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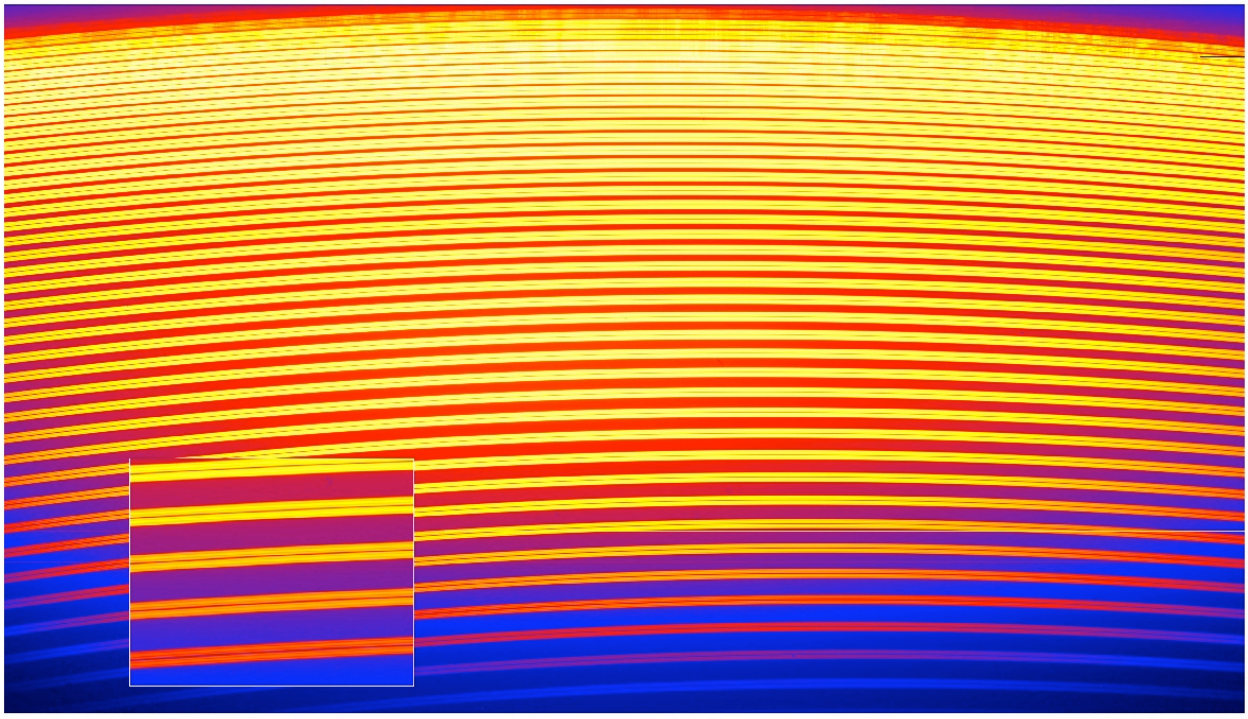
OPERA PIPELINE PROJECT

ds9opera



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Waimea, HI June 2013

Contents

1. Introduction

This document describes the **ds9opera** observing tool. ds9opera is a tcl-based modification to saoimage ds9 that enables automatic update while observing with additional views on the opera quicklook reduction. It is a successor to the ds9espadons tool currently in use in remote observing with ESPaDOnS.

ds9opera shows statistics such as the median flux, the maximal SNR over an image, and highlights the order with maximal SNR. It also shows a history of the last 4 images. It also has a quicklook spectrum view.

The rest of this document describes the various features of this tool in detail.

2. Operation

This section describes the features and operation of ds9opera in detail.

