AstroLive Manual

Covers Version 1.3.x

7/10/2014

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Introduction

AstroLive is one-stop tool for controlling everything you need for live or near-live viewing with a variety of video and still ccd cameras. Using only AstroLive you can capture, process, and view images in real time, control your computerized GOTO mount, remotely focus your telescope using a motorized focuser, create informative image overlays with descriptive text about what you're viewing for broadcast on Night Skies Network, and manage your targets for the night with the Observing Plan. AstroLive is capable of advanced image post-processing which is applied in real time so you never have to interrupt your viewing. You can stack multiple exposures (aligning images before stacking, including rotation), subtract dark frames, and stretch your image using the histogram without ever having to leave AstroLive.

There are a lot of things that AstroLive can do, but you can use each function independently so that you can have as much or as little automation as you like. If you don't use a motorized focuser, for example, all the other functionality will still work just fine, and if you prefer to use some other planetarium software to cotnrol your GOTO mount you can do that and just use AstroLive for image capture. Because of the wide range of devices which AstroLive supports some functions may work slightly differently from device to device, but this manual will give you an overview of the functionality and examples of how it works on some of the more commonly used devices.

Initial Setup

Download

AstroLive is available for download as a 30-day free trial from the product page at
http://astroprecisioninstruments.com/products/astro-live where the latest version of the software and
this manual can always be found. When you are ready to purchase AstroLive simply return to the same
product page, add AstroLive to your shopping cart, and check out. There is no need to re-download
your software and your license key file will arrive in an email along with instructions for adding the
license to your software.

Installing on Your Computer

AstroLive can be installed on any Windows computer which meets or exceeds the following minimum
system requirements:

- Windows XP/Vista/7/8

- ASCOM Platform 6.1SP1 (download at http://download.ascom-standards.org/ASCOMPlatform61SP1.exe)

- Microsoft .NET 4.0 or higher installed (download at http://www.microsoft.com/en-us/download/details.aspx?id=17851)

- One of the following for image capture:

    - DirectShow compatible frame grabber/video capture device (almost any Windows-compatible device) plus any native ASCOM Video compatible capture device/camera, or

    - Any ASCOM Camera compatible still CCD camera

- 1GB RAM

- CPU requirements will vary based on video integration length and post-processing options

**Before you run the AstroLive installer, please ensure that your computer meets the above
requirements and that you have installed both Microsoft .NET 4.0 and the ASCOM Platform
mentioned above.**

Once you have downloaded the AstroLive setup.exe file you should run the installer which will install
AstroLive and pop up 3 additional installers to install the ASCOM Video framework, the Astro-Video
Systems Video Camera Driver, and the Mallincam Video Camera Driver. **You should complete all of
these installers.**

Configuration of Devices
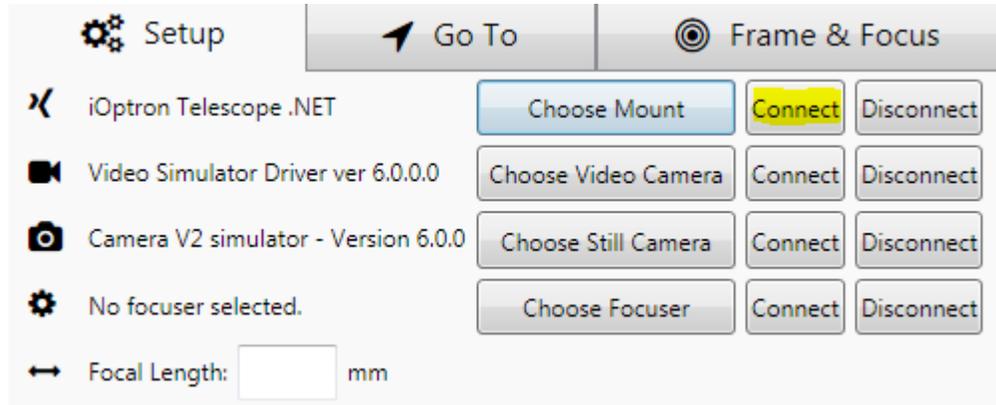
Connecting to a GOTO Mount

In order to connect to your mount, it must be ASCOM compatible and you must have first installed the appropriate ASCOM driver for it. If you have not yet installed the ASCOM driver for your mount, please consult your mount documentation or the manufacturer's web page for instructions on where to obtain the driver and how to set it up. Once your ASCOM driver is installed and AstroLive has been started you may connect to your mount using the "Setup" tab panel on the left side of the application and choosing the "Choose Mount" button as shown below:
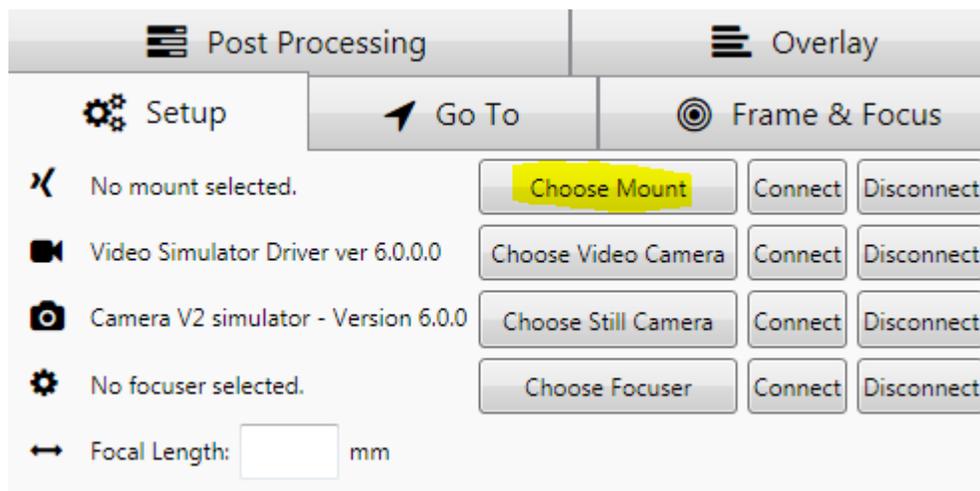
Once you click that button you will be presented with a dialog where you can choose your mount, and a second dialog is available by clicking the "Properties..." button to configure your mount connection as shown (the second dialog will be specific to your mount type and may look somewhat different from the example shown here; you should configure it according to your mount manufacturer's instructions):

