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[Home](#) > [Astronomers](#) > [Optical Instrumentation at SOAR](#) > [Goodman High Throughput Spectrograph](#) > Observing with Goodman

Observing with Goodman

Updated 5 Mar 2021

In this section the users will find the procedures and recommendations to carry out a successful observing night with Goodman. We strongly recommend that after going through this web page, you download and study the [Step-by-step User's Guide to Observing with Goodman](#).

NEW: For estimation of exposure times with Goodman, please see [this page](#). [1]

Before Your Run

Prior to your run at SOAR with the Goodman Spectrograph, you should have completed the [Instrument Setup Form](#) [2]. When using Goodman, it is important to send in this form well ahead of time so that any specific needs can be addressed before your run. In the instrument setup form you can also specify what binning you will use during your run. The recommended readout modes for 1x1 and 2x2 binning are 344ATTN3 for the RED Camera (gain=1.48 e-/ADU, readout noise=3.89 e-) and 200ATTN0 for the BLUE camera (gain=1.4 e-/ADU, readout noise=4.74e-). Information on the gain settings and readout noise for various readout options can be found in the [Goodman Overview](#) [3].

TARGETS: *we recommend you avoid using special characters in your target/file names, such as "." and "*". The acquisition software may truncate or not copy your file.*

In addition to filling out the [Instrument Setup Form](#) [2], visiting observers should read the [SOAR Visiting Astronomer's](#) [4] webpage for general information about traveling to and within Chile. Furthermore, visiting investigators should fill out the [Travel Information Questionnaire](#) [5] so that your transportation and lodgings can be arranged.

Observing logs for your run can be downloaded [here](#) [6].

Setting Up for the Start of Your Night/Run

Before you begin observing with Goodman, you should first make sure that the data acquisition GUI and the data analysis GUI are running as shown here in Figure 1.

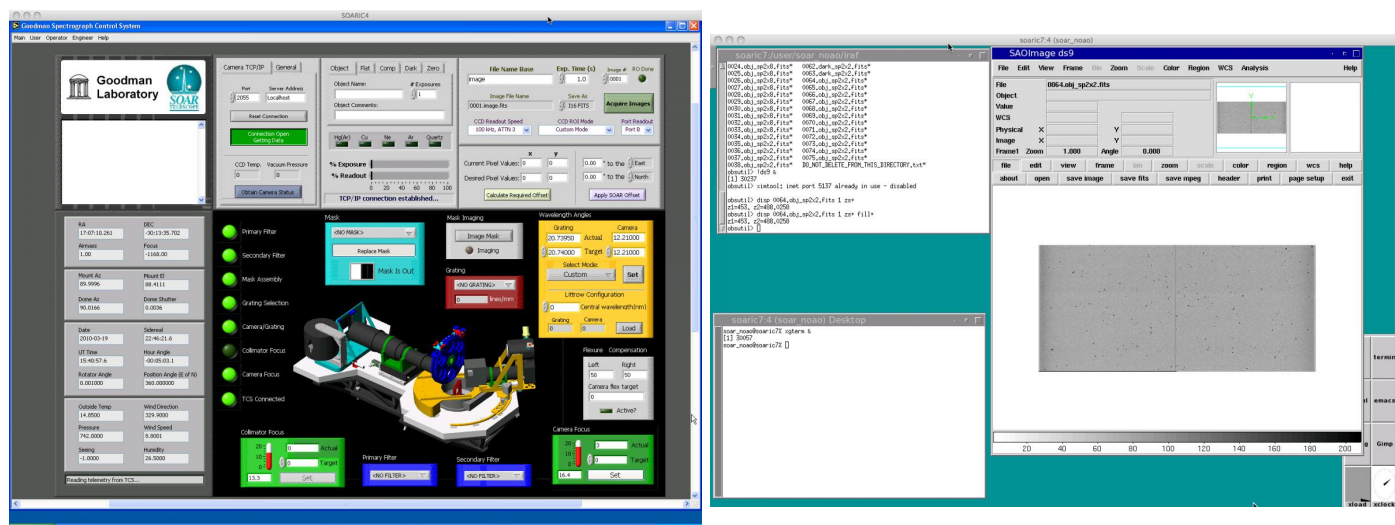


Figure 1: The Goodman Data Acquisition and Data Analysis GUI windows.

If these GUIs are not running, please refer to the sections about [Starting and Stopping the Data Acquisition GUI](#) [7] and [Starting and Stopping the Data Analysis GUI](#) [8] in the [Software](#) [9] section of the [Goodman Manual](#). [10] If you have problems with starting either of these, please contact the Telescope Operators or the Goodman instrument scientist (Sean Points). They will be able to help you with this task.

After the GUIs are running, you should check that:

- all of the connection status indicator lights are green.
- the readout speed, gain, and readnoise are set correctly for your program (see the [Goodman Overview](#) [3] for a description of these modes).
- the binning is set to the proper value (i.e., 1x1 imaging, 2x2 imaging, 1x1 spectroscopic, 2x2 spectroscopic, or custom). Information on how to set the binning is given in the **Acquisition and Exposure Status Region** section in the [Basic GUI Layout](#) [11], and in [this PDF document that gives guidance on how to best adjust the binning and set it to match your seeing conditions](#). [12]
- the focus values for observing modes are current. The current best-focus values for the preset Goodman observing modes are determined by the Instrument Scientist during engineering time, as time allows. If you want to make sure that you are achieving the best focus values for your run, we recommend that you perform a focus sequence at the start of your run. Details on determining the best focus are given below in the [During Your Night/Run](#) section of this manual.

You are now ready to use the Goodman Spectrograph.

During Your Night/Run

Daytime Calibration Data

Performing a focus:

- Select spectroscopic 1x1 binning to focus the internal camera optics of Goodman because it gives the highest angular and spectra resolution per pixel (see Figure 2).
- Change the ROI to speed up the process (see Figure 3).

- Select 750kHz ATTN 0 (or 400 kHz ATTN0 in blue camera) readout so that you have the shortest readout times for 1x1 spectroscopic mode (see Figure 4).
- Select the 0.45 arcsec slit mask to obtain the highest spectral resolution that is possible. That is, the average FWHM of a comparison lamp emission line profile should be ~ 3.0 pixels (see Figure 5).
- Select the filter you will use, if any (see Figure 6).
- Select the grating to be used (see Figure 7).
- Select the camera and grating angles (See Figure 8).
- Select to take a **Comparison Lamp Spectrum** (see Figure 9) and turn on one of the arc lamps (HgAr is preferred for all modes). You can take a comparison lamp spectrum by selecting the "Comp" tab in the Goodman "Acquisition and Exposure Status" region of the GUI. In the left-middle section of this region, one can turn on (off) the internal ISB calibration lamps. When the lamps are turned off, they are a dark green color. When they are turned on, they are bright green in color. We also note that sometimes there are communication problems between the Goodman GUI and the SOAR TCS. It is always recommended that you ask the TelOps staff if the lamps really is on (off). You will also need to ask the TelOps staff to place the comparison lamp mirror into the beam to take a comparison lamp spectrum.
- Set the Camera Focus to -2000 units (see Figure 10) and take a spectrum. Continue to increment the camera focus by +500 units until you have taken spectra with camera foci from -2000 to +2000 units.
- After you have taken arc lamp spectra for camera focus values between -2000 and +2000 units, you will need to determine the best camera focus value. This is easily done with the IRAF "**specfocus**" task that is located in the NOAO obsutil package. The output of specfocus should look like Figure 11.
- As a precautionary measure, it is also useful to check the output of specfocus using the IRAF imexam task. Display the spectrum in the data analysis window


```
>disp nnnn.hgar_400_gg385.fits 1 zs+
>imexam
```

 Use the "j" key to measure the FWHM of the arc lines that appear in the spectrum. For spectra taken without the order blocking filters, the FWHM should be around 3 pixels. For spectra taken with the order blocking filters, the FWHM will be around 3.5 pixels.
- You will want to take internal camera focus sequences for as many observing modes that you plan to use during the night - imaging and spectroscopic. The camera focus value changes between imaging and spectroscopic mode because the grating is either out of the beam or in the beam.
- Similar process for imaging. See figures [here](#) [13].

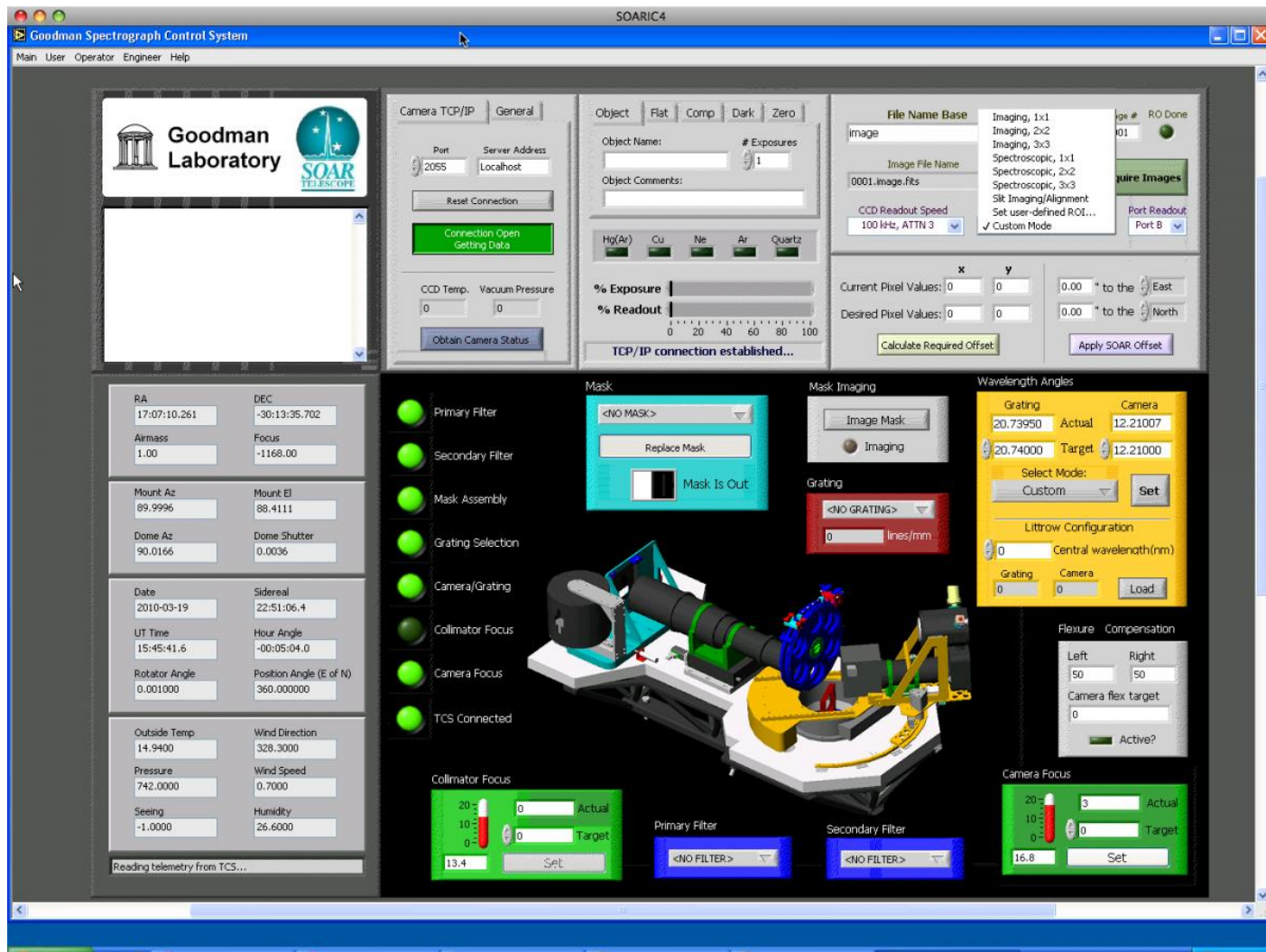


Figure 2: Selecting the CCD geometry (i.e., 1x1 imaging, 2x2 imaging, etc.)

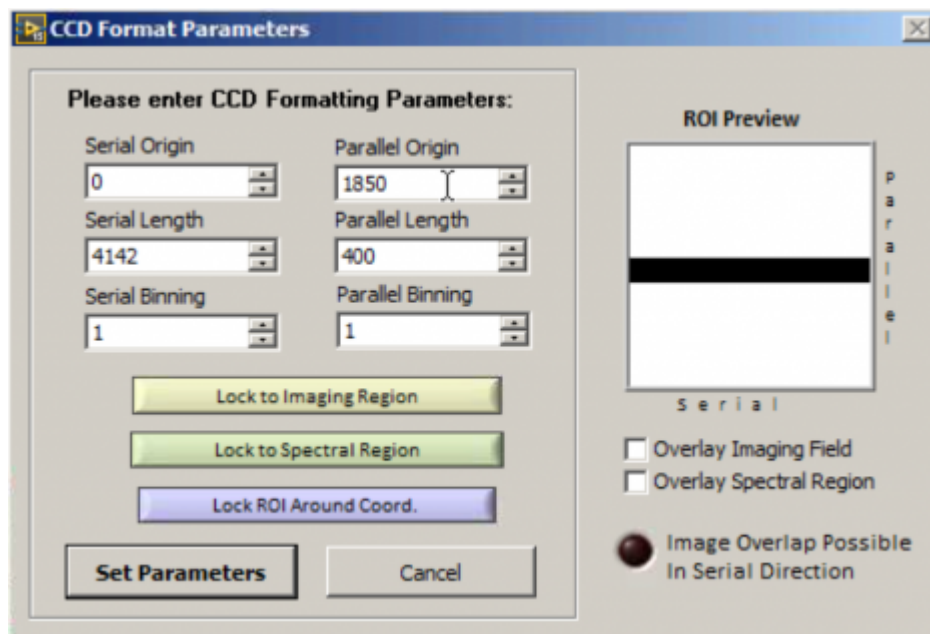


Figure 3: Selecting the CCD geometry (user-defined ROI)