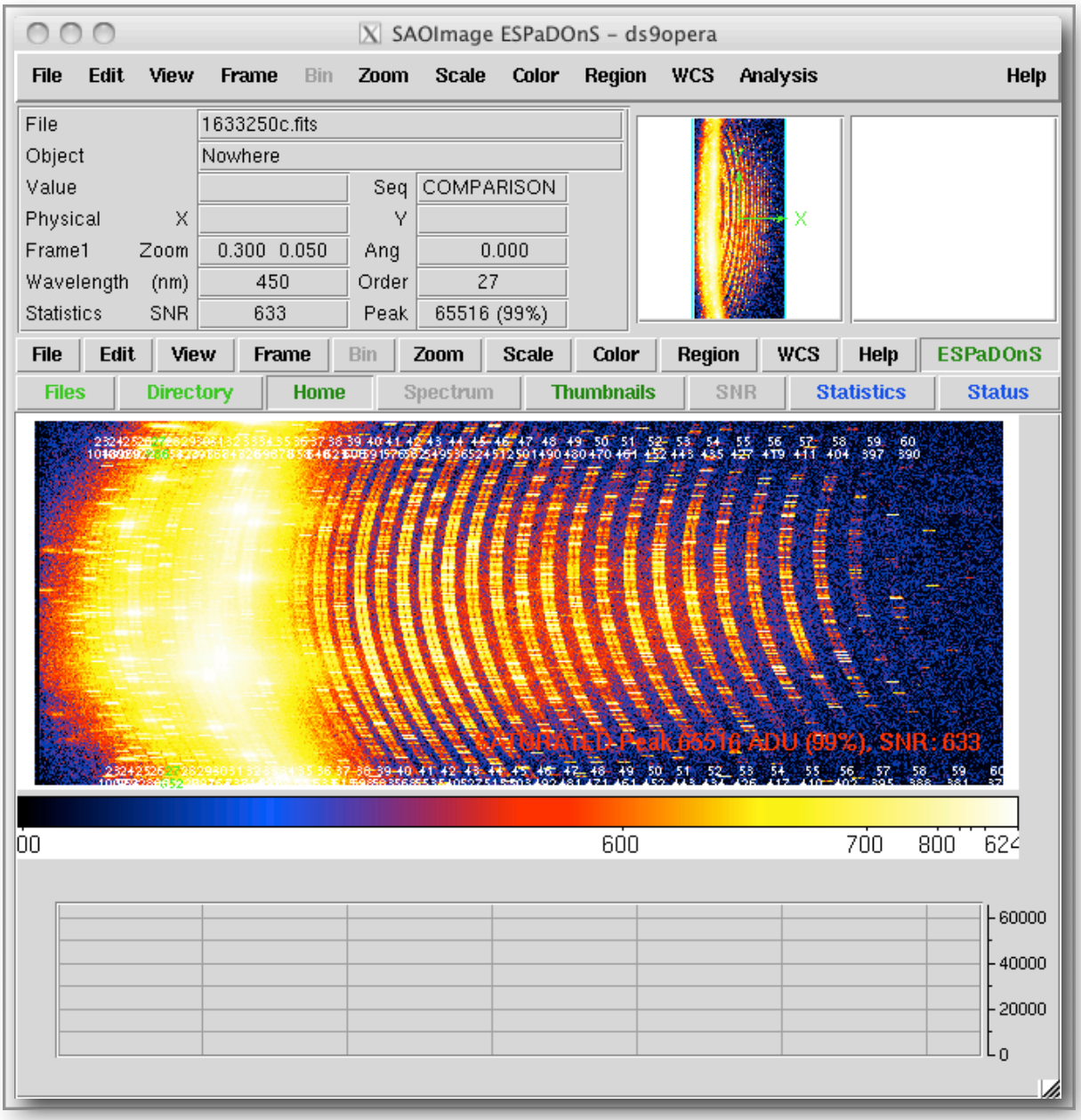

Figure 1 ds9opera Home Screen

Figure 1 shows the ds9opera Home screen.

Launch ds9opera by using ssh to log in to a server where ds9opera is installed, such as "*konane*". Then issue the command **ds9opera** in the terminal window, A screen as shown in *Figure 1* will appear. Click on the green **ESPaDOnS** button to get an extended button set. By default the Home screen showing an image with flux appears.

For ease of explanation, we will label some areas of the tool face:

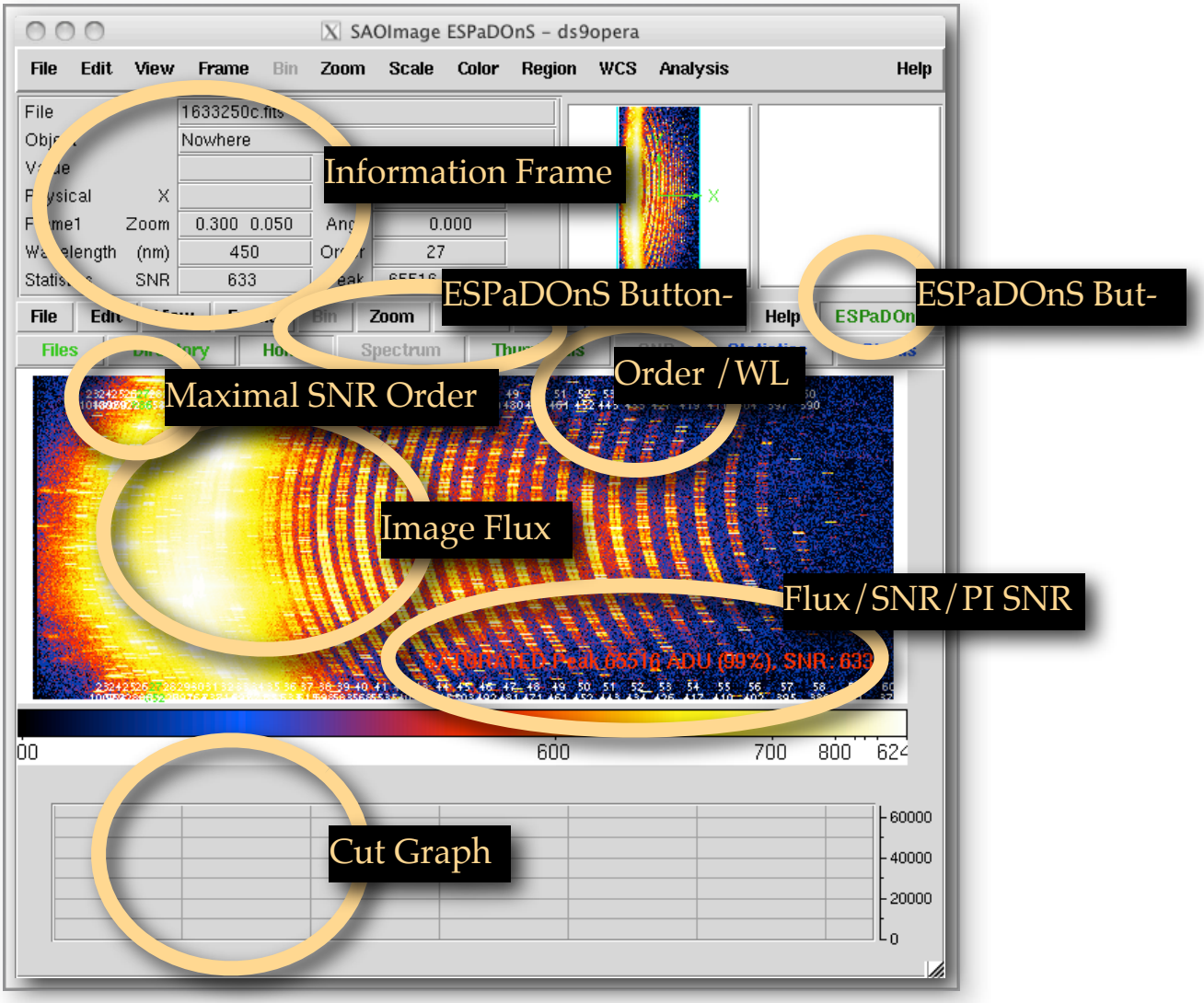

Figure 2 Areas of Interest

The areas of interest are as follows:

- Information Frame - shows quantities such as SNR, Flux, WL at a specific location on image.
- ESPaDOnS Button - hides / shows the extended ESPaDOnS buttonset.
- ESPaDOnS Buttonset - new ds9 buttons that have specific meaning in the context of ds9opera as will individually be discussed.
- Order / WL - Each order is annotated with the order number and wavelength at the top and bottom of the order.
- Maximal SNR Order - highlighted in green.
- Image Flux - shows the image flux in the Home view or SNR in the SNR View or the spectrum in Spectrum View or the last four images in the Thumbnail View.
- Flux SNR / PI SNR - shows the maximal SNR over all orders and the SNR that was requested by the PI.
- Cut Graph - shows a cut of intensity of the current view at the given y position.

Informational Areas

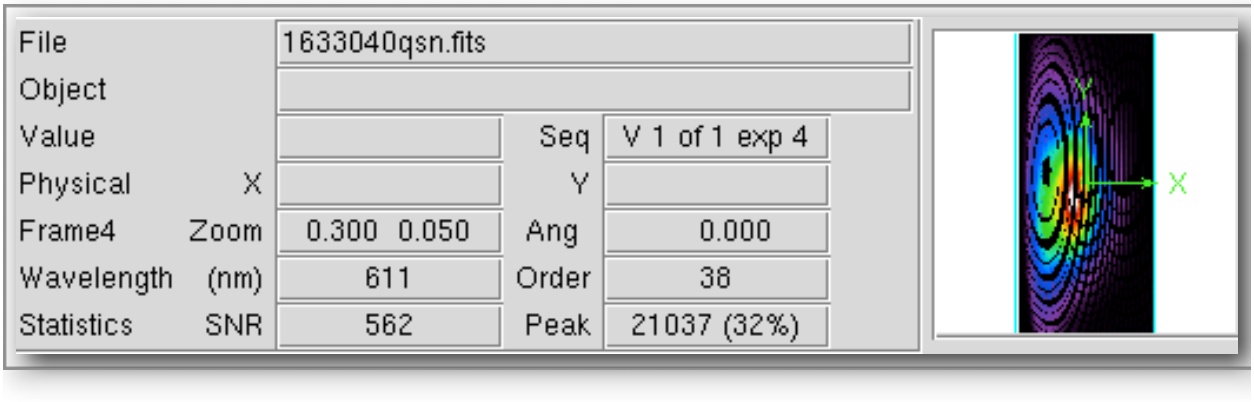

Figure 3 Information Frame

Figure 3 shows the extended ds9opera information frame. ds9opera adds new information boxes such as Wavelength, Order, SNR and Peak Flux. These are updated when the mouse hovers over an area of the image or set to the maximal values when a new image is displayed.

