Evora Documentation - Version 1.0

developed by Tristan J. Hillis
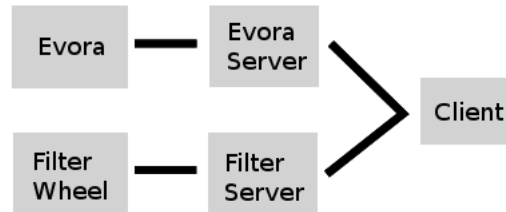
Contents

1   Introduction

Evora is a Andor CCD imager (1024x1024). Provided in this documentation is the means to run this modern camera system to the best of the user's need. At the most basic of levels the Evora eco-system is made up servers and clients; a basic illustration is given below.


The Evora graphical user interface (GUI) makes up the client side of the eco-system. The GUI wraps the commands that need to be sent to the server in an easy to use interface. The aforementioned commands reach the servers which have the responsibility of talking to the hardware and reporting back to the client. The rest of this documentation will focus on how to control the camera with the many various features offered in this GUI. Each section will have a detailed explanation on the available options as well as a quick view summary of each one for reference purposes.

2   Starting Up

Starting the executable named *EvoraGUI* from the desktop of Loki you are greeted with a window that should look similar to the following.
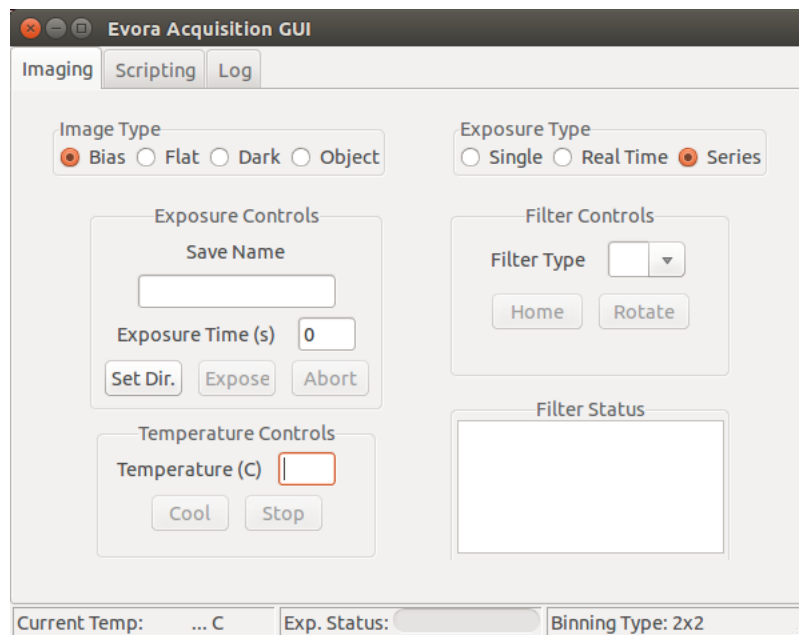
First you will notice that buttons are grayed out to lock down the GUI until a connection is made. This page controls the vast majority of the camera operations, from exposing, temperature control, and filter wheel slewing. One will notice the tabs in the upper left labeled *Imaging*, *Scripting*, and *Log*. Here are previews of the other two tabs to be covered in greater detail in later sections:
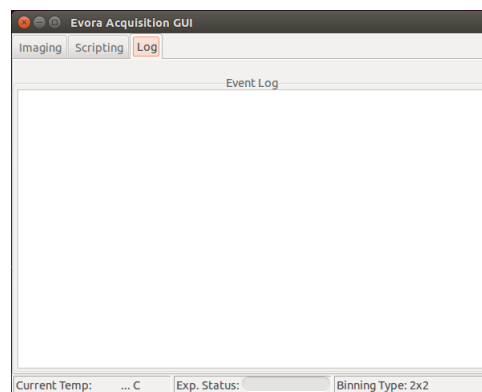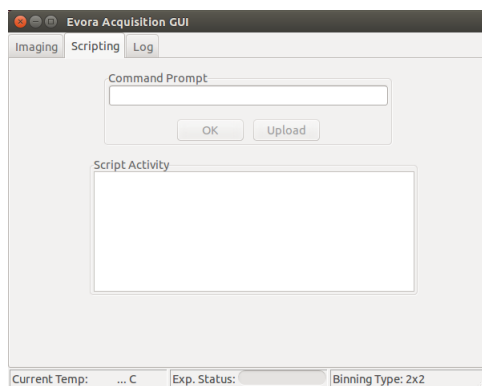
2.1   Camera: Connecting and Disconnecting

Under the **Camera** menu option click on **connect**. This will open a connection to the camera and start the initialization process, while also opening up the GUI capability. By being connected to the Evora camera the user can now disconnect or shutdown the camera from the same *Camera* menu.