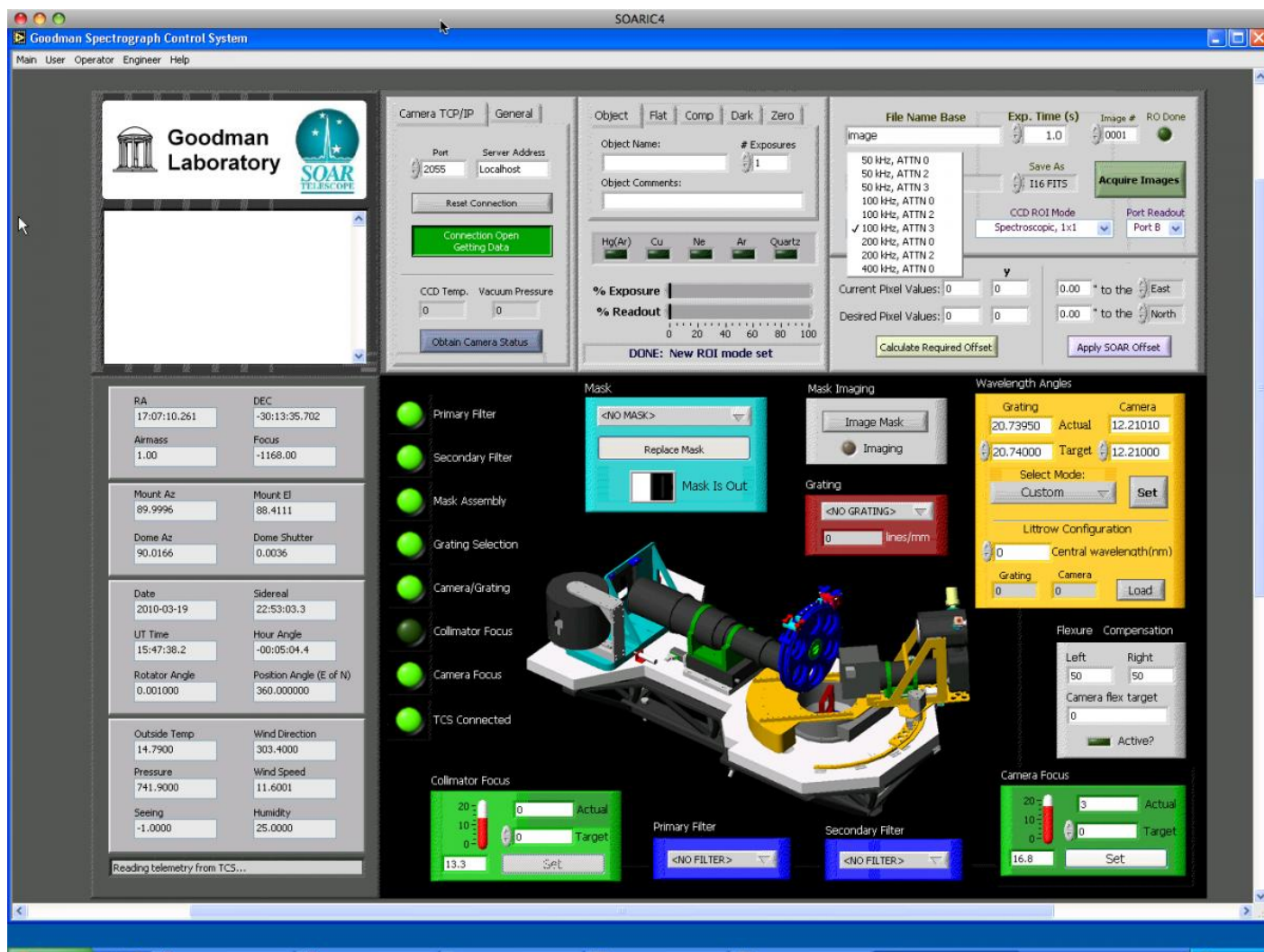


Figure 4: Selecting the CCD readout speed. Please see the Overview section of this manual for the gains (e/ADU), read noise (e), and readout times for 1x1 spectroscopic binning.

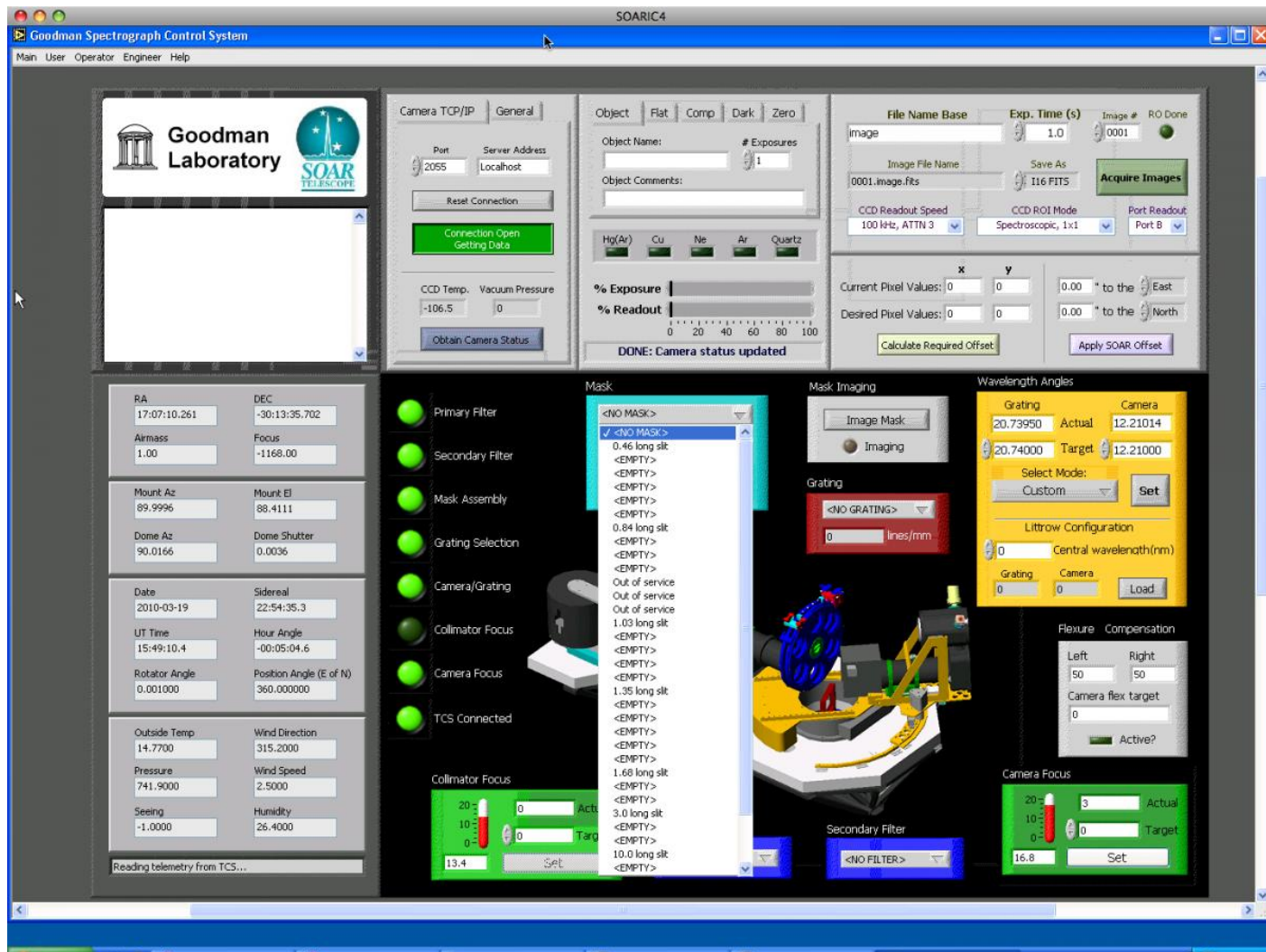


Figure 5: Selecting the slit mask to be used.

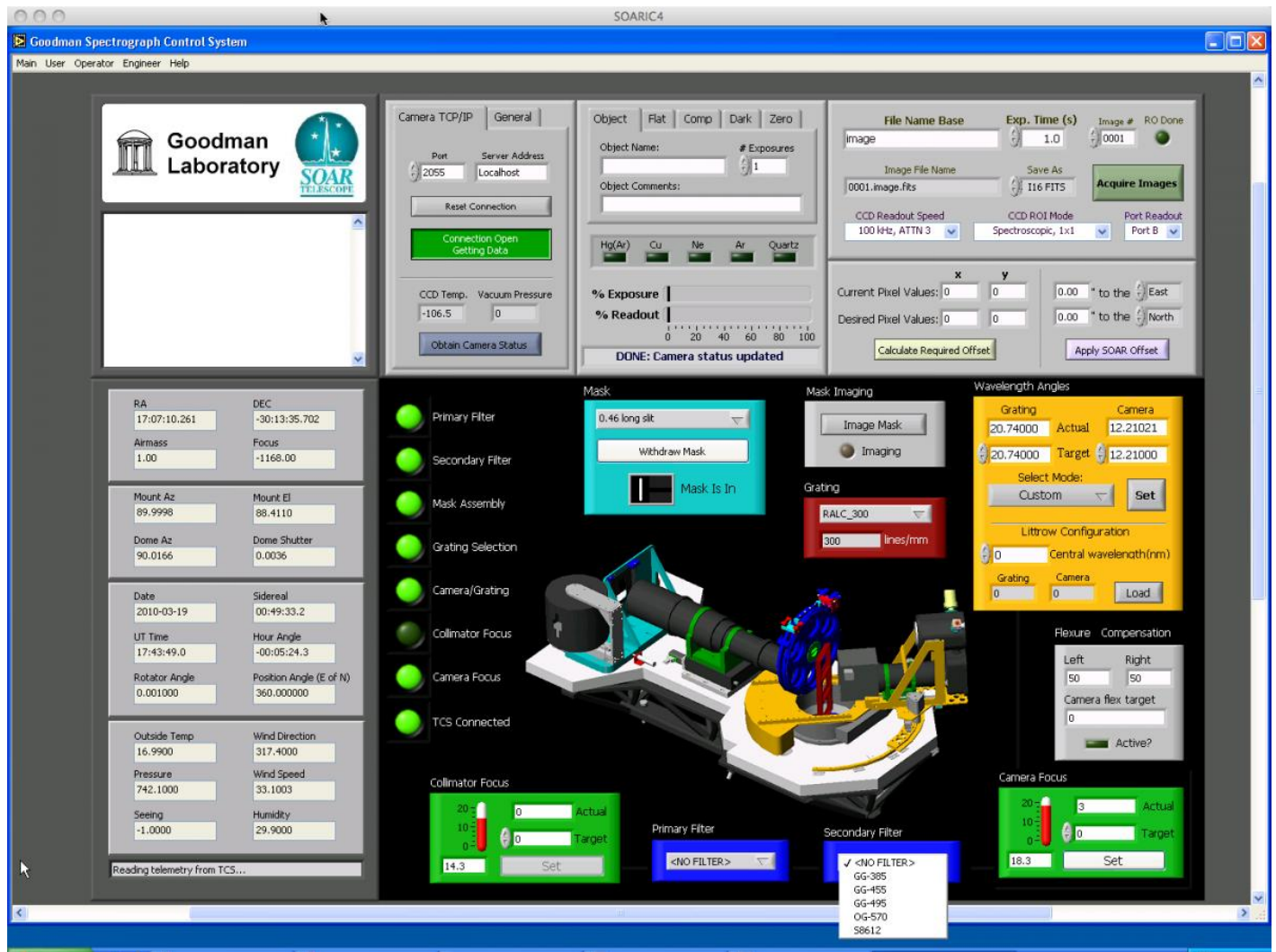


Figure 6: Selecting the order-sorting filter (secondary filter), if any, to be used.

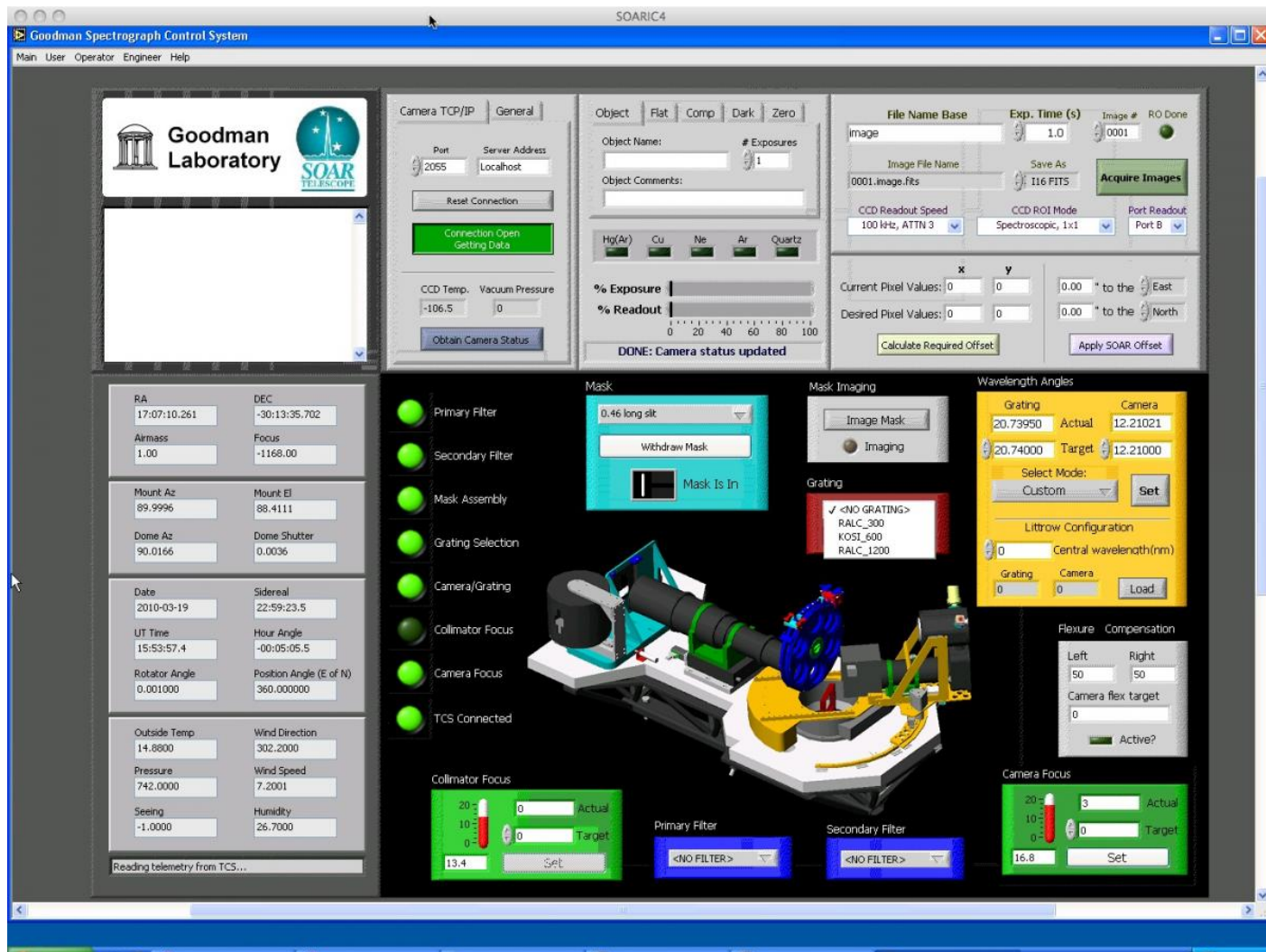


Figure 7: Selecting the grating.