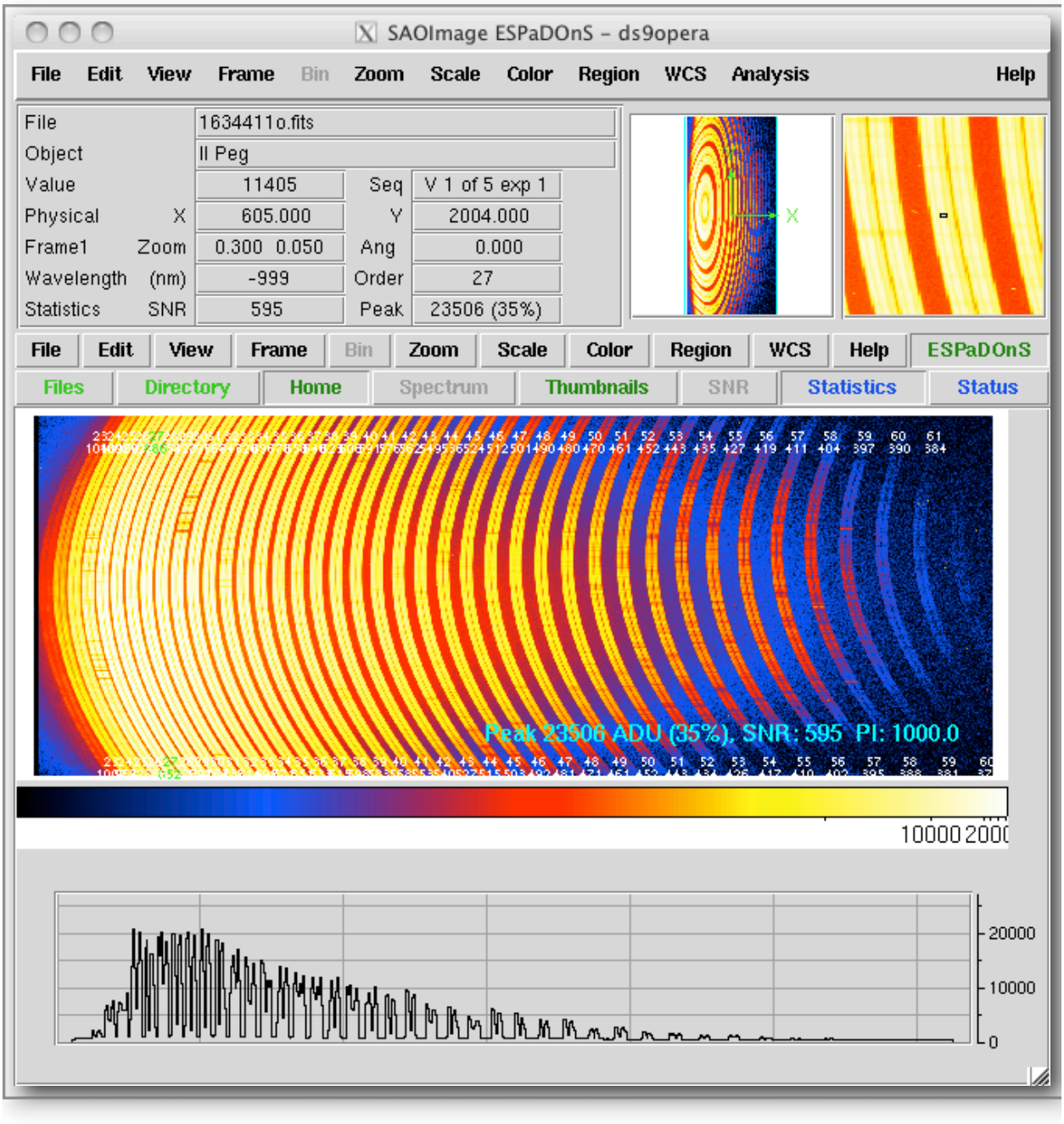

Figure 4 Image Flux View

Figure 4 shows a typical object image. Hovering the mouse over an order highlights the order number in green and shows the wavelength and SNR at that mouse position in the information frame boxes. Additionally, the cut-graph below the image shows flux across the image at that y value. The

cyan message shows peak SNR, ADU and PI requested SNR. The message is red if the SNR requirements are not met. The mouse is active. Hovering over a specific point in the image will switch focus to that point, indicate which order it is in green, and show the flux and wavelength at that point.

Pressing the **SNR** ESPaDOnS button shows the SNR View:

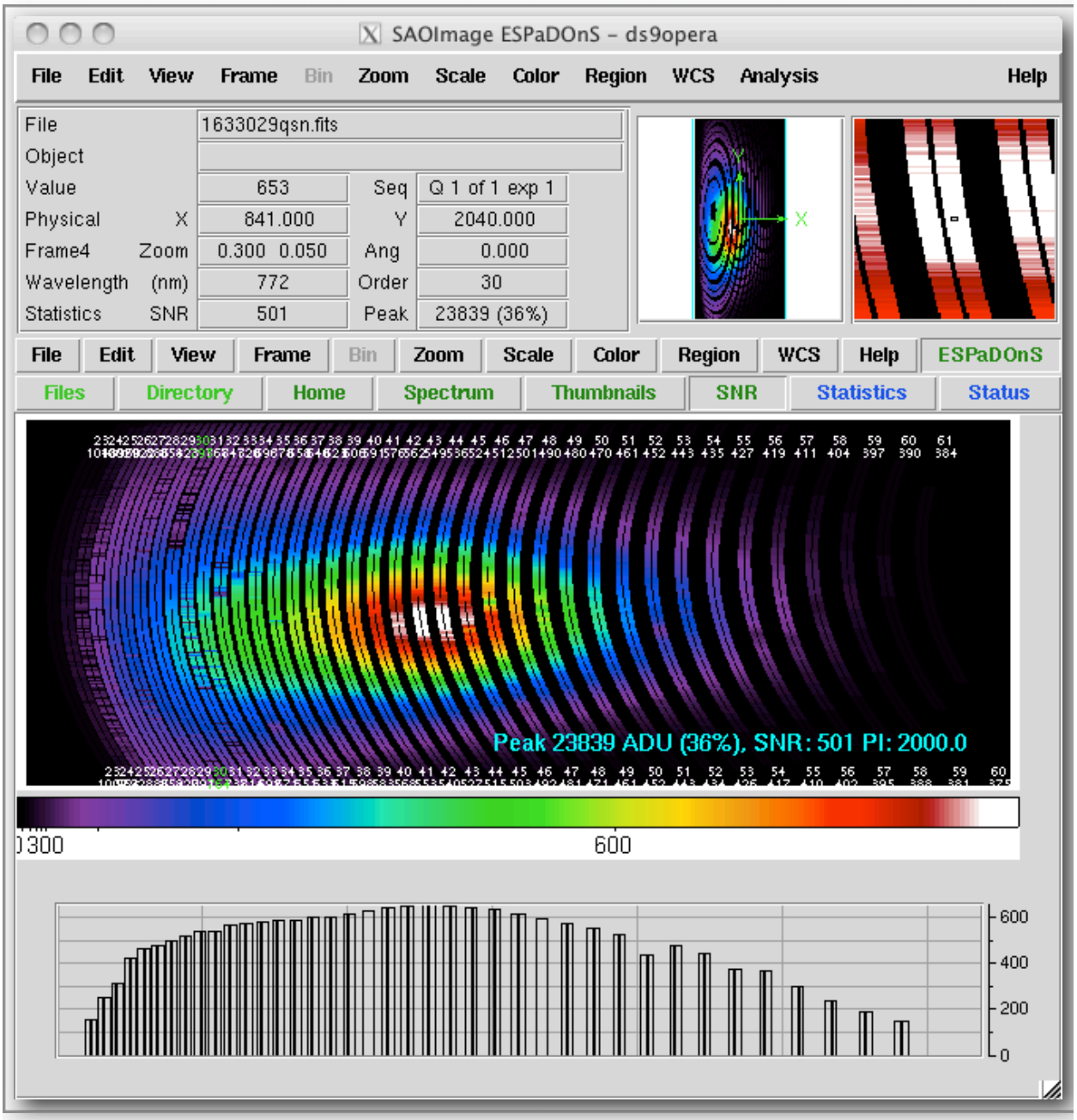

Figure 5 SNR View

The SNR View, as shown in *Figure 5*, is an image constructed from the calibration geometry polynomial and the wavelength polynomial and the calculated SNR along each order. Hovering the mouse over a particular point in the artificial image shows the SNR at that point in the Information area. This image is a good test that the geometry calibration was correct in that the order are well placed and the lines do not hop orders. Again, the mouse is active. Hovering over a point will select that order in green, and show the SNR and wavelength at that point.