Use the **disconnect** option to kill the instance's connection to the camera. For a full shutdown of the system click **shutdown**. If the current camera temperature is under 0 °C the user is prompted if they still want to shutdown. In this way, the camera should be warmed above 0 °C before shutting down.

2.1.1   Summary

- **Connect** - Connect to the Evora camera and start initialization of it.

- **Disconnect** - Disconnect from Evora camera but do not run shutdown, e.g. cooler does not shutdown.

- **Shutdown** - Shuts cooler down, un-initializes camera, and disconnects. This is a hardware shutdown of Evora. Invoke this only when camera is above 0 °C
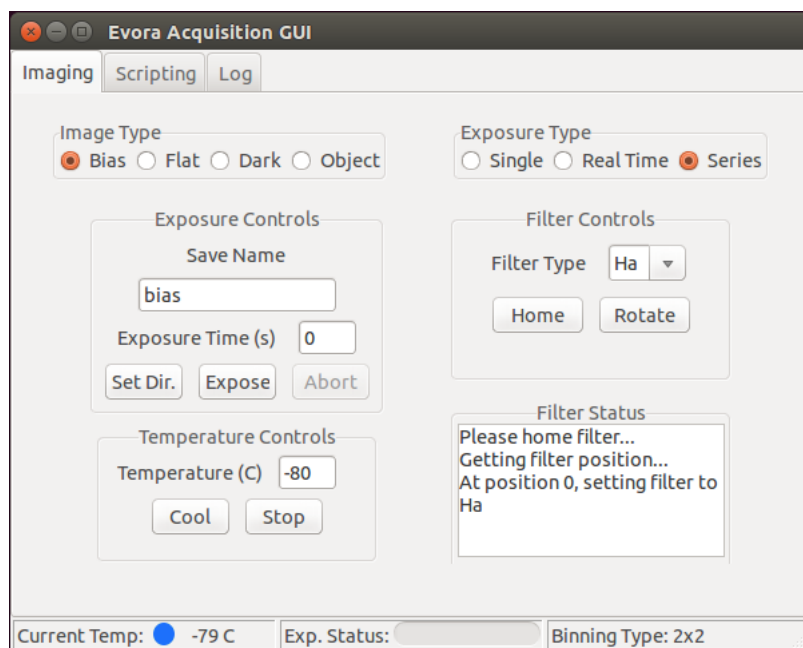
3   Filter

3.1   Connecting and Disconnecting

At the top of the Evora GUI there is a menu bar item labeled *Filter*, this is where the options for connecting and disconnecting to the filter are held. Clicking on **connect** will open a connection to the filter wheel server held on the Filter Raspberry Pi. On connection, the filter controls free up and the user can begin going through the steps to change the current filter position. Using **disconnect** in the filter menu options will close the connection to the filter wheel and further lock down the camera.

3.2   Status Box

The filter status box on the main Imaging tab is updated with relevant information concerning the filter wheel. When connecting or disconnecting from

the filter wheel server this box updates with the status of these processes. Also, when homing it will update when the homing is done and if it was successful, or when rotating it will update with the status of what position it is at as it rotates. Below is an example of successfully connecting to the filter; it will tell you to home but also set the filter wheel to the position it thinks its in first.

3.3   Homing and Rotating

When a new connection to the filter wheel is made the user should always home the filter wheel. The user can do this by simply pressing the **home** button in the filter wheel options area of the Imaging tab. The homing process is not always successful and should be tried again if it fails, which is reported in the filter status box. When homing is successful the filter wheel is ready to change to different filter positions.