5
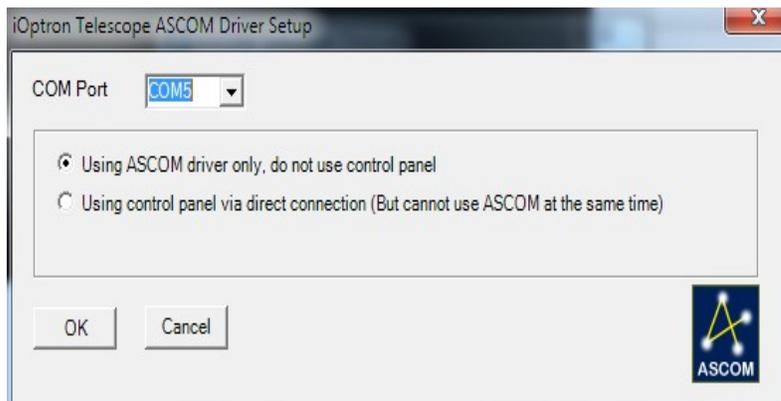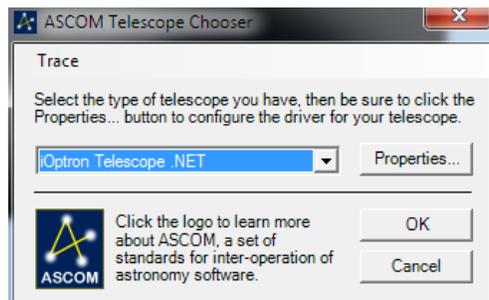
After you have configured your mount connection appropriately, you can select "OK" in the driver setup window, and then "OK" again on the ASCOM Telescope Chooser window to return to the AstroLive setup panel, where your selected mount will now be shown next to the "Choose Mount" button. You can then connect to your mount by clicking the "Connect" button to the right of the "Choose Mount" button as show below:

Once you have completed connecting to your mount, you will be able to utilize the Go To tab panel to enable computerized control of your mount's pointing. This will allow you to enter an object to go to from AstroLive and then slew the telescope to point at it without having to use your telescope handbox, all inside the AstroLive software.

Connecting to a Video Camera and Frame Grabber

Currently Supported Video Cameras

1. Mallincam Xtreme series cameras, FULLY SUPPORTED using my own ASCOM Video driver, provided with AstroLive (control, capture, etc.)

2. Mallincam Hyper/other series cameras, PARTIALLY SUPPORTED using my own ASCOM Video driver, provided with AstroLive (control of same limited settings you can control remotely with the Mallincam software or Miloslick, capture)

3. Mallincam MICRO-EX, FULLY SUPPORTED using my own ASCOM Video driver, provided with AstroLive (menu control, capture)

4. Mallincam Universe, NO SUPPORT

5. Astro Video Systems Advanced Mk II/III, FULLY SUPPORTED (control of everything except for integration length which has to be set in menu, capture)

6. Astro Video Systems APU-1, FULLY SUPPORTED (control of everything, capture)

7. Astro Video Systems DSO-1, FULLY SUPPORTED (control of anything which is available in DSO-1s more limited feature set, capture)

8. Any other video camera with capture card, PARTIALLY SUPPORTED (no control, but capture can be done using either the forthcoming DirectShow driver or using the AVS driver and just ignoring the control functionality)

Currently Supported Frame Grabbers

All DirectShow compatible Windows frame grabbers are supported by AstroLive (which includes nearly every frame grabber made for Windows), however some will have more configuration options available than others.

Camera and Grabber Configuration

Once you have verified that your camera is supported and your frame grabber has been connected and its software has been installed if required (Windows includes drivers for most grabbers and separate software install is usually unnecessary, but some grabbers require their software to be installed), then you are ready to connect your video camera and frame grabber to AstroLive. The process consists of selecting and configuring your camera type and then selecting which attached frame grabber to use to capture the video from it. Follow the steps below:
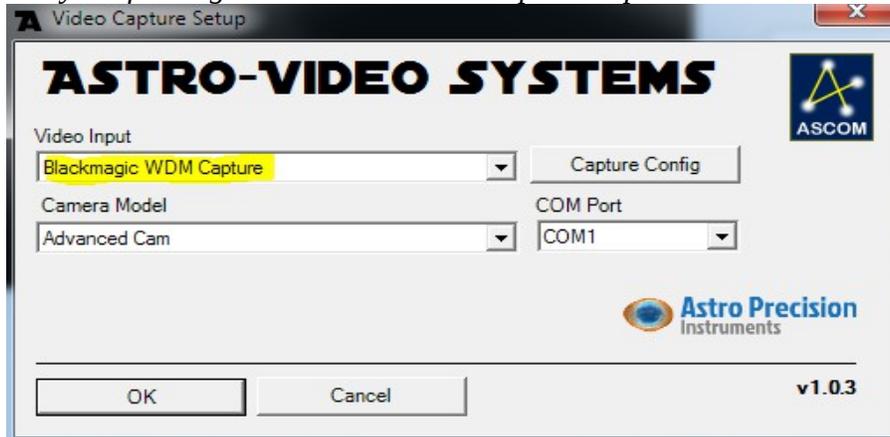
1. Using the "Setup" tab panel on the left side of the application, click the "Choose Video Camera" button.
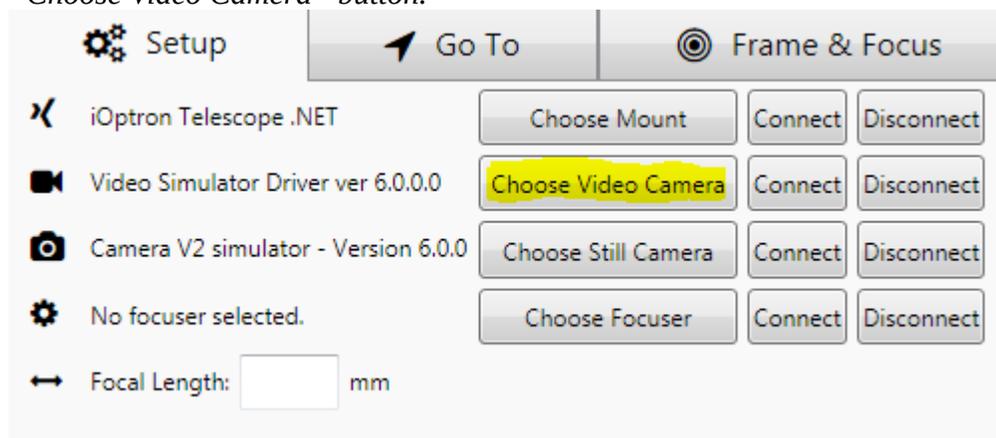
2. Select your video camera brand from the drop-down menu and then click the "Properties..." button to configure the connection.
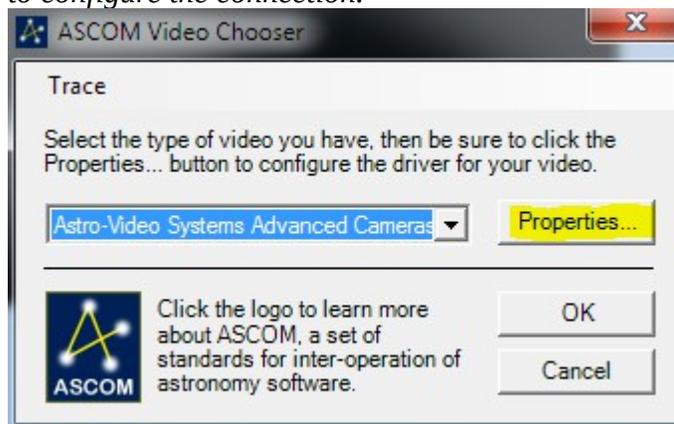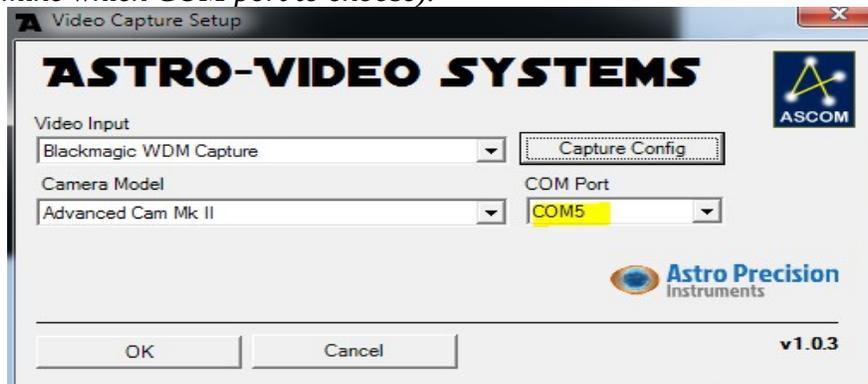
3. Select your frame grabber in the "Video Input" dropdown menu.