Press the **Spectrum** ESPaDOnS button to show the raw extracted spectrum as shown in *Figure 6*.

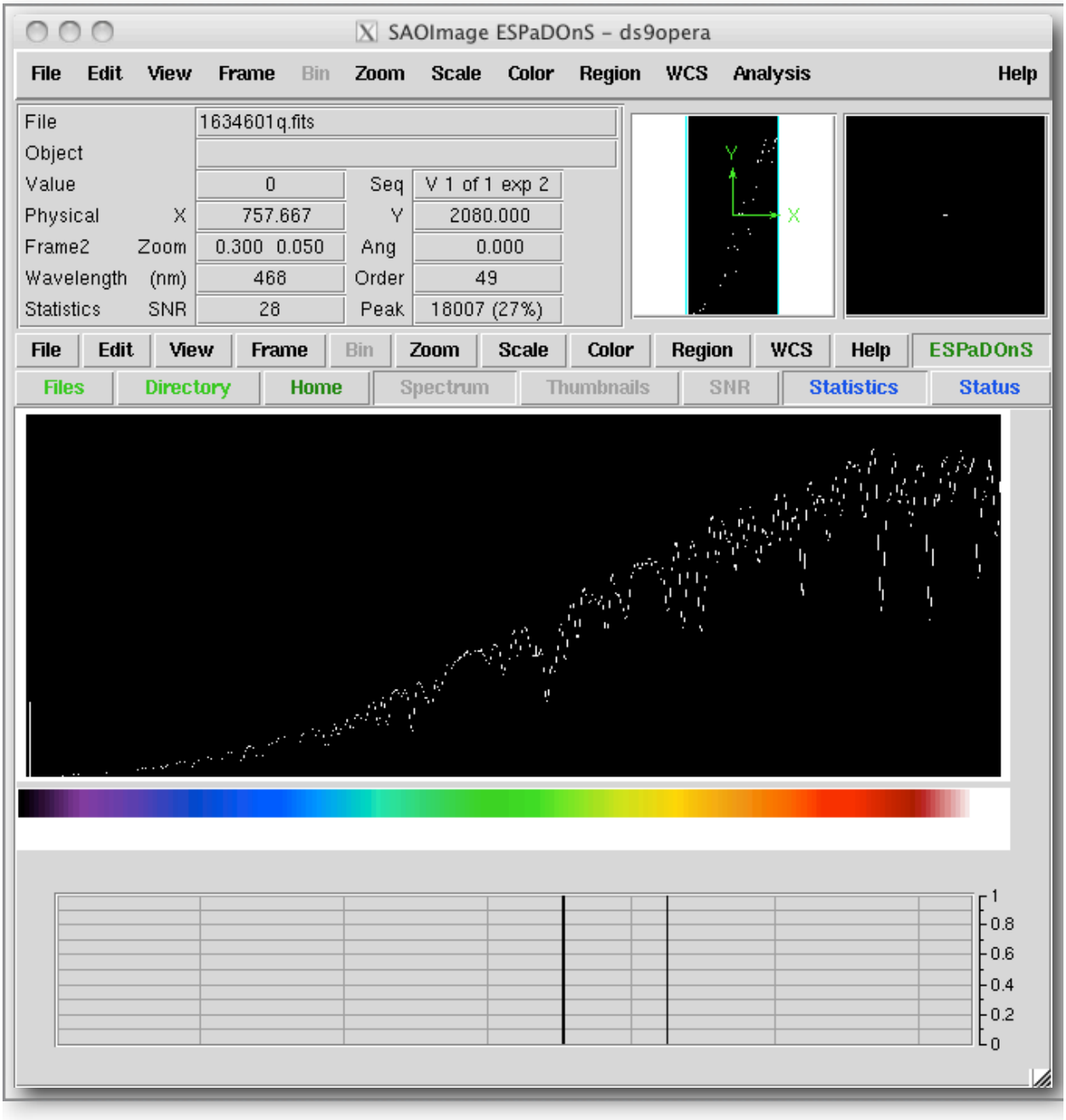

Figure 6 Spectrum View

Press the **Statistics** ESPaDOnS button to open a new scrolling window which shows updated image statistics as images are taken, as shown in *Figure 7*.