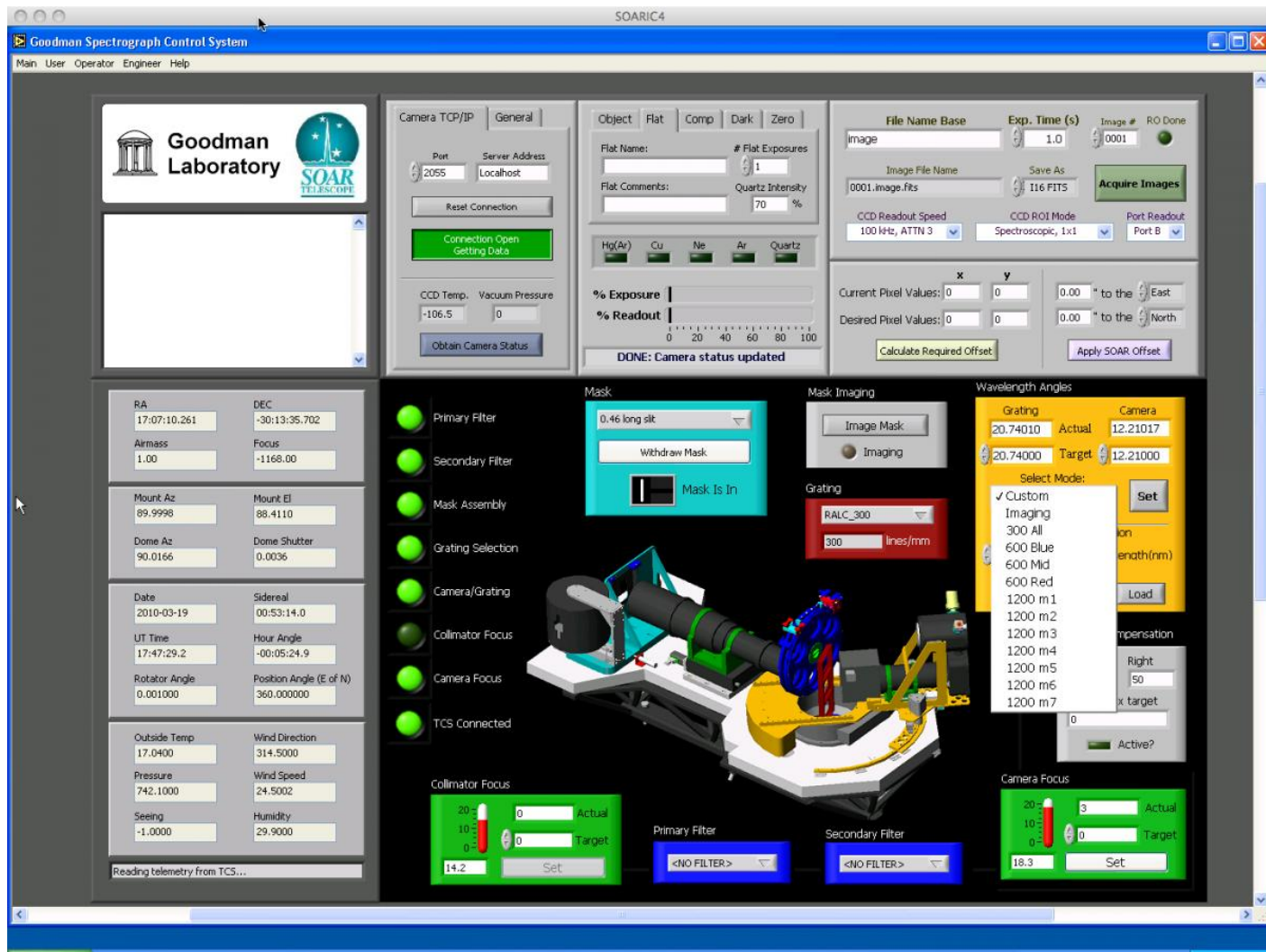


Figure 8: Selecting the camera and wavelength angles.

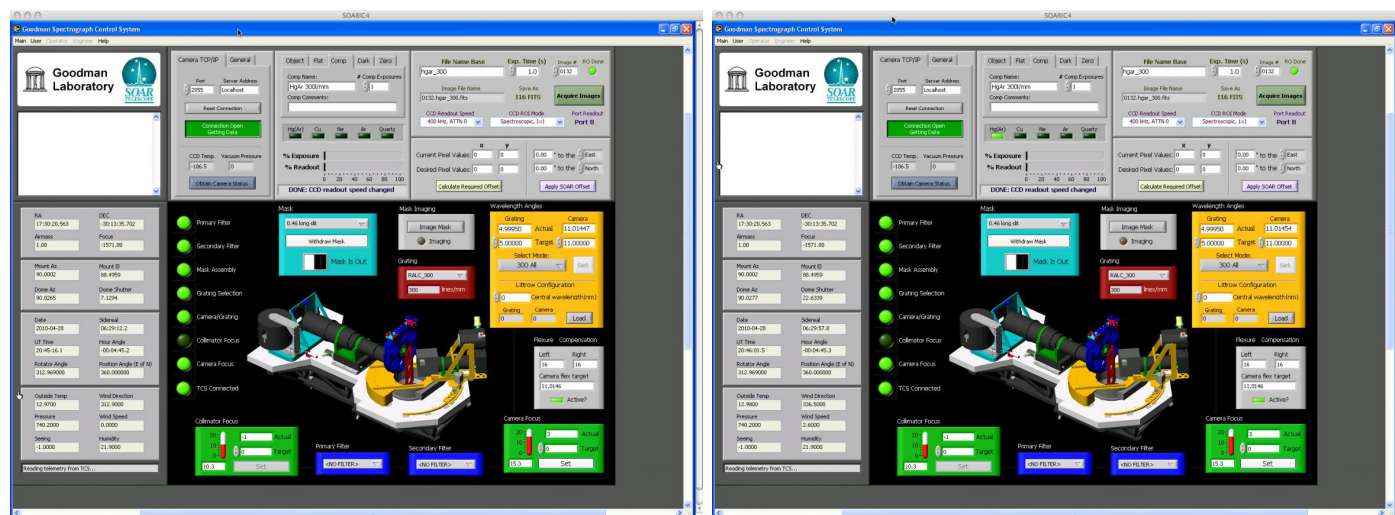


Figure 9: Taking an arc lamp spectrum.

Figure 11: Determining the best camera focus value with the specfocus task within IRAF.

Taking Bias Frames

Select the "Zero" tab in the **Acquisition and Exposure Status** region of the GUI. Make sure that the CCD binning and readout parameters are set to the values that you will use for your science observations. Select how many bias frames you want to take. You will want to take bias frames for as many different observing modes you plan on using during the night. That is to say, if you plan on observing during the night in 1x1 spectroscopic mode with the 300 l/mm grating 100kHz ATTN3 readout and the 600 l/mm grating (mid) 200kHz ATTN2 readout, you should take bias frames for both the 1x1 spectroscopic 100kHz ATTN3 and 200kHz ATTN2 readouts.

Taking Comparison Lamp Spectra

Select the "Comp" tab in the **Acquisition and Exposure Status** region of the GUI. Select the CCD binning and readout parameters to the values that you will use for the night. We advise that observers take a set of comparison lamp spectra using the 0.45" slit mask as well as the slit mask they will be using during the night. This may help the observer in deblending any lines when using the wider slit masks. We also note that it can be difficult to obtain a sufficient number of lines to determine an accurate wavelength solution in the blue preset modes using the HgAr lamp. Therefore, we also recommend taking some spectra of the CuHeAr lamp.

Taking Quartz Flats

Select the "Flat" tab in the **Acquisition and Exposure Status** region of the GUI. Select the CCD binning and readout parameters to the values that you will use for the night. Take the quartz flats you need for all of the observing modes you will use during the night.

Nighttime Observing

- 1) Slew to target
- 2) Move to "image mask" mode
- 3) Withdraw slit
- 4) Take image of field and note x,y coordinates of object in current position field (in "Current Pixel Values")
- 5) Move slit back into place
- 6) Take image of slit and note x,y coordinates of slit center in desired position field (in "Desired Pixel Values")
- 7) Make offset ("Calculate Required Offset" -> "Apply SOAR Offset")
- 8) Take image of object on slit. Is it centered? If not, perform another offset with slit in place.
- 9) Repeat 8 as needed
- 10) Change readout speed and move grating and camera into spectroscopic mode
- 11) Take spectrum
- 12) For faster target acquisition for relatively bright targets ($V \leq 18$), the [GACAM](#) [14] may be used.

[Click here for additional information and tips on how to get your target spectrum](#) [15].

[Click here for tips and advice on how to take direct images with Goodman.](#) [16]

After Your Night/Run

At the end of your observing night, please fill out the [End-of-Night](#) [17] report for the telescope. Please make note of any problems that were encountered during the night so that they may be resolved before the next night's observing.

Also, at the end of your night observing with Goodman, you may want to transfer your data back to your home institution. To do so, open a local Terminal in your home institution, and scp the data from soaric7.

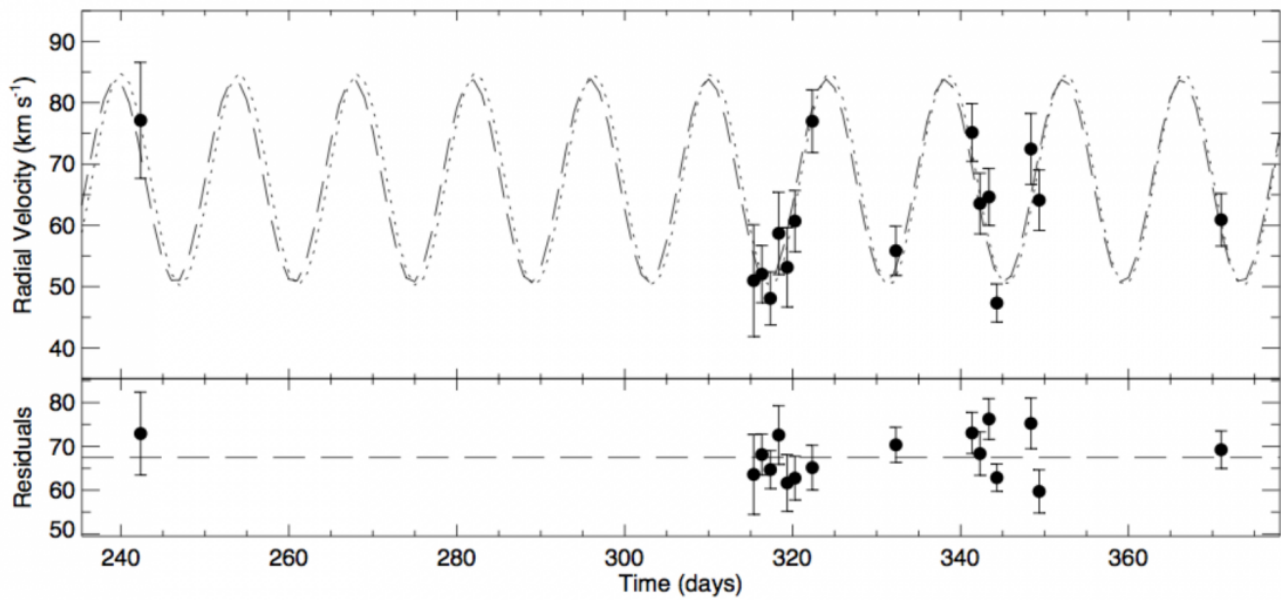
After your run is complete, please fill out the [End-of-Run](#) [18] report.

[The Goodman step-by-step Observing Guide \(PDF presentation\)](#) [19]

Observing with Goodman (PDF guides):

- [Connecting to the Goodman GUI](#) [20]
- [Starting up the Goodman GUI](#) [21]
- [The Goodman GUI layout](#) [22]
- [Setting up the binning](#) [12]
- [Setting up the Region-of-Interest \(ROI\)](#) [23]
- [How to take a spectrum](#) [15]
- [How to take a direct image](#) [16]
- [Shutting down the spectrograph](#) [24]

Measuring Radial Velocities with the Goodman HTS ([PDF guide #1](#) [25] and [#2](#) [26] - read both)



Goodman User Startup/Shutdown Guide

Goodman High Throughput Spectrograph

Startup/Shutdown Guide

Updated: May 25, 2020; C. Briceño

This is a step-by-step guide for the Goodman HTS users on the regular procedure for starting up the spectrograph GUI and related programs each evening. **It assumes that the CCD camera SI Image SGL software is running, and hence that the camera cryostat is at the appropriate vacuum (Pressure=0, T=-106.7 C for the Blue Camera and Pressure=0, T=-100 C for the Red Camera).**

