

## Documentation

### Goodman HTS Manual

<http://www.ctio.noao.edu/soar/content/goodman-hts-manual>

### Goodman Overview

<http://www.ctio.noao.edu/soar/content/goodman-spectrograph-overview>

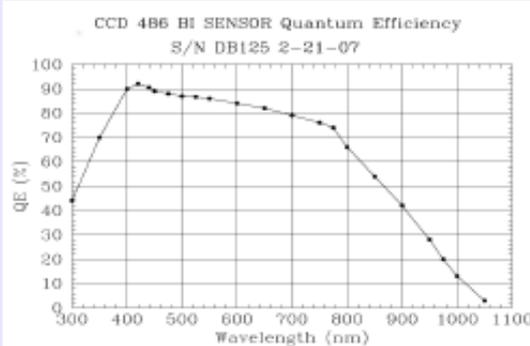
## Goodman Spectrograph Observer's Cheat Sheet - 1



### CCD Characteristics

Read Rate	Analog ATTN	Gain (e-/ADU)	Read Noise (e-)	50% Full Well (ADU)
50 kHz	0	0.25	3.33	279600*
	2	0.47	3.35	148723*
	3	0.91	3.41	76813*
100 kHz	0	0.56	3.69	124821*
	2	1.06	3.72	65943*
200 kHz	3	2.06	3.99	33932
	0	1.4	4.74	49928
400 kHz	2	2.67	5.12	26179
	0	5.67	8.62	12328

\* Digital saturation reached before 50% full well



#### Other Info:

Digital saturation: 65,536 e-  
Single Pixel Full Well: 139,800 e-  
Linearity: 0-80% Full Well  
Dark Current: 0.0003 e-/pixel/sec  
Pixel size: 15 microns

Mode	Binning	Serial Origin	Serial Length	Parallel Origin	Parallel Length	Approx. Image Size
Imaging 1x1	1x1	516	3096	500	3096	19 Mb
Imaging 2x2	2x2	516	1548	500	1548	5 Mb
Imaging 3x3	3x3	516	1032	500	1032	2 Mb
Spec 1x1	1x1	0	4142	1100	1896	16 Mb
Spec 2x2	2x2	0	2071	1100	948	4 Mb
Spec 3x3	3x3	0	1381	1100	632	2 Mb
Slit Imaging /alignment	1x2	1250	1200	1100	948	800 Kb

Note: Origins are given in un-binned, absolute pixels, lengths are given in binned pixels

### Spectroscopic Info

Grating (lines/mm)	Dispersion (Å/pixel)	Coverage (Å)	Max R @ 550nm (3pix with 0.46" slit)	Blocking Filter
400	1.00	M1: 300-705 M2: 500-905	1850	- GG-455
600	0.65	UV: 301-569 Blue: 350-616 Mid: 435-702 Red: 630-893	2800	-- -- GG-385 GG-495
930	0.42	M1: 300-470 M2: 385-555 M3: 470-640 M4: 555-725 M5: 640-810 M6: 725-895	4450	-- -- GG-385 GG-495 GG-495 OG-570
1200	0.31	M0: 302-436 M1: 350-485 M2: 420-550 M3: 490-615 M4: 555-685 M5: 625-750 M6: 695-815 M7: 765-880	5880	-- -- -- -- GG-455 GG-455 GG-495 OG-570
1800	0.19	800	9610	As needed
2100	0.15	630	11930	As needed
2400	0.12	510	14280	As needed

Order sorting filters: GG385, GG455, GG495, OG570, S8612

### Imaging Info

Field of View: 7.2' diameter circle

Pixel scale: 0.15"/pixel

Approximate exposure times in imaging mode required to achieve a SNR=100 on a star of V=16 and V=20, for a Moon Phase=7 days, Seeing=1", Airmass=1.2

#### Available Filters:

- Johnson UBV, Kron-Cousins Rc (round 4" diameter)
- UBVRI (Bessell; 4"x4")
- SDSS ugriz (4"x4")
- H $\alpha$  (4"x4")
- Other filters per request. Contact the instrument scientist

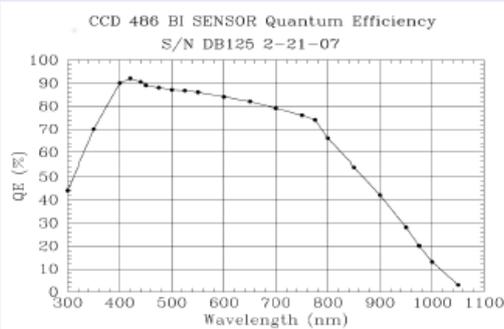
Filter	Exp (s) V=16	Exp (s) V=20
U	7	650
B	1	50
V	1	48
R	0.6	42
I	1.5	110



## Blue Camera

Read Rate	Analog ATTN	Gain (e-/ADU)	Read Noise (e-)	50% Full Well (ADU)
50 kHz	0	0.25	3.33	279600*
	2	0.47	3.35	148723*
	3	0.91	3.41	76813*
100 kHz	0	0.56	3.69	124821*
	2	1.06	3.72	65943*
	3	2.06	3.99	33932
200 kHz	0	1.4	4.74	49928
	2	2.67	5.12	26179
400 kHz	0	5.67	8.62	12328

\* Digital saturation reached before 50% full well



Digital saturation: 65,536 e-  
Single Pixel Full Well: 139,800 e-  
Linearity: 0-80% Full Well  
Dark Current: 0.0003 e-/pixel/sec  
Pixel size: 15 microns

Mode	Binning	Serial Origin	Serial Length	Parallel Origin	Parallel Length	Approx. Image Size
Imaging 1x1	1x1	516	3096	500	3096	19 Mb
Imaging 2x2	2x2	516	1548	500	1548	5 Mb
Imaging 3x3	3x3	516	1032	500	1032	2 Mb
Spec 1x1	1x1	0	4142	1100	1896	16 Mb
Spec 2x2	2x2	0	2071	1100	948	4 Mb
Spec 3x3	3x3	0	1381	1100	632	2 Mb
Slit Imaging /align	1x2	1250	1200	1100	948	800 Kb

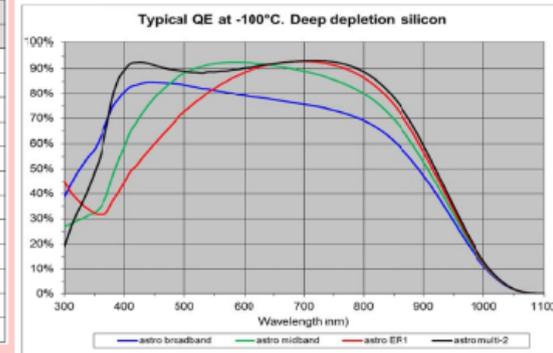
Note: Origins are given in un-binned, absolute pixels, lengths are given in binned pixels

## Red Camera

Read Rate	Analog ATTN	Gain (e-/ADU)	Read Noise (e-)	50% Full Well (ADU)
100 kHz	3	1.54	3.45	66,558*
100 kHz	2	3.48	5.88	29,454
344 kHz	3	1.48	3.89	69,257*
344 kHz	0	3.87	7.05	26,486
750 kHz	2	1.47	5.27	69,728*
750 kHz	0	3.77	8.99	27,188

\*Digital saturation reached before 50% full well

Full frame readout times		
Readout	ROI	t(s)
750ATTNO	Imaging 1x1	16.2
750ATTNO	Imaging 2x2	6.5
750ATTNO	Spec 1x1	14.0
750ATTNO	Spec 2x2	6.0
344ATTNO	Imaging 1x1	31.5
344ATTNO	Imaging 2x2	10.3
344ATTNO	Spec 1x1	26.0
344ATTNO	Spec 2x2	9.0
100ATTNO	Imaging 1x1	98.0
100ATTNO	Imaging 2x2	26.7
100ATTNO	Spec 1x1	80.5
100ATTNO	Spec 2x2	22.7



\* e2v 231-84 deep depletion CCD with multi-2 coating (black line)

Digital saturation: 65,536 e-  
Single Pixel Full Well: 205,000 e-  
Linearity: 5-80% Full Well  
Dark Current: 0.00008 e-/pixel/sec  
Pixel size: 15 microns

Mode	Binning	Serial Origin	Serial Length	Parallel Origin	Parallel Length	Approx. Image Size
Imaging 1x1	1x1	530	3096	388	3096	19 Mb
Imaging 2x2	2x2	530	1548	388	1548	5 Mb
Imaging 3x3	3x3	530	1032	388	1032	2 Mb
Spec 1x1	1x1	0	1896	980	4142	16 Mb
Spec 2x2	2x2	0	948	980	2071	4 Mb
Spec 3x3	3x3	0	632	980	1381	2 Mb
Slit Imaging/Align*	1x1	1100	1100	1300	1500	3 Mb

Note: Origins given in un-binned, absolute pixels, lengths are given in binned pixels  
\*Subject to change.

Virtual Network Computing (VNC) enables to remotely control other computers.



For Windows machines, we suggest either the *Real VNC Viewer* or the *Ultra VNC Viewer* client.