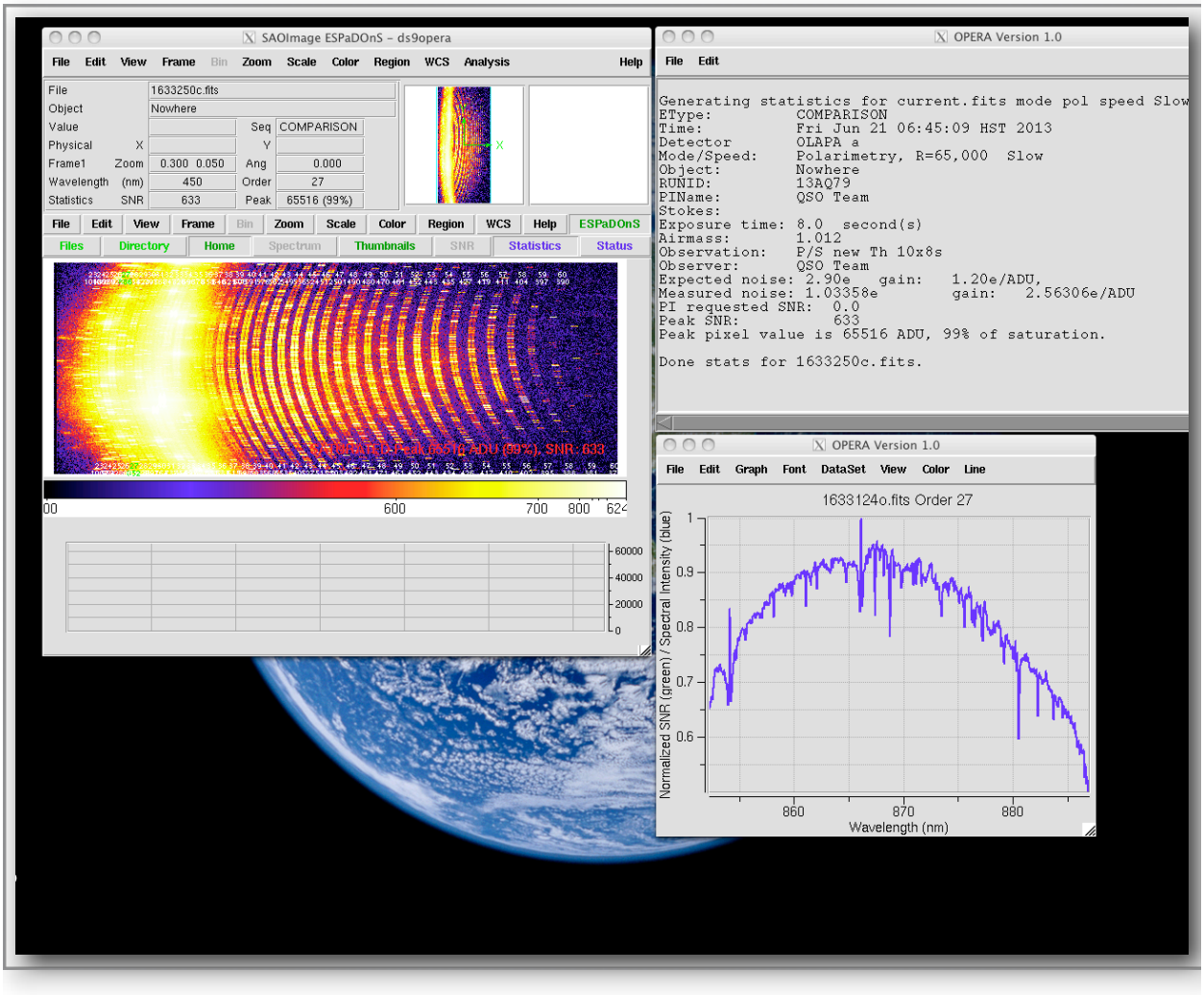

Figure 7 Statistics and SNR Window

Additionally a window showing the normalized spectrum of the order with maximal SNR and SNR over the order opens. It updates with each image.

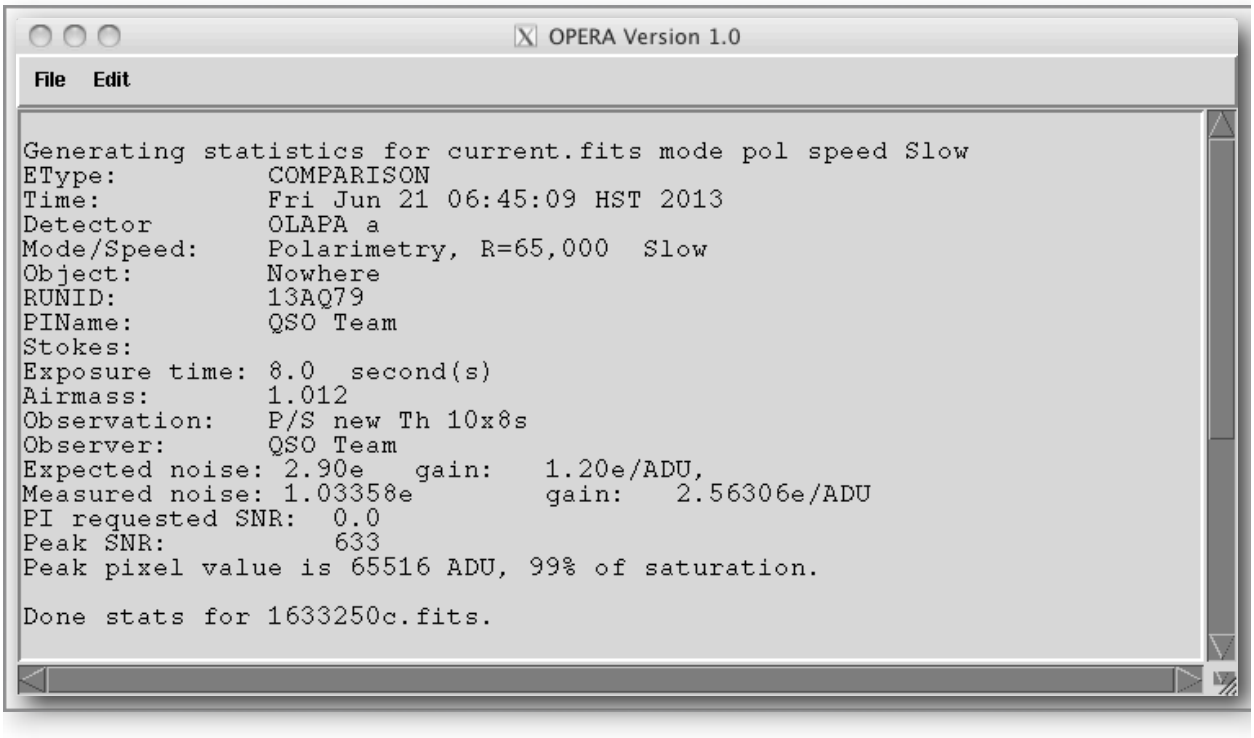

Figure 8 Statistics Output

Figure 8 shows a closeup of the statistics window. This window will remain open until the **Statistics** button is pressed again, updating statistics automatically as each image is taken.

