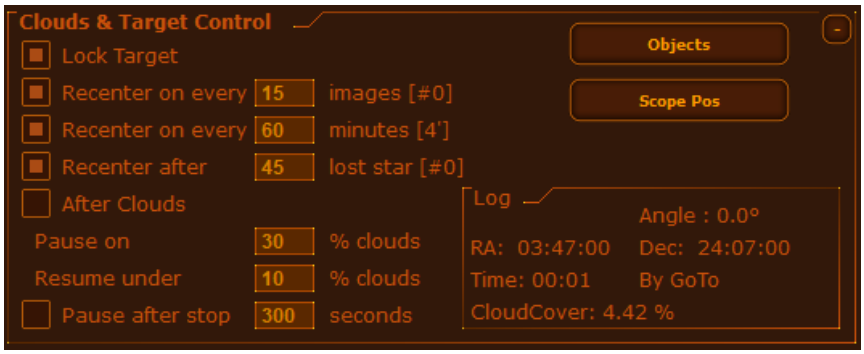

See Meridian Flip section.

## 2 Session Control




See Session Control section.

## 3 Clouds and Target Control




See Clouds and Target Control section

## 4 Focus Control




See Focus Control section.

# Automated Meridian Flip (AMF)

*The SessionCraft is accessible from Tools tab or with F9 key.*

*Related videos:*
*Meridian Flip - 4.60+*
*Meridian Flip*

Session Craft is designed to monitor various events and to control imaging session. It works even when the window is closed. The first feature from this tool is **"Automated Meridian Flip"** (AMF). APT can be configured to track the object position during the imaging and when it closes the celestial meridian passing to flip telescope position to prevent physical damage or bad guiding. After that flip the imaging process continues from the interruption moment, aiming to the exact same place of the sky.

To achieve this goal of **Automated and Unattended Meridian Flip (AMF)**, APT follows the next scenario:

1. If there is running plan, before every exposure is checked if there is enough time take a new image before the need to make flip. If there is no running plan the check is running in real-time
2. If the "Flip Moment" occurs or there is no enough time to take another exposure, Session Craft determines the exact position of the current target via PointCraft taking a short exposure
3. Pauses for user defined time, disables the tracking and guiding giving time the object to pass the meridian or the scope position to be safe after flipping the pier/tripod side
4. Once pause is elapsed, it enables the tracking and flips the scope position
5. Makes GoTo++ to the target in order to frame the object by the very same way as before the flip
6. Enables the guiding by selecting a new guiding star and making re-calibration if needed
7. Resumes the imaging plan

Because these operations could be dangerous for your setup, **in case of smallest problem for security reasons APT leaves the scope with disabled tracking, disabled guiding and stops the imaging plan. In every moment you can press the Stop button in Session Craft, the Stop button in Gear Tab or by pressing F12 key to stop all movements and actions.**

The default Meridian Flip settings are empirically proven and should work out of the box for virtually every setup. It will stop 5 minutes before the celestial meridian passing, will wait 5 minutes after the actual passing through the meridian (total pause of 10 minutes) and after that will flip the scope position. Every step of the process is logged in the Log panel. During the flip the SessionCraft windows will be displayed automatically if it was closed.

However you must to prepare your setup, learn its behavior and observe the first few flips to be sure that everything is fine and safe. **We do provide the automation, but you are using it by your own decision and you are taking the whole care for your scope! Keep eye on your setup during the first few flips!!!**

Since APT 4.60 there is an option **Try to lower the pre-flip waiting** however you can use it after you have explored the possibilities of your setup, so please read the next points.

Here are the most important checks to make before enabling Make Automatic Flip:

1. After preparing your setup and connecting all cables make "dry" manual flips moving the scope by hand from the both sides of the pier/tripod to make sure that all cables are free. Make these checks near the Zenith, but also above South and North points of horizon. It is very important! Short cables or short cable travel can cause serious damages to connectors, ports or to pull computer form table!!!

2. Make sure that you have configured PointCraft correctly and can solve images in near and blind more. It is used to determine the exact position before the flip and to reach the same position after the flip. We suggest to define Default exposure in PointCraft Settings which is long enough to get few stars with all of your filters, however if the difference between the filters is too big you can define plate solving exposure per filter in Filter Wheel tab in Settings. If defined by Blind solving will be used only for the first step of the GoTo++

3. Check the usual time for near/blind solving takes to solve an image from your scope. If it is more that 1-2 minutes increase the Flip Moment.

4. Make sure that you are using PHD2 or MGen2/3 for guiding and that Control Guiding is enabled. Meridian flip is also possible when your mount doesn't need guiding.

5. Make sure that you are using dark frames in PHD2 to avoid selection of hot pixels during guiding star auto-selection.

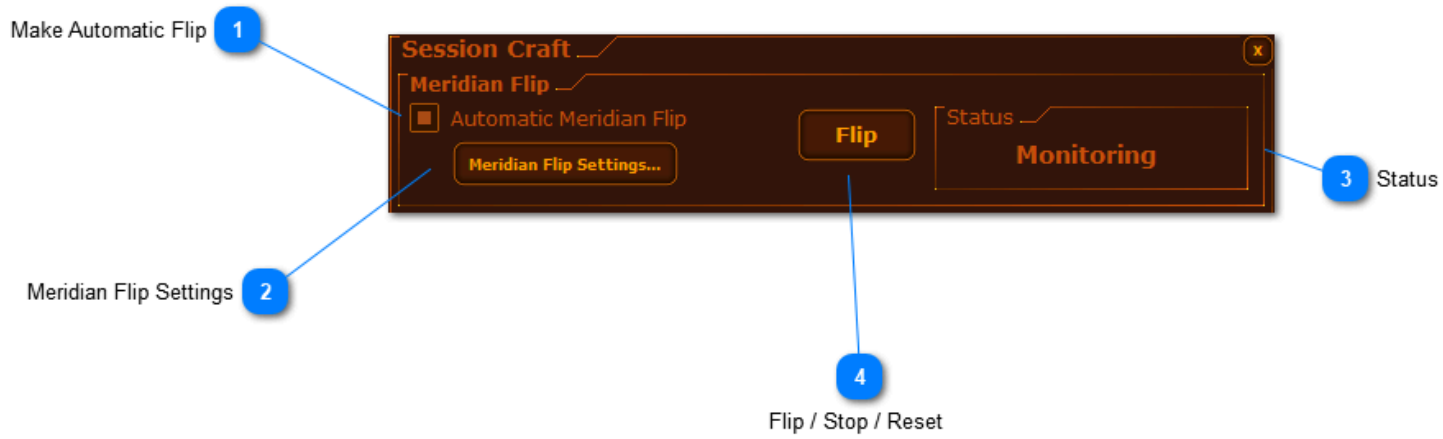
6. It is advisable to confirm the limits of your setup. Once the scope is aligned move it to position East from celestial meridian near Zenith via the handset, control panel of your driver or Gear Tab. Start making fine movements towards meridian and keep an eye on Meridian Flip Clock. See if the default limit of 5 minutes before meridian passing is safe for your kit. If not increase Flip Moment to a value that fits better. Move the scope from the other side of the tripod/pier and close it to meridian. Meridian Flip Clock will show values close to 720 minutes (this is the time of next meridian passing - the lowest object position). If the position that shows 715 is not safe see the value that fits better and subtract it from 720, set the result as Delay Flip Move. For example if the safe position is 713 minutes the needed delay is 720-713 = 7 minutes.

The point 1 has to be checked on every session. The other point are needed in the first time or after scope change. **You can skip point 6 only if you are trying the default settings and you are keeping an eye on the process!!!**

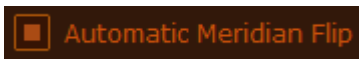
**Note:** If AMF happens during execution of Flat, Bias, Dark or Dark Flat plan APT will stop the tracking and guiding and will continue with the imaging plan.

**Note:** Some mounts/drivers support command to change the scope side according the tripod/pier side. If the execution of this command fails enable the option Flip via GoTo.

**Tips & Tricks:** If you are using **EQMOD** check this very useful article written by **Jim Hunt** - https://aptforum.com/phpbb/viewtopic.php?f=19&t=5101




## 1 Make Automatic Flip

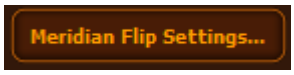



Enables/Disables making the automatic meridian flip (AMF). On enabling SessionCraft will check the flip settings and will give an error message in case of problem. Once you enable this option APT will check all the required parameters for unsupported combinations.

When AMF is enabled a small blinking indicator will be displayed in the upper left corner of the Status panel to show that SessionCraft is monitoring when flip has to be made.




### 2 Meridian Flip Settings




Opens the Meridian Flip Settings dialog box.

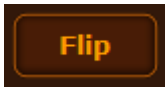
### 3 Status




This area show the Session Craft status. If Make Automatic Flip is unchecked Session Craft will not make any actions. During the flip process it shows the current step or the remaining time of pause defined by Delay Flip Move.

- When Flip Moment is positive the status will show count down counter from 3xDelay Flip minutes before the flip moment
- When Flip Moment is negative the status will show count down counter after the meridian passing till the flip moment

### 4 Flip / Stop / Reset




When Session Craft is in "Monitoring" status you can use the Flip button to start the process manually.

If automatic meridian flip is in progress this button becomes **Stop** that will immediately stop all movements, tracking, guiding, solving and imaging.

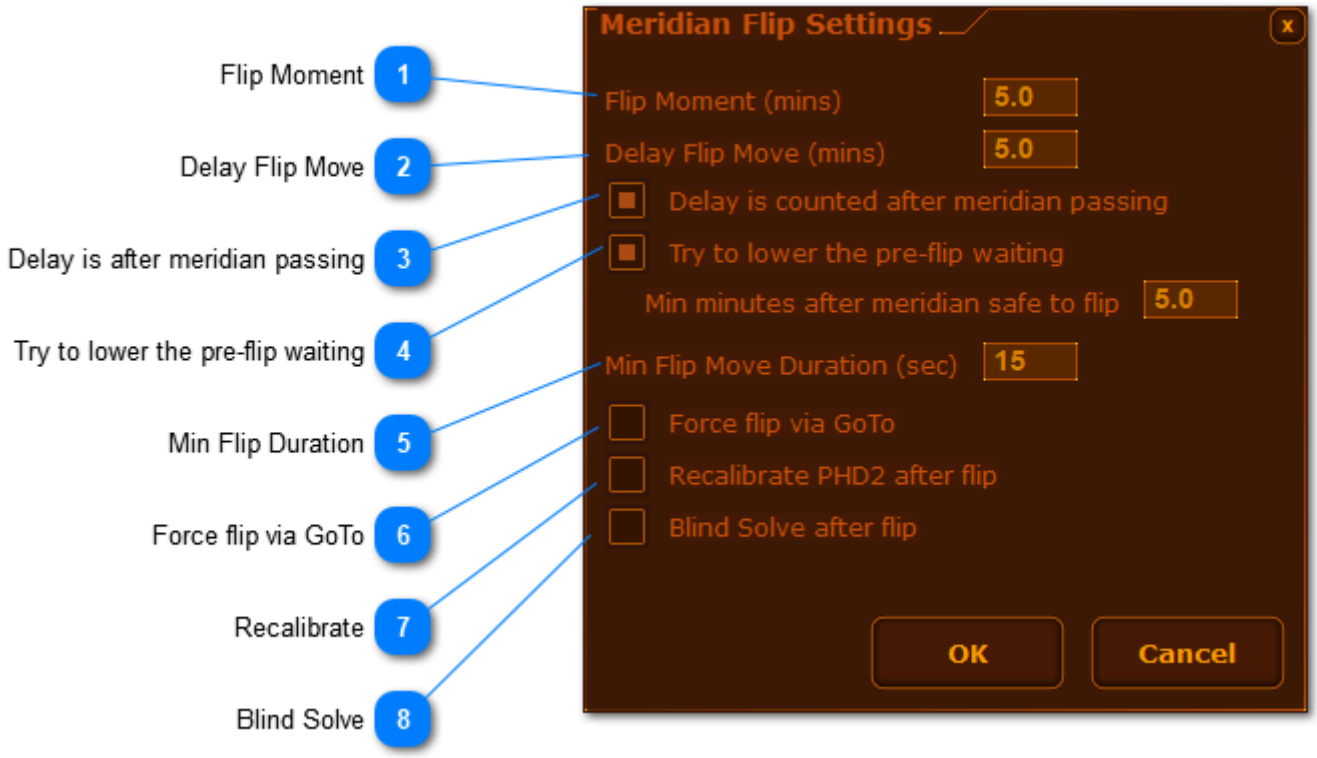
If the last automatic meridian flip process failed or Stop button is clicked this button becomes **Reset** that can clear all errors and flip process can be restarted. Note that you will have to start the scope tracking manually by Tracking in Gear Tab.

## Meridian Flip Settings

*The SessionCraft is accessible from Tools tab or with F9 key.*

*Related videos:*
*Meridian Flip*

The Meridian Flip Settings dialog box allow defining the options needed to make safe meridian flip.




## 1 Flip Moment




Defines how many minutes before the celestial meridian passing to start the preparations for flipping the mount. On process start it will determine the current position via taking a short image and plate solving it in PointCraft. It will stop the tracking and guiding once the position is determined.

If an imaging plan is in progress and there is no time to take the next exposure before the flip moment occurring, the imaging will be paused earlier and the additional time will not be counted as delay - it is an extra pause to prevent collisions.

Flip Moment works in combination with Delay Flip Move and Delay is counted after meridian. See the notes.

If this value is negative this means that process will start after meridian passing. **We suggest to investigate very carefully the behavior of your mount before using negative values!** Delay is counted after meridian passing has to be unchecked.

## 2 Delay Flip Move




Defines how many minutes to wait before executing the actual scope move that will flip its position according to the pier/tripod side. This delay can be counted from two moments - from the object passing through the celestial meridian (Delay is counted after meridian is checked) or from the "Flip Moment" (Delay is counted after meridian is unchecked).

During this delay the mount tracking and guiding are disabled. It gives time the object to move away from the positions where scope can hit the pier/tripod or/and to guide poorly.

Example: Let have an object that will pass through celestial meridian in 22:15. Let have *Flip Moment* set to **5** minutes and *Delay Flip Move* set to **7** minutes.

No matter if Delay is counted after meridian is checked or not, Session Craft will stop the guiding and tracking in **22:10** (or earlier if there is no time to take scheduled image, but for simplicity we will ignore that extra pause). This happens because we have set to stop 5 minutes before meridian reaching. Here are the two options depending on Delay is counted after meridian state:

1. If Delay is counted after meridian is checked - Session Craft will wait 5 minutes the object to pass the meridian in **22:15** after that will wait another 7 minutes and then will make the flip move. Total pause 5+7=12 minutes.
2. If Delay is counted after meridian is unchecked - Session Craft will wait 7 minutes after **22:10** and will make the flip move. Meridian passing is in 22:15, so the move will happen just 2 minutes after the passing. Total pause 7 minutes.

If we have running plan and there is extra pause, consider that Session Craft will be idle for X minutes till 22:10 is reached then the above calculation will be applied.

We suggest to use **Option 1** because it is easier to predict the flip move and measure the scope position limits. Be careful, not all mounts can flip the scope pier/tripod position before object passing through the meridian! **If the flip move is started too early is possible to be ignored by the mount and to leave the scope from the old side leading to crash!** Option 1 ensures that object will be on position that can be safely used by all mounts and flip will happens!

Option 2 gives possibility for optimizing the flip process and to take the maximum of your mount, but requires very careful measurements of the Flip moment (positive or negative) and the needed delay. Also needs knowing if it is possible to make flip move before meridian. Make experiments in various parts of the celestial meridian - from Zenith to South and from Zenith to North keeping an close eye on the mount and in the messages in the Log panel.

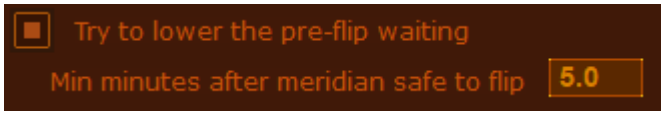
**In every moment you can press the Stop button in Session Craft, the Stop button in Gear Tab or press F12 key to stop all movements and actions.**

### 3 Delay is after meridian passing




Defines how the pre-flip delay is measured. When checked the delay is measured from the object passing through the celestial meridian. When unchecked the delay is measured from the Flip moment. See the Delay Flip Move notes!