Webpages: [www.realvnc.com](http://www.realvnc.com) and <http://www.uvnc.com/>

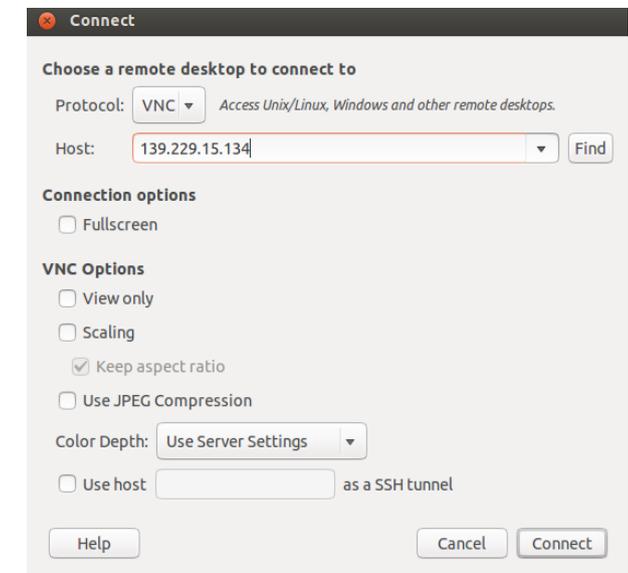


For GNU/Linux and Mac OSX machines, we suggest the *Real VNC Viewer* client. The VNC viewers *Remmina*, *Vinagre*, and *vncviewer* that come installed by default in several Linux distributions also work correctly.



For Mac OSX machines there is also a *Real VNC* client, do not use *Chicken VNC*.

## Vinagre



1) The Goodman data acquisition computer (GUI) is accessed with the command:

**Blue Camera:**

```
vncviewer -Shared soaric2.ctio.noao.edu or vncviewer -Shared 139.229.15.132
```

**Red Camera:**

```
vncviewer -Shared soaric6.ctio.noao.edu or vncviewer -Shared 139.229.15.136
```

2) The Goodman data data analysis computer (IRAF) is accessed with:

```
vncviewer -Shared soaric7.ctio.noao.edu:<N>
```

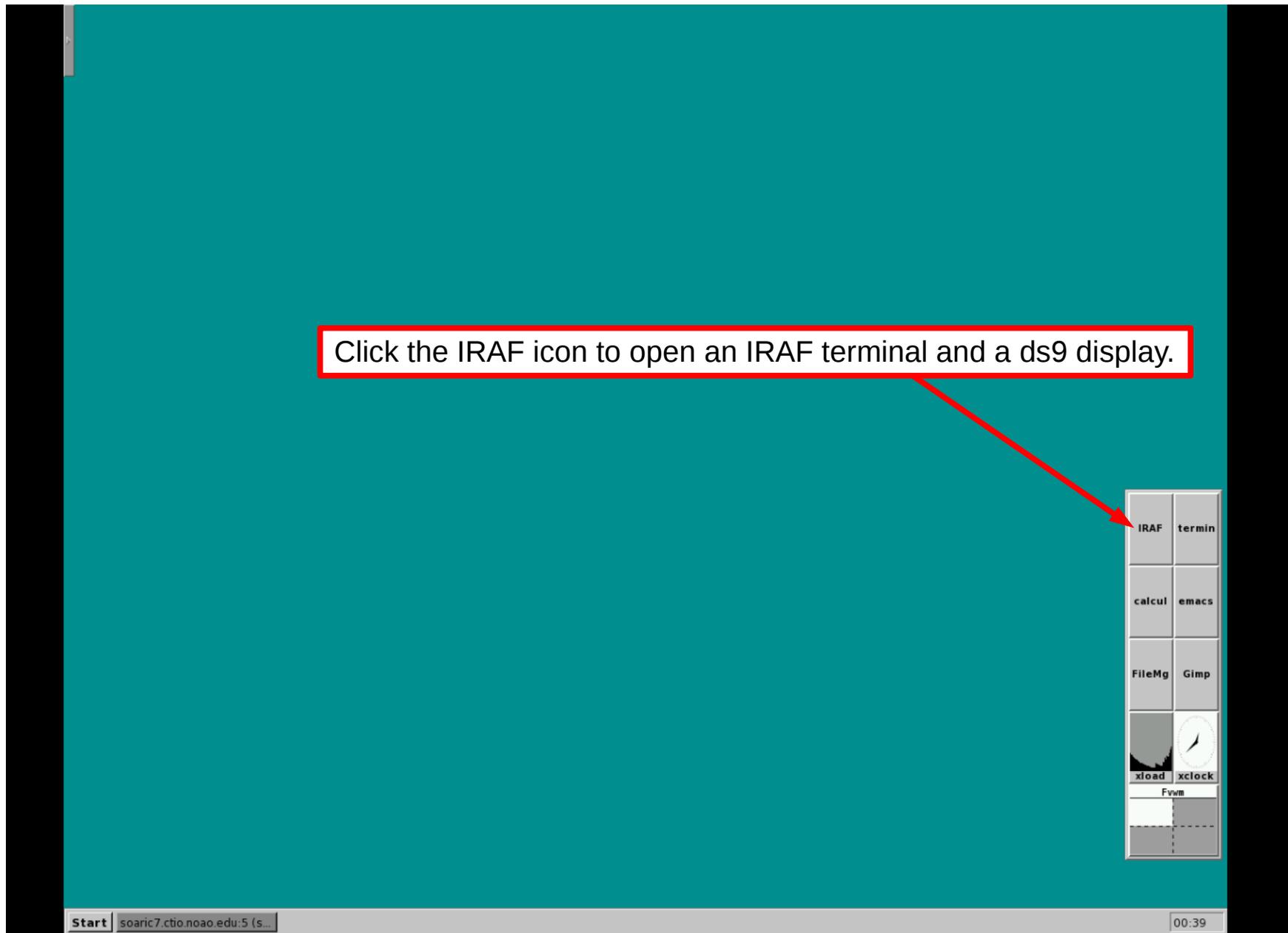
or

```
vncviewer -Shared 139.229.15.137:<N>
```

N is the display number of the respective SOAR partner.

If you have obtained time through NOAO or the Chilean TAC, please contact Cesar Briceño ([cbriceno@ctio.noao.edu](mailto:cbriceno@ctio.noao.edu)) or Sean Points ([spoints@ctio.noao.edu](mailto:spoints@ctio.noao.edu)) to get the password information.

If you have time through the Brazil TAC, contact Bruno Quint ([bquint@ctio.noao.edu](mailto:bquint@ctio.noao.edu))



Images acquired with Goodman are transferred in real time to /home3/observer/today/

```
SOAR-Brasil
NDAO/IRAFNET PC-IRAF Revision 2.14.1 Mon Sep  8 10:12:05 MST 2008
This is the RELEASED version of IRAF V2.14 supporting PC systems.

Welcome to IRAF. To list the available commands, type ? or ?? . To get
detailed information about a command, type 'help <command>'. To run a
command or load a package, type its name. Type 'bye' to exit a
package, or 'logout' to get out of the CL. Type 'news' to find out
what is new in the version of the system you are using.

Visit http://iraf.net if you have questions or to report problems.

The following commands or packages are currently defined:

  apropos  dimsum.  gemini.  msched.  plot.    system.
  ared.    esowfl.  gmisc.  nfextern. proto.  tables.
  color.   finder.  guiapps. nmisc.   rvsao.  utilities.
  ctio.    fitsutil. images.  noao.   softtools. wstools.
  dataio.  ftools.  language. obsolete. spz.     xdimsum.
  dbms.    fuzzy.   lists.  poodpack. stsdas. xray.

ec1> cd /home3/observer/today/
```

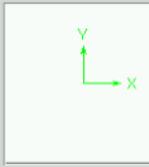
SAOImage ds9

File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help

File				
Object				
Value				
WCS				
Physical	X		Y	
Image	X		Y	
Frame 1	Zoom	1.000	Angle	0.000