To change to different filter positions the user makes a selection from the drop down filter menu. Once a selection is made they use the **rotate** button to change the filter position. Below is an example of homing and rotating to a different filter:
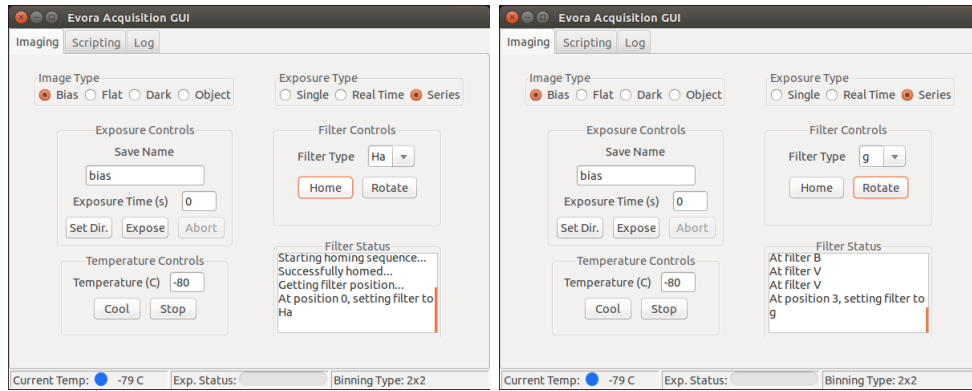
3.4 Refresh Filter List

The filter wheel is equipped with hot swappable ready to go filter wheels. When the user wants to switch to a different set of filters they swap the filter wheels noting the position of each filter for later usage. To then tell the GUI what the new filters are the user should open the file *filter.txt* in the directory */home/mro/ScienceCamera/gui*, and change the filter name to the corresponding position. Once done with the edit, the user presses **refresh** in the filter menu which will update the drop down menu for use.

3.5 Summary

3.5.1 Filter Menu

- **Connect** - Opens a connection to the filter wheel server. User should always home after doing this.

- **Disconnect** - Disconnects from the filter wheel server.

- **Refresh** - Used to refresh the filter type menu to reflect a new filter wheel set being used. Edit **/home/mro/ScienceCamera/gui/filter.txt** with the new filter types before using refresh.

3.5.2 Filter Controls

- **Filter Type** - A drop down menu enabling the selection of a filter.

- **Home** - Homes the filter to ready it for rotating accurately.

- **Rotate** - Rotates to the selected filter from the filter type menu.

4   Temperature

4.1   Temperature Reporting

On connection, the bottom left of the Evora GUI will report the current camera temperature with the value and a small colored circle indicating the state of the cooling. When this circle is green the camera has warmed up and is safe to shutdown. When the circle is red it indicates a transition from one temperature to another, when yellow the temperature is currently stabilizing, and when blue the camera is cooled and stable.

4.2   Setting Temperature

In the temperature area of the Imaging tab the user may set the camera temperature. Using the text field the user can specify a temperature between the range of -100 and -10 °C. Using the **set** button the camera will start the cooling process on the camera. The process will take several minutes and the user may see the cooler go past the target temperature and then stabilize upwards. When the user wants to warm up the camera, use the **stop** button to turn off the cooler. The user should not shutdown the camera until above 0 degrees Celsius. Below is an example of what it looks like to set the temperature to -80 °C:
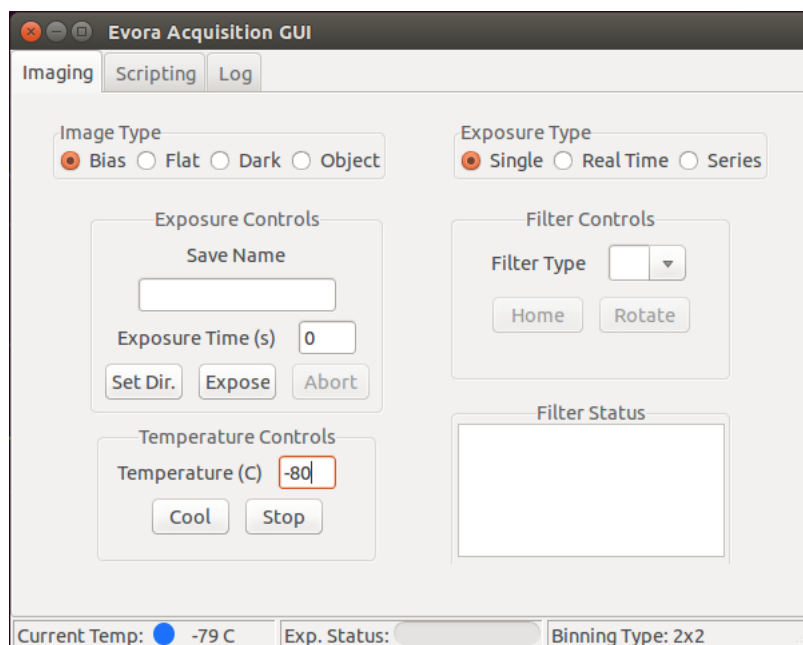
[H]