### 4 Try to lower the pre-flip waiting




The option **"Try to lower the pre-flip waiting"** is built to optimize the imaging time, but requires to explore your setup to be sure that there is no danger.

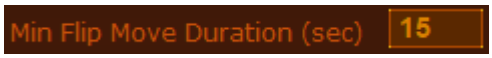
1. There is need to be sure that your setup can track safely after the meridian passing without danger to hit something.
2. How many minutes after the meridian passing it is still safe - **Lets name this number A for example 15 minutes**
3. What is the moment after meridian passing when executing GoTo command the mount will flip the position - this is exactly what you have used in "Delay Flip Move" - **Lets name this number B for example 5 minutes**

So when we have A and B, if we want to same as much imaging time as possible we have to set:

Flip Moment = **-15** (fifteen minutes after meridian passing as upper limit) - this is **the number A**
Delay Flip Move = **0**
Min Minutes after meridian safe to flip = **5 -** this is **the number B**
Try to lower the pre-flip waiting - **enabled**

The **A/B** will define that **it is safe to make the flip between 5 and 15 minutes after the meridian passing**. Depending on the running imaging plan Session Craft will try to execute the flip in this period without any waiting. In case the imaging exposure is longer than the defined interval of 5-15 minutes or it can fit in this interval, it will use the regular logic - stop the tracking and execute the flip **5** minutes after the passing.

### 5 Min Flip Duration




Defines the minimum time in seconds that your mount needs to change the pier/tripod side during usual meridian flip. Shorter time will be considered as indicator of problem with flip and SessionCraft will stop all movements in order to prevent damages.

### 6 Force flip via GoTo




Some mounts support command to change the side of the scope according to the tripod/pier. This command is handy during Automated Meridian Flip, however sometimes the mount refuse the change the side. If such problem occurs, enable this option and SessionCraft will use appropriate GoTo command to complete the task.

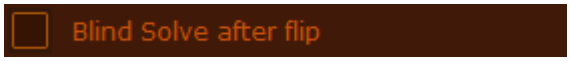
### 7 Recalibrate




When checked will force PHD2 recalibration after the flip before guiding star. Note that this is needed in extremely rare cares!

MGen2/3 does recalibration unconditionally.

### 8 Blind Solve



Defines what solving method to use for the first GoTo++ step after flipping the pier/tripod scope position. When checked the first solving will be blind solving via ASPS. All other GoTo++ steps will use near solving via PS2. When unchecked only PS2 will be used.

## Session Control

*The SessionCraft is accessible from Tools tab or with F9 key.*

*Related videos:*
*Session Control - 4.60+*
*Session Control*

The Session Control section of SessionCraft monitors for various events (triggers) and can execute defined imaging plans. These plans can contain script commands for object changing, scope parking, camera warming and etc.

There are different types of triggers that can be configured in any combination:

1. To execute plans on defined time - the time could be strict, calculated event like night start or scheduled after other trigger
2. To execute a plan when the scope position becomes under defined altitude
3. To execute a plan on the end of Deep Sky Darkness - the time without Moon and no astro twilight
4. To execute a plan on the end of Astro Night - the time with no astro twilight
5. To execute a plan on the end of Night - the time between Sun set and rise

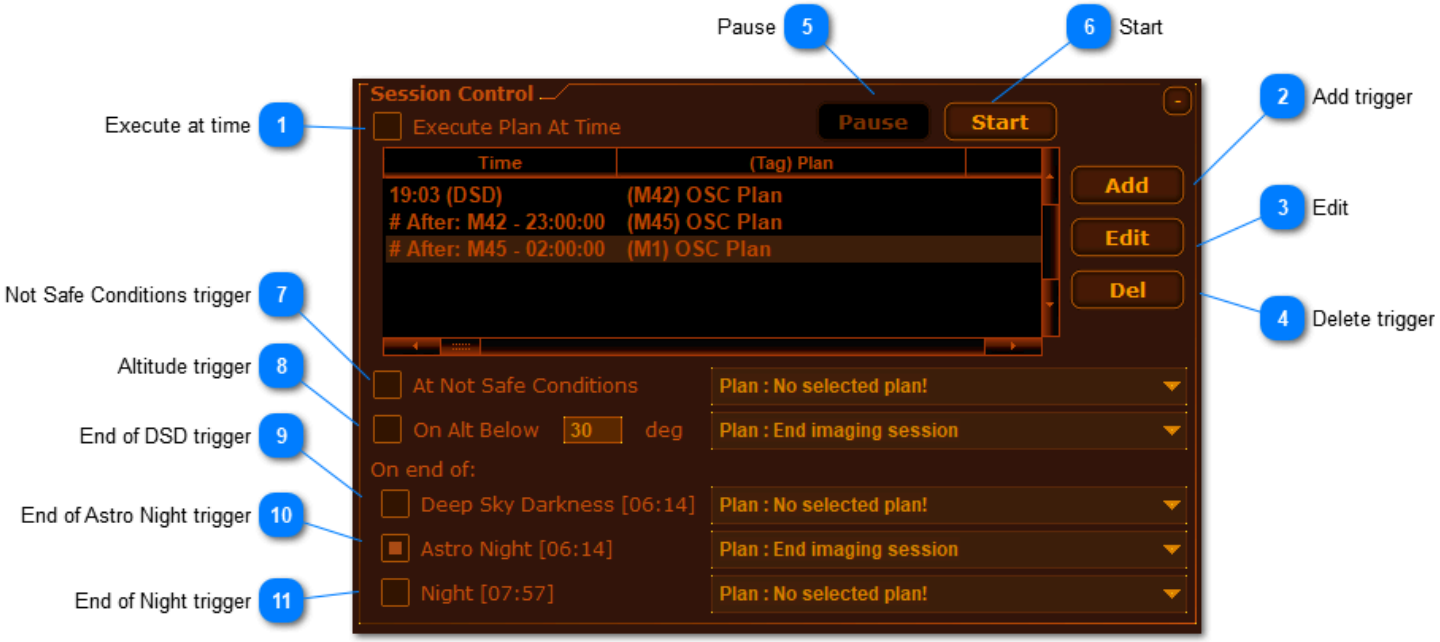
The **Execute Plan At Time** triggers have powerful options allowing object change and/or refocusing before the plan execution. Also is possible to define how long to execute the plan - to defined time or altitude. Assigning Tags (trigger names) allows creation of sequence of triggers and covering a complete imaging session. Using the trigger option Move To Object, Refocus or Execute till Time/Altitude gives possibility to reuse same imaging plan for multiple targets without need of using script commands for the most common actions like GoTo++, changing the object name, refocus and etc.

**The "On end of" triggers depend on the the Darkness Clock / Deep Sky Darkness calculator to determine the events time. In order to the calculation to be be correct you have to set your imaging / observing site coordinates in Location Settings!**

The priority of the triggers is ascending, i.e. the End of Night is top priority and if there are other events triggered by the same moment they will be ignored. It is possible more than one trigger to happens in same time, but we can execute only one plan in time so the only the one with highest priority will be executed.

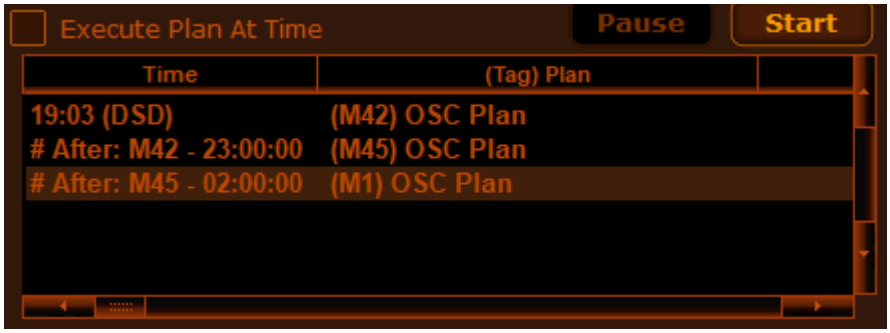
SessionCraft works even when the window is closed. However if there is running imaging plan, the triggers are checked after exposure end. For example if Deep Sky Darkness ended in the middle of running 600s exposure, it will not be interrupted. In case that there is no running plan the triggers will be executed at the moment of happening. For example your imaging plan has finished earlier than Astro Night end, the "End imaging session" plans from the screenshot will be executed when the time comes.

**Note: The triggers are remembered between the sessions (except the Execute at Time checkbox) so you may want to tweak some of them in the beginning of new session!**




Follows more detailed description.

## 1 Execute at time

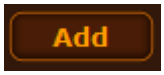



When the checkbox is enabled SessionCraft will check if the execution time of the defined plans has come. You can add multiple plans for different times or events (night start, astro night start and etc). When a plan is executed it will be marked with asterisk (*) and it will not be executed again during this session. When a trigger has Move To Object, Refocus or Execute till Time/Altitude options enabled the line is marked with hashtag (#).

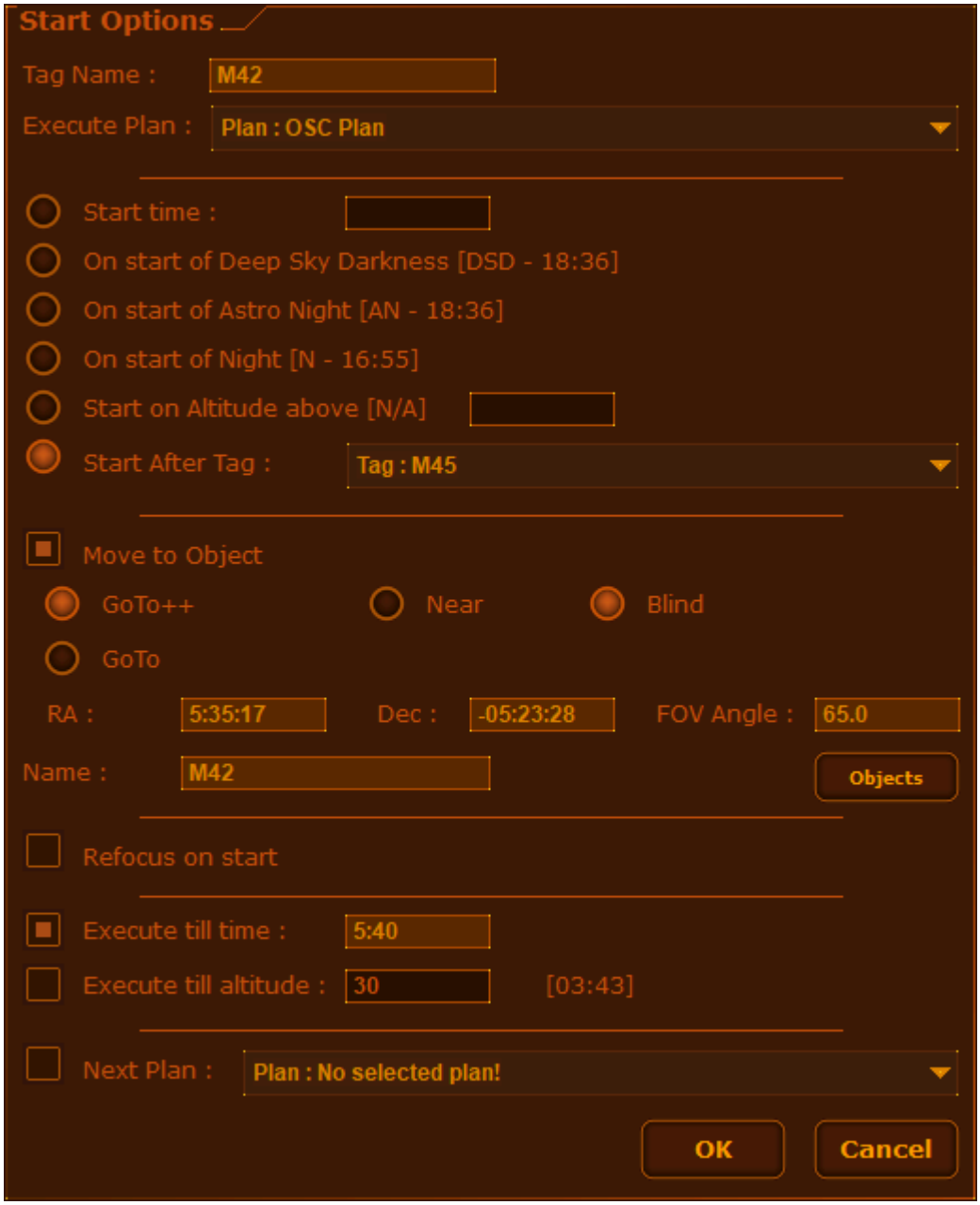
You can add/remove time triggers with the buttons Add and Del (see below)

**The checkbox state is not saved between the sessions, you have to manually enable it**. This prevents from starting unwanted plans from the previous session on the APT start. For example you have set a plan to start in 20:15 and on next night you start APT in 22:00. You will not want to start the plan immediately before focusing and centering object...

## 2 Add trigger




Adds a new trigger to start execution of an imaging plan. Every trigger can have a Tag Name. Having a Tag is possible to refer it in another trigger and by this way to create a sequence of triggers. For example we can have tags M63 and M44 and to schedule the M63 will be executed after the M44 end.




**Tag Name** defines the name of this trigger. Giving a name allows referring this trigger and creation of sequence of triggers.

**Execute Plan** defines which plan to execute.

**Start** options define when the trigger starts. It can be fixed time, night event, when an object reaches defined altitude or after completion of other trigger when "Start After Tag" is selected. If you select one of the "On start of..." options or "Start on Altitude above", SessionCraft will remember that it is not fixed time and will calculate the exact moment for the current night, but don't forget that you have to manually enable the option "Execute Plan At Time"!

You can define astro twilight offset and start Astro Night or DSD (when the Moon is below horizon, in other case the offset is not used) a bit earlier via Astro Twilight Offset in Location tab of Settings. Some astro-photographers like to start up to 15-20 minutes earlier when are using narrow-band filters.

**Move To Object** section allows to execute GoTo++ or GoTo before starting the imaging plan in order to frame the desired object. If there is connected rotator is possible to alter the camera angle. Name will set the object name which to be used for file naming, folders creation and etc.

**Refocus on Start** will execute automatic focusing before executing the imaging plan.

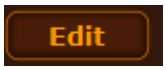
**Execute till time** will keep executing the selected plan till the defined moment. If the plan is shorter it will be restarted, if it longer will be canceled on the start of the next exposure after the defined moment. In brackets is the calculated time when the given coordinates will be below the defined limit.

**Execute till altitude** will keep executing the selected plan till object altitude gets below the defined limit. If the plan is shorter it will be restarted, if it longer will be canceled on the start of the next exposure after the defined moment.

**Next Plan** defines what plan to execute after completion of this trigger. It can be combined with **Execute till time** and/or **Execute till altitude**. If there is no canceling event defined, the next plan will be executed as soon as the current one finish.

**Note:** There is logic that prevents from creating loops of triggers. Also when a trigger is selected as "After Tag" it cannot use "Next Plan" option as it creates workflow confusion.

### 3 Edit




Allows editing the selected time trigger from the list.

### 4 Delete trigger




Deletes the selected time trigger from the list.

### 5 Pause




Pauses the selected trigger. This allows to skip a trigger and to enable it later or in other imaging session. Note that if the trigger is "After tag" it is not possible to pause it, you have to pause the first trigger in the chain which is scheduled by time or celestial event.

### 6 Start




Starts the selected trigger immediately.

### 7 Not Safe Conditions trigger



When enabled SessionCraft checks the Safety Monitor and if it reports that the conditions are not safe and the event is happening during the night (required to is to set correct observing site in Location tab of Settings) the selected plan will be executed. The plan can contain a set of script commands to be executed.

This is the **top priority** trigger and overrides all the other triggers set!

### 8 Altitude trigger




When enabled SessionCraft checks the telescope altitude and if it gets below the defined degrees will execute the selected plan. The plan can contain a set of script commands to be executed.