file edit view frame bin zoom scale color region wcs help

about open save image header page setup print exit



IRAF termin

calcul emacs

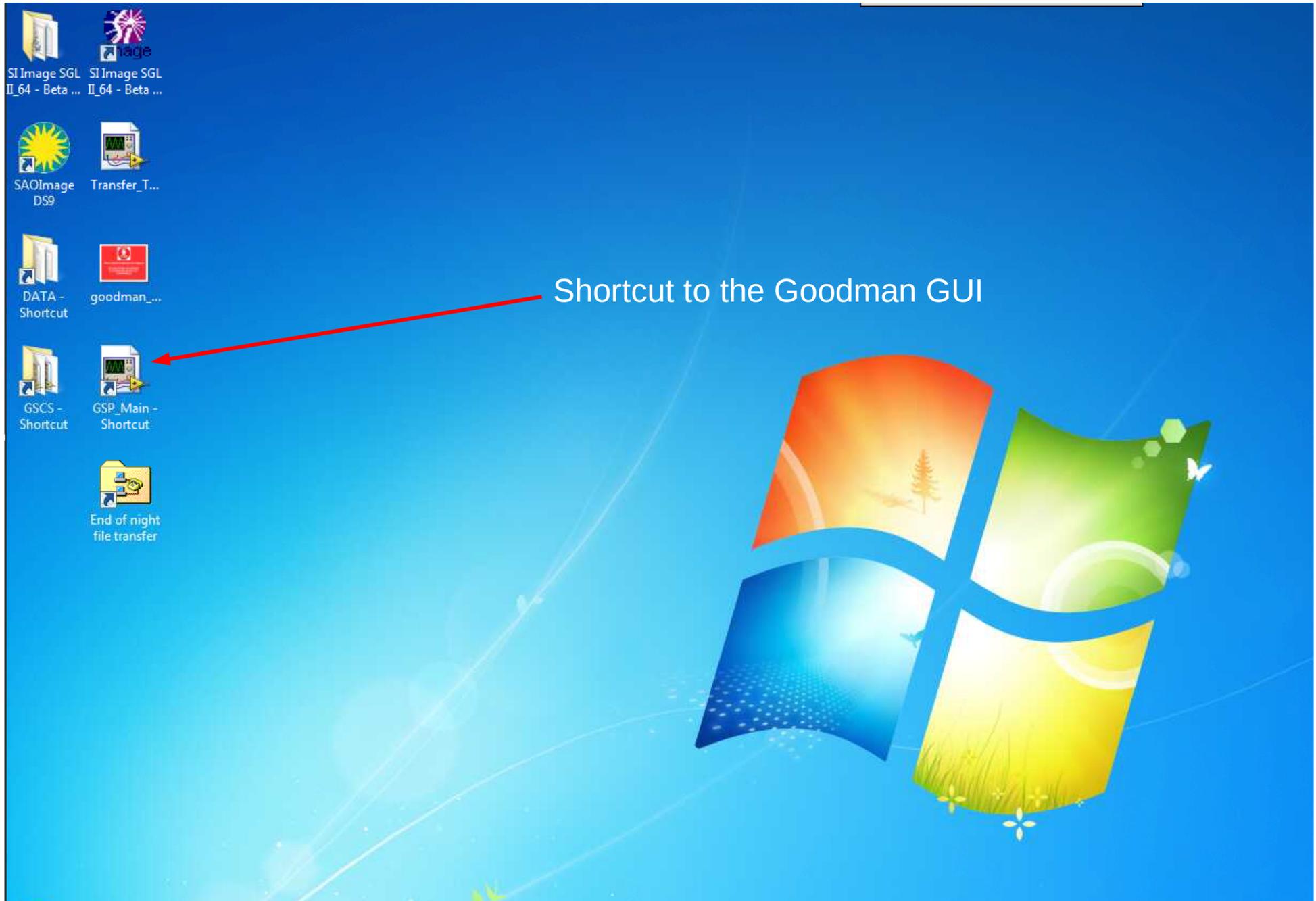
FileMg Gimp

xload xclock

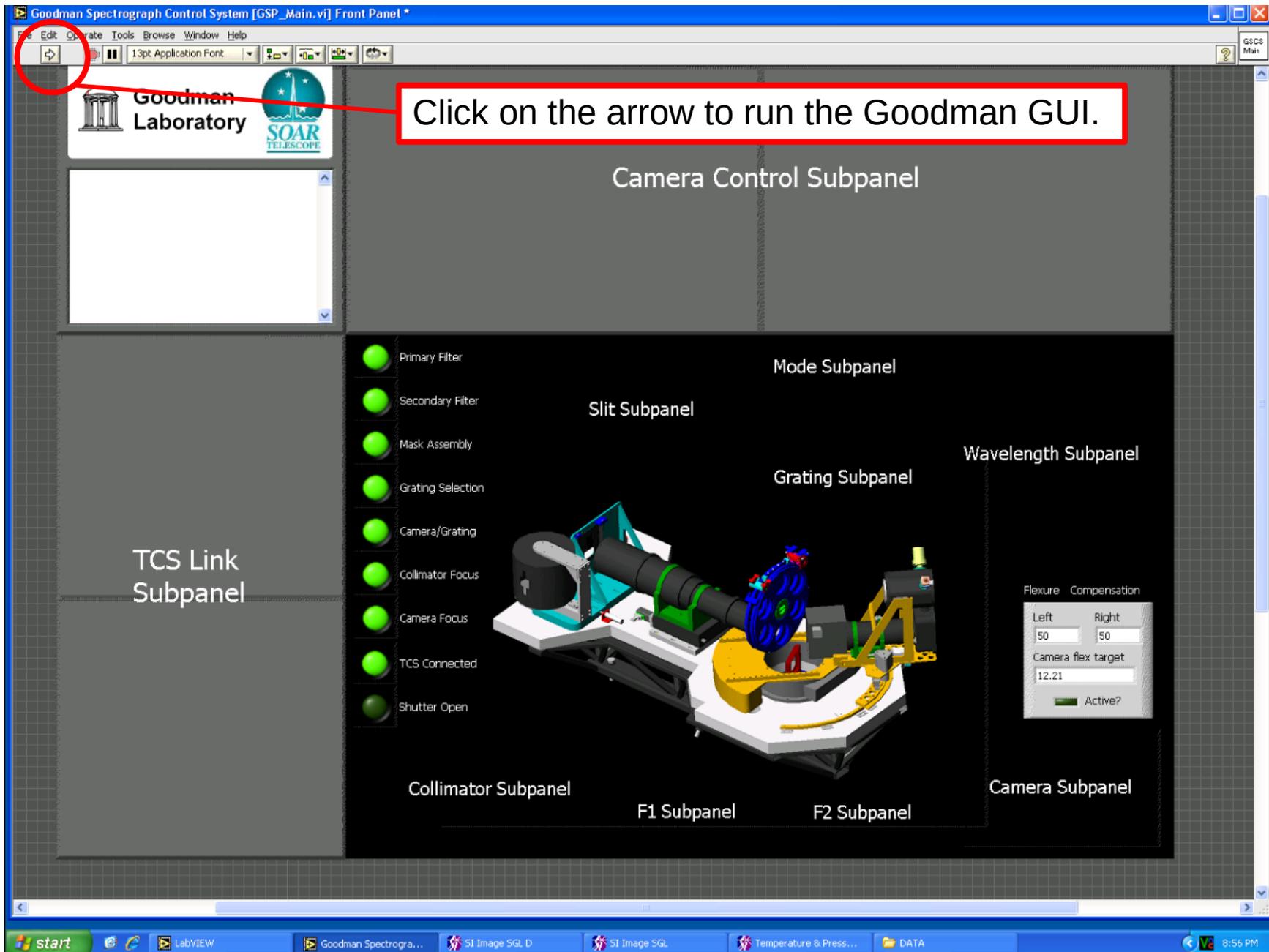
Fvwm

SOAR SDOH

00:40



# Starting the Goodman GUI



To log in...

**Click on "Main"**

Goodman Spectrograph Control System

Main User Operator Engineer Help

Goodman Laboratory SOAR TELESCOPE

Camera TCP/IP General Object Flat Comp Dark Zero

File Name Base: image Exp. Time (s): 1.0 Image #: 0001 RO Done:

Image File Name: 0001.image.fits Save As: 116 FITS Acquire Images

CCD Readout Speed: 100 kHz, ATTN 3 CCD ROI Mode: Custom Mode Port Readout: Port B

Current Pixel Values: x: 0, y: 0 Desired Pixel Values: x: 0, y: 0

Calculate Required Offset Apply SOAR Offset

Reset Connection Connection Open Getting Data Obtain Camera Status

CCD Temp.: 0 Vacuum Pressure: 0

Object Comments:

Hg(Ar) Cu Ne Ar Quartz

% Exposure % Readout

TCP/IP connection established...

Open Multislit Alignment Tool

RA: 10:25:03.992 DEC: -29:59:31.718

Airmass: 1.00 Focus: 0.00

Mount Az: 67.4773 Mount El: 89.2408

Dome Az: 303.8552 Dome Shutter: 0.0000

Date: 2013-04-24 Sidereal: 10:23:52.5

UT Time: 00:57:53.2 Hour Angle: -00:01:11.4

Rotator Angle: 359.030000 Position Angle (E of N): 360.000000

Outside Temp: 15.9300 Wind Direction: 184.4000

Pressure: 741.5000 Wind Speed: 0.0000

Seeing: -1.0000 Humidity: 13.0000

Reading telemetry from TCS...

Primary Filter Secondary Filter Mask Assembly Grating Selection Camera/Grating Collimator Focus Camera Focus TCS Connected Shutter Open

Mask: <NO MASK> Replace Mask Mask Is Out

Mask Imaging: Image Mask Imaging

Grating: <NO GRATING> 0 lines/mm

Wavelength Angles: Grating: 20.74020 Actual: 12.21007 Target: 0.00000

Litrow Configuration: Central wavelength(nm): 0

Flexure Compensation: Left: 50 Right: 50 Camera flex target: 12.21 Active?

Collimator Focus: 20 10 0 Actual: 16.5 Target: 0 Set

Primary Filter: <NO FILTER> Secondary Filter: <NO FILTER>

Camera Focus: 20 10 0 Actual: 19.4 Target: 0 Set

start LabVIEW Goodman Spectrogra... SI Image SGL D SI Image SGL Temperature & Press... DATA 8:57 PM

To log in...

The screenshot shows the Goodman Spectrograph Control System interface. A red circle highlights the 'Logon' button in the top-left menu, with a red arrow pointing to a text box that says "Click on 'Logon'". The interface includes various control panels for camera settings, mask assembly, grating selection, and environmental monitoring.

**Logon Button:** Located in the top-left menu, circled in red. A red arrow points from it to a text box that says "Click on 'Logon'".

**Camera TCP/IP Settings:** Includes fields for Camera TCP/IP, General, Object, Flat, Comp, Dark, Zero, and # Exposures. A green button labeled "Connection Open Getting Data" is visible.

**File Name Base:** Includes fields for File Name Base (image), Exp. Time (s) (1.0), Image # (0001), and RO Done.

**CCD Readout Speed:** Includes fields for CCD Readout Speed (100 kHz, ATTN 3), CCD ROI Mode (Custom Mode), and Port Readout (Port B).