4. Select your camera model in the "Camera Model" dropdown menu.
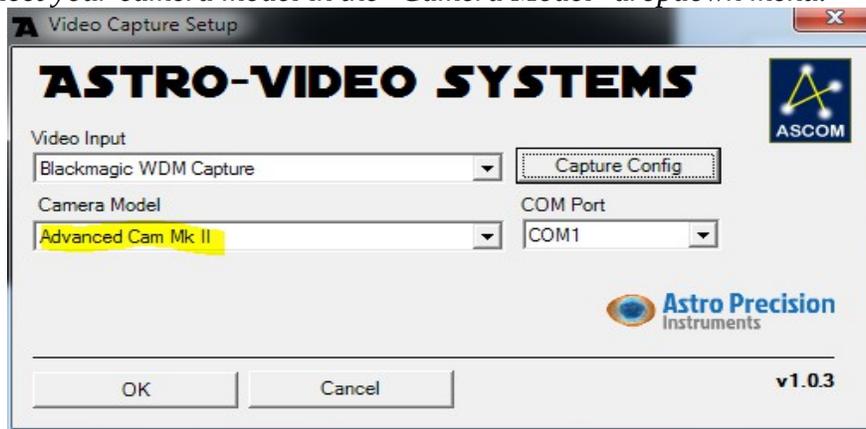
5. Select the COM Port that your camera is connected to (generally via a USB dongle, consult your camera manufacturer's documentation for how to determine which COM port to choose).