4.3 Summary

- **Set** - Set the Evora camera target temperature in the range of -100 and -10 °C.

- **Stop** - Stop the Evora camera cooler allowing it to warm up.

5 Exposing

5.1 Setting Save Path

Through the main *Imaging* tab go to the Exposure Controls area and click on the **Set Dir.** button to set the directory in which to save images in. This will prompt the user with a full path name to their directory of choice, and will notify them if it is found. In this way, the user must have created this directory before hand.
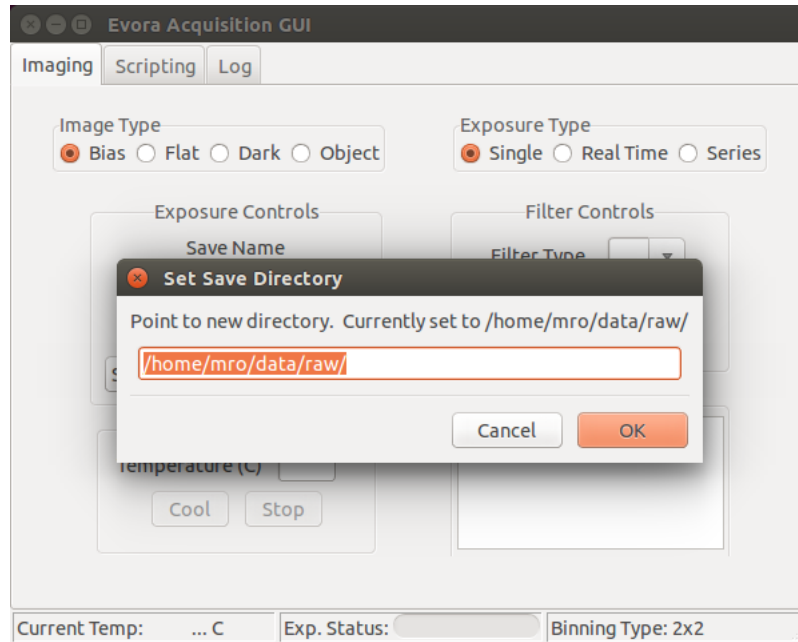
5.2   Exposing

To start an exposure from the main *Imaging* tab, first fill in the *Save Name* and *Exposure Time* fields within the Exposure Controls area. Once these are set, click the **expose** button telling the camera to start exposing, during which the **abort** button can be pressed to cancel this operation.