**Current Pixel Values:** Includes fields for Current Pixel Values (x, y) and Desired Pixel Values (x, y).

**Mask Assembly:** Includes a "Mask" section with a dropdown menu showing "<NO MASK>" and a "Replace Mask" button. A "Mask Is Out" indicator is present.

**Grating Selection:** Includes a "Grating" section with a dropdown menu showing "<NO GRATING>" and a "lines/mm" field.

**Wavelength Angles:** Includes a "Wavelength Angles" section with fields for Grating (20.74020), Actual (12.21010), Camera (12.21010), and Target (0.00000).

**Flexure Compensation:** Includes a "Flexure Compensation" section with fields for Left (50), Right (50), and Camera flex target (12.21).

**Environmental Monitoring:** Includes a "Reading telemetry from TCS..." section with various sensor readings such as RA, DEC, Airmass, Focus, Mount Az, Mount El, Dome Az, Dome Shutter, Date, Sidereal, UT Time, Hour Angle, Rotator Angle, Position Angle (E. of N), Outside Temp, Wind Direction, Pressure, Wind Speed, Seeing, and Humidity.

**System Status:** Includes a "TCS Connected" indicator and a "Shutter Open" indicator.

**Collimator Focus:** Includes a "Collimator Focus" section with a vertical scale and fields for Actual (16.7) and Target (0).

**Primary Filter:** Includes a "Primary Filter" section with a dropdown menu showing "<NO FILTER>".

**Secondary Filter:** Includes a "Secondary Filter" section with a dropdown menu showing "<NO FILTER>".

**Camera Focus:** Includes a "Camera Focus" section with a vertical scale and fields for Actual (19.4) and Target (0).

To log in...

The screenshot shows the Goodman Spectrograph Control System interface. A 'User Login' dialog box is open in the center, with a red box highlighting the text: "Select the partner (brazil, noao, unc, msu, etc) and enter the password that was provided to you by the Support Scientist". A red arrow points from this text to the 'brazil' dropdown menu in the dialog. The background interface includes various control panels for camera settings, telescope parameters, and environmental data.

**User Login Dialog Box:**

Welcome to the Goodman Spectrograph Control System. Please Select your username to the right or enter a new name and press "OK"

Username: brazil

Password: [masked]

Buttons: Logon, select user, enter password

**Main Interface Panels:**

- Top Left:** Goodman Laboratory logo, SOAR TELESCOPE logo.
- Top Center:** Camera TCP/IP, General, Object, Flat, Comp, Dark, Zero, File Name Base, Exp. Time (s), Port Done.
- Top Right:** CCD Readout Speed (100 kHz, ATTN 3), CCD ROI Mode (Custom Mode), Port Readout (Port B).
- Center:** % Exposure, % Readout, TCP/IP connection established...
- Right:** Current Pixel Values (x, y), Desired Pixel Values (x, y), Calculate Required Offset, Apply SOAR Offset, Open Multislit Alignment Tool.
- Bottom Left:** RA (10:26:01.843), DEC (-29:59:30.942), Airmass (1.00), Focus (0.00), Mount Az (67.4773), Mount El (89.2408), Dome Az (303.8552), Dome Shutter (0.0000), Date (2013-04-24), Sidereal (10:24:51.1), UT Time (00:58:51.0), Hour Angle (-00:01:11.3), Rotator Angle (359.030000), Position Angle (E. of N) (360.000000), Outside Temp (15.8900), Wind Direction (226.3000), Pressure (741.5000), Wind Speed (5.7000), Seeing (-1.0000), Humidity (12.9000).
- Bottom Center:** Camera Focus, TCS Connected, Shutter Open, Collimator Focus (Actual: 16.8, Target: 0), Primary Filter (<NO FILTER>), Secondary Filter (<NO FILTER>).
- Bottom Right:** Wavelength Angles (Grating: 20.74020, Camera: 12.21010, Actual: 0.00000, Target: 0.00000), Litrow Configuration (Central wavelength(nm): 0), Flexure Compensation (Left: 50, Right: 50, Camera flex target: 12.21, Active? checkbox).

# Homing the systems

Goodman Spectrograph Control System

Menu: User Operator Engineer Help

Save Configuration  
Home Systems

Goodman Laboratory  
SOAR TELESCOPE

Camera TCP/IP General Object Flat Comp Dark Zero File Name Base Exp. Time (s) Image # RO Done

1.0 0001

Save As 116 FITS Acquire Images

CCD Readout Speed 100 kHz, ATTN 3 CCD ROI Mode Custom Mode Port Readout Port B

Current Pixel Values: x y 0.00 " to the East  
Desired Pixel Values: x y 0.00 " to the North

Calculate Required Offset Apply SOAR Offset

Open Multislit Alignment Tool

CCD Temp. Vacuum Pressure 0 0 Obtain Camera Status

Hg(Ar) Cu Ne Ar Quartz

% Exposure  
% Readout

TCP/IP connection established...

Primary Filter  
Secondary Filter  
Mask Assembly  
Grating Selection  
Camera/Grating  
Collimator Focus  
Camera Focus  
TCS Connected  
Shutter Open

Mask Imaging  
Image Mask  
Imaging

Grating  
<NO GRATING>  
0 lines/mm

Wavelength Angles  
Grating Actual Camera  
20.74020 12.21010  
0.00000 Target 0.00000  
Select Node: Custom Set  
Litrow Configuration  
Central wavelength(nm)  
Grating Camera Load  
0 0

Flexure Compensation  
Left Right  
50 50  
Camera flex target  
12.21  
Active?

Collimator Focus  
20 0 Actual  
10 0 Target  
0 0  
16.6 Set

Primary Filter  
<NO FILTER>

Secondary Filter  
<NO FILTER>

Camera Focus  
20 0 Actual  
10 0 Target  
0 0  
19.4 Set

Reading telemetry from TCS...

start LabVIEW Goodman Spectrogra... SI Image SGL D SI Image SGL Temperature & Press... DATA 9:01 PM

First click on the "User" menu tab and then on "Home Systems"

## Homing the systems

Click on “Select All” and then on “Home Selected”.

**WARNING:** Before you home systems, make sure the Goodman electronics has been powered on by the Telescope Operator (TO), and that the rotator angle is at 0 deg. Check with the TO.

Initialization

Assure that each component is clear of interference before homing. A homing sequence will be initiated for each selected system. You will not have control of uninitialized systems.  
 !!!NOTE: The collimator is temporarily disabled!!!

Double click to change a system's status

- Wavelength Assembly
- Grating Translation
- Slit Assembly
- Filter Wheel #1
- Filter Wheel #2
- Collimator Focus
- Camera Focus

Select All

Select None

Home Selected

Wavelength Angles

Grating	Actual	Camera
20.74020		12.21010
0.00000	Target	0.00000

Select Node: Custom

Littrow Configuration

Central wavelength(nm)

Grating Camera Load

Flexure Compensation

Left	Right
50	50
Camera flex target	
12.21	
Active?	

Camera Focus

Collimator Focus

Primary Filter

Secondary Filter

# Homing the systems

Yellow lights indicate that the mechanisms are moving.

RA: 10:29:10.808, DEC: -29:59:28.569  
 Airmass: 1.00, Focus: 0.00  
 Mount Az: 67.4773, Mount El: 89.2408  
 Dome Az: 303.8552, Dome Shutter: 0.0000  
 Date: 2013-04-24, Sidereal: 10:27:59.8  
 UT Time: 01:01:59.8, Hour Angle: -00:01:11.0  
 Rotator Angle: 359.030000, Position Angle (E of N): 360.000000  
 Outside Temp: 15.8800, Wind Direction: 222.8000  
 Pressure: 741.5000, Wind Speed: 5.1000  
 Seeing: -1.0000, Humidity: 13.0000

Primary Filter: <NO FILTER>  
 Secondary Filter: <NO FILTER>  
 Mask: <NO MASK>, Mask Is Out  
 Grating: <SPD GRATINGS>, 0 lines/mm  
 Wavelength Angles: Grating 21.01420, Actual 12.26390, Target 20.74000, Camera 12.21000  
 Collimator Focus: 16.8 Actual, 0 Target  
 Camera Focus: 19.4 Actual, 0 Target  
 Flexure Compensation: Left 50, Right 50, Camera flex target 12.21

# Homing the systems

The screenshot displays the Goodman Spectrograph Control System interface. A red box highlights the text: "Green lights indicate that the systems are homed." A red arrow points from this box to a vertical column of green status lights on the left side of the interface. The interface includes several control panels:

- Top Panel:** Contains menu options (Main, User, Operator, Engineer, Help), camera settings (Camera TCP/IP, General, Object, Flat, Comp, Dark, Zero), and acquisition parameters (Exp. Time, Image #, RO Done, Save As, Acquire Images).
- Left Panel:** Displays RA (10:29:58.045), DEC (-29:59:27.989), Airmass (1.00), Focus (0.00), Mount Az (67.4773), Mount El (89.2408), Dome Az (303.8552), Dome Shutter (0.0000), Date (2013-04-24), Sidereal (10:28:47.1), UT Time (01:02:47.0), Hour Angle (-00:01:10.9), Rotator Angle (359.030000), Position Angle (E. of N) (360.000000), Outside Temp (15.8600), Wind Direction (183.9000), Pressure (741.5000), Wind Speed (5.4000), Seeing (-1.0000), and Humidity (13.0000).
- Center Panel:** Features a 3D model of the spectrograph and various control buttons like "Reset Connection", "Connection Open Getting Data", "Obtain Camera Status", "Mask", "Mask Imaging", "Grating", "Wavelength Angles", "Flexure Compensation", "Collimator Focus", "Camera Focus", "TCS Connected", "Shutter Open", "Primary Filter", and "Secondary Filter".
- Right Panel:** Shows CCD Readout Speed (100 kHz, ATTN 3), CCD ROI Mode (Custom Mode), Port Readout (Port B), Current/Desired Pixel Values, and Wavelength Angles (Grating: 20.74010, Camera: 12.20990).