6. Optionally, you may configure settings specific to your frame grabber using the "Capture Config" button. This dialog will be specific to your model of frame grabber and you may consult the frame grabber documentation for what settings you may configure and how they work.
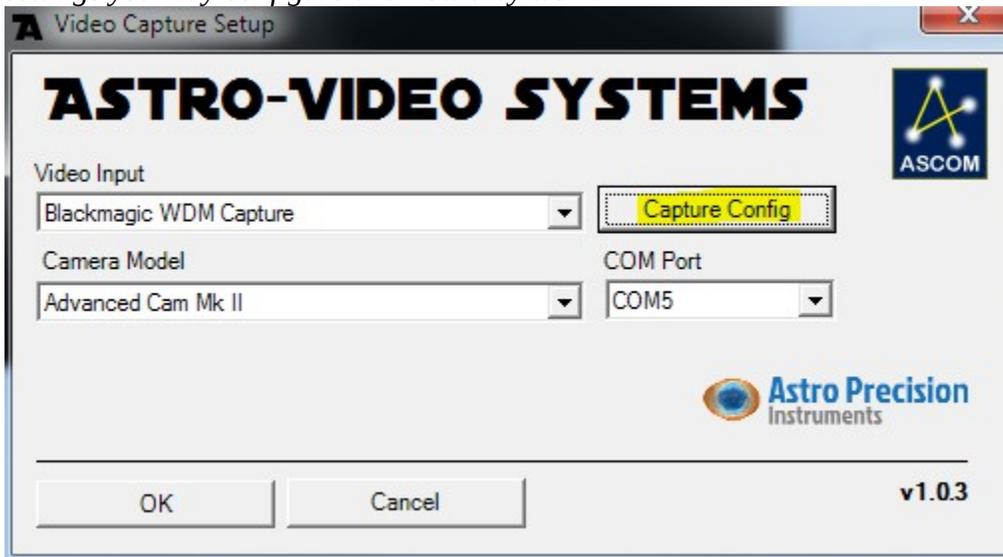
7. Click the "OK" button, and then "OK" again on the "ASCOM Video Chooser" window to complete configuration and return to the AstroLive Setup panel.
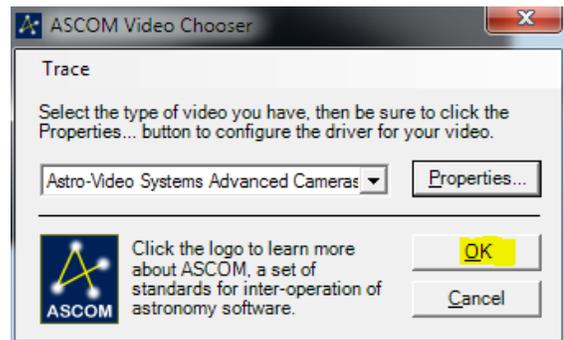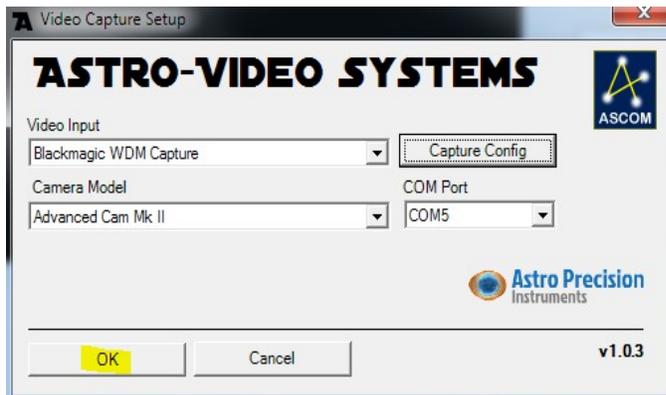
8. Click the "Connect" button to the right of the "Choose Video Camera"
button in order to connect to your video camera and frame grabber and start
capturing frames.
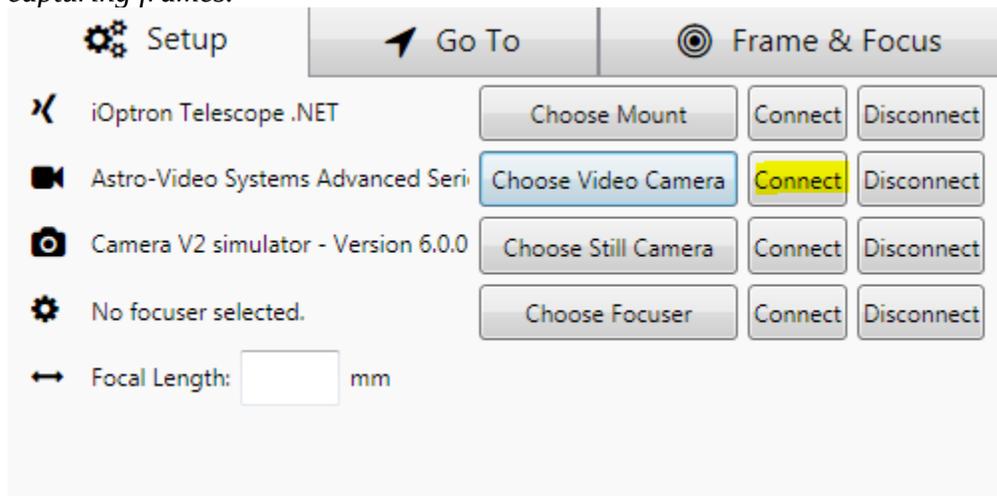
Once you have completed this connection process AstroLive will begin capturing video frames which you can control using the controls on the right side of the screen. Please see the video capture portion of the manual for more details. The next time you run AstroLive your configuration will be saved, so you will not have to configure all your devices each time you run the software.

Connecting to a Still CCD Camera

Currently Supported Still CCD Cameras

Any camera with an ASCOM Camera driver provided by the camera manufacturer is supported by AstroLive. Some common camera brands which provide such a driver include Atik, QHY, Starlight Xpress, Orion, ASI, etc. Currently no DSLR cameras or Micro 4/3 cameras as known to have ASCOM Camera driver support. Please contact your camera manufacturer to inquire regarding ASCOM Camera driver support and availability.

Camera Configuration

Generally still CCD cameras connect to your computer via USB and are therefore very easy to configure for connection to AstroLive once the driver has been installed. Follow the steps below (but they may vary slightly depending on your camera type):

1. Select the "Choose Still Camera" button on the Setup tab panel.
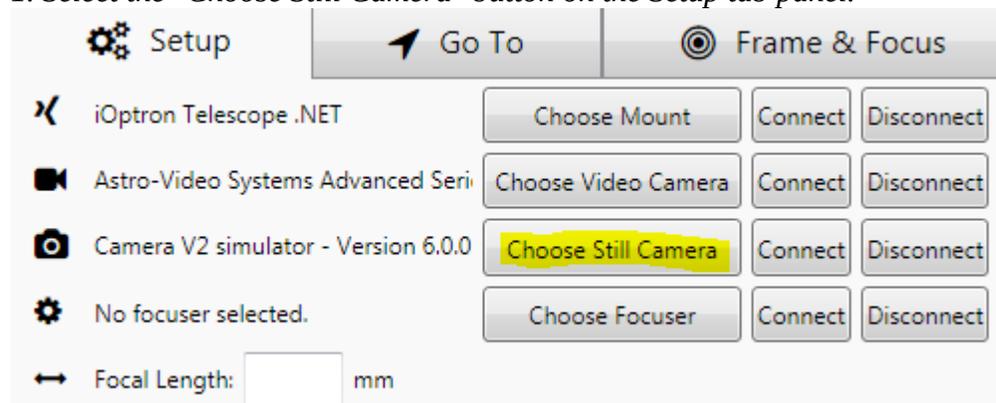
2. Select your camera model from the dropdown menu and perform any necessary (camera specific) configuration using the "Properties..." button. Once you have finished, click "OK" to return to the Setup tab panel.
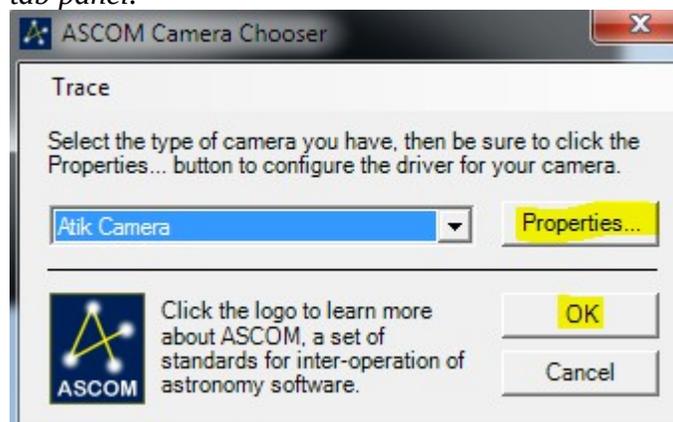
3. Click the "Connect" button next to the "Choose Still Camera" button to connect to the camera and begin capturing images.
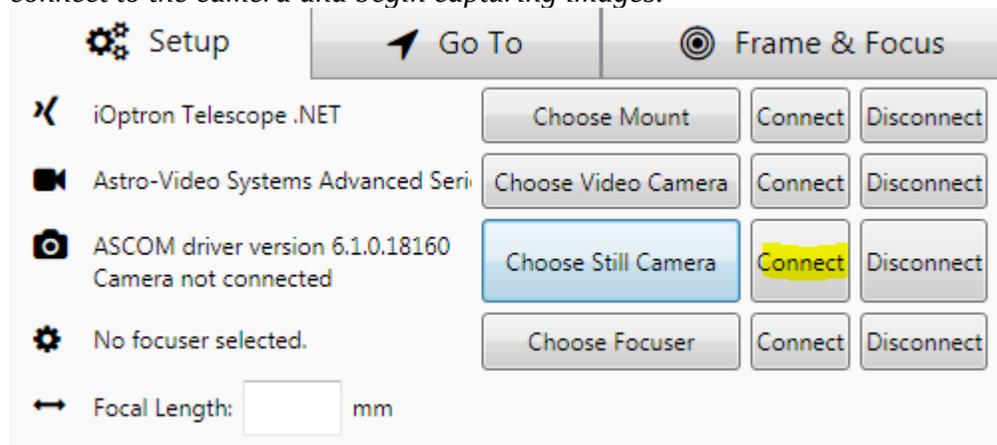
Once you have completed connecting the still camera AstroLive will capture images using the controls on the right side of the window. Please see the still capture portion of the manual for more details. The next time you run AstroLive your configuration will be saved, so you will not have to configure all your devices each time you run the software.