### 9 End of DSD trigger




When enabled will execute the selected plan at the end of the Deep Sky Darkness (when Moon rises or astro twilight starts). The plan can contain a set of script commands to be executed.

You can define astro twilight offset and end DSD (when the Moon is below horizon, in other case the offset is not used) a bit later via Astro Twilight Offset in Location tab of Settings. Some astro-photographers like to finish imaging up to 15-20 minutes later when are using narrow-band filters.

The time in the brackets shows the exact moment for the trigger in the current night. N/A shows that there is no deep sky darkness in the current night.

### 10 End of Astro Night trigger




When enabled will execute the selected plan at the end of the Astro Night (when astro twilight starts). The plan can contain a set of script commands to be executed.

You can define astro twilight offset and end Astro Night a bit later via Astro Twilight Offset in Location tab of Settings. Some astro-photographers like to finish imaging up to 15-20 minutes later when are using narrow-band filters.

The time in the brackets shows the exact moment for the trigger in the current night. N/A shows that there is no astro night in the current night.

### 11 End of Night trigger




When enabled will execute the selected plan at the end of the Night (when Sun rises). The plan can contain a set of script commands to be executed.

The time in the brackets shows the exact moment for the trigger in the current night. N/A shows that there is no true night in the current today.

# Clouds and Target Control

*The SessionCraft is accessible from Tools tab or with F9 key.*

The Clouds and Target section of SessionCraft monitors for various events (triggers) and executes target re-centering. The target re-centering on PointCraft and GoTo++ so make sure that you have configured them correctly in order to be able to solve images.

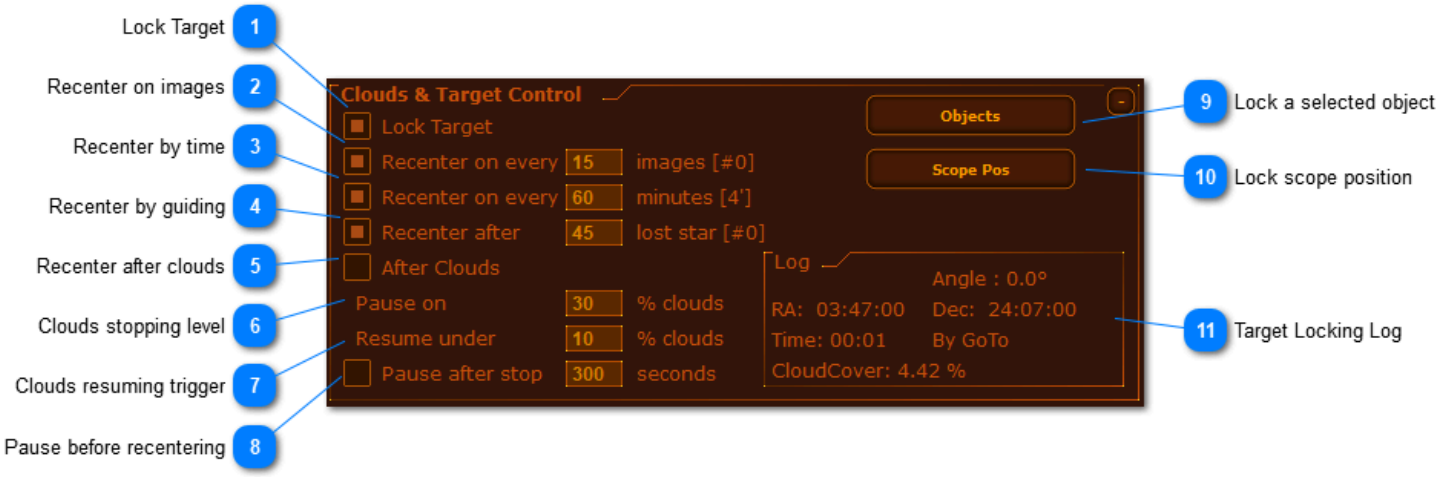
The Clouds and Target section defines the events (triggers) on which to make target re-centering, but also provide valuable information as information about the locked position and the last target re-centering.

There are different types of triggers that can be configured in any combination:

1. Re-center after every X images
2. Re-center after every X minutes
3. Re-center after X "lost star" reports in row from PHD2
4. Re-center after cloud coverage has lowered under defined limit

**Note:** *All automatic re-centering triggers require the option Lock Target to be enabled. It enables a smart logic to track what you are imaging without need to do any specific actions. It just knows where the scope is pointed and is able to get back to this position via GoTo++.*

In the Clouds and Target it is all about same action - re-centering so when we have configured multiple triggers there is no matter which trigger exactly will start the process, the other triggers will be also restarted. For example re-centering by clouds coverage will reset the image counter and time counter and guiding counter.




## 1 Lock Target




When enabled SessionCraft will monitor all mount movements via GoTo++, GoTo or slew detection (except guiding and dithering) and remember the exact position. Having this position is possible to define target re-centering on various events. The current target lock cloud be found in the Log section.

The re-centering will be made with GoTo++.

## 2 Recenter on images




Enables target re-centering on every X images. In the brackets is shown how many images are taken since the last re-centering. Every mount move, resets the trigger.

Requites Lock Target to be enabled.

## 3 Recenter by time




Enables target re-centering on every X minutes. In the brackets is shown how many minutes has passed are taken since the last re-centering. Every mount move, resets the trigger.

Requites Lock Target to be enabled.

## 4 Recenter by guiding




Enables target re-centering after X "lost star" reports from PHD2 in row. If PHD2 manage to restore the guiding, the counter is reset. In the brackets is shown how many "lost star" reports in row are detected so far. If PHD2 manage to restore the guiding, this counter is reset.

This feature can be combined with Pause after stop When is it defined, SessionCraft will wait the time and will try to recenter, try to start guiding and resume the imaging.

Requites Lock Target to be enabled.

## 5 Recenter after clouds




Enables could coverage tracking via Observing Condition device which can measure the cloud coverage. It is possible to define a clouds coverage percent that pause the imaging and clouds coverage percent that allow target re-centering and resuming of the imaging.

Requires Lock Target to be enabled.

## 6 Clouds stopping level



Defines the cloud coverage above which to pause the imaging.
Requires Lock Target to be enabled and a connected device in Observing Condition with the clouds sensor.

### 7 Clouds resuming trigger




Defines the cloud coverage under which to re-center the target and to resume the imaging.
Requires Lock Target to be enabled and a connected device in Observing Condition with the clouds sensor.

### 8 Pause before recentering




When enabled will wait X before re-centering triggered by lost star or cloud coverage. If the GoTo++ fail, SessionCraft will make the pause again and will make another to re-center the object. Any other Session Craft trigger will stop this loop. During the pause no re-focusing will be made.

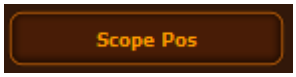
### 9 Lock a selected object




Opens the Object Browser and the selected object coordinates will be locked as locked target.

Requires Lock Target to be enabled.

### 10 Lock scope position




Locks the current mount coordinates as locked target.

Requires Lock Target to be enabled.

### 11 Target Locking Log




Shows information about the last target locking.

1. Ra/Dec are the coordinates from the last detected mount move, last GoTo or GoTo++ actions.
2. Angle is the value detected by the last images solving in PointCraft or via GoTo++

3. Time shows when the last locking is made
4. By X shows what has triggered the locking, manual move, GoTo or GoTo++

5. Shows the current cloud coverage if there is connected Observing Condition device

## Automatic Refocusing

*The SessionCraft is accessible from Tools tab or with F9 key.*

*Related videos:*
*Focus Control - 4.60+*
*Focus Control*

The Focus Control section of SessionCraft monitors for various events (triggers) and executes automatic refocusing. The automatic refocusing depends on FocusCraft and Auto Focus Aid so make sure that you have configured them correctly in order to provide valid focusing metrics (like HFD or InvPower) for all of your filters. This means that you need exposure duration and gain that can work well for all your filters.

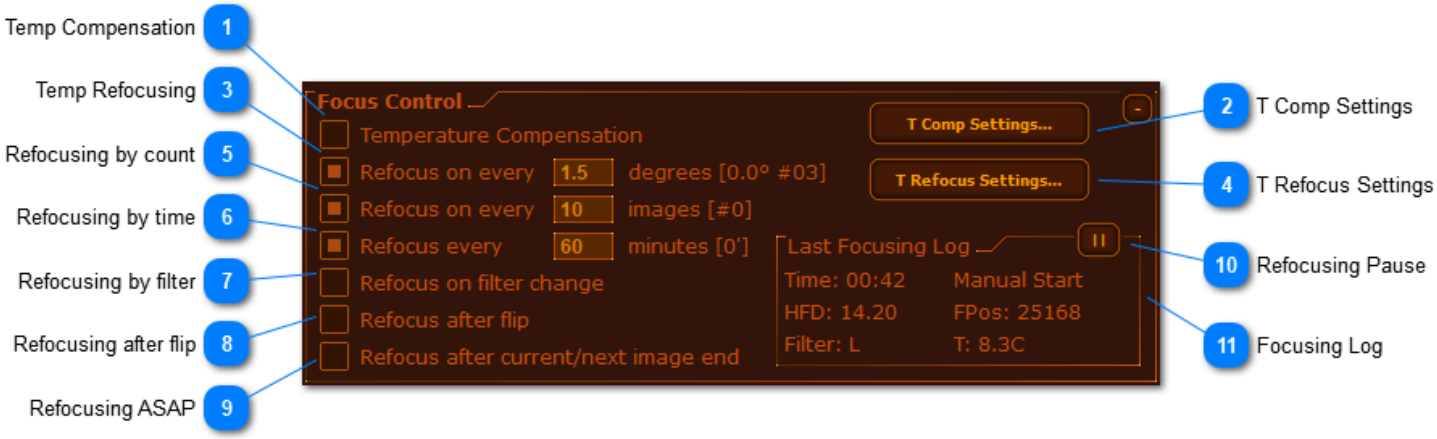
The Focus Control section defines the events (triggers) on which to execute refocusing, but also provide valuable information as information about last refocusing and information for triggers closing.

There are different types of triggers that can be configured in any combination:

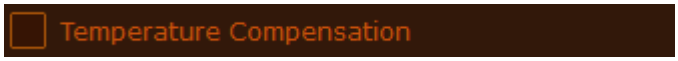
1. Temperature compensation - this is fixed focuser position altering depending on the temperature change. No refocusing is executed. It is tricky but is also the fastest way to keep the scope focused.
2. Refocus on temperature change
3. Refocus after every N images
4. Refocus every X minutes
5. Refocus on filter change
6. Refocus after meridian flip
7. Refocus after the running exposure is completed

**Note:** *All automatic refocusing triggers will be ignored when the mount is not tracking or is parked and if the astro night has ended. Also the triggers will be ignored when the running imaging plan is not "Light Plan". The logic is that you don't need refocusing during flats or darks taking.*

In the Focus Control it is all about same action - refocusing, so when we have configured multiple triggers there is no matter which trigger exactly will start the process, the other triggers will be also restarted. For example if imaging plan changes the filter and there is refocusing, the temperature, count and time triggers will restart gathering data.




## 1 Temp Compensation



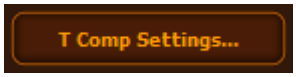

Enables the temperature compensation. It helps to compensate the focus point changes cased by the changes in the ambient temperature. Note that temperature compensations will not be applied when Focusing Aid, Auto Focus Aid or Bahtinov Aid are open.

In order to use temperature compensation you have to determine how many focuser steps have to move per one ambient temperature degree in order to preserve the best focus. This is called "steps per one degree change". There are different approaches how to measure this. The most common is to focus on various temperatures and record the temperature/position pairs. After that to compute the "steps per one degree change" from the sequential pairs and average the results.

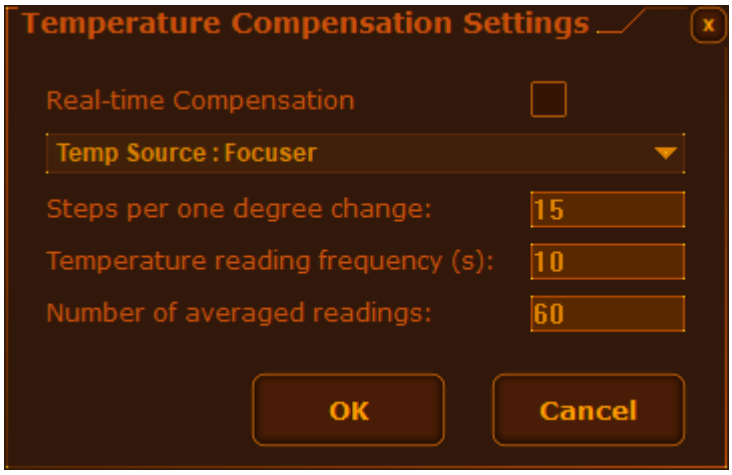
APT has powerful algorithm for temperature compensation. It averages defined number of temperature readings and calculates the needed focuser position change no matter if there is full degree change. It also keep care for the changes which are not whole number position.

Click on **T Comp Settings...** button to configure the parameters described below.

## 2 T Comp Settings




Defines the parameters for the temperature compensation algorithm.




### Real-time compensation

Enable this option if you want the temperature compensation to be applied even during image exposures. Disabling it will apply compensations after the running exposure is completed.

### Temperature Source

Defines which sensor to use for determining the ambient temperature. Supported are focuser's internal sensor, external sensor or combination of both. The last option will average the readings of the internal and external sensors.

### Steps per Degree

Define how many steps to change per one degree drop/rize in the temperature. When the value is positive APT will apply inward move on temperature drop and outward move on temperature rising. Enter negative value if you want to reverse the behavior and make outward moving on temperature dropping. APT works with high precision corrections and support even compensation with fraction of one position.

### Reading frequency

Defines the frequency of checking the ambient temperature.

### Averaging

Defines how many readings to average before calculating the needed temperature compensation. Averaging helps to avoid short temporary changes caused by wind. Frequency 10 combined with Averaging 60 will make temperature compensation on every 600s (10x60 = 600s -> 10 minutes). Note that telescopes can't react fast on the temperature changes, so it not advisable to make corrections in very short intervals.

## 3 Temp Refocusing

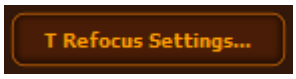



Enables refocusing on temperature change trigger. In short SessionCraft will average at least N temperature readings and if the difference between the calculated value and the temperature during the last refocusing is above the defined limit, new refocusing will be executed.

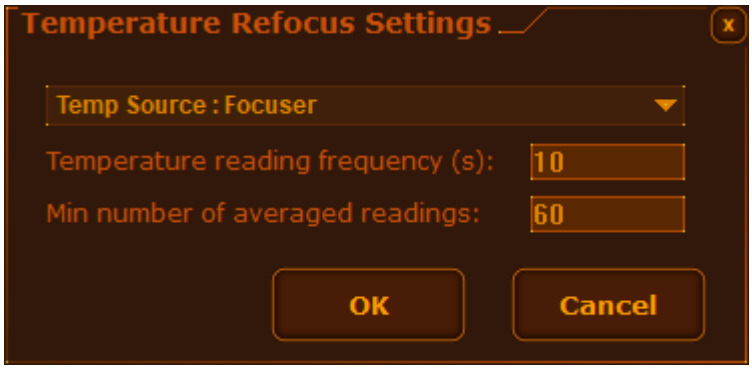
The numbers in the brackets show the current status of the trigger [-0.4 #01*] means that there is accumulated -0.4 degrees difference from the previous refocusing. #01 shows the current number of averages readings. When there is asterisk (*) we already have accumulated at least once the defined number of readings. Having asterisk (*) means that as soon as temperature limit is reached, refocusing will be started. No asterisk (*) means that we need more data to measure accurately the temperature change. If 60 is entered in min averaged readings, no asterisk (*) will be displayed till 60 readings are gathered, after that the number of the counter will start again from #01 but now we have enough data and can start the refocusing when it is needed.

Click on **T Refocus Settings...** button to configure the parameters described below.

## 4 T Refocus Settings




Defines the parameters for the refocusing on temperature change trigger.




### Temperature Source

Defines which sensor to use for determining the ambient temperature. Supported are focuser's internal sensor, external sensor or combination of both. The last option will average the readings of the internal and external sensors.