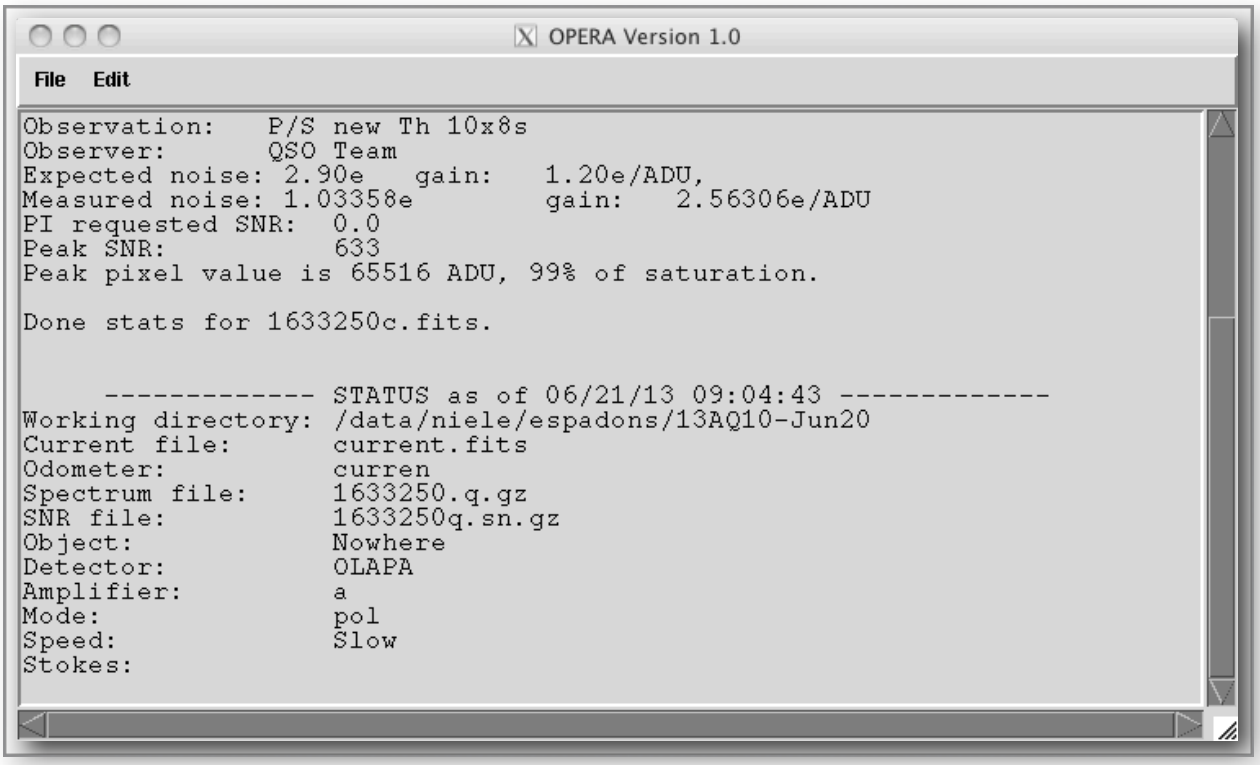

Figure 9 Status Output

The **Status** button shows one-time reduction status as shown in *Figure 9*.

Select from the **Menu, View -> Exposure** Meter to launch the Exposure Meter window. This window shows flux counts over time during an object exposure, as shown in *Figure 10*. Note that the Exposure Meter window replace the SNR window.