Connecting to a Motorized Focuser

Connecting to a motorized focuser is very straight forward and follows the same procedure as connecting to a telescope mount except that you will be choosing your focuser driver instead of a mount driver. Please see the mount connection instructions for details.

Viewing and Capturing

Video Controls

Integration

The main control for video is the "Integration" slider which determines how long the camera will expose each frame. The longer the exposure, the more light which is captured and the bighter dim objects will appear. On some cameras (such as Astro-Video Systems APU-1, also known as Peltier Advanced camera) this setting can control the exposure of the camera directly, but on other cameras (such as the Astro-Video Systems Advanced series) this setting just tells AstroLive how frequently a frame should be captured to sync up with the exposure length set in the camera menu. In the screenshot below the exposure length of an Astro-Video Systems Advanced Mk. III camera is being set via the menu to match the setting in AstroLive as shown:
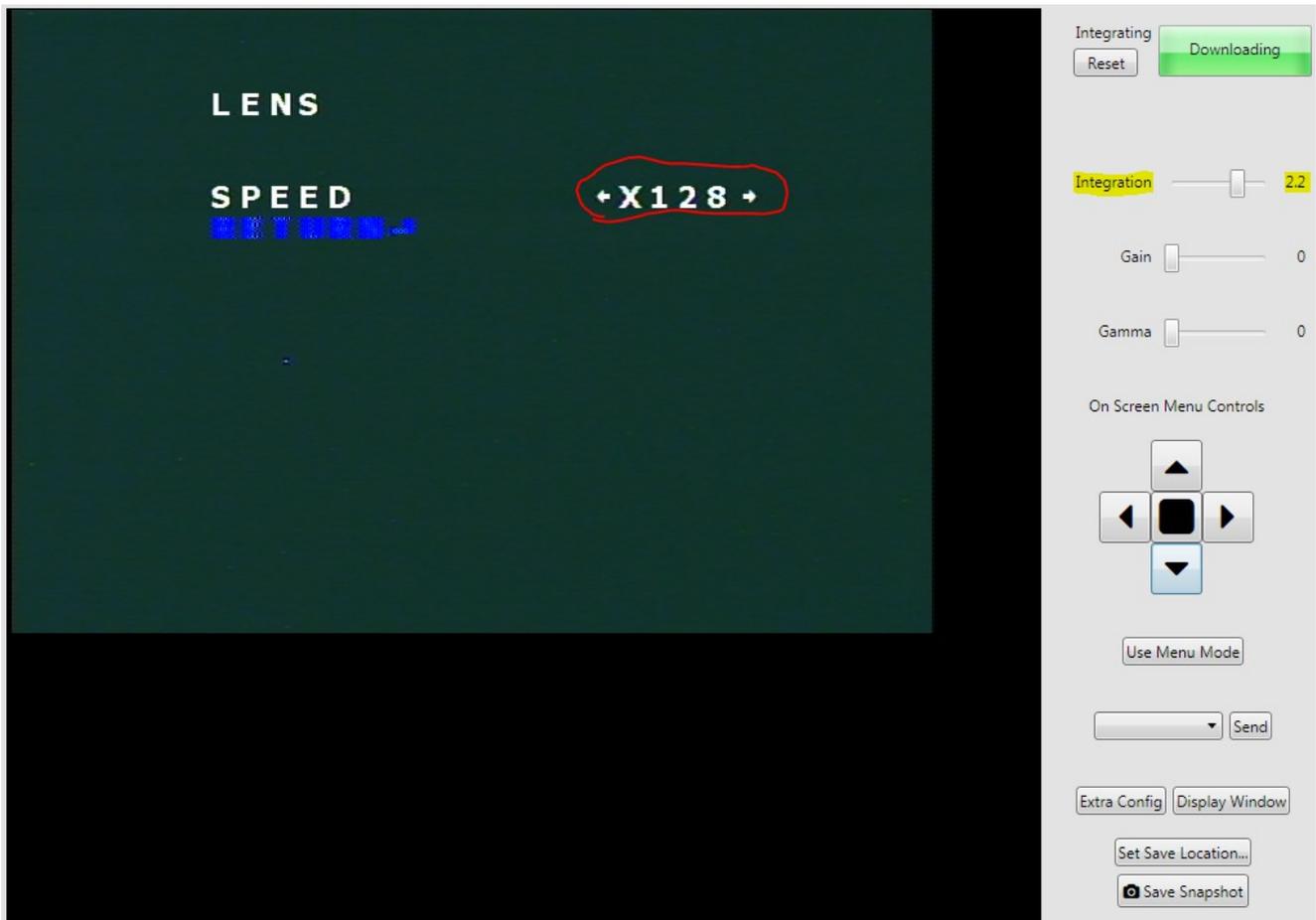
Gain

The "Gain" setting controls the analog gain inside the camera. A higher setting will make the image brighter, but will introduce more "noise" in the image past a certain point, especially on uncooled cameras when the temperature is warm. A lower setting will make the image less bright, but it will limit the digital noise introduced into the image and will lead to more pleasing results.