### Reading frequency

Defines the frequency of checking the ambient temperature.

### Averaging

Defines the minimum number of readings to average before calculating the temperature difference form the previous refocusing. Averaging helps to avoid short temporary changes caused by wind. Note that telescopes can't react fast on the temperature changes, so it not advisable to make corrections in very short intervals.

## 5 Refocusing by count



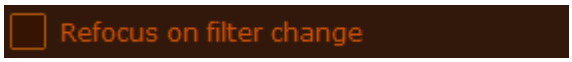

Enables refocusing on images count trigger. For example is possible define to refocusing after every 15 exposures. The number in the brackets shows how many images have been taken since the last refocusing. LiveView by Images and images taken with Shoot button are ignored - only the images taken by plan are counted.

## 6 Refocusing by time




Enables refocusing by time trigger. Defines how many minutes after the previous refocusing have to start new one. The number in the brackets shows how many minutes has elapsed since the last refocusing.

## 7 Refocusing by filter




Enables refocusing after filter change. If the filter is changed manually from the Gear tab, APT will ask for confirmation if you want to start refocusing. If the change is made during imaging plan execution the plan will be paused, the refocusing will be started automatically and after that the imaging will resume.

## 8 Refocusing after flip




When enabled automatic refocusing will be executed as last step of the Automated Meridian Flip (AMF) before resuming the running imaging plan.

## 9 Refocusing ASAP



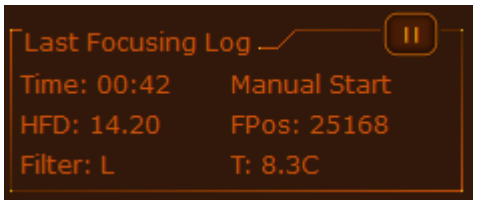

Enable this option if you want to refocus as soon as possible. If there is running exposure it will refocus as soon as it is completed. If the next exposure preparation is in progress APT will wait the whole exposure to finish and after that will refocus. After that the imaging plan will resume and the check box will be unchecked.

## 10 Refocusing Pause



Allows to pause/resume all automatic refocusing triggers. There are situations you may prefer to skip a refocusing without altering the settings you have set.

## 11 Focusing Log




Shows information about the last executed refocusing:

1. Time
2. Which trigger started the refocusing

3. HFD / FWHM / InvPower value in the focus point
4. The focuser position of the focus point

5. The used filter used for the focusing
6. The temperature in the end of the last refocusing

# FocusCraft

*The FocusCraft is accessible from Tools tab or with F6 key*

*Related videos:*
*Focus Craft*
*Focusing A to Z*

**FocusCraft** is the heart of the automatic refocusing as it purpose is to measure how good the focus is.

FocusCraft can work in three modes. The first is to detect all the stars in the frame and calculated the averaged **HFD** (Half Flux Diameter) and **FWHM** (Full Width Half Maximum). The seconds calls **ASTAP** to calculate the **HFD**. The third is analyzing the whole image without detecting the stars and to calculate the **InvPower** (Fourier method).

**Please note that star detection and the HFD / FWHM needs time and this can make the APT operation slower than you have used to!**

**Cheng-Yang Tan** and **Benjamin Schulz** have invented and implemented new focusing method named Fm after Fourier method and the metrics that it produces is named InvPower. It analyzes the whole image without need to detect the stars and because of that, there is need to tweak any parameters**.** The source code of the Benjamin's library can be found here https://github.com/bschulz81/hyperbolicfitdll. The sources used in this version of APT are also available in the "Sources" subfolder of the folder where APT is installed.

The InvPower numbers are very big and hard to read (in fact they are small, but in APT they are inverted). So in APT instead of 948 161 073 905 664.00 you will see 14|9.48 (a small tweak by the APT team). It is short form to display 9.48161073905+e14. In other words, 14 is the power of 10 or scale of the number and 14|9.48 is bigger than 13|1.53. This is what we need when are talking about focusing - to know if it is getting better or worse.

Here is example how FocusCraft looks with real data, simulating imaging session. It monitors the quality of the images and is possible to see when there is need to refocus. Pointing the graph will show the data in this moment including the focuser position if such was connected by the time of the analysis.

If the option **Calculate** is unchecked FocusCraft calculations will be disabled. Note that if automatic refocusing is started via imaging plan of via SessionCraft the calculations will be made no matter if Calculate is checked.

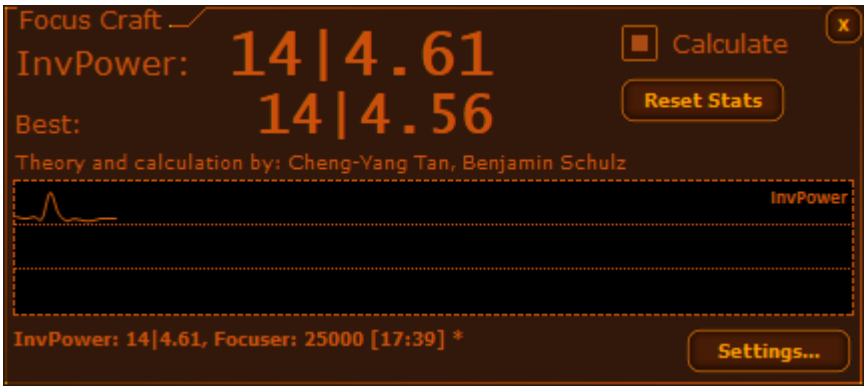



If the stars count is in brackets this means that the current image can't be processed. More information is printed in the Log panel. Usually once the parameters are tweaked there are no problems.

Here is how the FocusCraft looks when ASTAP is used.




Here is how the FocusCraft looks in InvPower mode.




Here is how the settings dialog box looks like. It is possible to make more changes so this is the reason describe them in free form. For the next version will rework this section to look like the other parts of the User's Guide




**InvPower** - when enabled FocusCraft will be in InvPower mode and the settings below are disabled and not used.

**Use ASTAP** - when enabled FocusCraft will call ASTAP to calculate the HFD. There is need ASTAP to be installed and configured in PointCraft Settings.

**Star detection SNR** - defines the "signal to noise" ratio parameter that is sent to ASTAP. Increase this parameter if you are using DSLR and/or the image is too bright and ASTAP can't detect stars.

**Calculate sky brightness** - FocusCraft analyzes the image to detect the brightness of the sky. This is needed to identify the stars.

**Use fixed sky brightness** - If you want to speed the calculations you can enter fixed brightness of the sky. FocusCraft will take everything with value lower than the entered as sky. The **Calculate sky brightness** should be unchecked to use this value.

**Saturation detection** - values closer to 1.0 expect darker images to work. Increasing the value with give possibility to analyze brighter images. The value of 5.0 is empirically found to work fine in most of the time.

**Star detection threshold** - control how bright the stars should be in order to include them. Lower value include more stars, higher value include less. This depends on the scope and the camera. Default value is 50. If there are no stars detected in the image try to lower it. If you are using DSLR start with a value around 300 and play from both sides till to find a number that gives good number of detected stars. Good number, no matter the camera is not more than 500-600. Usually any threshold that detects less than 50 stars is good.

**Min star size** - defines the minimum star diameter in pixels need to be included in the analysis. The default value is 6. This parameter helps to ignore the noise without additional processing.

**Apply noise reduction** - when enabled a noise reduction will be applied on the image before the analysis. It is the most time consuming operation, so use it only when the **Min star size** can't help because you are using very short focal length scope/lens.

**Reduce stars count (mid range) -** takes only half of the detected stars excluding the 25% which are most faint and 25% of the most bright stars. Try enable this option if you see huge difference in the detected stars in images with same conditions.

**Reduce stars count (high range) -** takes only half (most bright) of the detected stars.  Try enable this option if you see huge difference in the detected stars in images with same conditions.

**Use Not de-bayered FITS imag**e -  when enabled and the FITS / XISF file comes from color camera, FocusCraft will use the image before de-bayering. This could help to detect more stars and measure the HFD/FWHM better.

**Draw auto-focusing data** - when enabled the Focus Craft graph will include the data from the auto focusing. When disabled the graph will show only the saved images results.

## DataCraft and database

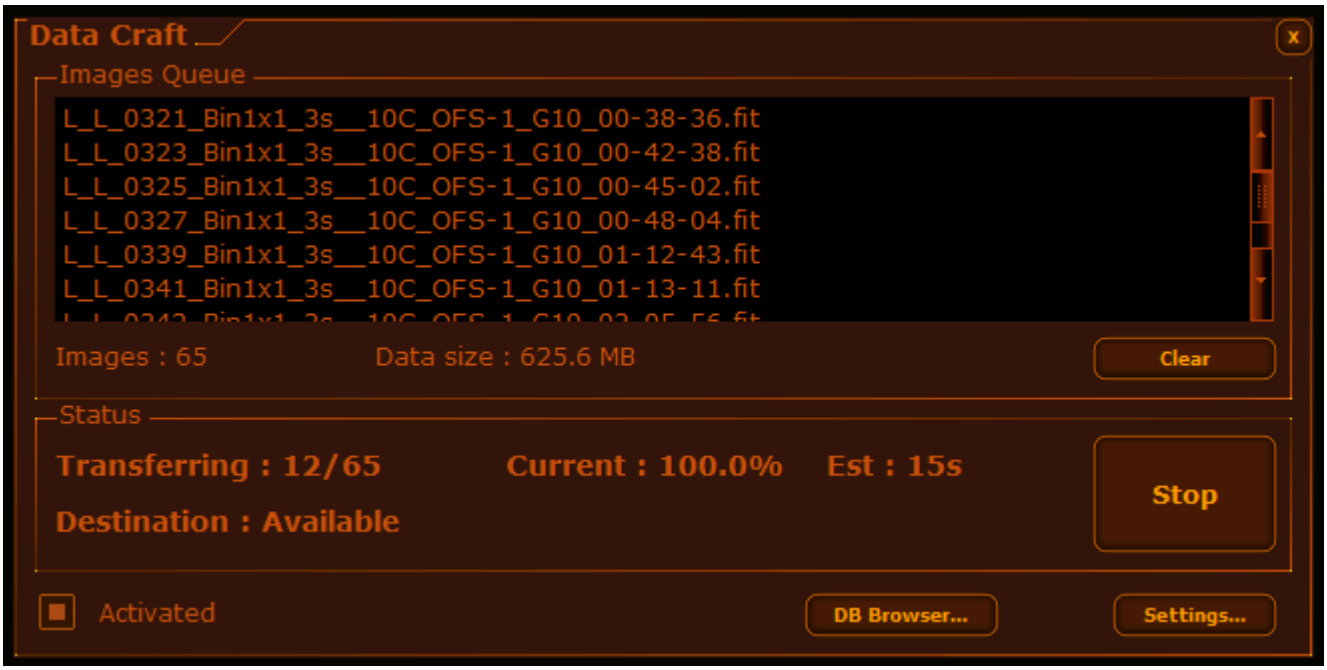
*The DataCraft is accessible from Main Screen*

**DataCraft** is designed to help with managing the image files as well as gathering information during the imaging process. It allows transferring the images from the imaging computer to another one for processing or to external drive for backing up. DataCraft creates the same folder structure in the destination, so it is easy to find the images on both places.

The **DB Browser** allows searching in the database for locating the needed images. Depending on the settings the database could be available on the processing computer or to be share by multiple instances.

The button DataCraft in Main Screen has several states:
- Un-highlighted - the Activated check box is not selected and DataCraft will not do any work
- Highlighted - the Activated check box is selected and DataCraft will add every new image in the queue. After that will transfer it according the settings
- Highlighted with flashing dot / full stop / period - a transfer is in progress
- Highlighted with exclamation mark - DataCraft is activated and will add every new image in the queue, but the destination folder is not available

Here is how DataCraft looks in action. When the "**Activated**" check box is selected every taken image will be added in the queue and depending on the settings it will be transferred automatically or when you decide to process the queue.




The interface is pretty self-explanatory. There is section about the images queue with simple info - images count and total size. The **Images Queue** is preserved between the sessions, so if your processing computer is in home you can do it after you are back from several nights session. If you have copied the files by other ways you can empty the queue with the **Clear** button. The source image files will remain untouched.

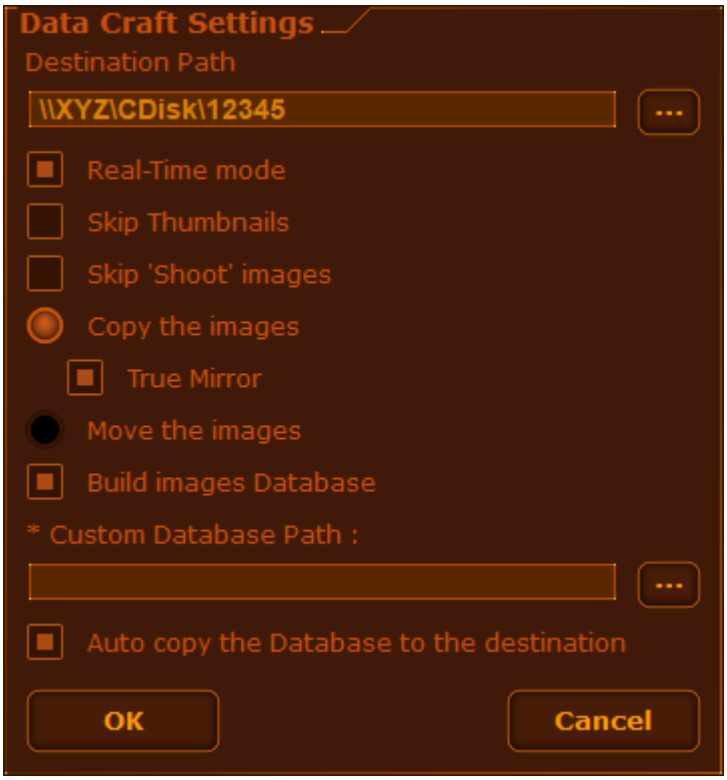
Follows the **Status** section. It shows the transfer status - number of the transferred images, remaining images, the percent transferred from the current file and the estimated remaining time to process the whole queue. On the next row there is status of the destination.

The **Transfer / Stop** button gives manual control over the process.

As it is mentioned above **Activated** enables / disables adding the newly taken images in the queue.

DB Browser opens the dialog box for searching images in the images database.

There are several **Data Craft Setting** you can use to tune the behavior:




- **Destination path** - defines where to transfer the images. It can be network path directly, SD card, external drive or other drive on the computer. The selected file grouping options will be applied to the destination path.

- **Real Time mode** - when enabled every image will be transferred in the background as soon as it arrives without interfering with the imaging process. When disabled DataCraft will queue the images and you can start the process manually via the Transfer button in the main DataCraft window.

- **Skip Thumbnails** - when enabled DataCraft will not transfer the thumbnails associated with the source image.

- **Skip 'Shoot' Images** - when enabled DataCraft will not transfer the images taken with Shoot button.

- **Copy the images** - when selected the image files will remain in the source folder

- **True Mirror** - when enabled, if you delete an image from the Img Tab because the guiding was bad or because of other reason and the file is already transferred, DataCraft will remove the image from the destination automatically for you. There is no need to delete it yourself from the destination folder. Note if you delete an image from Img Tab before the transfer, it will be removed from the queue, no matter if this option is selected or not.

- **Move the images** - when selected the source image files will be removed after successful transfer. Currently this option is disabled because most likely we will add additional verification to be sure that no data will be lost.

- **Build images Database** - when enabled DataCraft will gather various data for every light image taken and store it in a database which allows to search for images in very powerful ways. For example by filter, exposure, temperature and etc.

- *** Custom Database Path** - allows defining custom path where to store the database file (requires APT restart). It is useful when you are using imaging and processing computers. When the database is transferred to the processing PC it will be stored in the transfer destination path. In the APT settings of the processing computer set the path of the folder where the database is copied. Also make sure to same values for Images Path in Setting Main tab. The drive letter could be different but folder names should be same in order all features of the Database Browser to work. For example you can have C:\AstroImages on the imaging PC and D:\AstroImages on the processing PC.

Also it is possible to use shared folder for the database path which to be used by multiple instances of APT.