5.3   Image Type

There are four image types which can be selected before exposing from the *Image* type selection area. When set to **bias** the exposure time is automatically set to 0 seconds and will only readout the CCD. **Flat** should be used when taking either sky flats or dome flats to properly set the camera. **Dark** will set the camera to keep the shutter closed so the user can properly characterize the dark current per specified exposure time. The user should set the camera to **object** when taking science images. These types are written to the image headers for ease of image reduction and analysis.
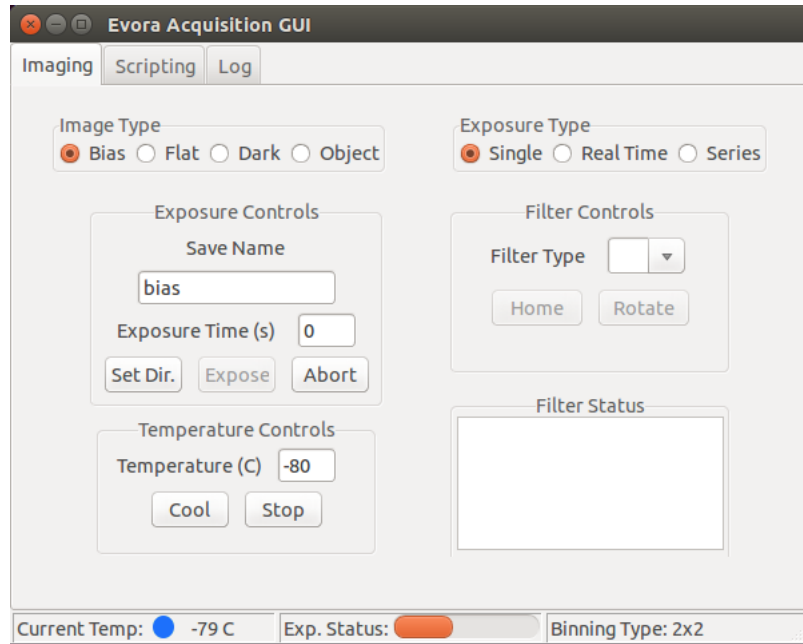
5.4 Binning and Readout Time

Under the file menu the user can change the binning type for the CCD as well as the readout time. The current binning mode is displayed in the status bar in the bottom right corner of the GUI and is defaulted to 2x2. There are two available options for binning, 1x1 or 2x2 which should be set through this file menu.

Readout time changes the speed of which the image is being converted from electrons to ADUs. There are four options to choose from 0.05, 1.0, 3.0, and 5.0 MHz where 0.05 MHz is the default choice. The higher the MHz the more read noise there will be in the image bringing down the signal-to-noise ratio. An approximate time for each option is given respectively: 6, 0.3, 0.1, and 0.08 seconds.

5.5 Exposure Type

The exposure type is set through the *Imaging* tab of the GUI.

5.5.1 Single

This setting is self explanatory, and is used to take one exposure at a time.
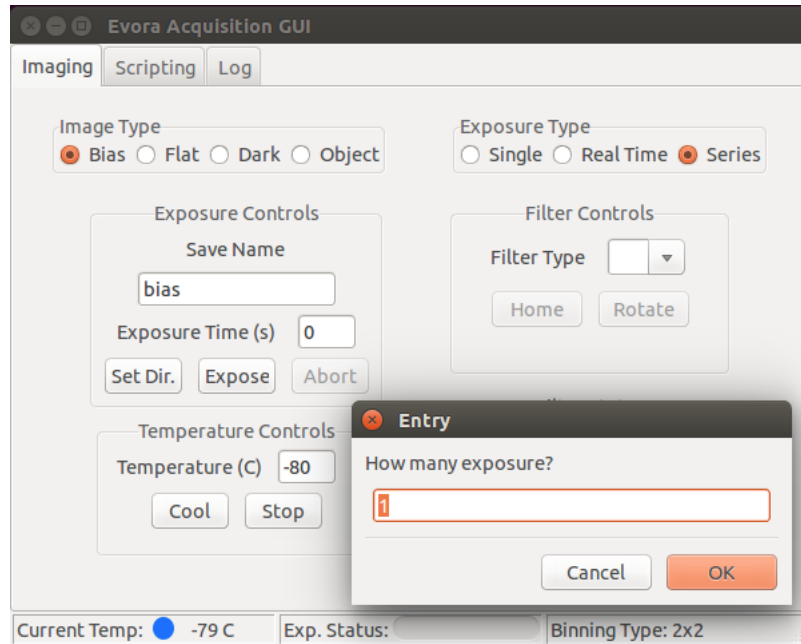
5.5.2   Real Time

In this mode, no name is needed to start the exposure and it will continuously expose for the specified time until the user aborts the run. Images are not saved in this mode but the user should set the image type appropriately still to still set the camera properly. Note also the read mode here is permanently set to 3.0 MHz to ensure quick feed back from image to image.

5.5.3   Series

In this mode, the user can specify the amount of images to be taken. By setting all the same options as in *Single* mode and clicking expose the user will be prompted to type in the number of images to acquire.