Usually it is best to first use a longer exposure to get a brighter, cleaner image, then use a combination of the camera's gain (discussed here) and/or brightness and black level settings (discussed under the Extra Config section) to get the desired object and background brightness once you've increased the exposure to the longest your mount tracking accuracy or other constraints will allow. Only once you have exhausted all these in camera adjustments should you then use the adjustments for you frame grabber (model specific, discussed under the Extra Config section) or AstroLive post-processing to stretch the image to brighten it further.

Gamma

The "Gamma" setting controls the non-linear "stretching" of the output of the ccd sensor as it is converted into a video signal. This control operates differently depending on which camera you have, but will operate in the same way the camera's native Gamma setting operates via the remote control box, native control software, or menu system, generally. It is usually safe to not modify this setting unless you know you need to for a particular reason.

On-Screen Menu Controls

Some video cameras have an on screen menu which can be navigated with these controls. The arrow buttons navigate the indicated direction in the menu and the central button functions as an "Enter" button

The "Use Menu Mode" button will temporarily disable post-processing and set frame capture to the full frame-rate of the frame grabber (NTSC 60 frames per second, PAL 50 frames per second) in order to allow you to properly see and operate the menu without the image being modified by AstroLive.

Command Sending

The drop-down box below the "Use Menu Mode" button contains a list of custom commands which your camera model responds to such as enabling an on-screen crosshairs, entering a color bars test mode, etc. Select the command to send in the dropdown menu and then press the "Send" button to send the command to the camera.

Extra Config

The "Extra Config" button brings up a dialog box which will allow you to configure certain settings which are not available on all camera models and which vary between different camera manufacturers, such as Sharpness, Black Level, Color Balance, etc. Please consult your camera documentation for how these settings operate on your particular camera model as the settings in AstroLive will be adjusted in the same way as the settings in the on-screen display or remote control box for your camera. In addition, it also allows access to the "Capture Device Config" dialog which allow you to set the configuration of your frame grabber. That dialog will be different depending on which frame grabber you are using and you should consult your frame grabber documentation for which settings are available and how to use them. Some settings frame grabbers commonly allow adjustment on are Contrast, Brightness, Color Tint, Capture Gamma (different from Camera Gamma discussed above), White Point, Black Point, Sharpness, etc.
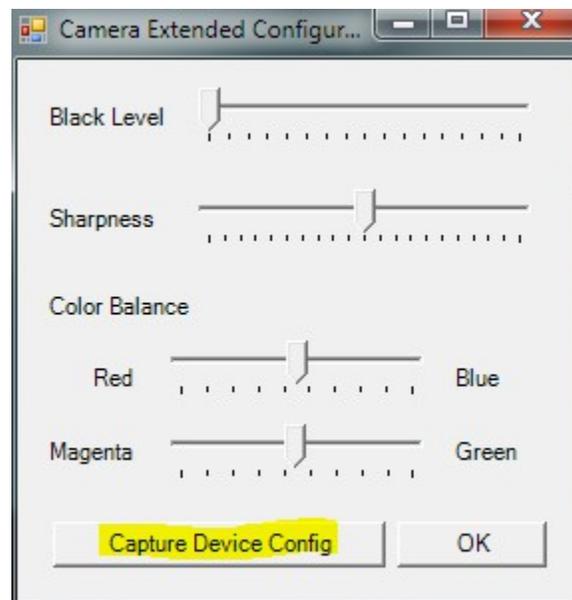
Display Window

The "Display Window" button will bring up a large window which will show what your are currently capturing, with all post-processing applied. This window can be moved to a second display such as a TV or projector that you may have connected to your computer for showing others and can be made full screen (using ALT+ENTER). The image can be scaled to fill the full size of the screen for optimal display.

Saving Snapshots

The "Set Save Location..." button allows you to choose where saved snapshots of your capture will be located. To save a snapshot of your current capture press the "Save Snapshot" button.
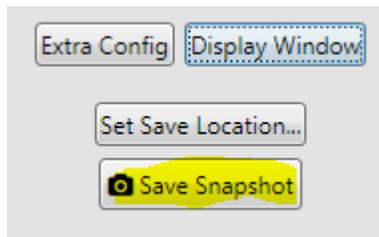
Still Controls

The still image controls operate very similarly to the video controls detailed above except that the exposure duration is set by typing in any number of seconds rather than being constrained to selecting via a slider and there are no on-screen menu controls or menu mode. Please see the Video Controls section for more details on individual settings.

Image Preview

The image preview second of the application is composed of one large image which shows the latest capture with all post-processing and stacking applied and then underneath at the bottom of the window several small thumbnail images of the last few raw frames captured from the camera so that you can see what the post-processing is working with. The large image will always display the captured and post-processed image at full native resolution.

Post-Processing

Post processing applies changes to your images as they are being displayed in real time. Once you set up your post processing settings they will be applied to each image as it comes in from the camera automatically. Each astronomical object will have different settings which maximize the quality of your images, so post-processing is more art than science, although certain general guidelines are usually applicable. All post processing controls are found on the "Post Processing" tab on the left side of the AstroLive window.

Histogram Stretching

The simplest type of post-processing which can be applied to an image is histogram stretching. A histogram is a graphical representation of the distribution of image intensity in your image. If most of your image is dark you will see the graph peak near the left side. Likewise if most of your image is bright the peaks will be towards the right side. Your monitor has a limited range of intensities available for display, typically 256 different brightnesses of each of the colors red, green, and blue are available. The goal of histogram stretching is to occupy as much of that range with the "interesting" parts of your image's native histogram as possible so that the "interesting" parts are stretched out to fill most of the output histogram with most of the "uninteresting" parts discarded so that they don't occupy space in the output histogram. This will allow you to see small variations in your image spread out into larger variations when shown so that objects and their details are easier to detect.