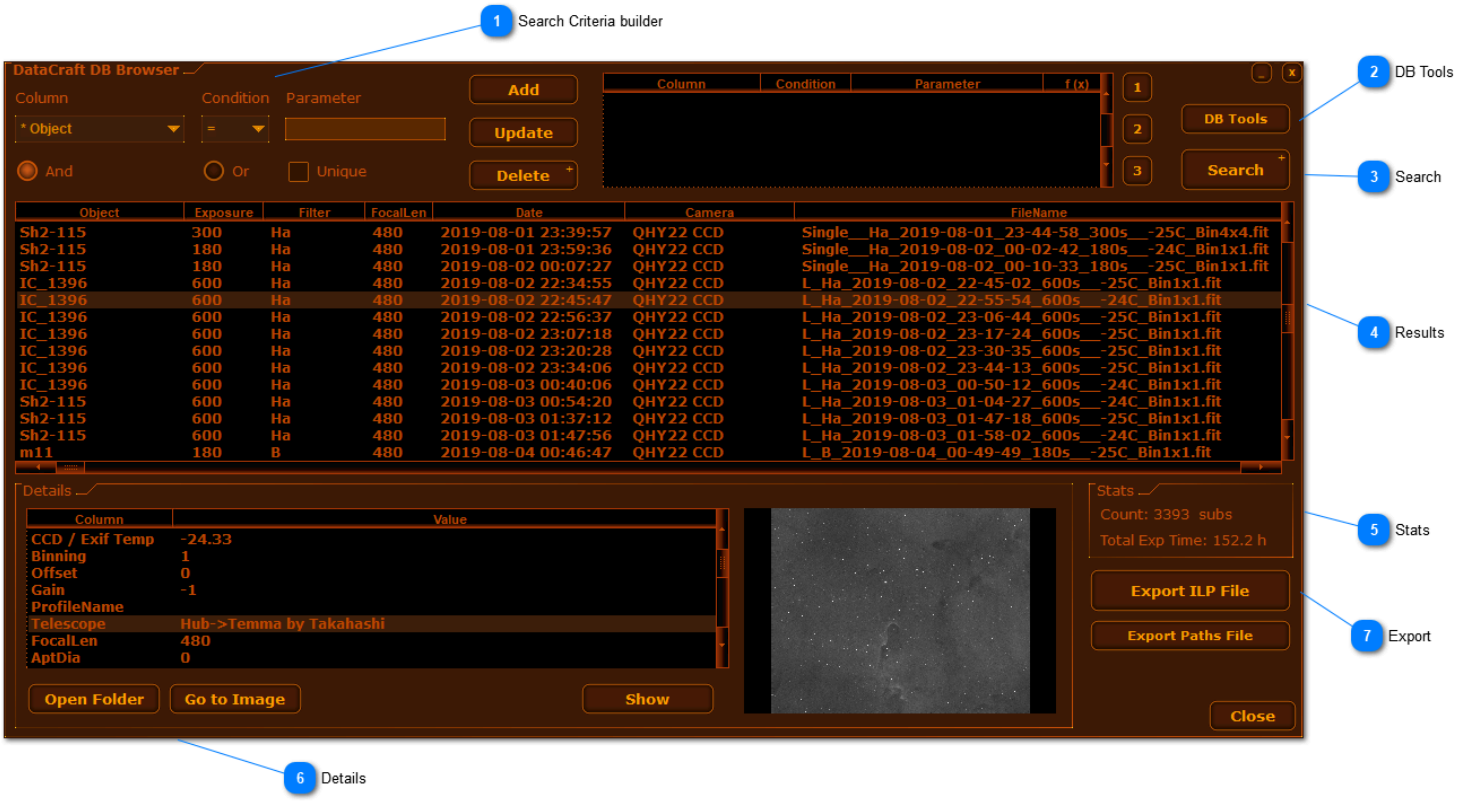
- **Auto copy the Database to the destination** - when enabled the database file will be added to the transfer queue after the end of every lights frames plan. If **"Real-time mode"** is disabled only one entry in the queue will be created.

## Database Browser

*The Database Browser is accessible from DataCraft*

The Database Browser or DB Browser for short, gives a way to search and navigate to your images by very flexible and powerful way. You can search not only by filenames, but via various data like filter name, focal length, used camera, exposure and etc. Once you locate the files you can open them it the Image Browser or navigate the the folder in Windows Explorer and use the files in processing software.

Special thanks to Chris Gifford for giving the idea to build a database with images data!




If you have used databases in the past you will find the interface pretty intuitive. If you have no experience so far, you will see that it is easy to use.

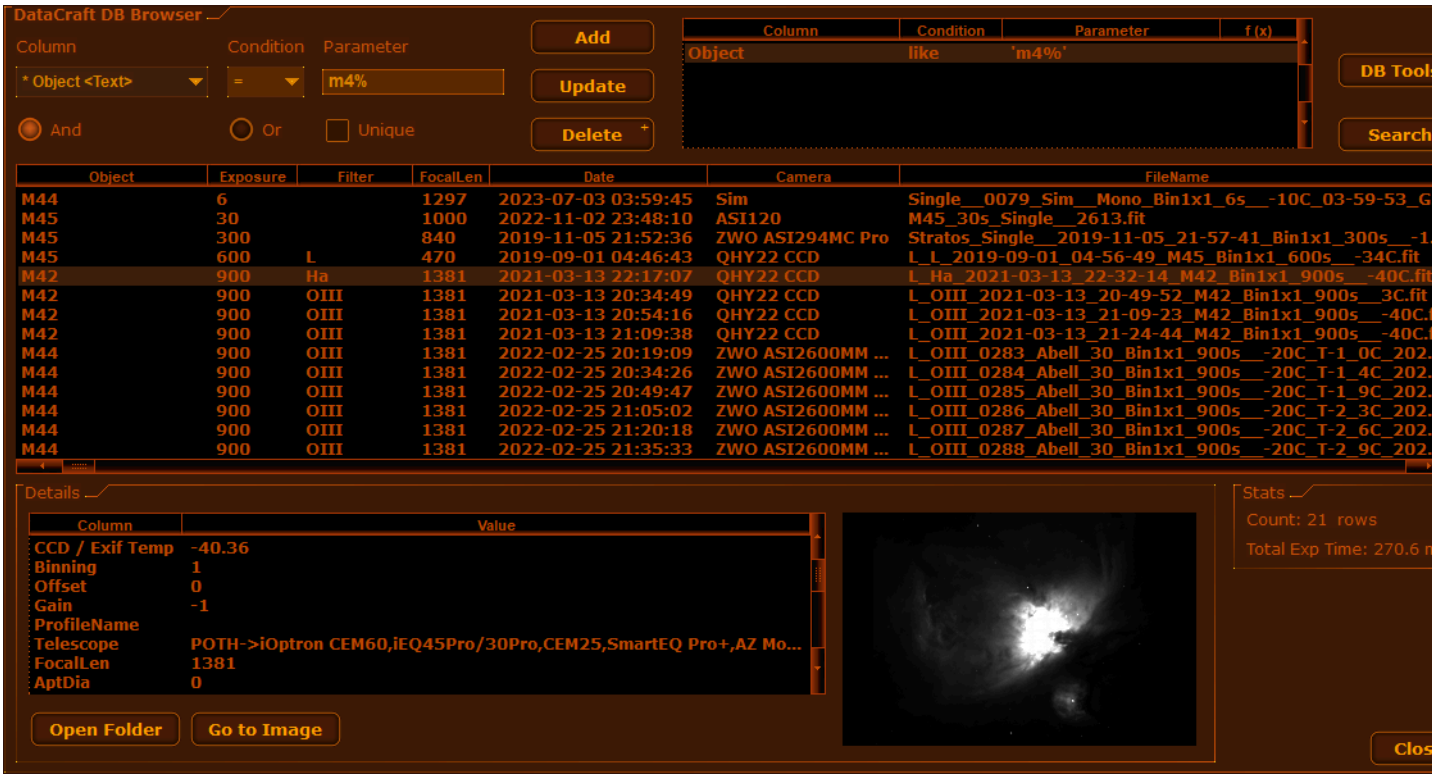
First, you need to select the column from the drop-down control that will be used as a search criteria. After that, you have to choose the conditions, and finally, you need to enter the search parameter. The combination of these three elements will call "sub-query".

The columns available for searching can be of three types:

1. **Text column:** It can be used in conditions with the "=" (equal) and "!=" (not equal) operators. In this case, the parameter can contain "%", which acts as a wildcard and can be replaced by any string. The string in the parameter is not case-sensitive.

Examples:

• Object = m4%
This will return all records in the database where the value in the 'Object' column starts with "m4", i.e. m40 to m49:



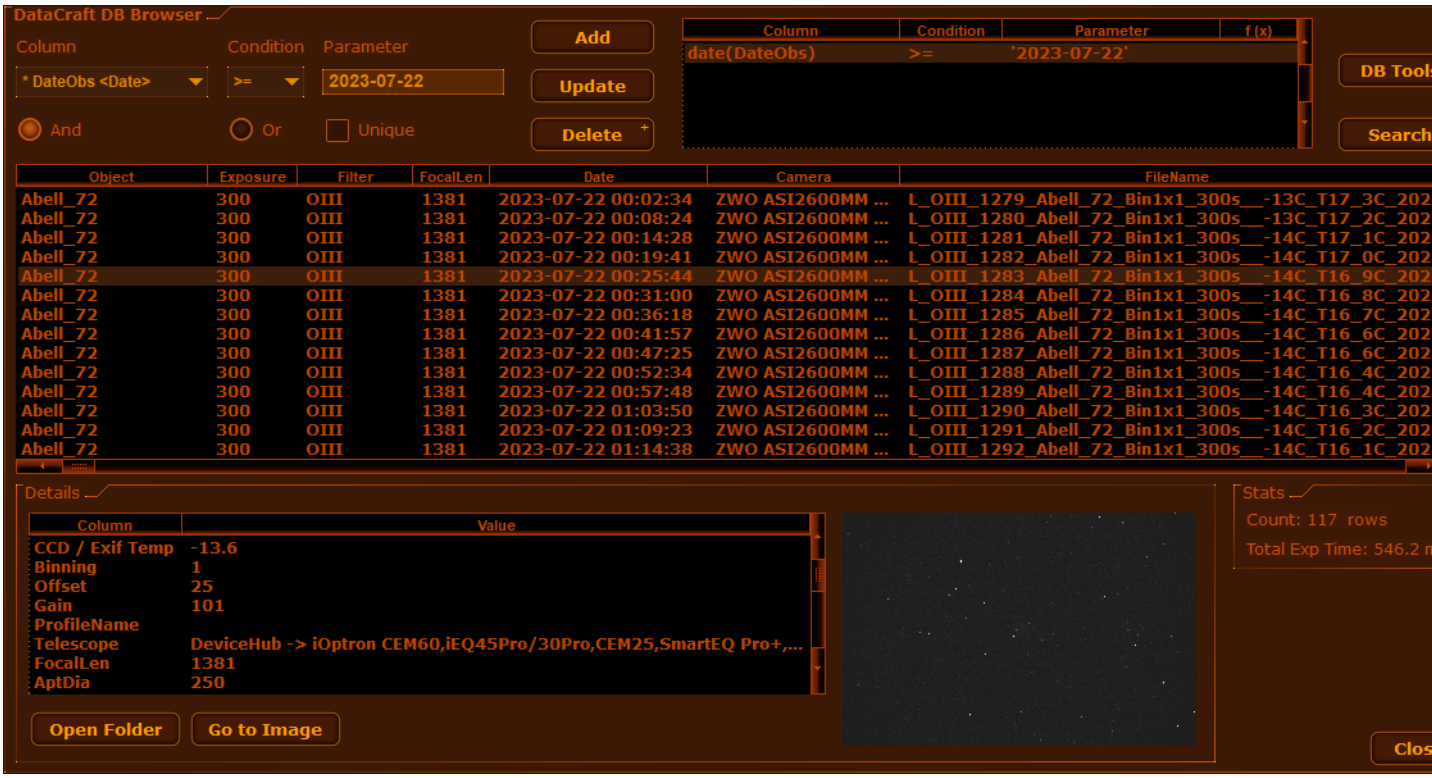

• Camera != %CCD
This will return all records where the value in the 'Camera' column does not end with "CCD":




2. **Date Time** column: It can be used in conditions with all operators - "=" (equal), "!=" (not equal), "<=" (smaller or equal), ">=" (greater or equal) and "like" . The format for the date in the parameter has to be:

- yyyy-mm-dd hh:mm:ss: In this case, the condition will be based on both date and time.
- yyyy-mm-dd: In this case, the condition will be based only on the date.

Example:




When "like" is used you can to use % to replace the date parts. Examples:

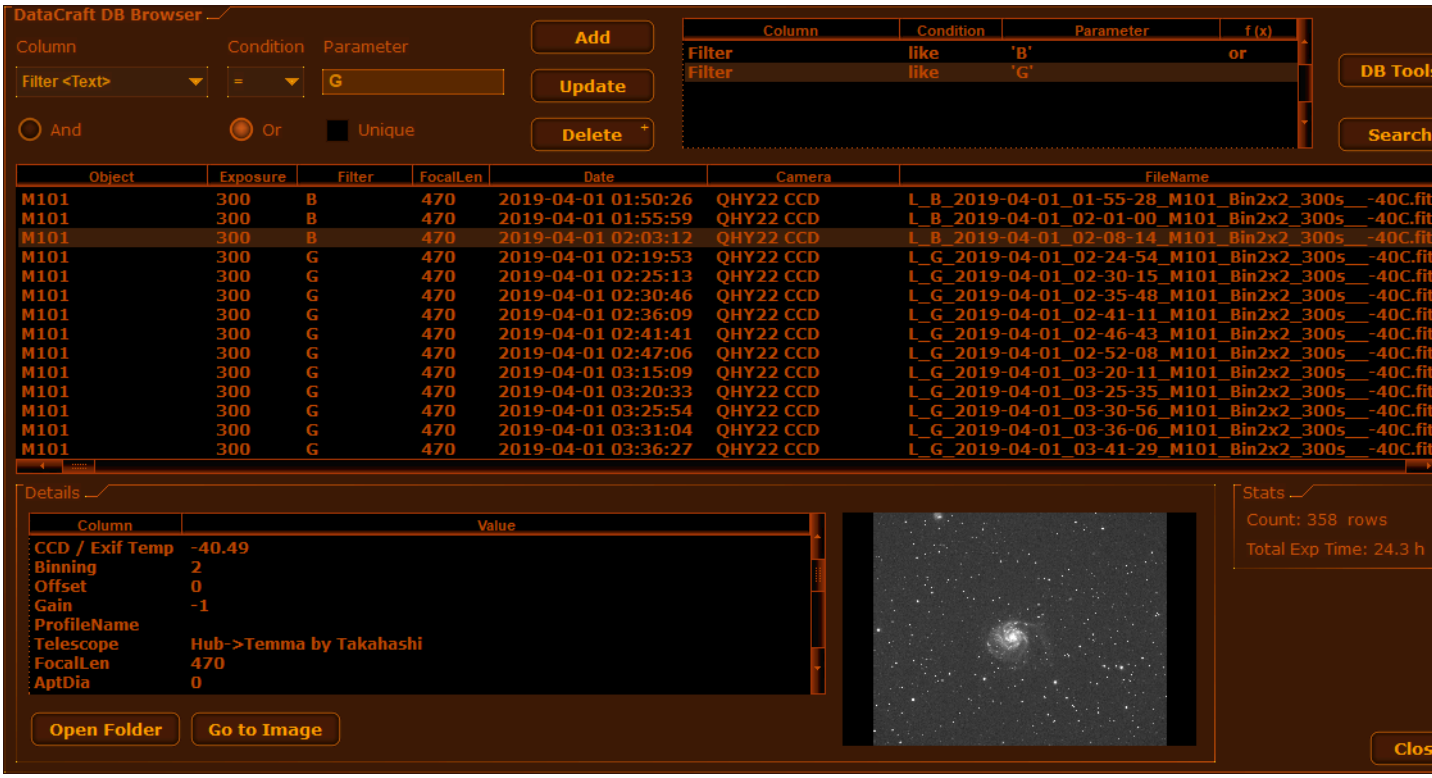
- 2023-03% - will show all images taken in March 2023. Note the month should have leading zero.
- 2023% - will show all images taken in 2023
- %-05-% - will show all images taken in May no matter the year

3. **Number column**: It can be used in conditions with all operators - "=" (equal), "!=" (not equal), "<=" (smaller or equal) and ">=" (greater or equal).