Initial settings

The screenshot shows the Goodman Spectrograph Control System interface. A large red-bordered box in the center contains the text "Attention!!" and "Do not forget to turn on flexure compensation." Below this, a smaller red-bordered box points to a green indicator light in the "Flexure Compensation" section, with the text "Click here to activate" and "Light green: turned on / Dark green: turned off". The interface includes various control panels for telescope parameters, camera settings, and filter/grating selection.

## Initial settings

The screenshot displays the Goodman Spectrograph Control System interface. A large red-bordered box in the center contains the text "Attention!!" and "The collimator focus must to be adjusted to "1000"". Below this, a smaller red-bordered box provides instructions: "Enter 1000 in the target control box and click on "Set". Wait until the collimator reaches the position 1000 in the actual indicator box". A red arrow points from the "Set" button in the "Collimator Focus" control panel to the "Actual" value field, which currently shows 16.6. The "Target" value is set to 1000. The interface also shows various other controls and data fields, including RA, DEC, Airmass, Focus, Mount Az, Mount El, Dome Az, Dome Shutter, Date, Sidereal, UT Time, Hour Angle, Rotator Angle, Position Angle (E. of N), Outside Temp, Wind Direction, Pressure, Wind Speed, Seeing, Humidity, Flexure Compensation, and Camera Focus.

Goodman Spectrograph Control System

Main User Operator Engineer Help

Goodman Laboratory

Camera TCP/IP General Object Flat Comp Dark Zero File Name Base Exp. Time (s) Image # RO Done

image 1.0 0001

# Attention!!

The collimator focus must to be adjusted to "1000"

Enter 1000 in the target control box and click on "Set".  
Wait until the collimator reaches the position 1000 in the actual indicator box

RA 10:33:08.210 DEC -29:00:00.000  
Airmass 1.00 Focus 0.00  
Mount Az 67.4773 Mount El 89.2408  
Dome Az 303.8552 Dome Shutter 0.0000  
Date 2013-04-24 Sidereal 10:31:56.9  
UT Time 01:05:57.0 Hour Angle -00:01:10.5  
Rotator Angle 359.030000 Position Angle (E. of N) 360.000000  
Outside Temp 15.9200 Wind Direction 163.6000  
Pressure 741.5000 Wind Speed 10.6001  
Seeing -1.0000 Humidity 13.3000  
Reading telemetry from TCS...

Secondary Filter Replace Mask Imaging 20.74000 Target 12.21000  
Mask Assembly Mask Is Out Grating Select Mode: Custom Set  
Collimator Focus Actual 16.6 Target 1000 Set  
Camera Focus Actual 19.3 Target 0 Set  
Flexure Compensation Left 0 Right 0 Camera flex target 12.21 Active?

start LabVIEW Goodman Spectrogra... SI Image SGL D SI Image SGL Temperature & Press... DATA 9:05 PM

GUI Layout

The screenshot shows the Goodman Spectrograph Control System interface. The main window title is "Goodman Spectrograph Control System". The interface is divided into several functional areas:

- CCD Communication:** Located at the top center, it includes fields for "Port" (2055) and "Server Address" (localhost), a "Reset Connection" button, and a green "Connection Open Getting Data" button. It also displays "CCD Temp." and "Vacuum Pressure" (both at 0) and an "Obtain Camera Status" button.
- Image Acquisition Control:** Located at the top right, it features tabs for "Object", "Flat", "Comp", "Dark", and "Zero". It includes fields for "Object Name", "# Exposures" (1), "Object Comments", "File Name Base" (image), "Exp. Time (s)" (1.0), "Image #", and "RO Done". A green "Acquire Images" button is prominent. Below these are settings for "CCD Readout Speed" (100 kHz, ATTN 3), "CCD ROI Mode" (Custom Mode), and "Port Readout" (Port B). It also has "Current Pixel Values" and "Desired Pixel Values" for x and y coordinates, along with "Calculate" and "Apply SOAR Offset" buttons.
- TCS Status:** Located on the left side, it displays a grid of telescope parameters: RA (10:35:20.901), DEC (-29:59:24.444), Airmass (1.00), Focus (0.00), Mount Az (67.4773), Mount El (89.2408), Dome Az (303.8552), Dome Shutter (0.0000), Date (2013-04-24), Sidereal (10:34:10.6), UT Time (01:08:09.6), Hour Angle (-00:01:10.2), Rotator Angle (359.030000), Position Angle (E. of N) (360.000000), Outside Temp (15.9100), Wind Direction (175.3000), Pressure (741.6000), Wind Speed (2.4000), Seeing (-1.0000), and Humidity (13.0000). A note at the bottom says "Reading telemetry from TCS...".
- Offsets:** Located in the middle right, it contains a "Calculate" button and an "Open Mul" button.
- Instrument Status:** Located at the bottom center, it features a 3D model of the telescope and a list of status indicators: Primary Filter, Secondary Filter, Mask Assembly, Grating Selection, Camera/Grating, Collimator Focus, Camera Focus, TCS Connected, and Shutter Open. Below the list are control panels for "Mask" (set to <NO MASK>), "Grating" (set to <NO GRATINGS>), "Collimator Focus" (Actual: 1001, Target: 1000, Set: 16.6), "Primary Filter" (set to <NO FILTER>), "Secondary Filter" (set to <NO FILTER>), "Wavelength Angles" (Grating: 20.74010, Actual: 12.20979, Target: 12.21000, Camera: 12.20979, Select Mode: Custom, Set), "Litrow Configuration" (Central wavelength(nm): 0, Grating: 0, Camera: 0, Load), and "Flexure Compensation" (Left: 0, Right: 0, Camera flex target: 12.21, Active? checkbox).

# Setting the CCD Readout Speed

Click on the "CCD Readout Speed" pull-up menu and select the desired readout mode

Goodman Spectrograph Overview

	Read Rate	Analog ATTN	Gain (e/ADU)	Noise (e)	Read Out Time (sec) Imaging/Spectroscopic
Read Out	400 kHz	0	5.67	8.62	24/20
	200 kHz	0	1.40	4.74	48/40
		2	2.67	5.12	
	100 kHz	0	0.56	3.69	96/79
		2	1.06	3.72	
3	2.06	3.99			
50 kHz	0	0.25	3.33	192/157	
	2	0.47	3.35		
	3	0.91	3.41		

The screenshot shows the Goodman Spectrograph Control System interface. A red box highlights the 'CCD ROI Mode' pull-up menu, which is open and showing options: Imaging, 1x1; Imaging, 2x2; Imaging, 3x3; Spectroscopic, 1x1; Spectroscopic, 2x2; Spectroscopic, 3x3; Slicer; Slit Imaging/Alignment; Set user-defined ROI...; and Custom Mode. A red arrow points to the 'Set user-defined ROI...' option. The interface includes various control panels for camera settings, mask assembly, grating selection, and wavelength angles. A central 3D model of the spectrograph is visible.

Click on the "CCD ROI Mode" pull-up menu and select the region of interest (ROI)

# Selecting the image type

Goodman Spectrograph Control System

Main User Operator Engineer Help

Goodman Laboratory SOAR TELESCOPE

Camera TCP/IP General **Object** Flat Comp Dark Zero

Port: 2055 Server Address: Localhost

File Name Base: SO2013B-000\_2704

Exp. Time (s): 3.0

Image #: 0001

Object Name: Object acq # Exposures: 1

Image File Name: 0001\_SO2013B-000\_2704.fits

Save As: 116 FITS

Acquire Images

CCD Readout Speed: 400 KHz, ATTN 0

CCD ROI Mode: Spectroscopic, 1x1

Port Readout: Port B

Current Pixel Values: x: 0, y: 0

Desired Pixel Values: x: 0, y: 0

Calculate Required Offset

Apply SOAR Offset

Wavelength Angles

Grating	Actual	Camera
20.74010	20.74000	12.20983
20.74000	Target	12.21000

Select Mode: Custom

Litrow Configuration

Central wavelength(nm): 0

Grating: 0 Camera: 0

Load

Flexure Compensation

Left	Right
0	0
Camera flex target	12.21

Active?

Collimator Focus

16.7 1001 Actual 1000 Target

Set

Primary Filter: <NO FILTER>

Secondary Filter: <NO FILTER>

Camera Focus

19.4 20 10 0 Actual Target

Set

Enter the "File Name Base"

Select the type of image you will take. This information will go into the image header Keyword OBSTYPE.

start LabVIEW Goodman Spectrogra... SI Image SGL D SI Image SGL Temperature & Press... DATA 9:31 PM

# Selecting the slit

The screenshot shows the Goodman Spectrograph Control System interface. The 'Mask' dropdown menu is open, showing a list of options including '<NO MASK>', '0.46" long slit', '1.0" 77" image slicer', '0.84" long slit', '3.0" spot', 'Out of service', '1.03" long slit', '0.46" Pinholes', '1.35" long slit', '1.68" long slit', '1.00" long slit new', '3.0" long slit', and '1.07" long slit new'. A red box highlights the '<NO MASK>' option, and a red arrow points to it from a text box that says 'Click and select the slit'.