The "uninteresting" parts of an image can occur at the left, black, end of the histogram, the right, white, end of the histogram, or both. For astronomical images the black end is often occupied by lots of empty dark sky background and the white end is often occupied by bright stars. If your camera has a method of adjusting the black level or white level either via AstroLive's Extra Config or Capture Device Config (see "Extra Config" section above) or via hardware frame grabber or procamp controls you should first utilize those controls to optimize the image before stretching with the histogram. Once the input image is as high quality as you can make it using the histogram stretching tools in AstroLive will allow you to further optimize your results.

The histogram control in AstroLive is made up of two histogram graphics with slider handles underneath each graph. The top histogram represents the camera input captured by AstroLive and is primarily where adjustment will occur. The bottom histogram represents the post-processed output which is being displayed on the screen. As you manipulate the controls of the top histogram you will see the results changing on the bottom histogram. Generally the goal is to get as much of the "interesting" part of the histogram as possible to show up on the bottom histogram while simultaneously minimizing the amount of "uninteresting" parts of the histogram which show up on the bottom histogram. This is done by adjusting the three sliders on the top histogram to change the white point, black point, and gray point (gamma) settings.

When stretching the histogram you can start on either end, but I usually start by adjusting the white point since I've usually set the black point fairly close to optimal using my camera's hardware. The white point is the point which will be shown on the screen as full brightness white, the brightest thing that the monitor can display and is controlled by the right most handle on the histogram as shown in the image below.


By moving the right, white point, handle towards the left, the white point can be moved so that it discards or "clips" the uninteresting data on the right side of the input histogram and expands the "interesting" part of the histogram to occupy a larger part of the output histogram, seen below.
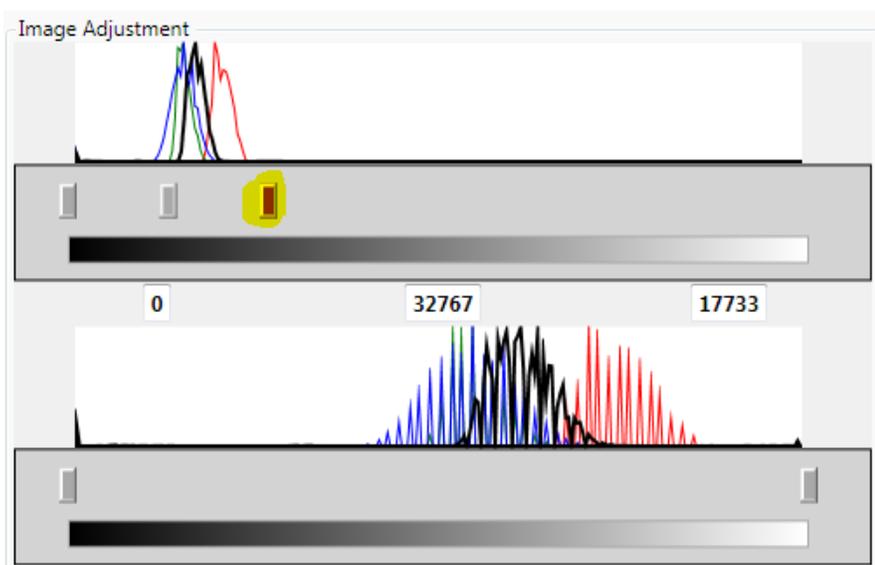
You can then further enhance the effect by similarly dragging the left, black point, handle towards the right. While you are adjusting the sliders you can watch both the histograms and the image itself to see the effect of your changes. Especially when adjusting the black point it is important to be careful not to clip the fainter details of your target object since they are usually fairly close in brightness to the sky background. Moving the black point to the right will darken the sky background and remove sky glow etc. from the image.
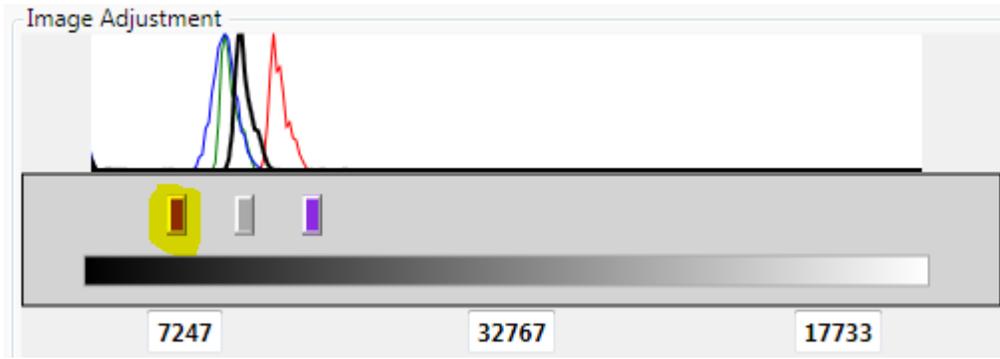