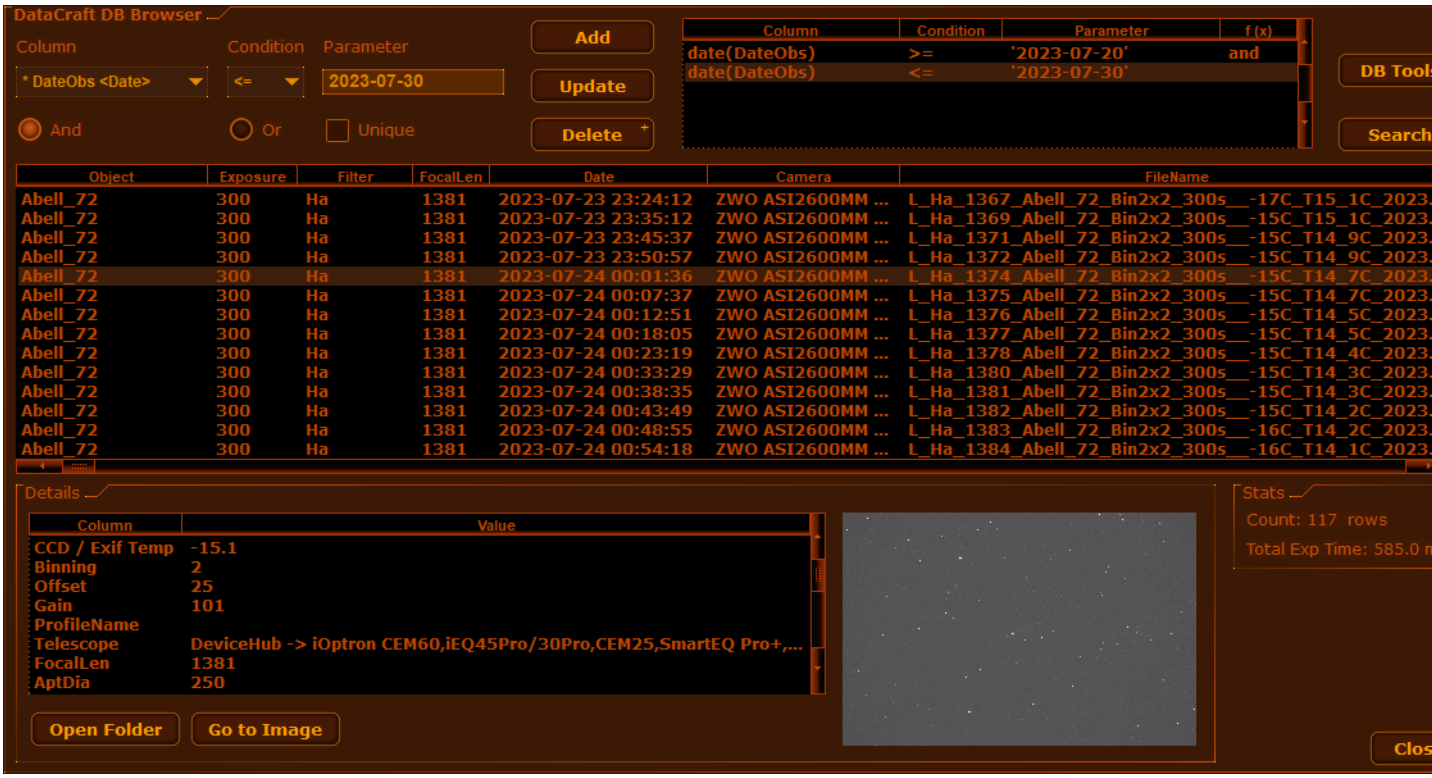
When the sub-query is ready, you have to add it in the sub-queryies grid by clicking the 'Add' button. You can update or delete the selected sub-query using the relevant buttons.

If you need to add more sub-queries, you have to use the radio buttons labeled 'Add' and 'Or'. If you choose 'Add' the result will contain the records that meet both sub-queries. If you choose 'Or' the result will contain the records that meet at least one of the sub-queries.

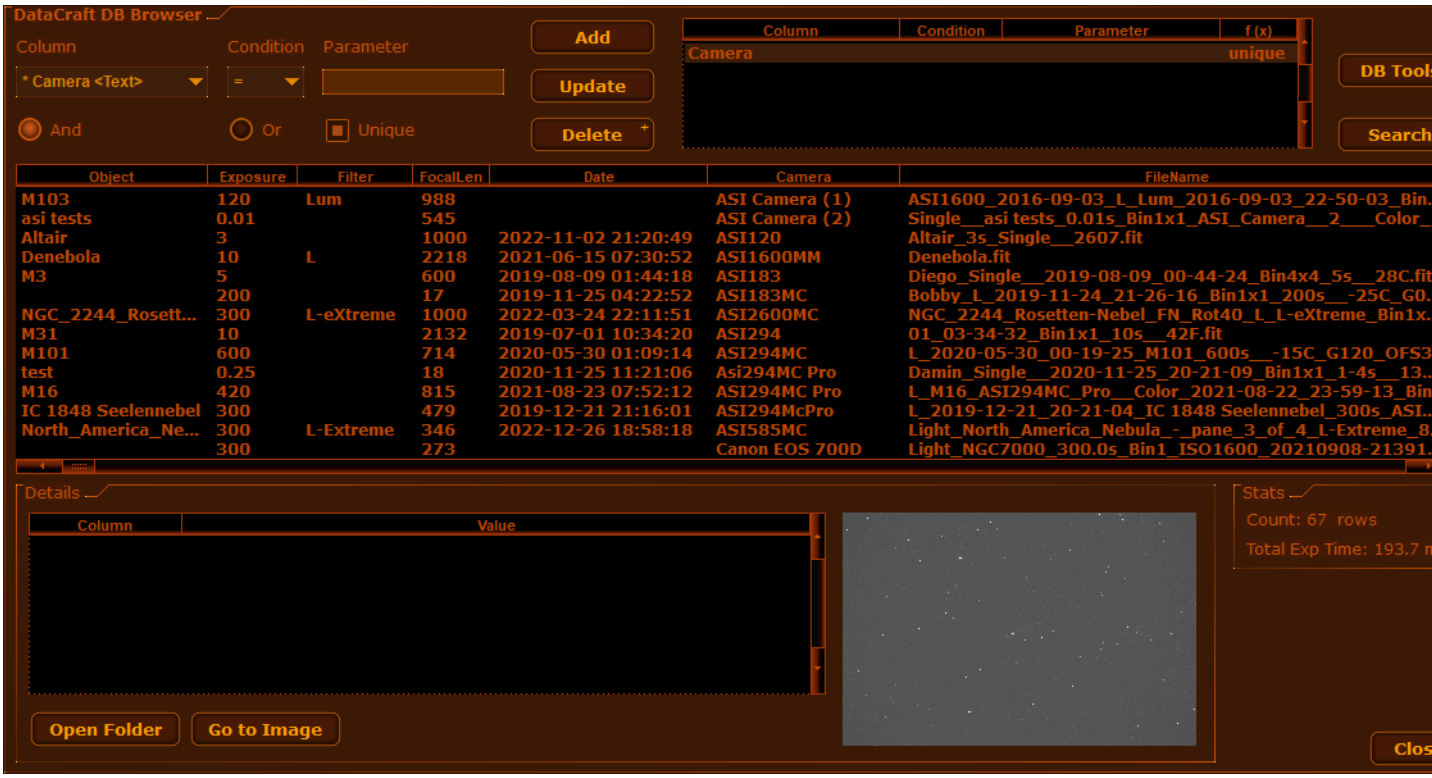
Examples:
• To retrieve all images taken with the 'G' or 'B' filter, you have to use the 'Or' option.




- To retrieve all images taken between the 20th and 30th of July, you have to use the 'And' option:




Part of the column names starts with the symbol '*', which allows you to search for unique values in this column. For example, if you want to see all unique cameras that you have used, the query will be:




If you add Object Name with Unique, the list will contain the unique object you have imaged.

Unique option can be combined with other criteria. If you select Object with "And" and "Unique" enabled to the search criteria above for the images between 20th and 30th of July will get result of all objects imaged in this period.

In the end, if you are good into SQL and want to play even more with the data you can install "SQLite DB Browser." In the Documents folder -> APT_Data you will find APT.db. **Shift+Click** on Search button allows copying the generated SQL query in the clipboard  and to use it in "SQLite DB Browser" (https://sqlitebrowser.org/). If you need a query which can't be generated in APT, let us know and we will try to make interface about it.

## 1 Search Criteria builder



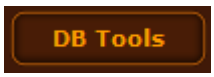

In this area is used to define query which images you want to show. Take a look above for detailed explanation and exam
In short you can define one more more columns in the database what values you look for and how to combine these s
selected, use Add to add the sub-queries in the list.
Update and Delete can be used to manage the list of the sub-queries.

You can save and reuse up to 3 searches. Use Shift+Click on the buttons 1, 2 or 3 to save the current search query ar
that clicking on the button will reload the parameters.

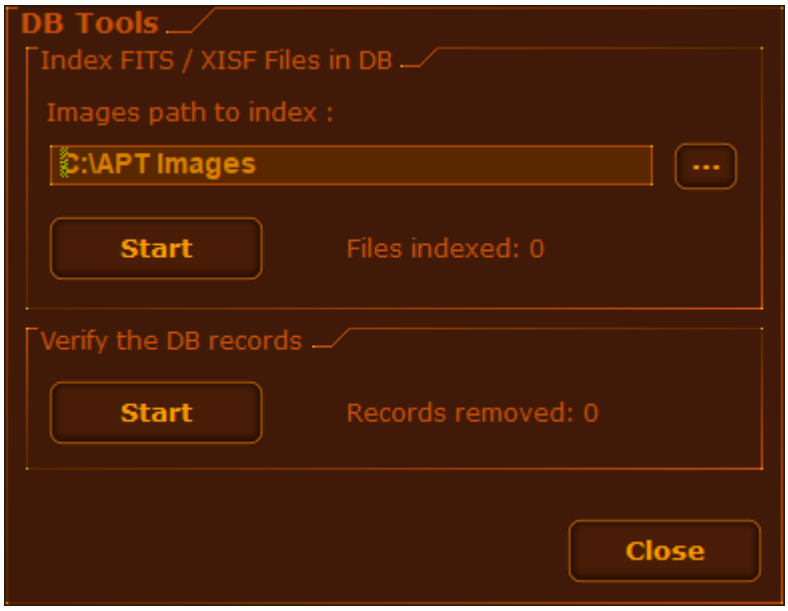
Note the last used query is remembered and will be reloaded it on DB Browser opening.

**Tips & Tricks**: **Shift+Click** on the Delete button clears the list of the sub-queries.

## 2 DB Tools



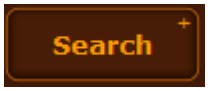

Opens a dialog box which provide way do to some actions related to database




This first part - "Index FITS / XISF Files in DB"  will scan the select folder and will index all FITS / XISF files which contain light frames.  If the file is already index it will be skipped.

The second part - "Verify the DB Records" will check every record in the database and see if the image file still exists on the disk. If the file is deleted, the record will be removed from the database.

## 3 Search

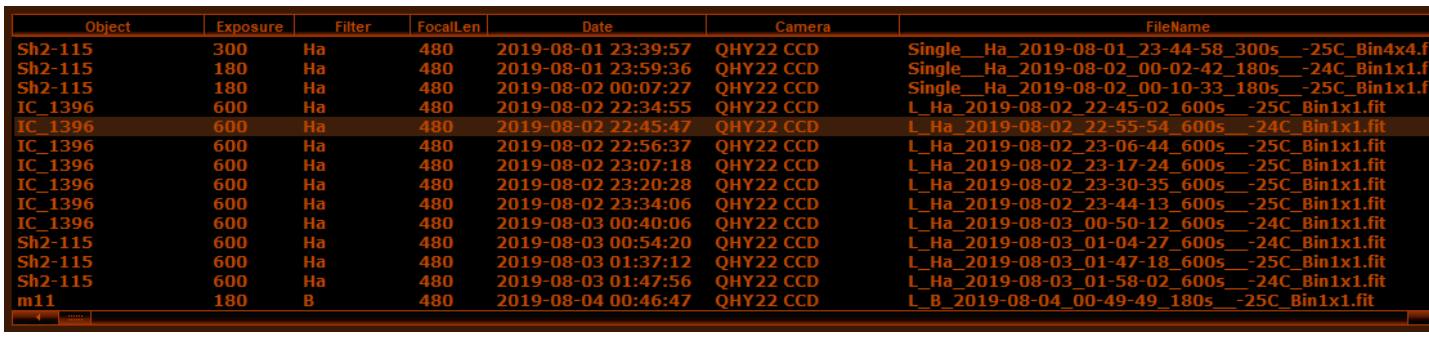



Searches for all images which meet the defined search criteria.

**Shift+Click on Search** button will copy the generated SQL query in the clipboard. It is useful if are familiar with SQL.

**Ctrl+Click on Search** button will delete all the records which corresponds to the search criteria (two confirmations required). First use regular search to see and inspect the records that will be deleted. Keep in mind that there is no Undo.

## 4 Results



| Object | Exposure | Filter | FocalLen | Date | Camera | FileName |
|---|---|---|---|---|---|---|
| Sh2-115 | 300 | Ha | 480 | 2019-08-01 23:39:57 | QHY22 CCD | Single__Ha_2019-08-01_23-44-58_300s__-25C_Bin4x4.f |
| Sh2-115 | 180 | Ha | 480 | 2019-08-01 23:59:36 | QHY22 CCD | Single__Ha_2019-08-02_00-02-42_180s__-24C_Bin1x1.f |
| Sh2-115 | 180 | Ha | 480 | 2019-08-02 00:07:27 | QHY22 CCD | Single__Ha_2019-08-02_00-10-33_180s__-25C_Bin1x1.f |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 22:34:55 | QHY22 CCD | L_Ha_2019-08-02_22-45-02_600s__-25C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 22:45:47 | QHY22 CCD | L_Ha_2019-08-02_22-55-54_600s__-24C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 22:56:37 | QHY22 CCD | L_Ha_2019-08-02_23-06-44_600s__-25C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 23:07:18 | QHY22 CCD | L_Ha_2019-08-02_23-17-24_600s__-25C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 23:20:28 | QHY22 CCD | L_Ha_2019-08-02_23-30-35_600s__-25C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-02 23:34:06 | QHY22 CCD | L_Ha_2019-08-02_23-44-13_600s__-25C_Bin1x1.fit |
| IC_1396 | 600 | Ha | 480 | 2019-08-03 00:40:06 | QHY22 CCD | L_Ha_2019-08-03_00-50-12_600s__-24C_Bin1x1.fit |
| Sh2-115 | 600 | Ha | 480 | 2019-08-03 00:54:20 | QHY22 CCD | L_Ha_2019-08-03_01-04-27_600s__-24C_Bin1x1.fit |
| Sh2-115 | 600 | Ha | 480 | 2019-08-03 01:37:12 | QHY22 CCD | L_Ha_2019-08-03_01-47-18_600s__-25C_Bin1x1.fit |
| Sh2-115 | 600 | Ha | 480 | 2019-08-03 01:47:56 | QHY22 CCD | L_Ha_2019-08-03_01-58-02_600s__-24C_Bin1x1.fit |
| m11 | 180 | B | 480 | 2019-08-04 00:46:47 | QHY22 CCD | L_B_2019-08-04_00-49-49_180s__-25C_Bin1x1.fit |

The grid shows the images which correspond to the search criteria. You can sort the lines clicking on the column header.