Starting up the Goodman GUI programs

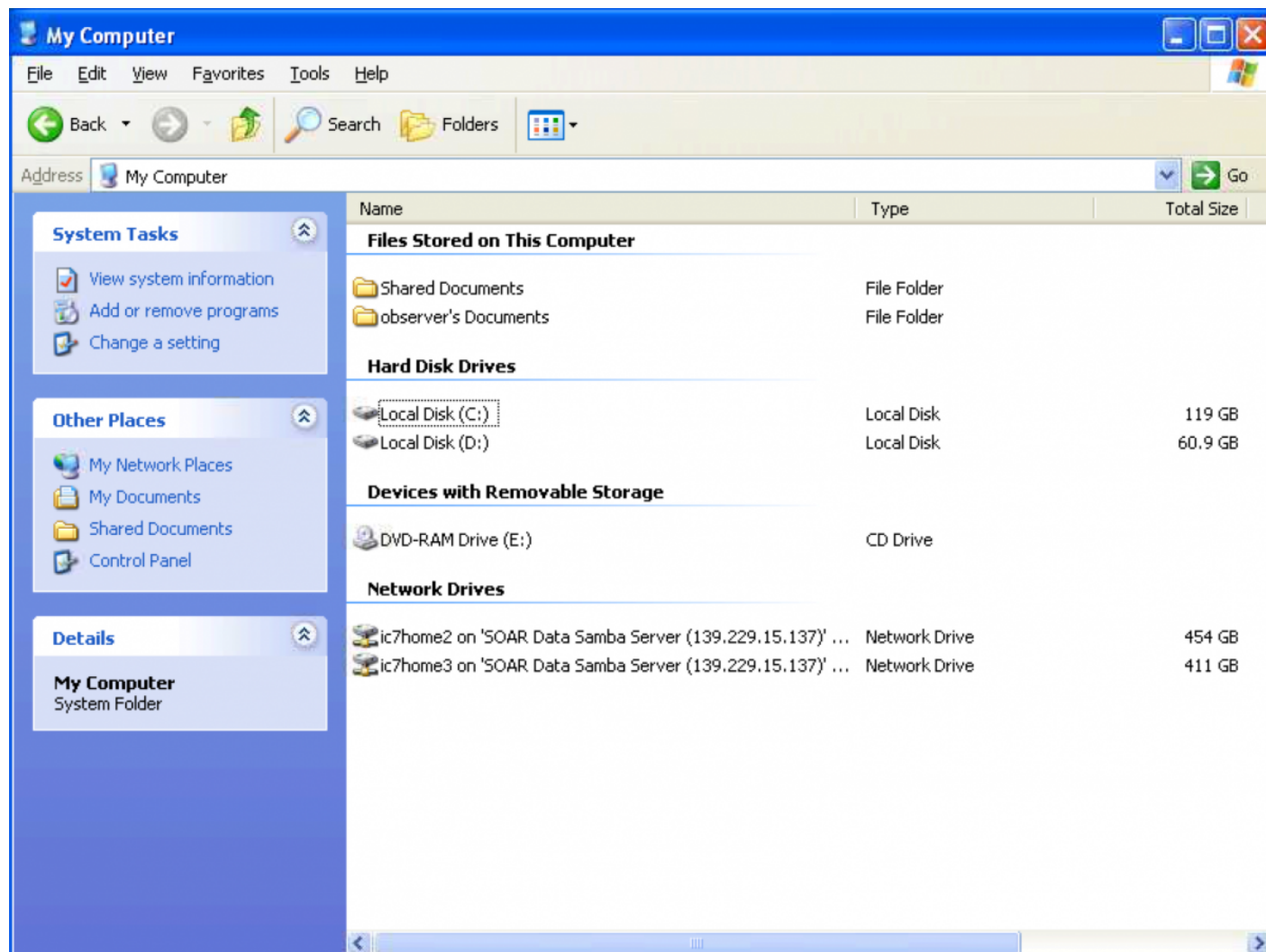
(the procedure is the same for both the Blue and Red Cameras)

[Click here for a PDF document containing information and screenshots on the GUI-related startup procedures.](#) [21]

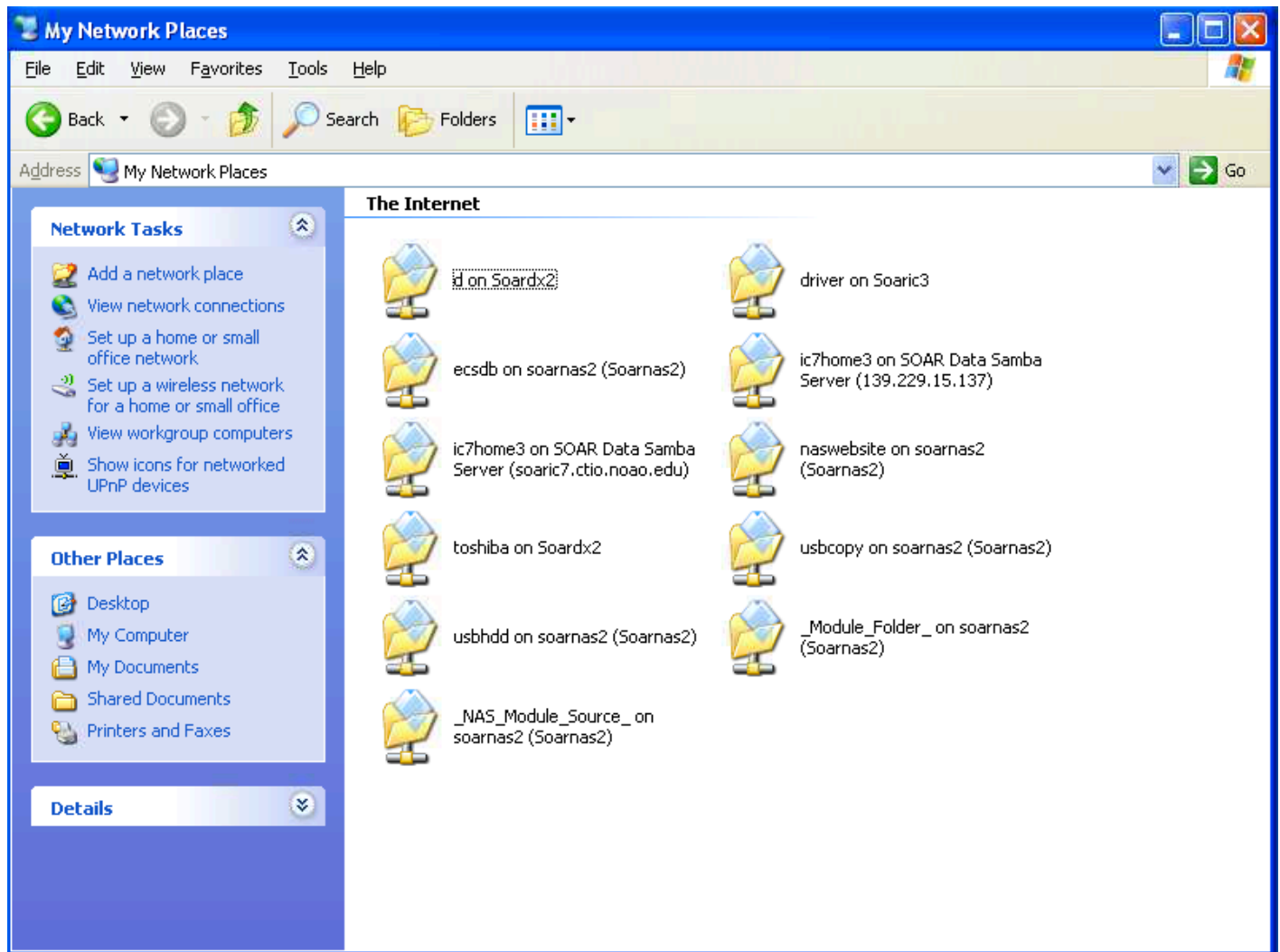
Starting the LabView Applications

1) Make sure that the transfer to soaric7 is working.

2) Open the "My Computer" icon on the Desktop and see if "ic7home3" on "SOAR Data Samba Server" is present.

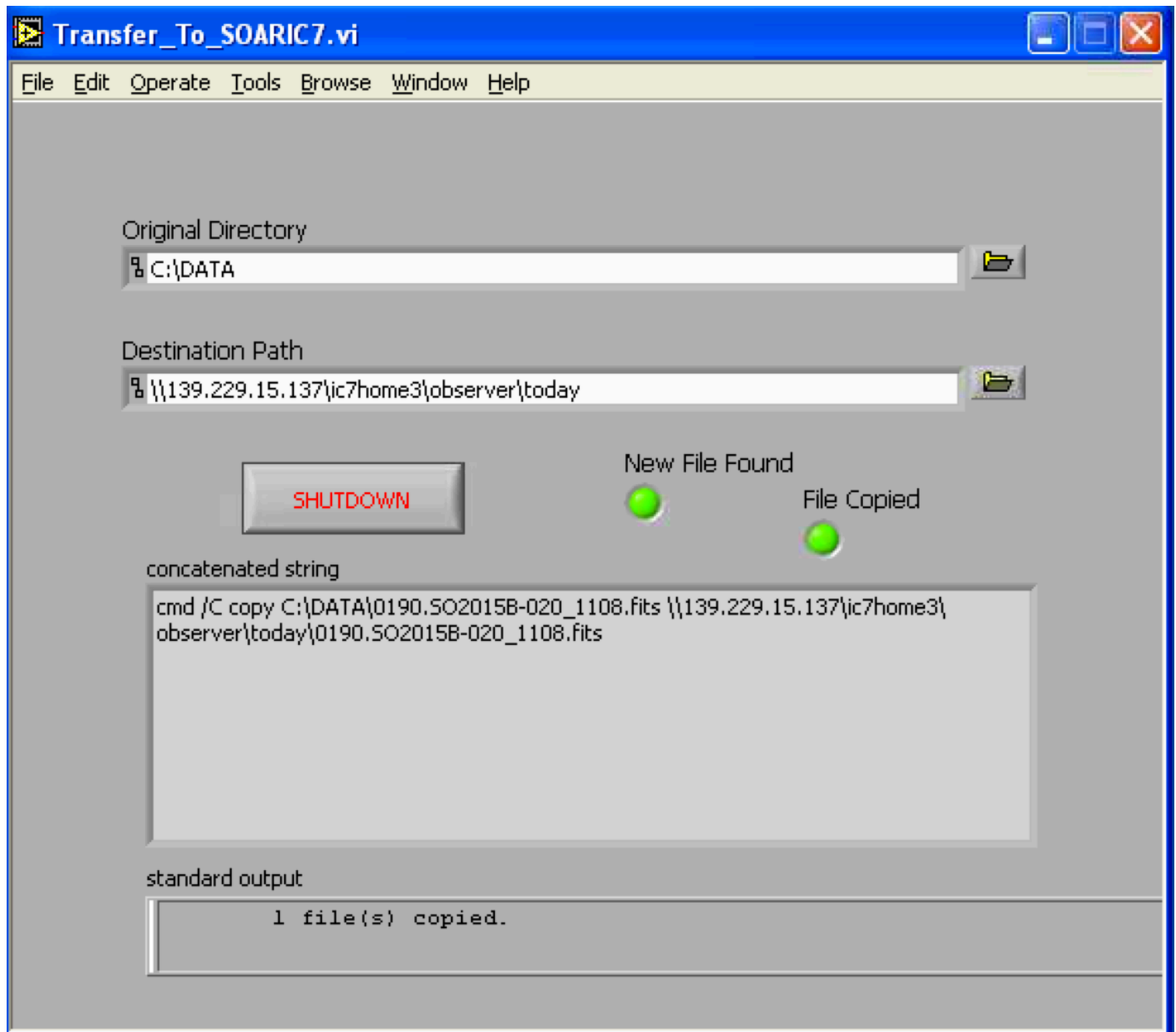


3) If it is not open, click on the "My Network Places" icon on the Desktop and then click on the "ic7home3 on SOAR Data Samba Server" icon. The Instrument Scientist has the logon and password information.

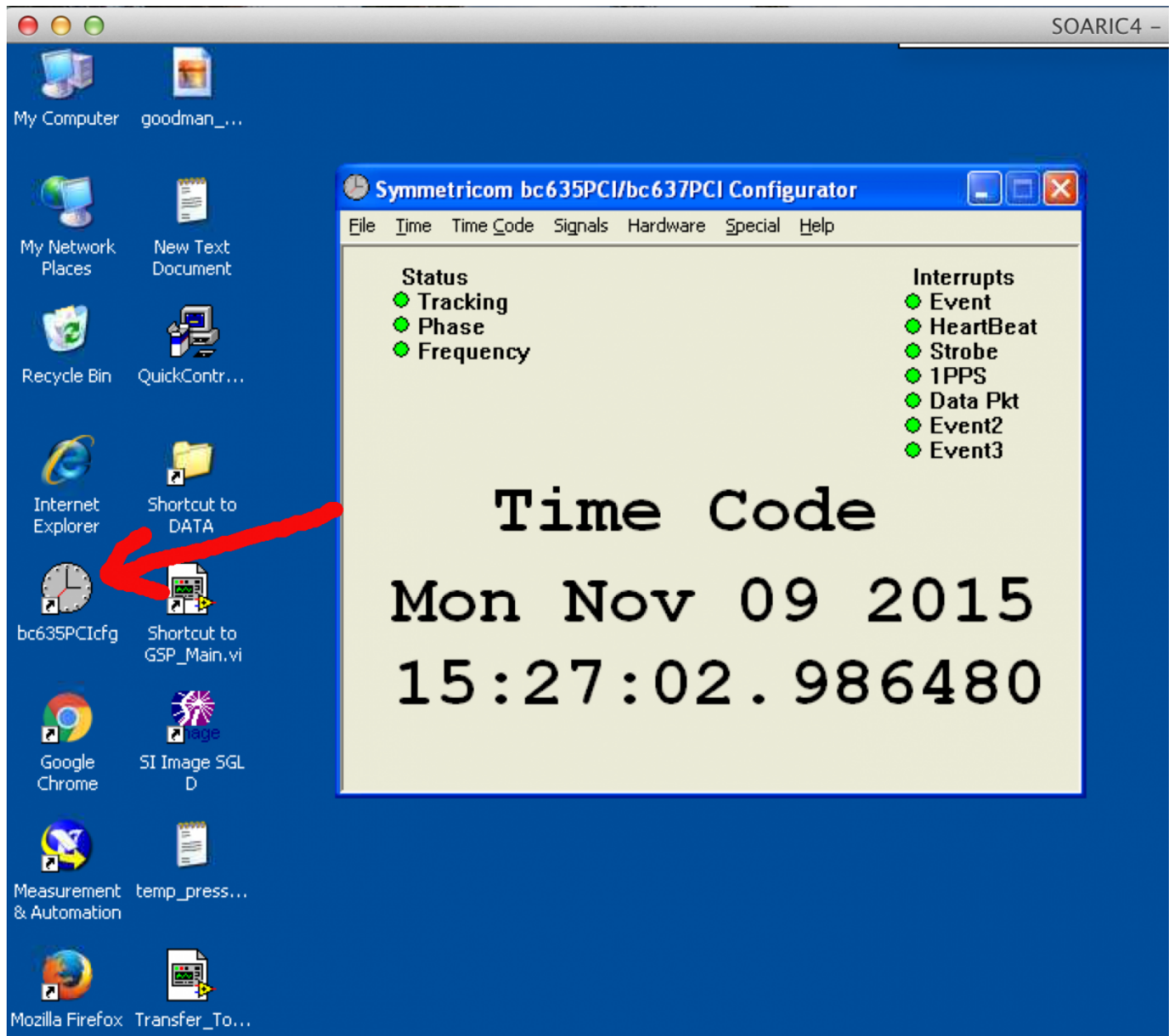


4) Click the "Remote Transfer to soaric7" LabView shortcut on the Desktop and start the application by clicking on the light grey arrow in the upper left corner of the LabView window.