Other visible interface elements include:

- Camera TCP/IP:** Port 2055, Server Address Localhost.
- Object:** Object Name: acq, # Exposures: 1.
- File Name Base:** SO2013B-000\_2704.
- Exp. Time (s):** 3.0.
- Image #:** 0001.
- Image File Name:** 0001.SO2013B-000\_2704.fits.
- Save As:** 116 FITS.
- CCD Readout Speed:** 400 kHz, ATTN 0.
- CCD ROI Mode:** Spectroscopic, 1x1.
- Port Readout:** Port B.
- Wavelength Angles:** Grating 20.74010, Camera 12.20986, Target 12.21000.
- Flexure Compensation:** Left 0, Right 0, Camera flex target 12.21.
- Collimator Focus:** 16.8, Target 1000.
- Camera Focus:** 19.4, Target 1000.

# Selecting the slit

The screenshot shows the Goodman Spectrograph Control System interface. The 'Mask Assembly' indicator is highlighted in yellow, and a red box highlights the text 'This process takes ~ 2 min' with an arrow pointing to it. The interface includes various control panels for camera settings, object information, and telescope parameters.

**Camera TCP/IP / General**

Port: 2055, Server Address: Localhost

Connection Open  
Getting Data

CCD Temp.: 0, Vacuum Pressure: 0

Obtain Camera Status

**Object** | Flat | Comp | Dark | Zero

Object Name: Object acq, # Exposures: 1

Object Comments:

Hg(Ar) | Cu | Ne | Ar | Quartz

% Exposure: [Progress Bar], % Readout: [Progress Bar]

DONE: New ROI mode set

**File Name Base**: SO2013B-000\_2704, Exp. Time (s): 3.0, Image #: 0001, RO Done: [Green]

Image File Name: 0001.SO2013B-000\_2704.fits, Save As: 116 FITS, Acquire Images

CCD Readout Speed: 400 kHz, ATTN 0, CCD ROI Mode: Spectroscopic, 1x1, Port Readout: Port B

Current Pixel Values: x: 0, y: 0, 0.00" to the East, North

**Mask**

Mask: [Dropdown: No long slit], Withdraw Mask, Mask Is In

**Mask Imaging**

Image Mask, Imaging

**Grating**

<NO GRATING>, 0 lines/mm

**Wavelength Angles**

Grating	Actual	Camera
20.74010	20.74000	12.20993
20.74000	Target	12.21000

Select Mode: Custom, Set

Littrow Configuration

Central wavelength(nm): 0

Grating: 0, Camera: 0, Load

**Flexure Compensation**

Left	Right
0	0
Camera flex target	12.21

Active? [Green]

**Collimator Focus**

20 - 1001 Actual, 1000 Target, 16.8 Set

**Primary Filter**: <NO FILTER>

**Secondary Filter**: <NO FILTER>

**Camera Focus**

20 - 1 Actual, 0 Target, 19.4 Set

**Telescope Parameters**

RA	DEC
10:59:45.021	-29:59:13.806

Airmass	Focus
1.00	0.00

Mount Az	Mount El
67.4772	89.2408

Dome Az	Dome Shutter
303.8552	0.0000

Date	Sidereal
2013-04-24	10:58:37.8

UT Time	Hour Angle
01:32:32.8	-00:01:07.2

Rotator Angle	Position Angle (E of N)
359.030000	360.000000

Outside Temp	Wind Direction
15.7200	270.9000

Pressure	Wind Speed
741.6000	4.8000

Seeing	Humidity
-1.0000	13.1000

Reading telemetry from TCS...



# Selecting the grating

The screenshot displays the Goodman Spectrograph Control System interface. A red box highlights the 'Grating Selection' control, which is currently set to 'KOSI\_600' (600 lines/mm). A red arrow points from a text box stating 'This process takes ~ 1 min' to this control. The interface includes various panels for camera settings, object information, and environmental data.

**Camera TCP/IP**  
Port: 2055, Server Address: Localhost  
Reset Connection  
Connection Open (Getting Data)  
CCD Temp.: 0, Vacuum Pressure: 0  
Obtain Camera Status

**Object** | Flat | Comp | Dark | Zero  
Object Name: Object acq, # Exposures: 1  
Object Comments:  
Hg(Ar) | Cu | Ne | Ar | Quartz

**File Name Base**: SO2013B-000\_2704  
**Exp. Time (s)**: 3.0  
**Image #**: 0001  
**Image File Name**: 0001.SO2013B-000\_2704.fits  
**Save As**: 116 FITS  
**Acquire Images**  
CCD Readout Speed: 400 kHz, ATTN 0  
CCD ROI Mode: Spectroscopic, 1x1  
Port Readout: Port B

**Grating Selection**  
Mask: 0.46" long slit  
Replace Mask  
Mask Is Out  
Grating: KOSI\_600 (600 lines/mm)

**Wavelength Angles**  
Grating: 20.74010 Actual, 12.20997 Target  
Camera: 20.74000 Actual, 12.21000 Target  
Select Mode: Custom  
Set  
Littrow Configuration  
Central wavelength(nm): 0  
Grating: 0, Camera: 0  
Load

**Flexure Compensation**  
Left: 0, Right: 0  
Camera flex target: 12.21  
Active?

**Collimator Focus**  
Actual: 1001, Target: 1000  
Set: 16.8

**Primary Filter**: <NO FILTER>  
**Secondary Filter**: <NO FILTER>

**Camera Focus**  
Actual: 1, Target: 0  
Set: 19.6

**Environmental Data**  
RA: 11:03:30.752, DEC: -29:59:12.821  
Airmass: 1.00, Focus: 0.00  
Mount Az: 67.4772, Mount El: 89.2408  
Dome Az: 303.8552, Dome Shutter: 0.0000  
Date: 2013-04-24, Sidereal: 11:02:24.0  
UT Time: 01:36:18.4, Hour Angle: -00:01:06.7  
Rotator Angle: 359.030000, Position Angle (E of N): 360.000000  
Outside Temp: 15.6600, Wind Direction: 285.0000  
Pressure: 741.5000, Wind Speed: 5.4000  
Seeing: -1.0000, Humidity: 13.0000

This process takes ~ 1 min

# Setting the camera and grating angles

Adapted by D. Sanmartim from L. Fraga's Guide

Click and select one of the predefined modes

Wavelength Angles

Grating	Actual	Camera
20.74020		12.20986
20.74000	Target	12.21000

Select Mode:

- Custom
- Imaging
- 300 All
- 600 UV
- 600 Blue
- 600 Mid
- 600 Red
- 1200 m0
- 1200 m1
- 1200 m2
- 1200 m3
- 1200 m4
- 1200 m5
- 1200 m6
- 1200 m7
- 1200 RESOLVE

**Setting custom angles:**

- 1) Select the "Custom" option in the "Select Mode" drop-down menu;
- 2) Insert the desired grating and camera angles in "Target";
- 3) Click the "Set" button.

**Setting camera and grating angles for the desired  $\lambda_c$ :**

- 1) Insert the desired  $\lambda_c$  in "Central Wavelength";
- 2) Click the "Load" button and then "Set".

The interface includes the following sections:

- Goodman Laboratory SOAR TELESCOPE** logo and navigation (User, Operator, Engineer, Help).
- Camera TCP/IP** and **General** settings (Port: 2055, Server Address: Localhost).
- Object** and **Flat** settings (Flat Name, # Flat Exposures: 1, Quartz Intensity: 50%).
- File Name Base** and **Exp. Time (s)** (3.0).
- Image File Name** (0026.image.fits) and **Save As** (116 FITS).
- Acquire Images** button.
- CCD Readout Speed** (400 kHz, ATTN 0) and **CCD ROI Mode** (Spectroscopic, 1x1).
- Port Readout** (Port B).
- Current Pixel Values** (x: 0, y: 0) and **Desired Pixel Values** (x: 0, y: 0).
- Calculate Required Offset** and **Apply SOAR Offset** buttons.
- Wavelength Angles** dialog box (highlighted in red):
 

Grating	Camera
9.49680 Actual	18.99107
9.49723 Target	18.99447

 Select Mode: Custom | Set  
 Litrow Configuration  
 Central wavelength(nm): 550  

Grating	Camera
9.49723	18.9945

 Load
- Mask Imaging** section with **Image Mask** and **Imaging** buttons.
- Grating** selection (KOSI\_600, 600 lines/mm).
- Flexure Compensation** section (Left: 1, Right: 1, Camera flex target: 18.9913, Active?).
- Camera Focus** section (Actual: 18.3, Target: 1000, Set).
- Collimator Focus** section (Actual: 15.8, Target: 1000, Set).
- Primary Filter** (<NO FILTER>) and **Secondary Filter** (GG385).
- Telemetry** section (Air mass, Focus, Mount Az/EI, Dome Az/Shutter, Date, Sidereal, UT Time, Hour Angle, Rotator Angle, Position Angle, Outside Temp, Wind Direction, Pressure, Wind Speed, Seeing, Humidity).
- 3D Model** of the telescope and spectrograph.

## Centering the object on the slit

Procedure to center the target on the slit:  
1) Click the "Withdraw Mask" button to remove the mask from the optical path;

The screenshot displays the Goodman Spectrograph Control System interface. The 'Mask' section is highlighted with a red box, and a red arrow points to the 'Withdraw Mask' button. The interface shows various control panels for telescope parameters, filter selection, and camera settings.