To fine tune the final result once the white point and black point have been set you can adjust the gray point, also known as gamma, setting. The gamma handle is the center handle and it determines the intensity level which will be shown on the screen as mid-gray. The area between the black point and gray point will occupy half the output histogram as will the area between the gray point and the white point. Therefore by moving the gray point you can determine where the middle of the histogram will be and thus which parts of the input histogram occupy the most space on the output histogram. By moving the gray point left, towards the black point, half of the histogram will be allocated to the smaller number of intensities between the two which will result in bringing out detail in dimmer objects which is generally what we want for astronomy.
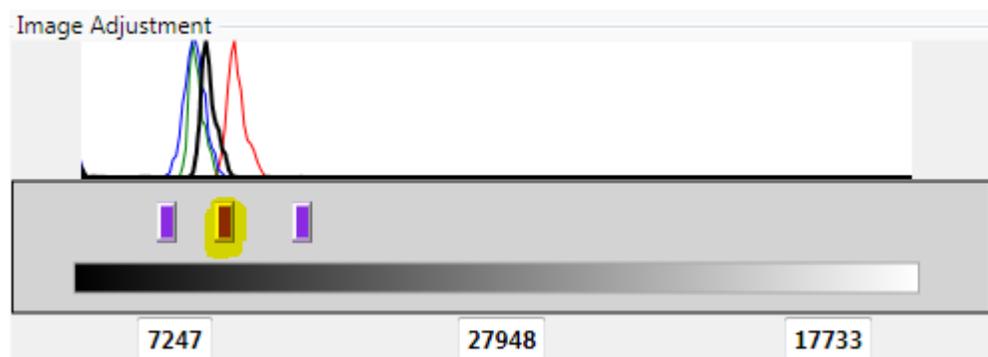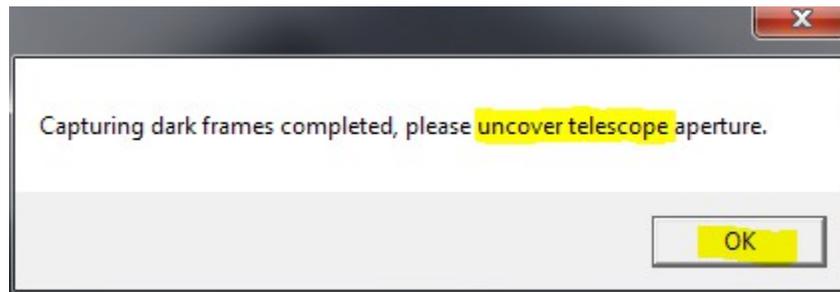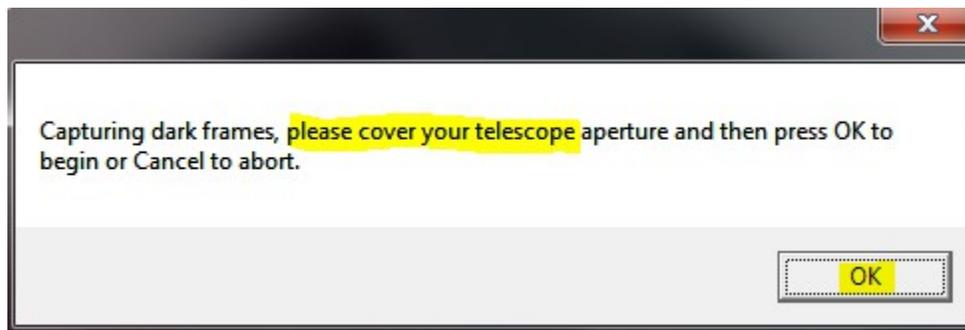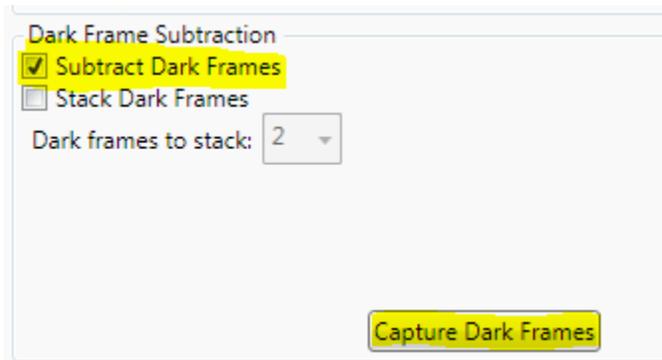
Stacking

Stacking is the process of taking multiple exposures and combining them to enhance the image. Since every exposure contains a certain amount of random "noise", taking several exposures and averaging them together will provide a final image that averages out this noise which will be different in each exposure, but keeps the signal you're interested in which will stay constant between exposures. Stacking exposures can dramatically increase the quality of your image, especially when operating at high gain values on your camera which will tend to increase digital noise.

To stack frames in AstroLive you check the "Stack Frames" checkbox and then choose how many exposures to stack using the "Frames to stack" dropdown selection. This number is the maximum number of frames AstroLive will stack and it will continuously restack on each exposure giving you a live view of the stacked result of the last number of exposures. "Stack Until New Starget" will cause AstroLive to continue stacking all frames captured until you either press "Reset Stacking" to clear the stack or GoTo a new target using the GoTo tab. "Auto-align Frames" will try to detect stars in the captures and adjust subsequent exposures to match the orientation of the first image so that you can stack exposures even if your tracking is a bit off or you have field rotation due to using an Alt-Az mount. Certain objects can fool the auto-alignment procedure, especially with low resultion video cameras, however, so if you see strange results with distorted images while auto-aligning you may need to turn it off.
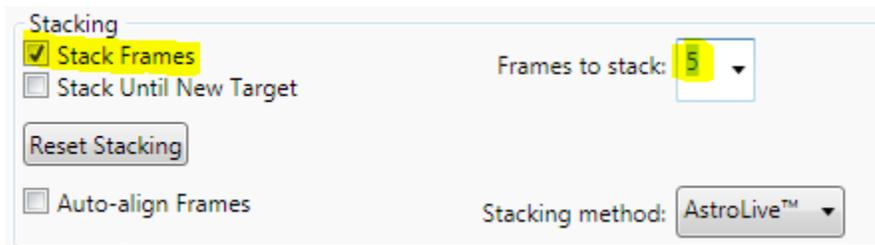
Dark Subtraction

Dark subtraction is a method of taking "test" exposures with the telescope covered or camera shutter closed so that the non-random "noise" caused by heat during a long duration exposure can be subtracted from the image. To capture dark frames for subtraction, press the "Capture Dark Frames" button which will pop up a dialog asking you to cover the telescope, then take the dark frame, then ask you to uncover the telescope. You can then check the "Subtract Dark Frames" checkbox to star subtracting the dark frame in real time from your image as shown below. When you have completed the process you will see a small picture of the captured dark frame inside the "Dark Frame Subtraction" area of the interface.

When capturing dark frames, in addition to the non-random heat noise (dark current), you also capture some of the random noise discussed above in the "Stacking" section. Since this noise will be different in each exposure it should be removed using stacking of exposures and cannot be removed using dark frames. In order to prevent this random noise from influencing your dark frame you can stack several dark frames rather than only capturing one. Select "Stack Dark Frames", select how many below, and then click "Capture Dark Frames" if you wish to take advantage of this capability.

Go To Telescope Control

This section is coming soon.

Frame and Focus Controls

This section is coming soon.

Adding Image Overlays

This section is coming soon.

Managing Targets with the Observation Plan

This section is coming soon.