5.6   Naming Scheme

In single exposure mode user inputs a name that will be checked against the directory that was set using the **Set Dir.** button. If found it will ask if the user would like to clobber the file.

In series mode the image number will be appended as "_XXX" (e.g. _001)

automatically, which means the user only needs to specify a root name in series mode. The GUI will check to see if a name_001 exists before starting and will prompt for a clobber. If the user wishes to pick up where they left off in a count they simply specify the image name with the number that would be next in the format of "_XXX".

5.7   Summary

- **Set Dir.** - Used to set the save directory.

- **Expose** - Start the camera acquisition.

- **Abort** - Abort the current camera acquisition.

- **Binning** - Set the pixel binning type, 1x1 or 2x2.

- **Readout Time** - Set the image readout time, 0.05, 1.0, 3.0, or 5.0 in MHz.

- **Save Name Field** - Set the name of the image.

- **Exposure Time Field** - Set the exposure time in seconds.

- **Image Type** - Type is written to image headers.

  - **Bias** - Sets the camera to take a zero second exposure.
  - **Flat** - Set for when taking sky or dome flats.
  - **Dark** - Sets the camera to keep the shutter closed. Used to characterize dark current.
  - **Object** - Set for when taking science images.

- **Exposure Type**

  - **Single** - Sets the camera to only take a single image.
  - **Real Time** - Sets camera to acquire till abort for the specified time without a needed name.
  - **Series** - Sets the camera to acquire the user given number of images. Appends "_XXX" onto the end of the save name.
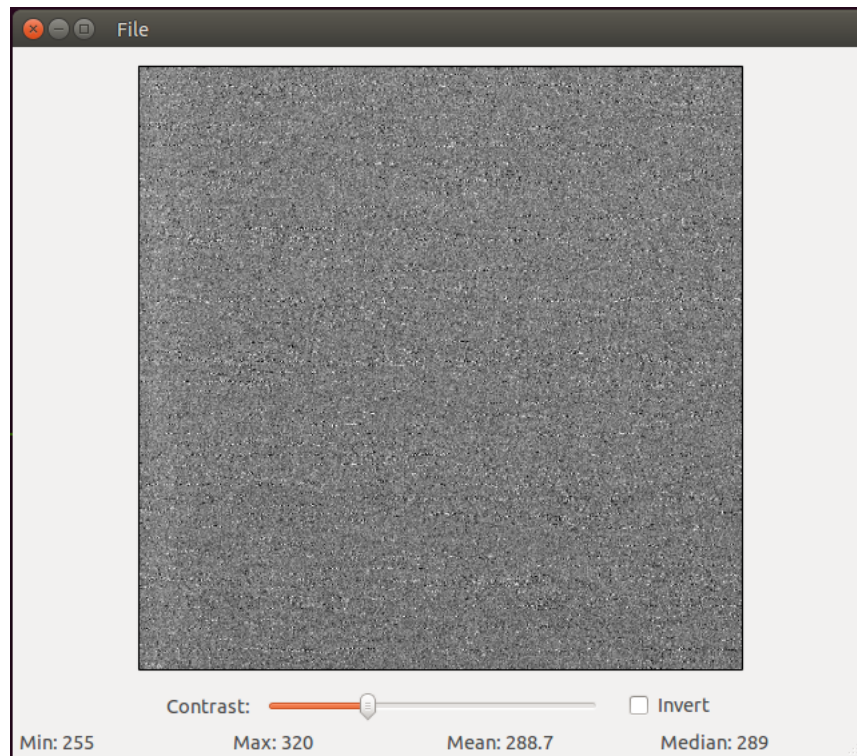
6   Image Viewer

Under the *View* menu item the user can click on **Image** which opens up a new window that will be used to display incoming images. The user can use the slider to tweak the image contrast or check the invert option to invert the gray scale. The image statistics are displayed in the status bar below. Also user can also open a fits image from the **open** option under the file menu located in the Image Viewer window.

7   Help

Using the help menu option will open up the Evora Documentation section of the MRO website.

8   Scripting

Implementation of Scripting with the Evora camera is not done yet, therefore the *Scripting* tab is locked down.