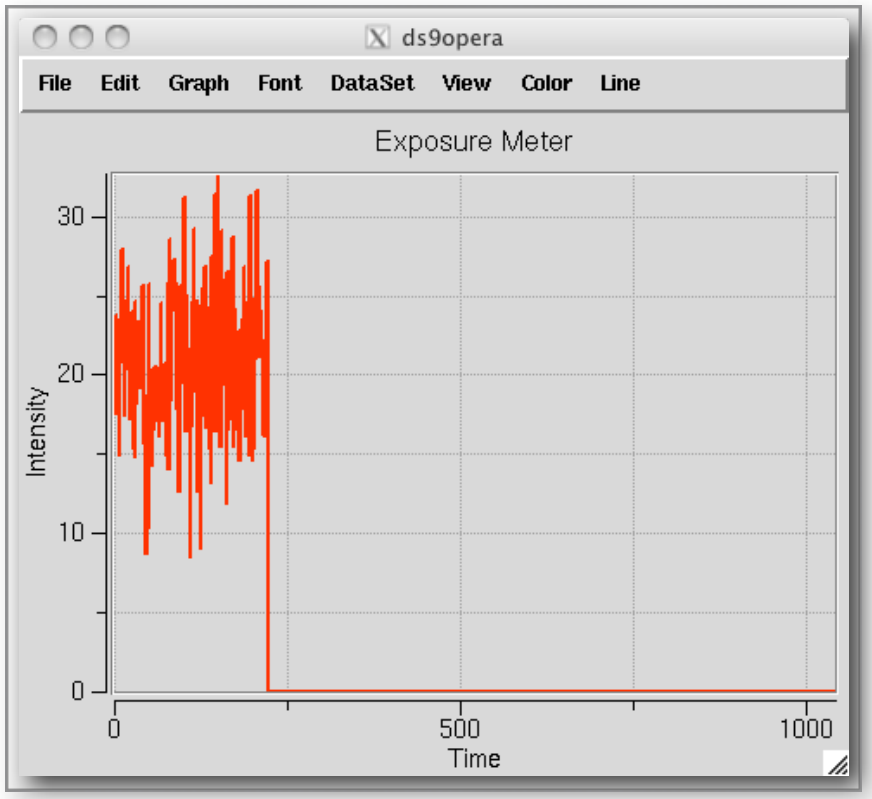

Figure 10 Exposure Meter

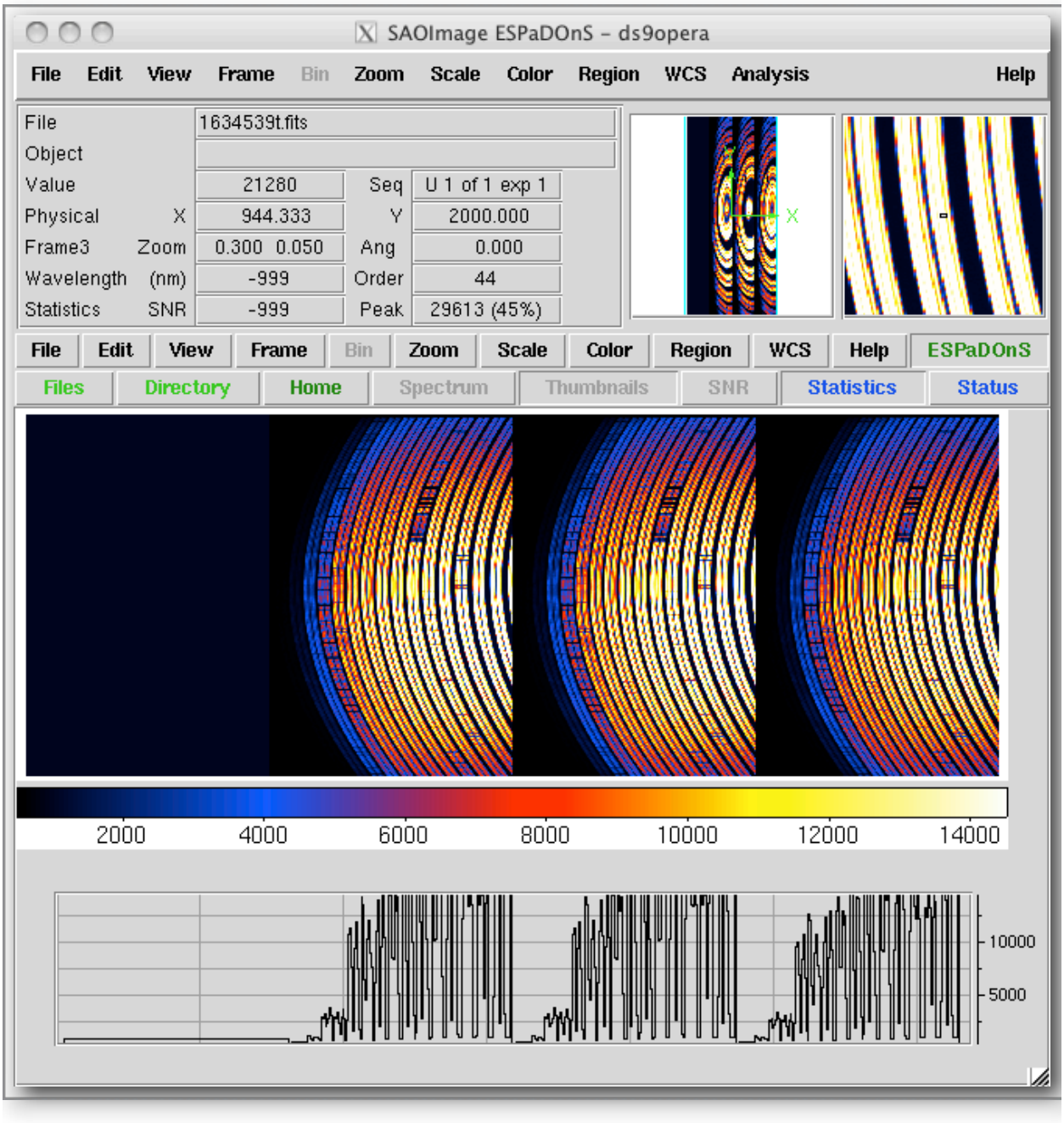

Figure 11 Thumbs View

Press the **Thumbs** ESPaDOnS button to view the flux of the last four images taken, as shown in *Figure 11*. This is useful for seeing trends in flux over time

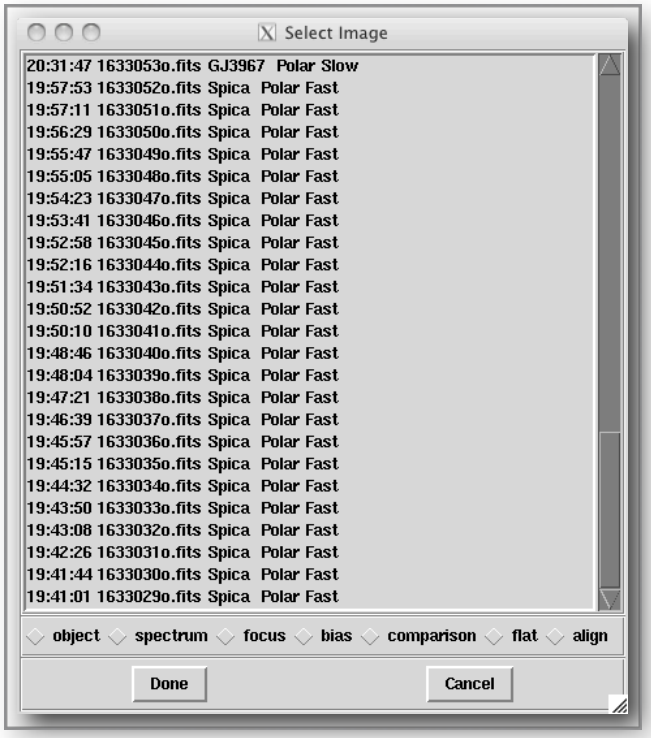

Figure 12 Files Dialog

Open the **Files** dialog as shown in *Figure 11*, by pressing the **Files** button. Then select a file for viewing from the list.The object name and mode / speed are shown for convenience in selecting an image. This feature is useful for offline browsing of images.

3. Conclusion

dsopera is a quicklook observing tool that significantly extends the capabilities of it's predecessor ds9espadons. It gives near real-time feedback of the images and statistics of images that are being taken during observation.