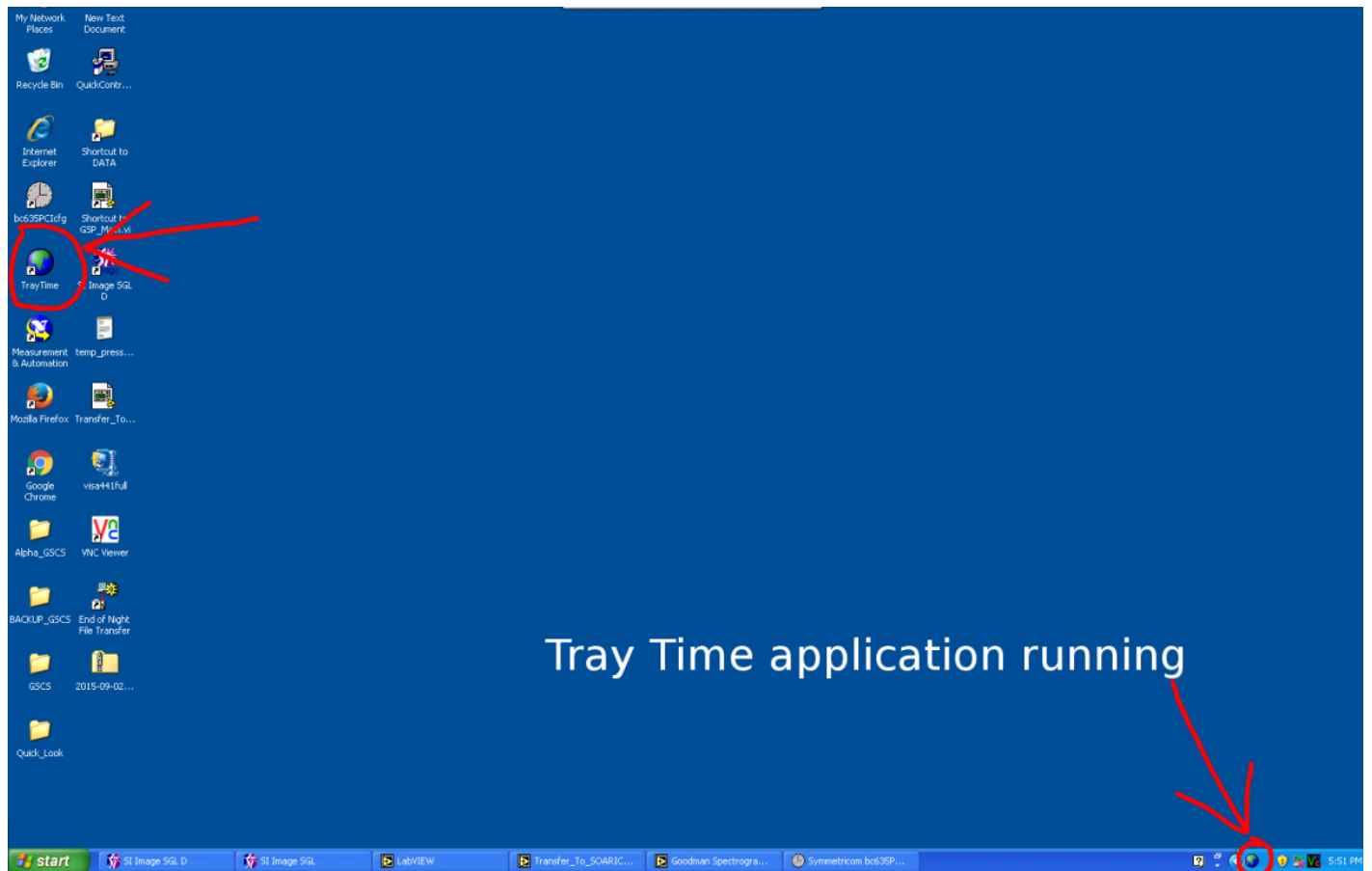




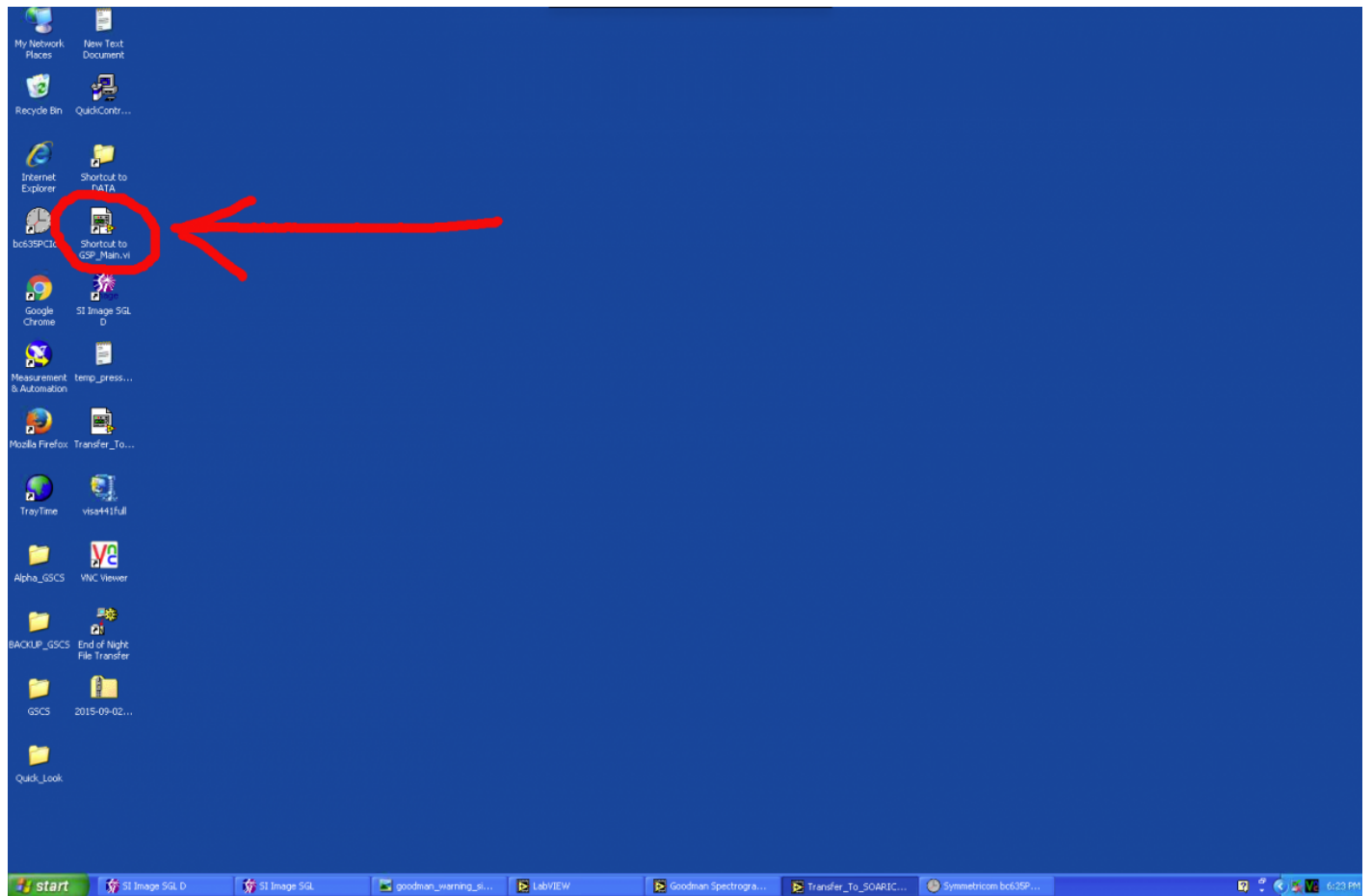
5) Make sure the Symmetricon GPS Real Time clock is running, and minimize it. It should be left running. This will be the time signal that will be recorder in the Goodman FITS image headers:

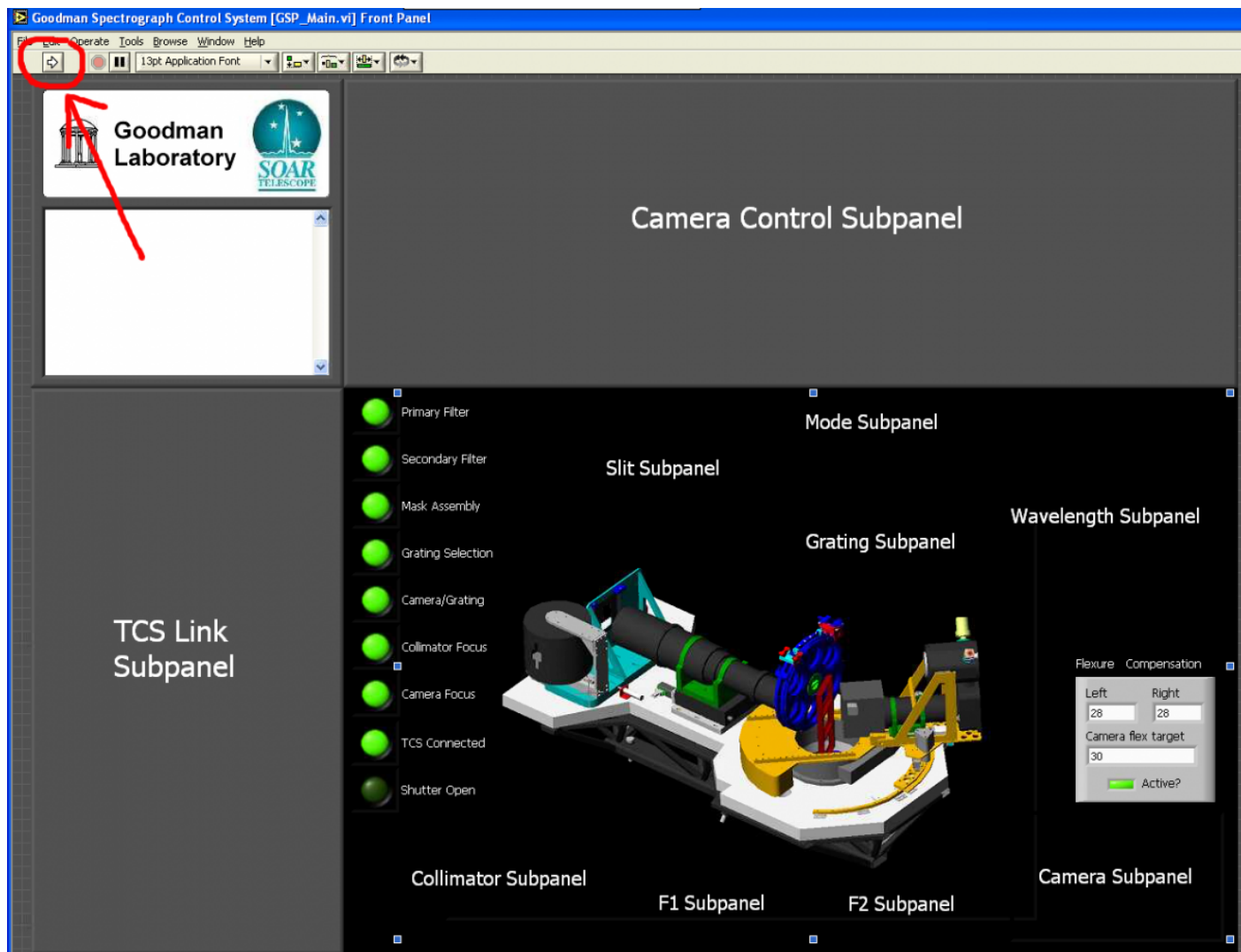


6) Make sure the Tray Time Application is running. Tray Time is the little globe icon indicated in the screenshot below. Tray Time is used to automatically sync the computer's system time with the symmetricom gps time. Even with symmetricom running GSCS still only reads the system time so without Tray Time running we are not actually recording GPS times in the header. Once you double click Tray Time, you should see the little globe icon appear down in the taskbar on the bottom right of the screen.

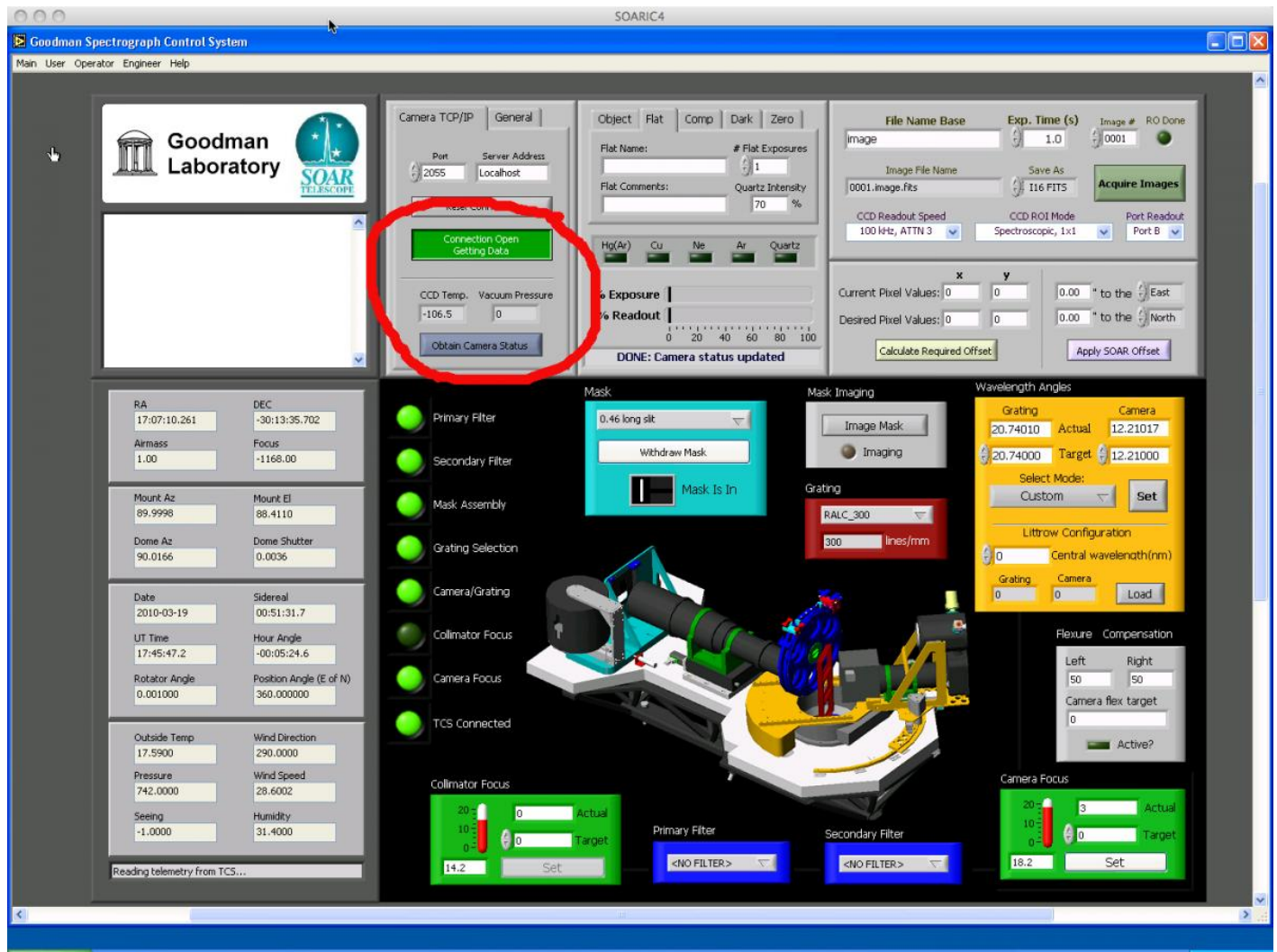


7) Open the Goodman controls by clicking on the "GSP_Main" LabView shortcut on the Desktop and start the application by clicking on the light grey arrow in the upper left corner of the LabView window.