**Single Click** load all the stored information in the details section.

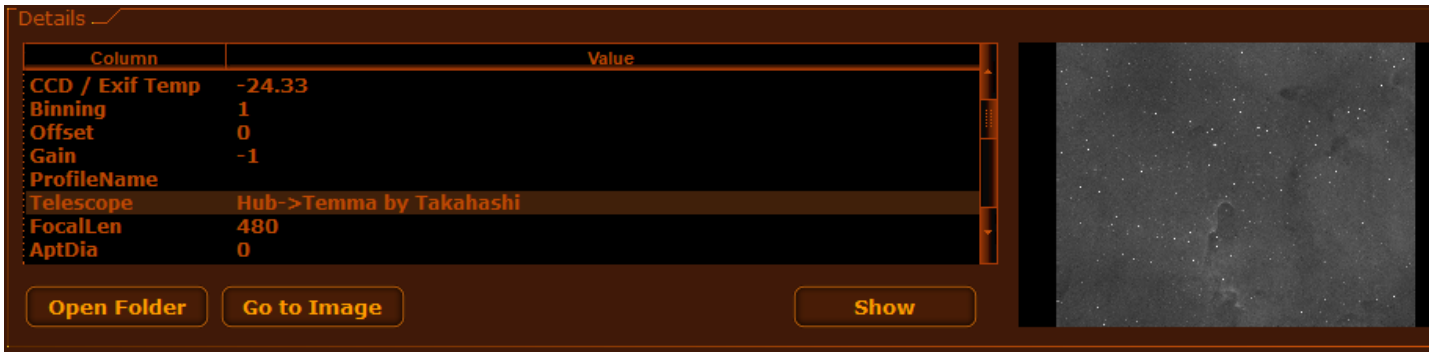
**Double Click** does the same as single click, but also navigates and highlights the selected image in the Img Browser.

## 5 Stats




Shows brief statistics how many images meet the search criteria and the combined exposure time.

## 6 Details




Details section contains all the gathered information (except the data available in the results grid), if there is generated thu
it will be displayed.

The **Open Folder** button navigates the folder which contains the selected image in Windows Explorer. It is handy for impo
processing application.

The **Go to Image** button navigates the folder which contains the selected image in Img Browser.

The **Show** buttons shows the object/coordinates of the selected file in the connected Planetarium application

## 7 Export



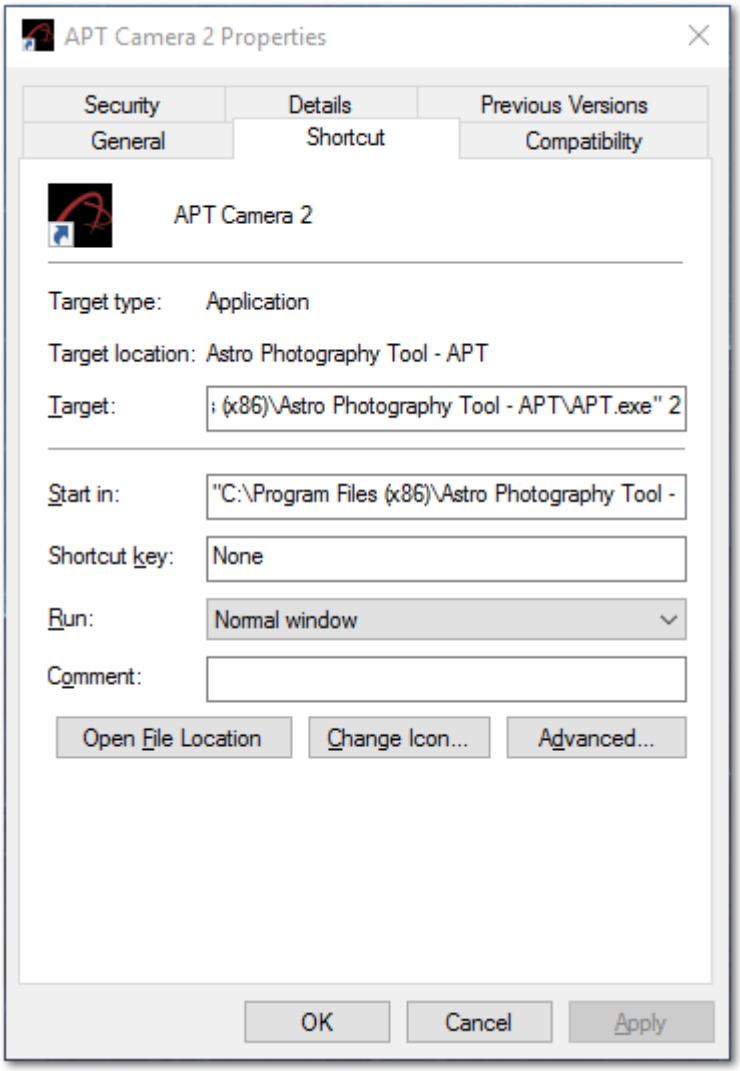

The two buttons allow exporting information about the filtered images.
**Export ILP File** will create a ILP - "Images List to Process" file which to be used in procession application. Ask the developer teams of your processing application to add support for this format. It is easy to implement. You can find more information here.

**Export Paths File** will create a simple text file with the paths to the images

## Multi-Camera Operation

The APT installation creates in Windows Start menu 3 icons “APT”, “APT Camera 1”, “APT Camera 2”. The first two can be used if you have one camera. The last one is used when you want to use second camera. There is no limitation for cameras number you can use. If you want more, create more shortcuts to APT.EXE and put the corresponding number as start parameter in the "Target" field. The sample below shows the "Properties" of a shortcut and the number is set to 2

**Note: Before you can start using multiple cameras in same time you have to create separate profiles via the Settings !**




For each camera APT will create folder “Camera X” into the Images Path folder set in Main settings tab. This will be root for the image taken with this camera. Depending on the settings of Files Grouping other sub-folbers could be created.

Every APT instance has its own configuration. This means that you can have one set of settings for CCD/CMOS, other for Canon EOS and third for Nikon camera, including different skins for easier camera management.

See the Select Camera Types section about details how to define the camera connections. When you are using multiple cameras at the same time you can configure the APT Dithering (Direct Dithering) System to synchronize the exposures and the dithering. See Multi-camera Dithering / Synchronization section.

**Tips & Tricks**. *Every time, turn ON your DSLR cameras in same sequence. The first turned on camera will be found from APT as Camera 1, second will be found as Camera 2 and so on.*

**Tips & Tricks**. *If you use different Nikon models in* Select Camera Types *set the Camera # to 1*

## INDIGO / INDI and RaspberryPi (RPi)

Let start with the question **"What are INDIGO and INDI?"** They are platforms for controlling various astro gear under Linux and MacOS like ASCOM is for Windows. Unlike ASCOM in INDIGO / INDI there is a server that communicates with the hardware and client applications that connect to the server in order to use the hardware. The ideology is distributed by design which means that server and client can be on different machines and can talk each other though internet or network.

INDIGO and INDI are independent open source projects developed by different teams, however currently they have good level of compatibility, so application that can talk INDIGO protocol can connect to INDI server and the reverse. Each project has its own advantages, but the most important is that they give another option for remote control of astro gear.

The next logical question is "**Why INDIGO / INDI could be interesting for the Windows users?**" The answer is the RaspberryPi computer - small and cheap device that can run Linux, has small power consumption and can be used as INDIGO / INDI server. There are commercial devices based on RPi like ZWO ASIAir, QHYCCD StarMaster, StellarMate which are more or less stock RPi computers with added additional software. However every **RaspberryPi 3 Model B+** or newer, bought from your favorite store will do the job!

So far so good, one can say :) "**But I'm an Windows user and don't want to struggle with Linux!**" Here come two solutions - easy to install and pre-configured packages which give you INDIGO or INDI servers running out of the box - INDIGO Sky and Astroberry. The instructions how to flash the images on SD card and to how make the device visible into your network are really simple. If you have a commercial device and want to give a try of INDIGO Sky you can flash a new SD card.

Of course a more advanced user can configure and run INDIGO / INDI server on any Linux or MacOS machine, APT will not see any difference!

## Connecting to INDIGO / INDI Server

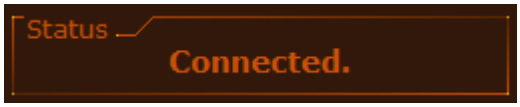
Once an INDIGO / INDI server is visible in the network you can make connection to it in APT via the INDIGO / INDI button in Gear tab. Required is just to enter the server address, port and to click on the Connect button. See below for more information on the other available configuration options.

Having a connection to the server you can access the available devices using **Shift+Click** on the corresponding "**Connect**" button in the Camera or Gear tabs. APT will remember your selections and in next session you have just click on **Connect**. There is no difference in device use via ASCOM or via INDIGO / INDI. You have the same features set available, same look and feel!

**Note:** APT can connect to the INDI server of a ZWO ASIAir, QHYCCD StarMaster or StellarMate device, but an INDIGO server can give better performance. Experiment and find which solution works best with your setup.




## 1 Status




Shows the status of the connection to INDIGO / INDI server.

## 2 Enable connection




When enabled APT will try to make connection INDIGO / INDI server on APT starting.

## 3 Address



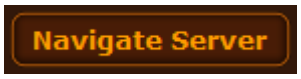

Defines the INDIGO / INDI server address. In could be and IP address or machine name like "indigosky" or "astroberry".

## 4 Port



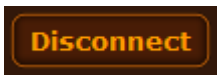

Defines the INDIGO / INDI server port. The default value is 7624.

## 5 Navigate Server



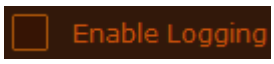

This button currently works when the connection is to INDIGO server. It navigates the INDIGO web interface for managing the server. There you can load drivers, update the server, change exotic properties and more. Required is installed browser Chrome or Chromium.

### 6 Connect/Disconnect



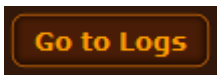

Connects/Disconnects APT to an INDIGO / INDI server. Detailed information about the process is displayed in the Log panel. Once you see that "server is ready to use" you can connect to the available devices.

### 7 Enable Logging




When enabled the INDIGO / INDI communication library will create a detailed log file (separate from the APT log) per every session. Use this only in case of problem because the log files could become quite big.

### 8 Go to Logs




Opens the folder where the INDIGO / INDI logs are stored.

## APT Simulation mode

*Related videos:*
*APT Simulation With Sky Simulator - How I Use It*
*APT Simulation, Sky Simulator For ASCOM and Alpaca v3.0.4b with PHD2 simulation*
*Simulation Mode*

Starting from APT 4.10 the setup installs a new icon on the desktop - **APT Simulation**. It opens APT in special mode which allows testing auto-focusing, PointCraft, many features of SessionCraft, Script and Commands and more indoors without need to connect hardware. For this mode are used the Han Kleijn Sky simulator and ASTAP solver. Great thanks to **Jim Hunt** for suggesting the idea and to **Han Kleijn** for the cooperation!

You have to download and install:
1. the Sky Simulator from here - https://sourceforge.net/projects/sky-simulator/
2. The 64 bits ASTAP from here- https://www.hnsky.org/astap.htm
3. The H18 database for ASTAP

Once you have these things installed there are two simple steps every time you want to make a simulation:
1. Start "ASCOM Sky Simulator" application and click on Start Simulation button
2. Start the APT Simulation icon

On the first start, check if the focuser position is set to 25 000 in Gear Tab, if not enter that value and click GoTo.

You are ready to experiment with the auto-focusing, PointCraft and SessionCraft. Also, you can tweak the camera/scope parameters in Tools tab, to load old images from your scope via Img Tab and experiment solving them in PointCraft. All settings changes will not affect the real-imaging profiles. If you want to reset this special profile, stop APT and delete the folder "Simulation Profile" located in the Documents->APT_Data folder. On the next start the profile will be re-created.

If you have created an imaging plan that you want to use it in the reals situation you can use the Export/Import feature of the Plan Editor.

## Keyboard shortcuts

Here is the list of the keyboard shortcuts defined in APT.

**Alt+Space** - Shoot
**Alt+H** - Histogram
**Alt+F** - Focus Aid
**Alt+A** - Auto Focus Aid
**Alt+K** - Framing Masks
**Alt+O** - Object Browser
**Alt+P** - PointCraft
**Alt+D** - DSD Calculator
**Alt+L** - LiveView
**Alt+T** - Cross

**Alt+S** - Settings
**Alt+G** - Graphs
**Alt+B** - Bahtinov Aid
**Alt+M** - Magnifier
**Alt+X** - Pixel Aid
**Alt+I** - FITS Headers
**Alt+V** - Advanced GoTo
**Alt+Q** - Sky Quality
**Alt+E** - Preview Effects
**Alt+W** - Show in Map (Shift+Click on Recalc)

**F1** - Camera Tab
**F3** - Tools Tab
**F5** - Plan Start/Stop
**F8** - Dithering Monitor
**F9** - SessionCraft

**F2** - Gear Tab
**F4** - Img Tab
**F6** - FocusCraft
**F7** - Dithering Settings
**F10** - USB Monitor

**F12** - Stop GoTo, Automated Meridian Flip, Focuser, Wheel and Rotator moves

## Supported Hardware

There are no special requirements for the computer that can be used to run APT. Every computer that can run any version of Microsoft Windows (7 or newer) is fine.

In the following sections are described the different hardware devices that APT can control.

## Canon EOS Cameras

APT can control seven generations of Canon EOS cameras:

- Cameras with Digic 2 processor requires additional cable to control the shutter
- Cameras with Digic 3 processor requires additional cable only if there is need to make native mirror locking
- Cameras with Digic 4 and newer processor do not requires additional cable

Various information about the Canon EOS models including the built-in processor can be found in the Canon EOS Matrix page on the APT site.

See Starting APT or Select Camera Type sections for details how to connect the camera.

Also APT can control and **astronomically** auto-focus Canon compatible lens when they are attached to Digic III or latter camera via Lens Control panel.

## Nikon Cameras

APT can control most of the Nikon DSLRs (except the models 3xxxx):

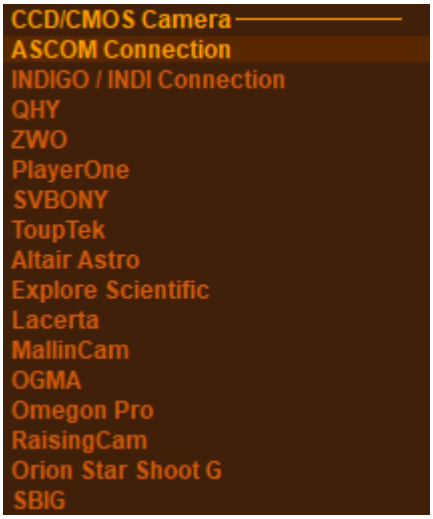
- The cameras D5000, D5100, D7000, D700, D300(S), D90, D80, D60, D40 require additional cable to control the shutter/bulb exposure.
- The cameras D200, D80, D60, D40, D3S require APT to be started in **Windows Vista SP2 compatibility mode**. To that right click on the APT icon, select Properties and go to Compatibility tab.
- The other Nikon models have no special requirements.

Various information about the supported Nikon models can be found in the Nikon Matrix page on the APT site.

See Starting APT or Select Camera Type sections for details how to connect the camera.

## CCD/CMOS Cameras

APT can control various types of CCD/CMOS cameras:



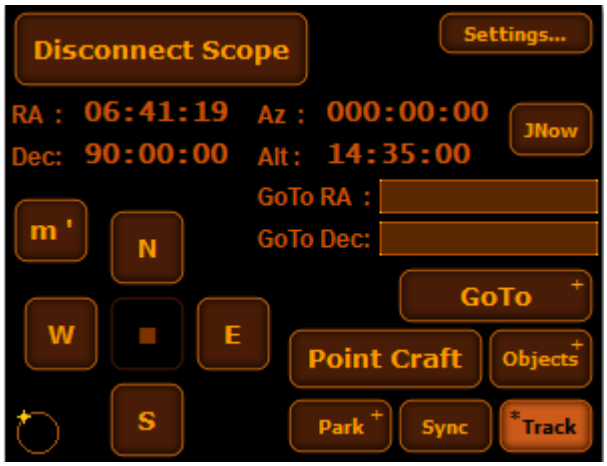

See Starting APT or Select Camera Type sections for details how to connect the camera.

## Mounts

APT is able to control telescopes via ASCOM drivers and INDIGO / INDI. There is still no full native support for LX200 compatible mounts (take a look on this ASCOM driver for LX200 mounts), but APT is able to send most of the LX200 commands through the ASCOM connection which can be used to get better performance form the mount.