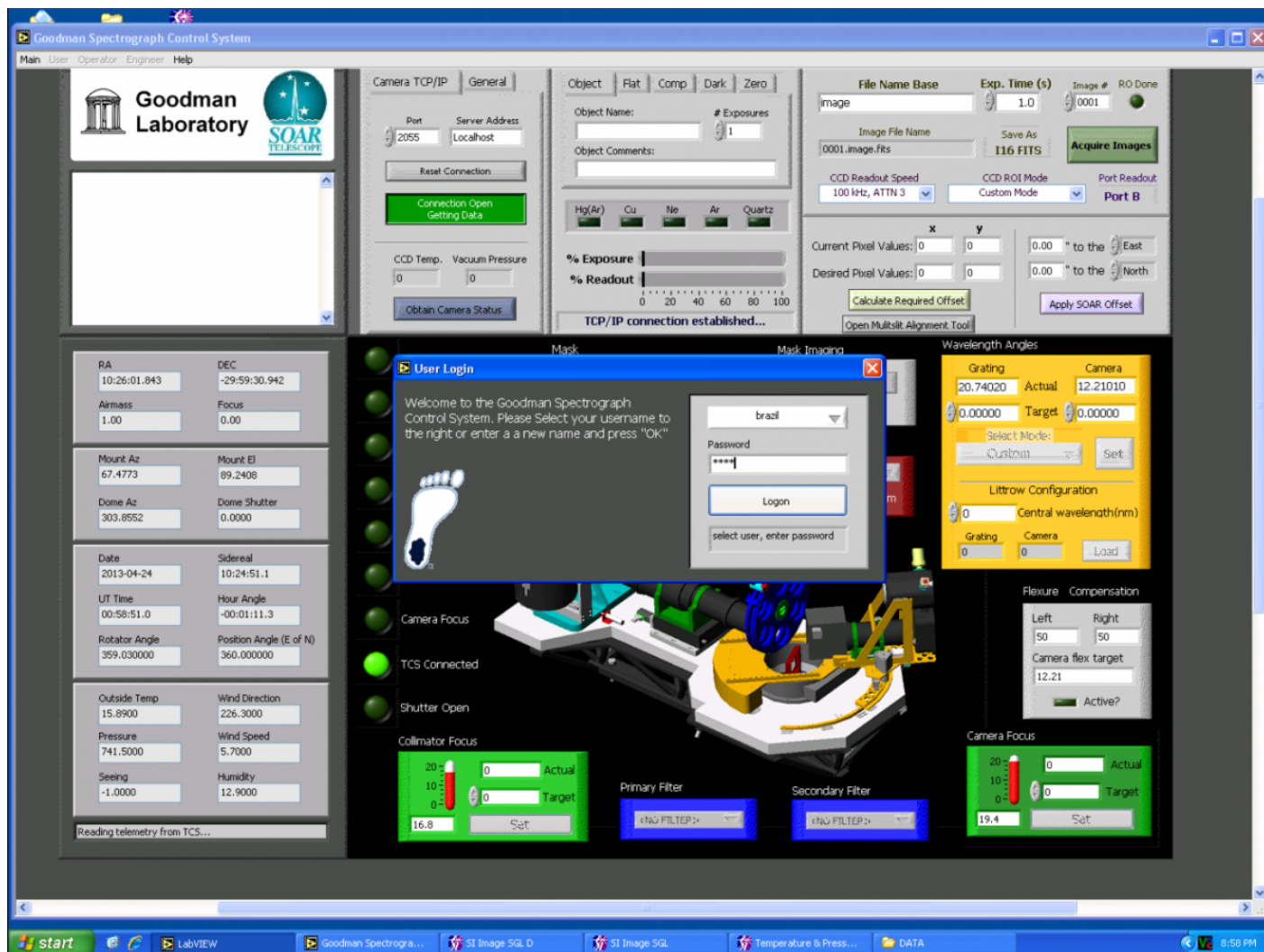




8) Check the camera panel. If a green button is present for "Connection Open/Getting Data" in the upper left of the GUI, Goodman "sees" the SI Image camera control software and a TCP/IP connection is available to take data. You can confirm this by clicking on the "Obtain Camera Status" button. During a normal startup of the GSP Main GUI the Camera Temp will read "0". If the TCP/IP connection is operating, clicking on the "Obtain Camera Status" will show the latest temperature. If Goodman is cooled, the CCD Temp should be -106.5. If the CCD Temp does not update, you will need to check the SI Image SGL D window and make sure that a TCP/IP connection is open.



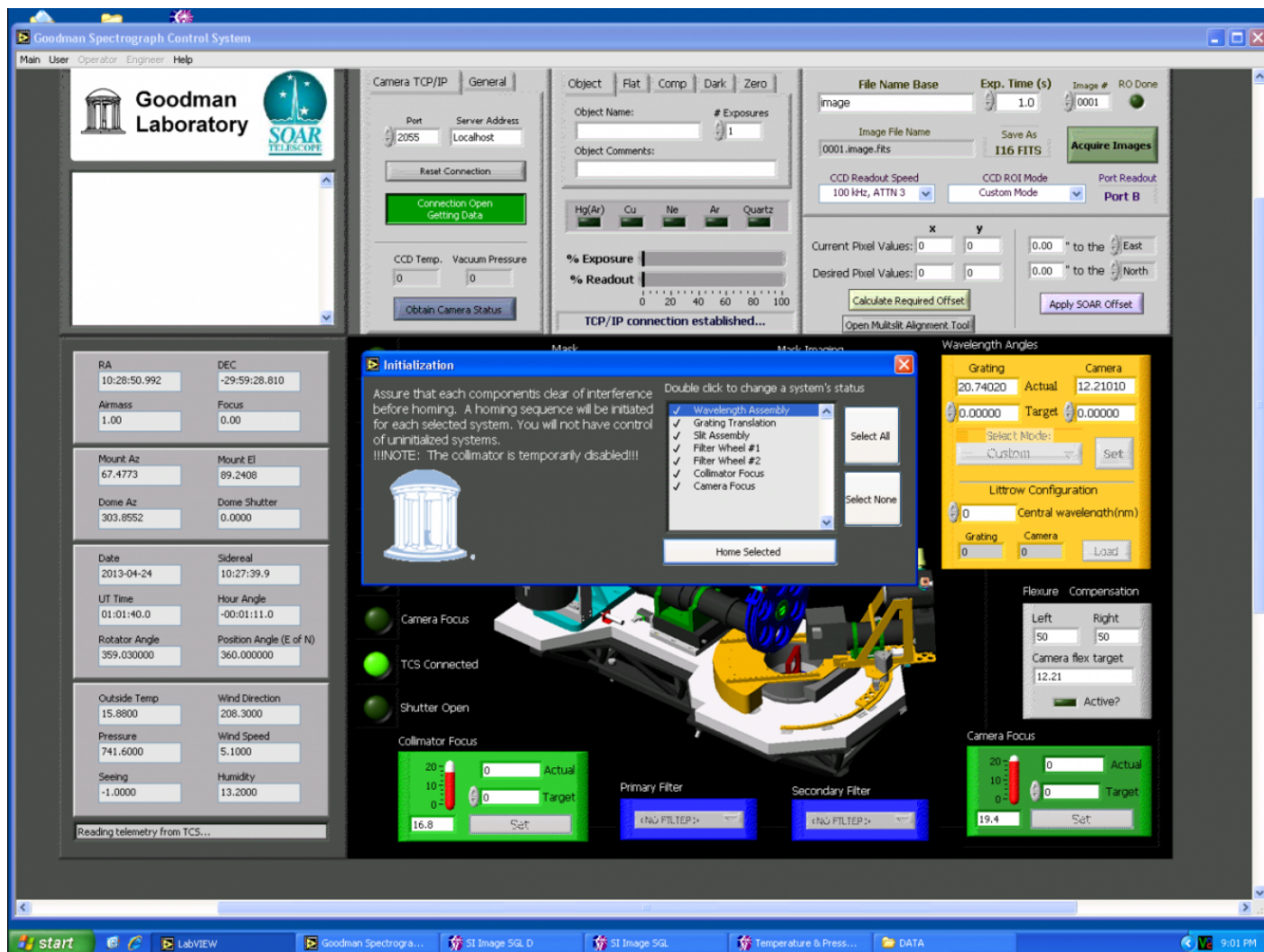
9) Click on Main tab and logon;



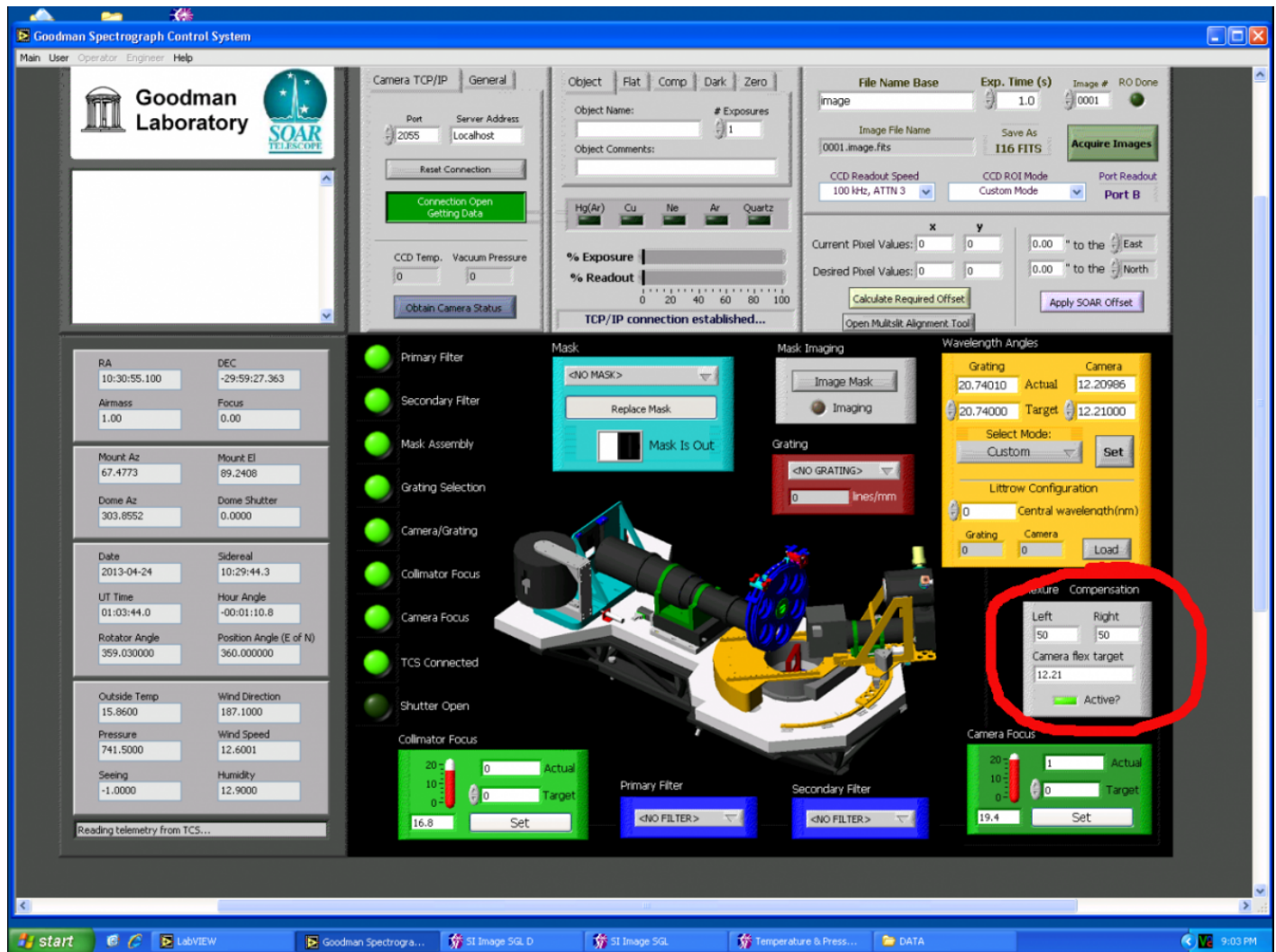
Use the account appropriate for your observing program (i.e., BRAZIL, CHILE, MSU, NOAO, OTHER, or UNC) with the password provided by your institution.

10) Click the User tab and go to "Home Systems" Select **Home all** (**WARNING NOTE:** Always make sure with the Telescope Operator that it is ok to home systems, e.g., that the telescope is at **Rotator Angle=0**, the instrument is at **PA=0**, and that the Goodman electronics have been powered on. If you see a red warning sign displayed in the Goodman VNC, **STOP**, do not proceed under any circumstance and contact the Telescope Operator before continuing with any task). Once you have clicked on **Home all** you should see the dark green lights change to yellow on the control panel as systems are being homed. This process will take several minutes; the Slit Mask stage will take the longest. Upon a successful homing of the systems, all lights should be bright green. If there are any red lights, you will need to log out of GSP Main and shutdown and ask the Telescope Operator to cycle the power on the Goodman motor electronics.