In order to use INDIGO / INDI is needed connection to server running on RaspberryPi, ASIAir, StarMaster, StellarMate, or Linux/MacOS computer.

For information about mounts control see the Telescope section in Gear tab.




Meade mounts with AutoStar controller are automatically detected and additional control is provided by Meade section in Gear tab.

If "LX200 compatible mount" option is enabled in Scope & Focuser settings tab APT will use the LX200 protocol through the ASCOM connection.

The mount connection is used or can be used by the following APT features:

- PointCraft
- Dithering - direct mount control when there is no guiding - APT Dithering (Direct Dithering)
- Meridian Flip Clock
- Imaging plans - Scripts and Commands
- Use current position to create Custom item in Object Browser.

**Tips & Tricks:** If you are using **EQMOD** check this very useful article written by **Jim Hunt** - https://aptforum.com/phpbb/viewtopic.php?f=19&t=5101

## Focusers

APT is able to control focusers via ASCOM drivers, INDIGO / INDI as well as Meade focusers.

In order to use INDIGO / INDI is needed connection to server running on RaspberryPi, ASIAir, StarMaster, StellarMate, or Linux/MacOS computer.

For information about focusers control see the Focuser section in Gear tab.




For Meade focuser see "Meade Focuser" option in Scope & Focuser settings tab and Meade section in Gear tab.

The focuser connection is used or can be used by the following APT features:

- Auto Focusing Aid
- Filter Wheel - Adjust Focuser
- Imaging plans (Scripts and Commands)

## Filter Wheels / Drawer

APT is able to control filter wheels via ASCOM drivers, INDIGO / INDI as well as SBIG filter wheels through their native interfaces. Also it is possible to track the usage of manual filter wheel or filter drawer.

In order to use INDIGO / INDI is needed connection to server running on RaspberryPi, ASIAir, StarMaster, StellarMate, or Linux/MacOS computer.

See the following sections:

- To connect ASCOM filter wheel - Filter Wheel section in Gear tab.
- To connect SBIG filter wheel - Select Camera Type.
- To describe the filters, offsets, gains - Filter Wheel settings tab.




Note: For manual wheel or drawer there is need to switch the filter in the Gear tab once filter is manually changed. You can configure APT to show reminder when filter has to be changed via Filter Wheel settings tab.

APT supports the usage of the focus offset and gain per filter. If offsets are entered, there is connection to a Focuser and "Adjust Focuser" in Gear tab is enabled, the focuser position will be tuned on every filter change. If gain value is entered it will be used when the filter is in front of the camera.

**Note:** It is recommended to describe the filters in the Filter Wheel settings tab rather than in the ASCOM / INDIGO / INDI driver in order to get better behavior and experience!

The filter wheel connection is used or can be used by the following APT features:

- Imaging plans
- Imaging plans (Scripts and Commands)
- CCD Flats Aid

## Rotators

APT is able to control rotators that have ASCOM drivers.

See the Rotator section in Gear tab.

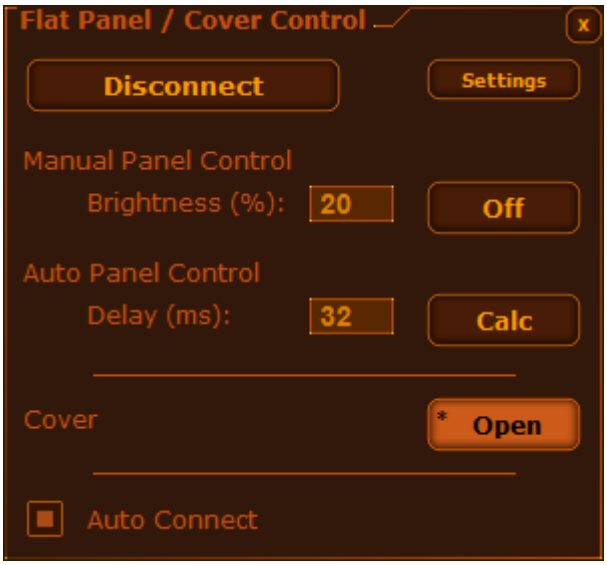



The rotator connection is used or can be used by the following APT features:

- Object Browser
- Object Calculator
- PointCraft
- Planetarium

## Flat Box Controllers / Panels And Covers

APT is able control flat panels and telescope covers that have ASCOM drivers via the Flat Panel / Cover Aid.




The flat panels support in APT was implemented before the definition of the ASCOM standard for these devices so for the flowing models you can also use Extra Devices to control them directly via serial communication.

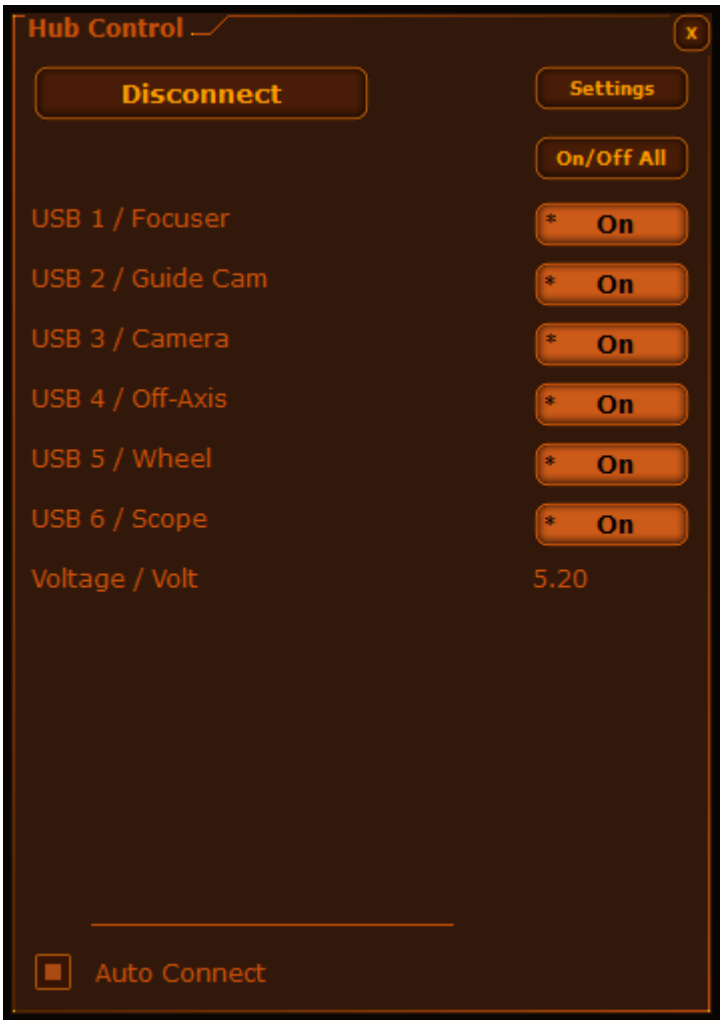
- Lacerta - FBC (Flat Box Controller)
- Pegasus Astro - FlatMaster
- ArteSky - Flat Box USB
- GeOptik Flat Field Generator
- Alnitak and clones Flat Fielding Devices

The connection to flat panel (ASCOM or Serial) is used by CCD Flats Aid and during Flats Type imaging plan execution (in both DSLR and CCD/CMOS modes). APT synchronizes the flat panel flashing with the running exposure.

## Ports / Switches Hubs

APT is able to control Ports / Switches Hubs that have ASCOM drivers.

See the Ports / Switches Hubs section in Gear tab.




## Temperature / Humidity Sensors

APT is able to use various external temperature and humidity sensors.

Here are the main types:

- Temper and TemperHum sensors made by PCSensor.com please see the note bellow!
- USB DewPoint made by usb-foc.us
- Any ASCOM / INDIGO / INDI compatible focuser with temperature sensor
- The AstroHub and JoloFocuser open source projects - support for both temperature and humidity.

The usage of the first two types should be configured in Temperature & Sky settings tab. The other two option are automatically detected and used on focuser connection.

See the section External Sensors for more information on how to use the temperature and humidity readings.

The sensors are used or can be used by the following APT features:

- Temperature/Humidity/Dew Point displaying

- Temperature/Humidity/Dew Point graphs
- Temperature/Humidity use for name parts
- Refocus notifications on temperature change
- Dew Point closing notifications

**Temper/TemperHum notes:** PCSensor are an unreliable producer, their communication protocol is changing with every production batch and they provide zero documentation and cooperation. To make the things harder, it is impossible to identify the batches via code and some batches look same physically...

If APT can't display the temperature or humidity readings correctly follow these steps.

1. Go to the APT folder,
2. Rename Temper.DLL to TemperX.dll
3. In the APT folder you will find OldTemperDLLs folder.
4. Start from newer to older DLLs to copy them in the APT folder.
5. Rename the copied DLL to Temper.DLL
6. Start APT

Repeat the procedure till you find the DLL which works with your sensor.

This is one time operation because next APT installers will keep the DLL you have applied.

## Sky Quality Meters

APT is able use external sensors to measure the sky quality. Supported are Unihedron and compatible Sky Quality Meter devices. Also APT can read the sky quality readings from front/rear EYE sensors of PrimaLuceLab EAGLE computers.

See the section External Sensors for more information on how to use the sky quality readings.

There is need to configure your device from the Temperature & Sky settings tab.

## GPS devices

APT is able talk with various GPS receiver devices sometime called "GPS dongles". All devices that can talk NMEA protocol and expose a COM port are supported. Various Android and iOS apps than export the smartphone's location as NMEA device via Bluetooth are supported. Also is possible to use the GPS readings from the PrimaLuceLab EAGLE computer.

See the section Extra Devices for information how to configure the connection to a GPS dongle.

The coordinates from a GPS dongle is used by by the mount, for the Darkness Clock and DSD Calculator.

## Canon/Nikon Shutter Cables

The shutter cables are additional PC operated devices. They are needed for Canon EOS cameras with Digic 3 processor in order use mirror lock feature. For Digic 2 camera such cable is need to make both - to use mirror lock feature and to control the shutter. Also some Nikon models need such cable to control bulb exposure.

There are different types of shutter cables that are supported by APT:

### USB Cable - Canon / Nikon

"Do-It-Yourself" instructions https://aptforum.com/phpbb/viewtopic.php?f=5&t=5237
"Do-It-Yourself" instructions for cable based on Relay Boards. **No soldering needed!**

### ReflexiBulb - Canon / Nikon

https://www.teleskop-express.it/accessori-per-astrofotografia/8385-reflexibulb-astronomy-expert.html

### Shoestring Astronomy DSUSB/DSUSB2 - Canon and Nikon

Shoestring Astronomy DSUSB/DSUSB2 long exposure shutter controller. Once a DSUSB or DSUSB2 option is selected from the "Long exposure control" list, APT will try to make a connection to the controller. More information about DSUSB/DSUSB2 can be found on http://store.shoestringastronomy.com/products_ds.htm

### Serial Cable - Canon

Serial control cable (RS232) connected to COM port or to USB (with appropriate Serial to USB converter). If you don't want to make such cable yourself, here is a vendor.

**Hap Griffin Astro-Cables** - http://imaginginfinity.com/astrocables.htm

Two links (of course there are more in The Net) with "Do-It-Yourself" instructions:
http://www.beskeen.com/projects/dslr_serial/dslr_serial.shtml
http://www.covingtoninnovations.com/dslr/CanonRelease.html

### Serial Cable - Nikon

Serial control cable (RS232) connected to COM port or to USB (with appropriate Serial to USB converter). Currently there is no way to buy a ready to use cable for Nikon camera. Here is a discussion how to make it yourself

https://www.cloudynights.com/topic/457536-usb-corded-shutter-control-for-nikon/

### Biula Audio trigger - Canon

Biula Audio trigger uses the audio port and special cable control the camera shutter. Instructions how to build this cable can be found here: https://astrophotography.app/BIULA_AUDIO_TRIGGER.pdf
Note - make sure that the audio volume is set to maximum!

## KMtronic or SDR-05V Cable

APT supports Canon/Nikon shutter cable based on USB Relay Broads. It is very easy way to make a cable and requires no electronics skills and **no soldering**! Other advantage is that there is no need of Serial-to-USB adapter, the cable is connecting directly to an USB port.

There are to options for relay boards:

1. **KMTronic** USB Relay Board (https://www.kmtronic.com/usb-relays.html/usb-relay-controller-one-channel-pcb.html). Once the cable is ready, the option KMTronic based shutter cable in Main Settings tab has to be enabled and the COM port should be selected in the Long Exposure Control
2. Any USB Relay Board based on **SRD-05VDC-SL-C** chip like this one AliExpress link Once the cable is ready, the option "USB Relay SDR-05" should be selected in the Long Exposure Control. We have report that this board also work fine.

Flows the instructions how to make the cable.

You need three main things:

1. A USB Relay Board
2. The cheapest possible shutter control for your camera
3. USB cable

The other things you will use are: something to cut wires, isolation band and a screwdriver.




**Step 1**

Cut the remote controller cable near to the button in order to get longer cable attached to the connector. Remove the isolation from the there wires and connect the cable to the camera. Turn the camera on. Start connecting the wires in a pair to see which pair will shoot an image (in this case it is the Blue and the White). **There is no risk to damage anything!** This is the same what the remote controller does ;)




**Step 2**

Cut the unneeded wire and isolate it with some band. You can use the plastic bag - cut one of the ends like on the picture ( smaller cut would be better :) ). If there is need shorten a bit the not isolated parts of the wires and connect the them to connectors **C** and **NO** (leave **NC** free) using the screwdriver. The green LED will be turned on during exposure so you may want to be visible...

***Nikon specific***: The remote controller has 3 wires Yellow, White, Red (R) and two positions - half press to focus and full press to take image. It makes contact between Yellow and White to focus and all three for image. So the working configuration is to connect White+Red to **C,** Yellow to **NO**. Your remote controller could have other wire colors, but the logic should be same.



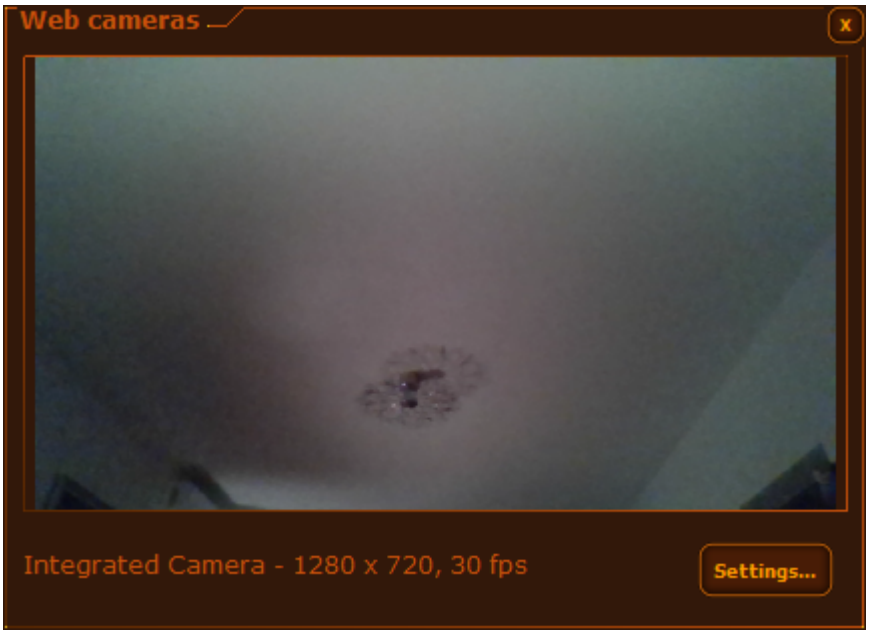

**Step 3**

Isolate the board somehow. On the picture is given one option. Other is to use white isolating band (white in order to see the green LED) and wrap both cables and the board in one package. If you have suitable plastic box, it can do the job...
**Do no use metal box!**



APT is able to control USB or IP Web Camera .

See the Web Cameras section in Gear tab.




## Old Links

There are several translations of old versions of the User's Guide. They are quite different from this guide, but one can find them useful.

- Ръководството на Български
- APT-Benutzerhandbuch
- Guida utente
- Guide non officiel en français