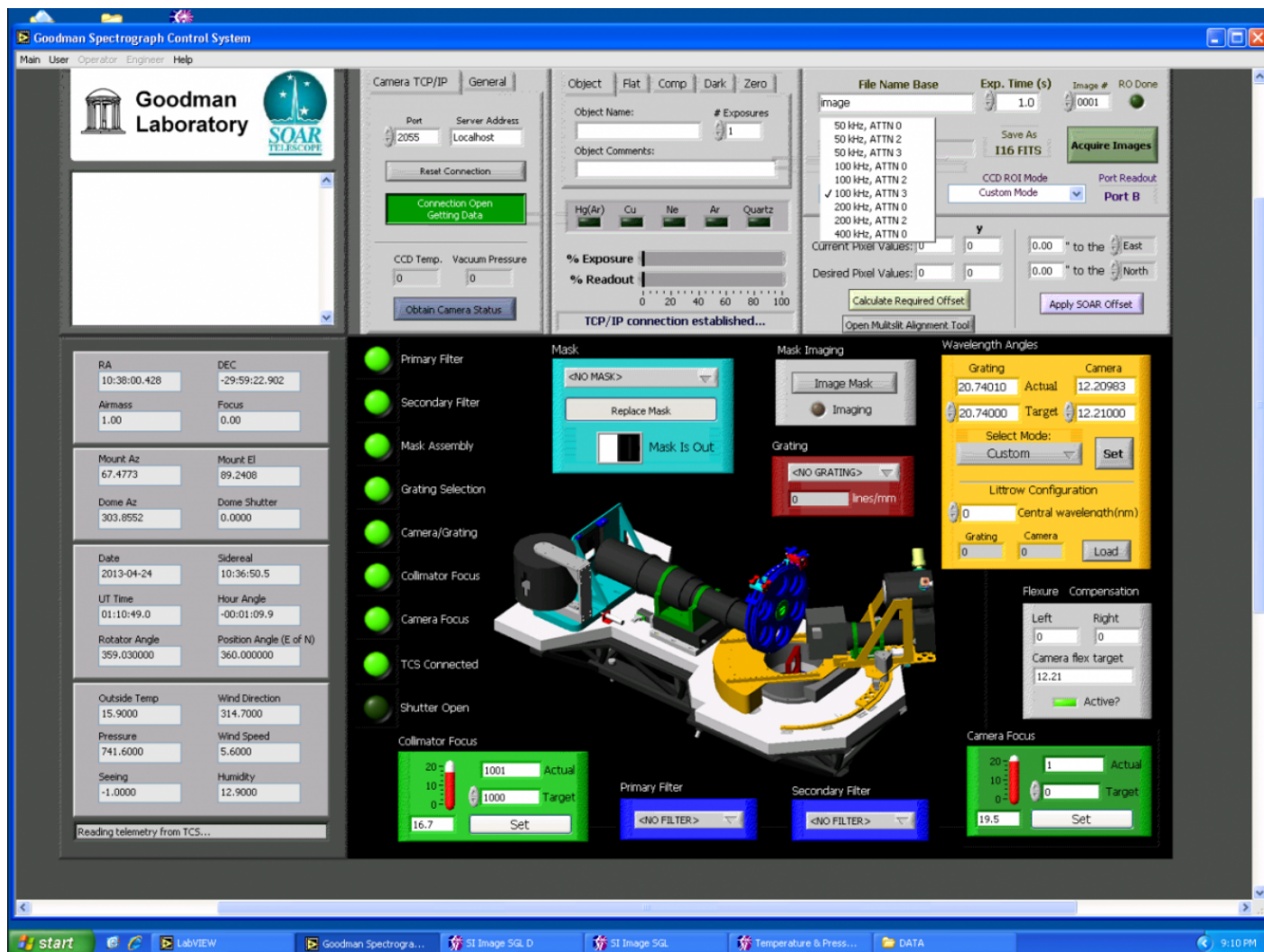


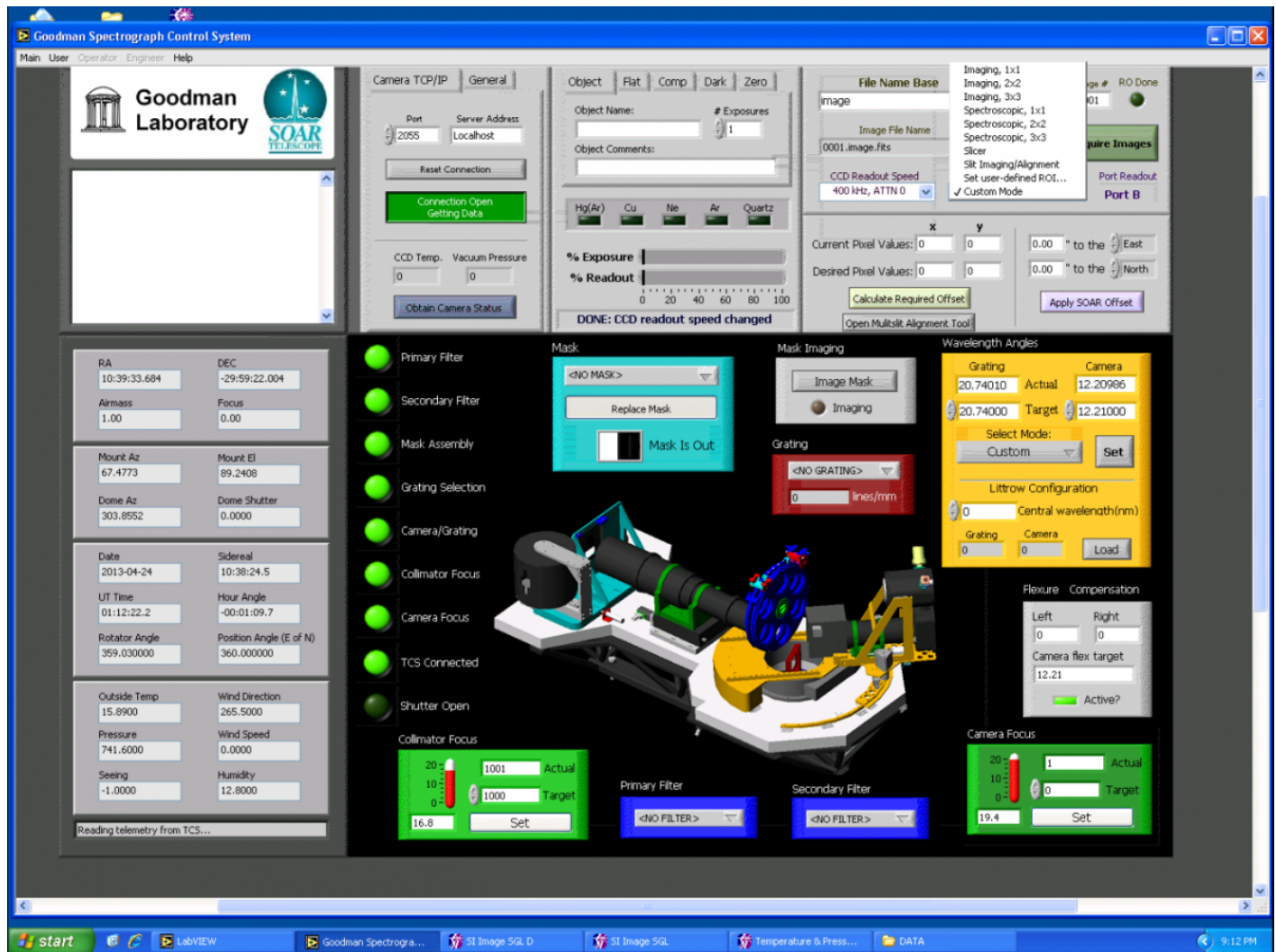


11) After the camera is homed, **start the flexure correction** by clicking the flexure LED. It should change from dark green to bright green.



12) Select Gain and Readout Setting. These values are given in the table below. The default is 100kHz ATTN3, but as with the Port readout, it needs to be changed to another value before it is initialized correctly.

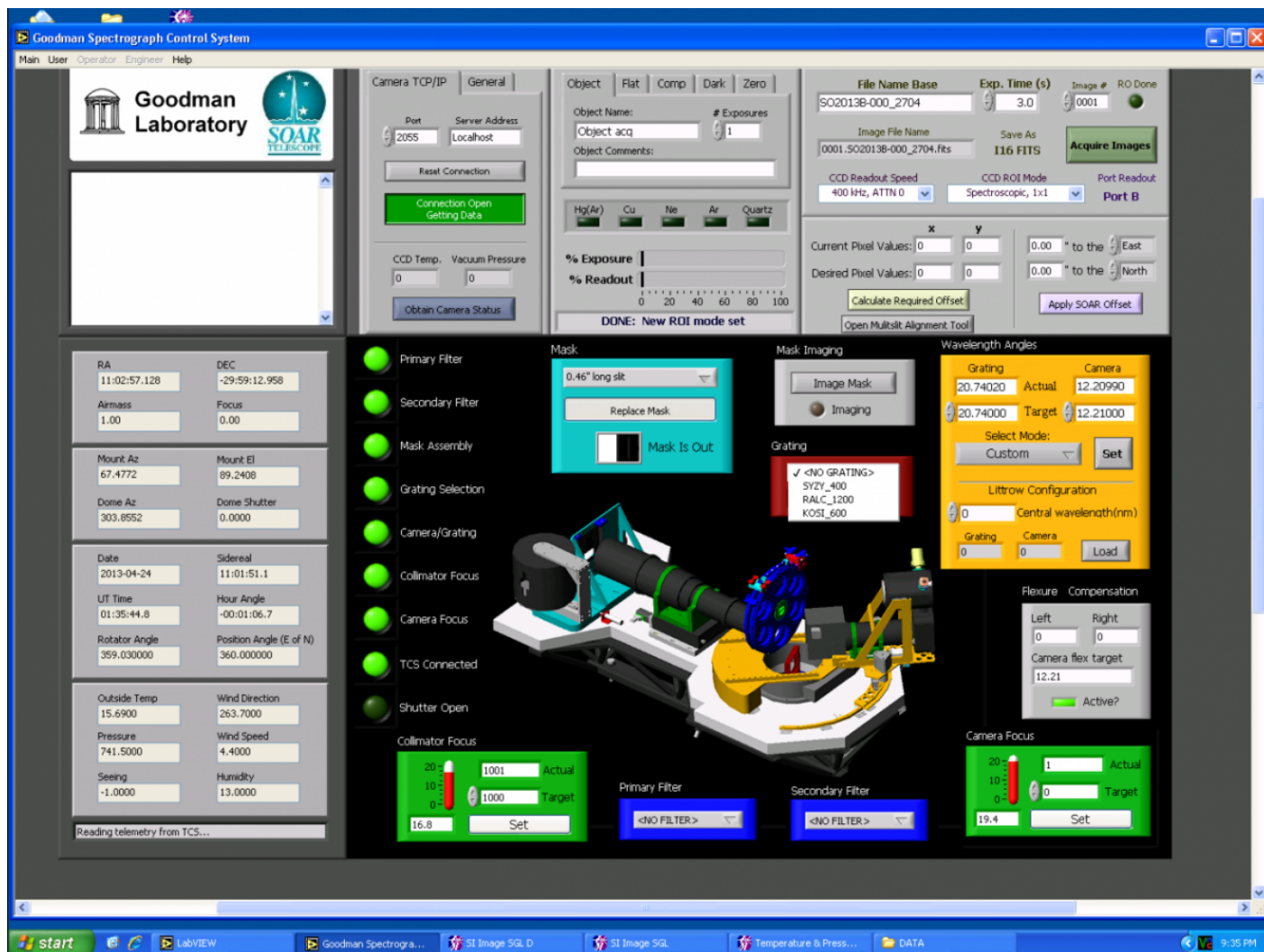




13) Select the imaging or spectroscopic mode in which you want to work.

Make sure that the "Save As" type is "I16 FITS".

14) Set up the grating and camera angles for your observations. The pre-defined modes are listed in the [Goodman Overview page](#). [3]





These steps are illustrated and explained in more detail in the [User's step-by-step Guide to Observing with Goodman](#) [27]. [28]

Shutdown

At the end of the night, the observer and TelOps staff should do the following:

Observers:

1. Logout of the Goodman GUI. This is found under the Main tab.
2. Shutdown the instrument motors. This is also found under the Main tab and will store all of the mechanisms in their home position.
3. Create a directory on soaric4 (Goodman Data Acquisition computer) in C:\Data for the night of your observations (YYYY-MM-DD). Move all FITS files to this directory. Do not move the DO_NOT_DELETE_FROM_THIS_DIRECTORY file.
4. Create a directory on soaric7 (Goodman Data Analysis computer) in /home3/observer/GOODMAN_DATA/<PROGRAM> /YYYY-MM-DD, where <PROGRAM> is one of [BRAZIL, CHILE, MSU, NOAO, OTHER, or UNC].
5. Move the FITS files from /home3/observer/today to /home3/observer/GOODMAN_DATA/<PROGRAM> /YYYY-MM-DD.

[Click on this link for a PDF with screenshots and additional information on the End-of-Night shutdown procedure.](#) [24]

TelOps:

- After the logout and shutdown are done, the power to the Goodman Electronics box should be turned off on the remote power control panel.

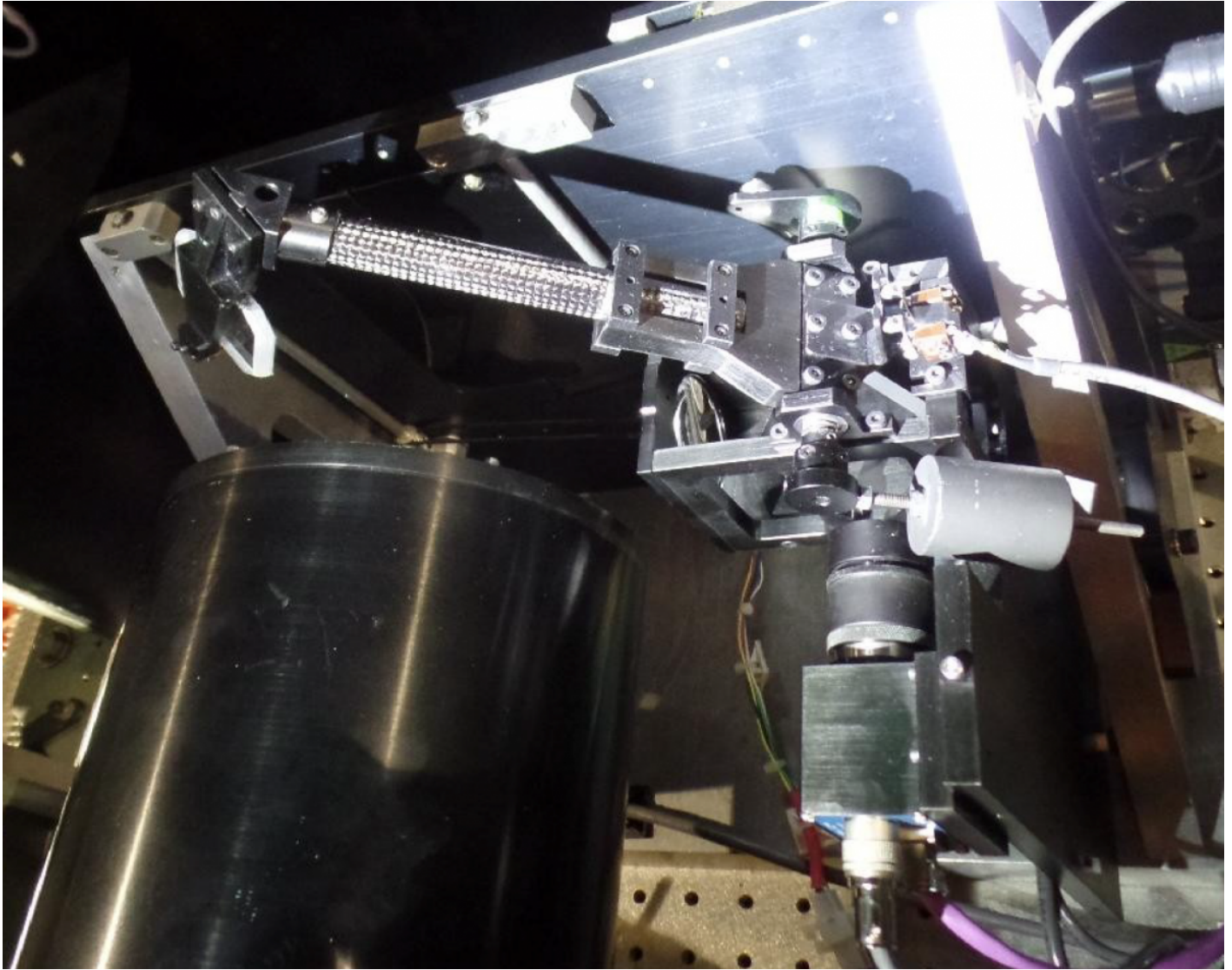
IC7 Shutdown and/or Rebooted:

If soaric7 is rebooted or shutdown, the postproc (PPROC) process to move data to the NOAO Science Data Archive (SDA) needs to be restarted.

1. To restart PPROC, open a vncviewer to soaric7.ctio.noao.edu:8 (the VNC password is the same as for SOI).
2. Open a terminal window.
3. Execute the command
4. `~/APPROOT/PPROC/exe/PPROC &`
5. The PPROC command should now be restarted. One can take a test image and see if it appears in the list of "Last Processed Files".

The Goodman Acquisition Camera (GACAM)

The need for faster target acquisition for relatively bright targets ($V \leq 18$) in the Goodman High Throughput Spectrograph (HTS) led to the development at CTIO of a slit-viewing acquisition camera, hereafter GACAM ([Tokovinin 2015: Goodman Acquisition Camera Instructions, July 14, 2015](#)) [29]



[30]). GACAM is located inside the spectrograph. Its deployable arm places a diagonal mirror between the slit and the collimator. The image is captured by a Prosilica GigE camera of 659x493 (Horizontal xVertical) pixel format, with a scale 0.165"/pixel and field of view of 1.82' x 1.36'. The software was developed by R. Cantarruti. GACAM was designed to be simple to use and unobtrusive to the spectrograph. An added advantage of the GACAM is that all settings in the Goodman GUI can now stay fixed. In particular, there is no need to switch from imaging to spectroscopic mode (i.e., grating and camera stay at fixed position), change the Region of Interest (ROI), readout mode, nor any other option in the spectrograph GUI

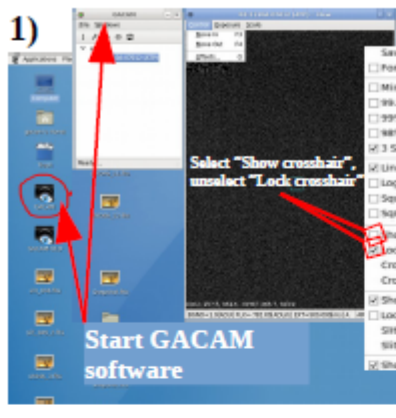
NEW - August 3, 2018 - GACam is now running on its own computer, and the IP address has changed to 139.229.15.168:1. All other aspects of operation are unchanged.

[GACAM User's Manual \(PDF\)](#) [31]

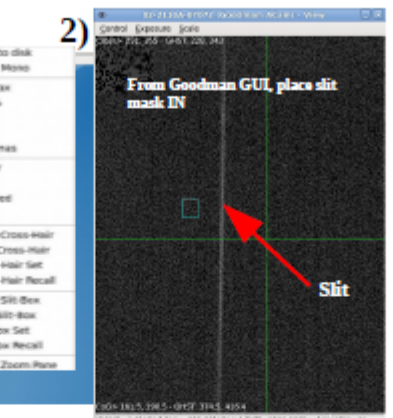
[GACAM Cheat Sheet \(PDF\)](#) [32]

Goodman Acquisition Camera (GACAM) Cheat Sheet (Dec 2015)

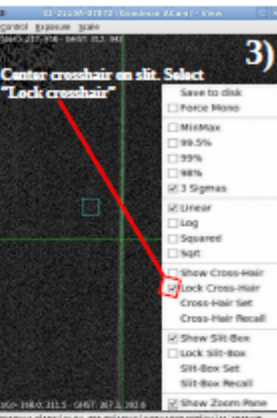
1) Start GACAM software



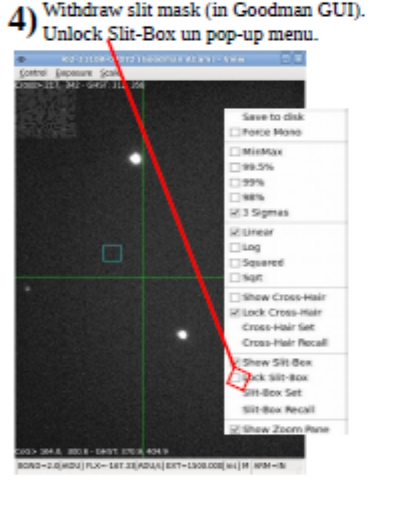
2) From Goodman GUI, place slit mask IN



3) Center crosshair on slit. Select "Lock crosshair"



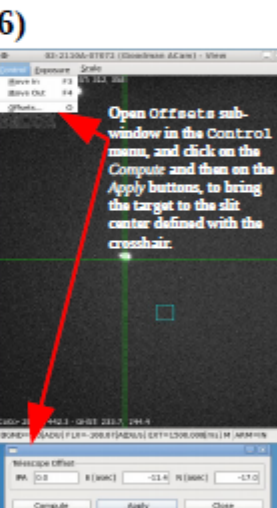
4) Withdraw slit mask (in Goodman GUI). Unlock Slit-Box on pop-up menu.



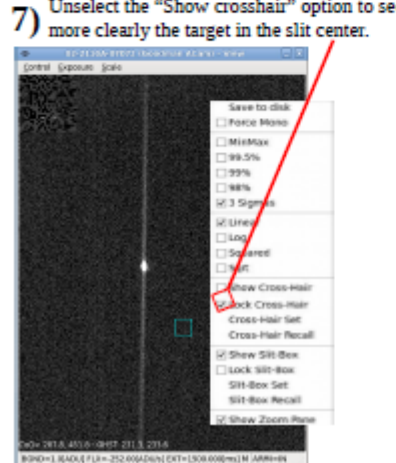
5) Click on target to center slit-box



6) Open Offsets sub-window in the Control menu, and click on the Compute and then on the Apply buttons, to bring the target to the slit center defined with the crosshair

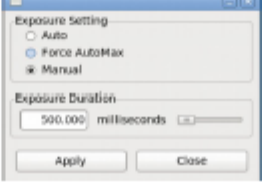


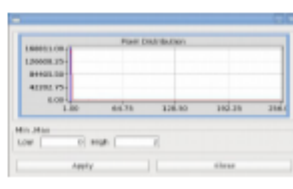
7) Unselect the "Show crosshair" option to see more clearly the target in the slit center.



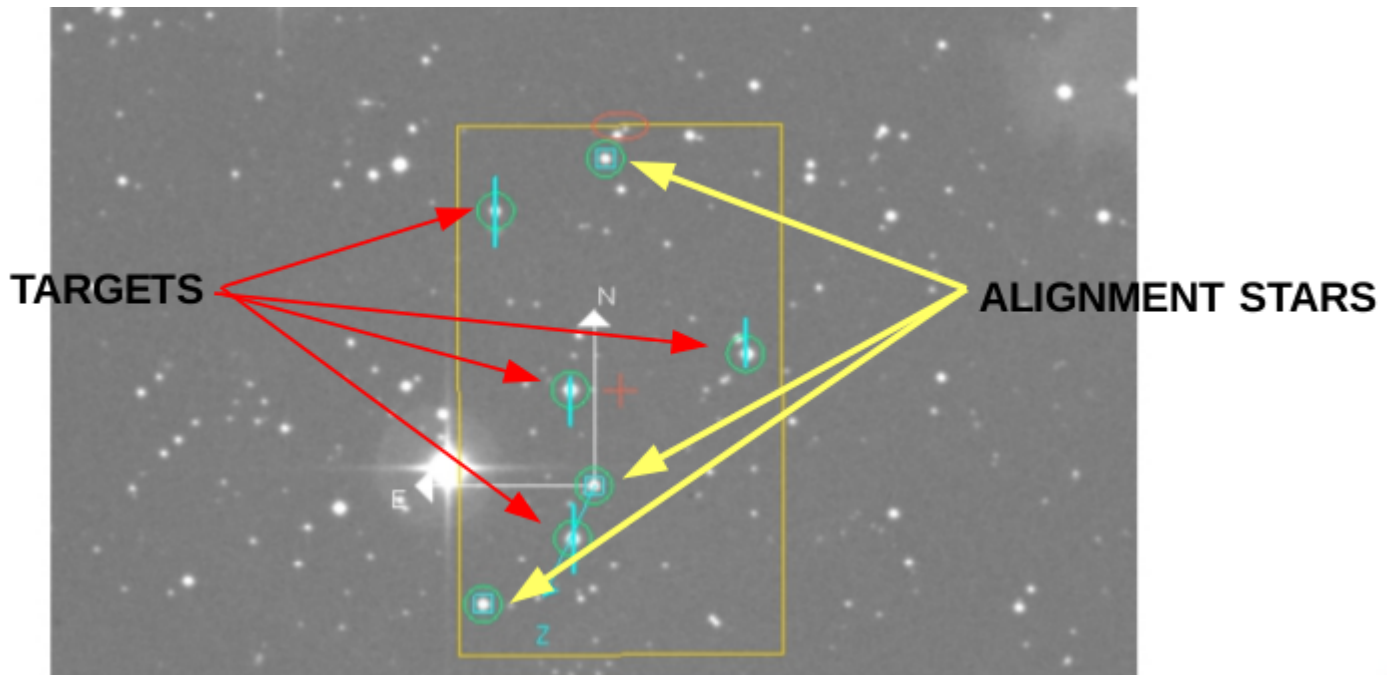
8) Move the GACAM arm to the OUT position. Start your science exposure.

Adjusting the exposure time and display scale:
 Use the Exposure (left) and Scale (right) sub-windows to adjust the exposure time and minimum/maximum scaling values depending on the conditions of your target and sky. Also, experiment with the display scaling options in the second and third block of the pop-up menu. Finally, you can always swap and use the slit box to define your slit center, and the crosshair for picking up a specific location on your target.





Goodman Multi-Object Spectroscopy (MOS) mode



Goodman Multi-Object Spectroscopy (MOS) mode brings multiplex capability over a field of view of 3' x 5'. Custom MOS masks are designed with a Mask Designing software, developed at UNC.

Goodman carrousel has 16 available positions for MOS masks.

Installing MOS masks is a daytime task, like changing filters, and should be requested beforehand in the [Instrument Setup Form](#) [2], or by email to the Support Astronomer with copy (cc) to soarops@ctio.noao.edu [33], so our Observer Support staff also receives the request.

[Click here to download the Goodman Mask Designing software \(tested on Windows 7 and 10, 64-bit installations\)](#) [34].

Now users have the option to design their MOS masks by login into a CTIO machine which is already running the mask design software. Please contact your Support Astronomer for details on VPN access, procedure and passwords.

See the PDF tutorials:

- [MOS Slit Design Software Manual \(PDF document\)](#) [35]
- [MOS Alignment User Manual \(PDF document\)](#) [36] [37]
- [MOS Observing Tutorial \(PDF document\)](#) [38]

Source URL: <http://www.ctio.noirlab.edu/soar/content/observing-goodman>

Links

- [1] http://www.ctio.noao.edu/~points/Goodman/goodman_etc_v3.html
- [2] <http://www.ctio.noao.edu/SOAR/Forms/INST/setup.php>
- [3] <http://www.ctio.noirlab.edu/soar/content/goodman-spectrograph-overview>
- [4] <http://www.ctio.noirlab.edu/soar/content/visiting-astronomers-guide>
- [5] <http://www.ctio.noao.edu/travel/itinerary.php>
- [6] <http://www.ctio.noirlab.edu/soar/content/soar-observing-logs>
- [7] <http://www.ctio.noirlab.edu/soar/content/goodman-software#S2>
- [8] <http://www.ctio.noirlab.edu/soar/content/goodman-software#S3>
- [9] <http://www.ctio.noirlab.edu/soar/content/goodman-software>
- [10] <http://www.ctio.noirlab.edu/soar/content/goodman-hts-manual>
- [11] <http://www.ctio.noirlab.edu/soar/content/goodman-software#S4>
- [12] <http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/binning.pdf>
- [13] <http://www.ctio.noirlab.edu/soar/content/imaging-focus>
- [14] <http://www.ctio.noirlab.edu/soar/content/goodman-acquisition-camera-gacam>
- [15] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/how_do_i_take_a_spectrum.pdf
- [16] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/how_to_take_images.pdf
- [17] <http://www.ctio.noao.edu/SOAR/Forms/EON/Form.php?telescope=SOAR>
- [18] <http://www.ctio.noao.edu/new/Tools/Forms/EOR/Form.php?telescope=SOAR>
- [19] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/Goodman_Tutorial_2017.pdf
- [20] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/connecting_to_goodman.pdf
- [21] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/starting_up_spectrograph.pdf
- [22] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/control_panel_layout.pdf
- [23] <http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/ROI.pdf>
- [24] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/shutting_down_the_spectrograph.pdf
- [25] <http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/RV.pdf>
- [26] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/goodman_rv.pdf
- [27] <http://www.ctio.noirlab.edu/soar/content/observing-goodman>
- [28] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/Goodman2013_EngVersion.pdf
- [29] <http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/Instruction.pdf>
- [30] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/AcqCam_User_Guide_Dec2015.pdf
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- [37] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/Manual_for_Goodman_MOS_v2.pdf
- [38] http://www.ctio.noirlab.edu/soar/sites/default/files/GOODMAN/mos_observing_with_goodman_Sep2015.pdf