**Telescope Parameters:**

RA	DEC
11:00:50.465	-29:59:13.508
Airmass	Focus
1.00	0.00
Mount Az	Mount El
67.4772	89.2408
Dome Az	Dome Shutter
303.8552	0.0000
Date	Sidereal
2013-04-24	10:59:43.4
UT Time	Hour Angle
01:33:38.2	-00:01:07.0
Rotator Angle	Position Angle (E of N)
359.030000	360.000000
Outside Temp	Wind Direction
15.7000	271.3000
Pressure	Wind Speed
741.5000	1.3000
Seeing	Humidity
-1.0000	13.0000

**Mask Section:**

Mask: 0.46" long slit

Withdraw Mask

Mask Is In

**Grating Section:**

Grating: <NO GRATING>

0 lines/mm

**Wavelength Angles Section:**

Grating	Actual	Camera
20.74010	20.74000	12.20993
20.74000	Target	12.21000

Select Mode: Custom

Littrow Configuration

Central wavelength(nm): 0

Grating: 0, Camera: 0

**Flexure Compensation Section:**

Left	Right
0	0
Camera flex target	12.21

Active?

**Collimator Focus Section:**

Collimator Focus: 16.8

Primary Filter: <NO FILTER>

Secondary Filter: <NO FILTER>

**Camera Focus Section:**

Camera Focus: 19.8

## Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode;

The screenshot displays the Goodman Spectrograph Control System interface. The central 3D model shows the telescope's optical path. A red box highlights the 'Mask Imaging' panel, which contains 'Image Mask' and 'Imaging' buttons. A red arrow points from the 'Image Mask' button to the 'Imaging' radio button. The 'Mask' panel shows '0.46\"/>

# Centering the object on the slit

- Procedure to center the target on the slit:
- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
  - 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode;

The screenshot shows the Goodman Spectrograph Control System interface. Key elements include:

- Top Panel:** Status indicators for Exp. Time (3.0 s), Image # (0001), and RO Done.
- Left Panel:** RA (11:17:46.823), DEC (-29:59:10.233), Airmass (1.00), Focus (0.00), Mount Az (67.4772), Mount El (89.2408), Dome Az (303.8552), Dome Shutter (0.0000).
- Center Panel:** Mask selection (0.46" long slit), Mask Imaging (Imaging mode selected), Grating selection (<NO GRATING>), and Wavelength Angles (Grating: 8.96490, Camera: 19.43088, Target: 0.00000).
- Right Panel:** CCD Readout Speed (400 kHz), CCD ROI Mode (Spectroscopic, 1x1), and Port Readout (Port B).
- Bottom Panel:** Collimator Focus (Actual: 1001, Target: 1000, Set: 16.8), Primary Filter (<NO FILTER>), Secondary Filter (<NO FILTER>), and Camera Focus (Actual: 1, Target: 0, Set: 19.8).

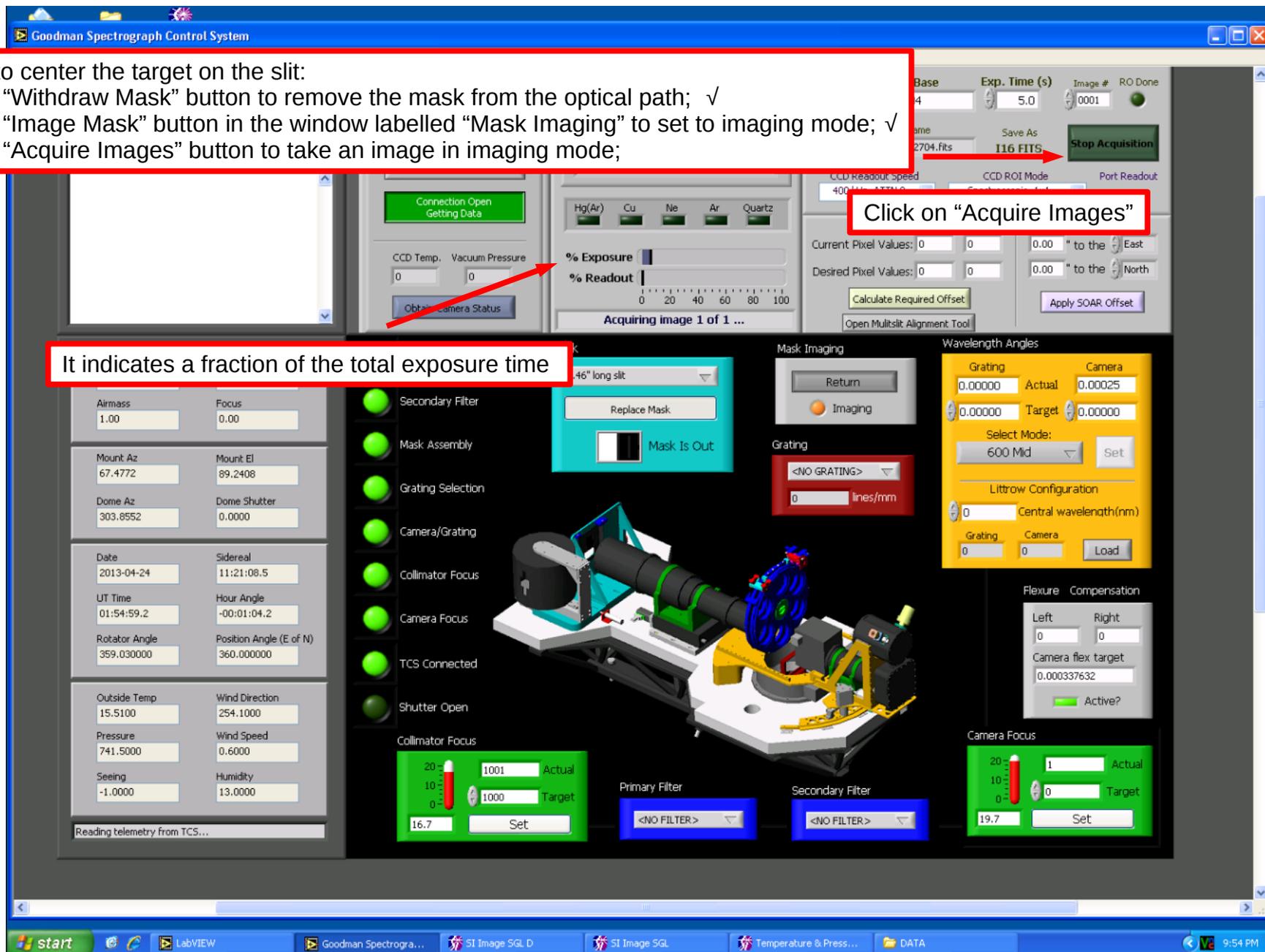
A red circle highlights the 'Grating Selection' and 'Camera/Grating' buttons. A red box at the bottom of the 3D model contains the text: "Camera and grating angles are being moved towards zero".

# Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode;



It indicates a fraction of the total exposure time

Click on "Acquire Images"

## Centering the object on the slit

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc);

The screenshot displays the SOAR-Brasil control interface. On the left, the SAOImage ds9 window shows the file 0001.SO2013B-000\_2704.fits. The Object is V0595Cen, and the Value is >589.383. The WCS is set to Physical X=2109.749, Y=920.852, Image X=2109.749, Y=920.852, Frame 1 Zoom=0.402, and Angle=0.000. The main window shows a grayscale image of a star field with a green circle around the target star. On the right, the terminal window shows the following commands and output:

```

ecl> display 0001.SO2013B-000_2704.fits
frame to be written into (1:16) (1):
z1=483, z2=589,3834
ecl> imexam
display frame (1:) (1):
# COL LINE COORDINATES
# R MAG FLUX SKY PEAK E PA BETA ENCLOSED MOFFAT DIRECT
2110.16 921.04 2110.16 921.04
35.13 9.15 2.175E6 530. 12903. 0.10 72 19.8 11.18 11.44 11.7
  
```

A red arrow points from the terminal output to the star in the main window, indicating the measured centroid.

Using "imexam", place the cursor over the object and type "a" to measure its centroid. Note the values of the centroid (Xc=2110.2, Yc=921.0).

# Centering the object on the slit

Adapted by D. Sanmartin from L. Fraga's Guide

Procedure to center the target on the slit:

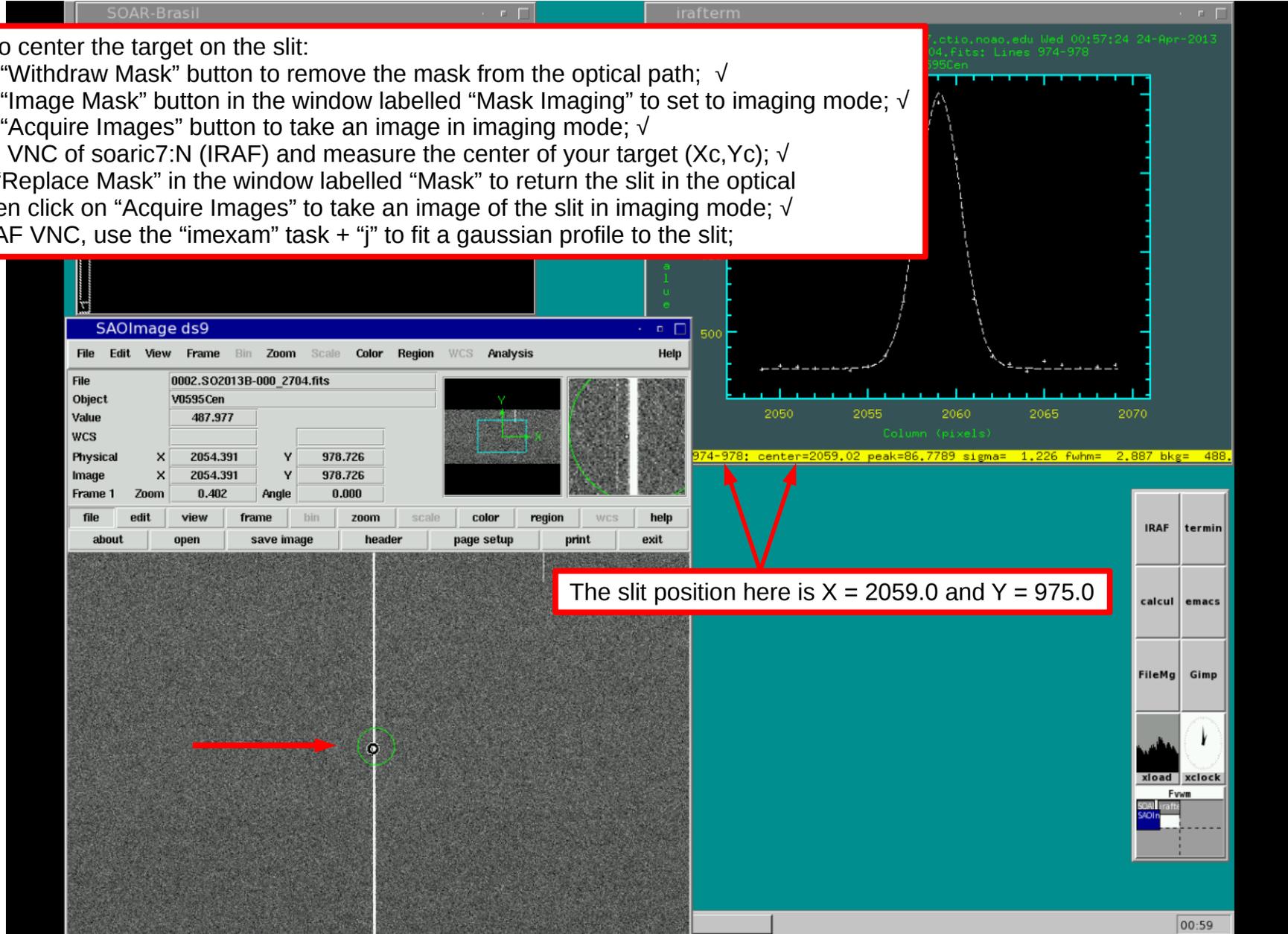
- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to place back the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode;

Click on "Acquire Images"

## Centering the object on the slit

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target ( $X_c, Y_c$ ); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "j" to fit a gaussian profile to the slit;



## Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "j" to fit a gaussian profile to the slit; ✓
- 7) Enter the centroid of the object in "Current Pixel Values" and the coordinates of the slit in "Desired Pixel Values";

The screenshot shows the Goodman Spectrograph Control System interface. A red box highlights the "Mask Imaging" window, which contains the following fields and controls:

- File Name Base:** SO2013B-000\_2704
- Exp. Time (s):** 5.0
- Image #:** 0003
- RO Done:** (Green indicator light)
- Image File Name:** 0003.SO2013B-000\_2704
- Save As:** I16 FITS
- Acquire Images:** (Green button)
- CCD Readout Speed:** 400 kHz, ATTN 0
- CCD ROI Mode:** Spectroscopic, 1x1
- Port Readout:** Port B
- Current Pixel Values:**
  - x: 2110.2
  - y: 921
- Desired Pixel Values:**
  - x: 2059
  - y: 975
- Offset Controls:**
  - 0.00 " to the East
  - 0.00 " to the North
- Buttons:** Calculate Required Offset, Apply SOAR Offset, Open Multislit Alignment Tool

Red arrows point from the "Current Pixel Values" and "Desired Pixel Values" fields to the "Calculate Required Offset" button.

## Centering the object on the slit

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "+" to fit a gaussian profile to the slit; ✓
- 7) Enter the centroid of the object in "Current Pixel Values" and the coordinates of the slit in "Desired Pixel Values"; ✓
- 8) Click on "Calculate Required Offset";

The screenshot displays the SOAR Telescope control interface. A dialog box titled "Calculate Required Offset" is prominently featured, containing the following fields and controls:

- File Name Base:** SO2013B-000\_2704
- Exp. Time (s):** 5.0
- Image #:** 0003
- RO Done:** (Green indicator light)
- Image File Name:** 0003.SO2013B-000\_2704
- Save As:** I16 FITS
- Acquire Images:** (Green button)
- CCD Readout Speed:** 400 kHz, ATTN 0
- CCD ROI Mode:** Spectroscopic, 1x1
- Port Readout:** Port B
- Current Pixel Values:** x: 2110.2, y: 921
- Desired Pixel Values:** x: 2059, y: 975
- Offsets:** 7.48 " to the East, 7.88 " to the South
- Buttons:** Calculate Required Offset, Apply SOAR Offset

Red arrows indicate the flow of the procedure: one arrow points from the "Calculate Required Offset" button in the dialog box to the "Calculate Required Offset" button in the main interface, and another arrow points from the "Calculate Required Offset" button in the main interface to the "Calculate Required Offset" button in the dialog box.

## Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "j" to fit a gaussian profile to the slit; ✓
- 7) Enter the centroid of the object in "Current Pixel Values" and the coordinates of the slit in "Desired Pixel Values"; ✓
- 8) Click on "Calculate Required Offset"; ✓
- 9) Tell the telescope operator (TO) you will move the telescope. Click the "Apply SOAR Offset" button to offset the telescope;

The screenshot shows the SOAR Telescope control interface. A red box highlights the 'Current Pixel Values' and 'Desired Pixel Values' fields. A red arrow points from a text box above to the 'Apply SOAR Offset' button. The text box contains the instruction: "Check if the values are suitable before applying the 'offsets'".

Field	Value
File Name Base	SO2013B-000_2704
Exp. Time (s)	5.0
Image #	0003
RO Done	<input checked="" type="checkbox"/>
Current Pixel Values: x	2110.2
Current Pixel Values: y	921
Desired Pixel Values: x	2059
Desired Pixel Values: y	975
Offset: East	7.48
Offset: South	7.88

## Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target ( $X_c, Y_c$ ); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "j" to fit a gaussian profile to the slit; ✓
- 7) Enter the centroid of the object in "Current Pixel Values" and the coordinates of the slit in "Desired Pixel Values"; ✓
- 8) Click on "Calculate Required Offset"; ✓
- 9) Tell the telescope operator (TO) you will move the telescope. Press "Apply SOAR Offset" button to offset the telescope; ✓
- 10) Click on "Acquire Images" to check if the object is aligned on the slit.

The screenshot displays the Goodman Telescope control interface. On the left, there are several data panels: Mount Az (67.4772), Mount El (89.2408), Dome Az (303.8552), Dome Shutter (0.0000), Date (2013-04-24), Sidereal (12:24:57.4), UT Time (02:58:38.2), Hour Angle (-00:00:56.3), Rotator Angle (359.030000), Position Angle (E of N) (360.000000), Outside Temp (15.4900), Wind Direction (178.3000), Pressure (741.4000), Wind Speed (7.6001), Seeing (-1.0000), and Humidity (14.5000). A central 3D model of the telescope is shown with various components labeled. On the right, there are control panels for Grating Selection (set to <NO GRATING>), Camera/Grating, Collimator Focus (set to 1000), Camera Focus (set to 19.8), TCS Connected, Shutter Open, Primary Filter (set to <NO FILTER>), and Secondary Filter (set to <NO FILTER>). A 'Wavelength Angles' panel shows Grating (0.00010) and Camera (0.00050) settings. A 'Flexure Compensation' panel shows Left (0) and Right (0) settings. A 'Mask Imaging' window is open, showing 'Exp. Time (s)' (5.0), 'Image #' (0003), and a 'Stop Acquisition' button. A red box highlights the 'Acquire Images' button in the 'Mask Imaging' window.

# Centering the object on the slit

```

SOAR-Brasil
ec1> display 0001.S02013B-000_2704.fits
frame to be written into (1:16) (1):
z1=483, z2=589,3834
ec1> inexam
display frame (1) (1):
# COL LINE COORDINATES
# R MAG FLUX SKY PEAK E PA BETA ENCLOSED HOFFAT DIRECT
2110.16 921.04 2110.16 921.04
35.13 9.16 2.175E6 530. 12903, 0.10 72 19.8 11.18 11.44 11.71
ec1> inexam 0002.S02013B-000_2704.fits
display frame (1) (1):
z1=483, z2=497,782
ec1> display 0003.S02013B-000_2704.fits zs= zr= z1=450 z2=900
frame to be written into (1:16) (1):
z1=450, z2=900,
ec1>
    
```

```

irafterm
NOAO/IRAF V2.14.1 soar_brazil@soaric7.ctio.noao.edu Wed 00:57:24 24-Apr-2013
0002.S02013B-000_2704.fits; Lines 974-978
V0595Cen
    
```

Column (pixels)

974-978: center=2059.02 peak=86.7789 sigma= 1.226 fwhm= 2.887 bkg= 488.

Checking if the object is aligned on the slit

Tip: Use the options zrange- and zscale- to display the slit image  
 cl> display 0003.S02013B-000\_2704.fits zs- zr- z1=450 z2=900

## Centering the object on the slit

Adapted by D. Sanmartim from L. Fraga's Guide

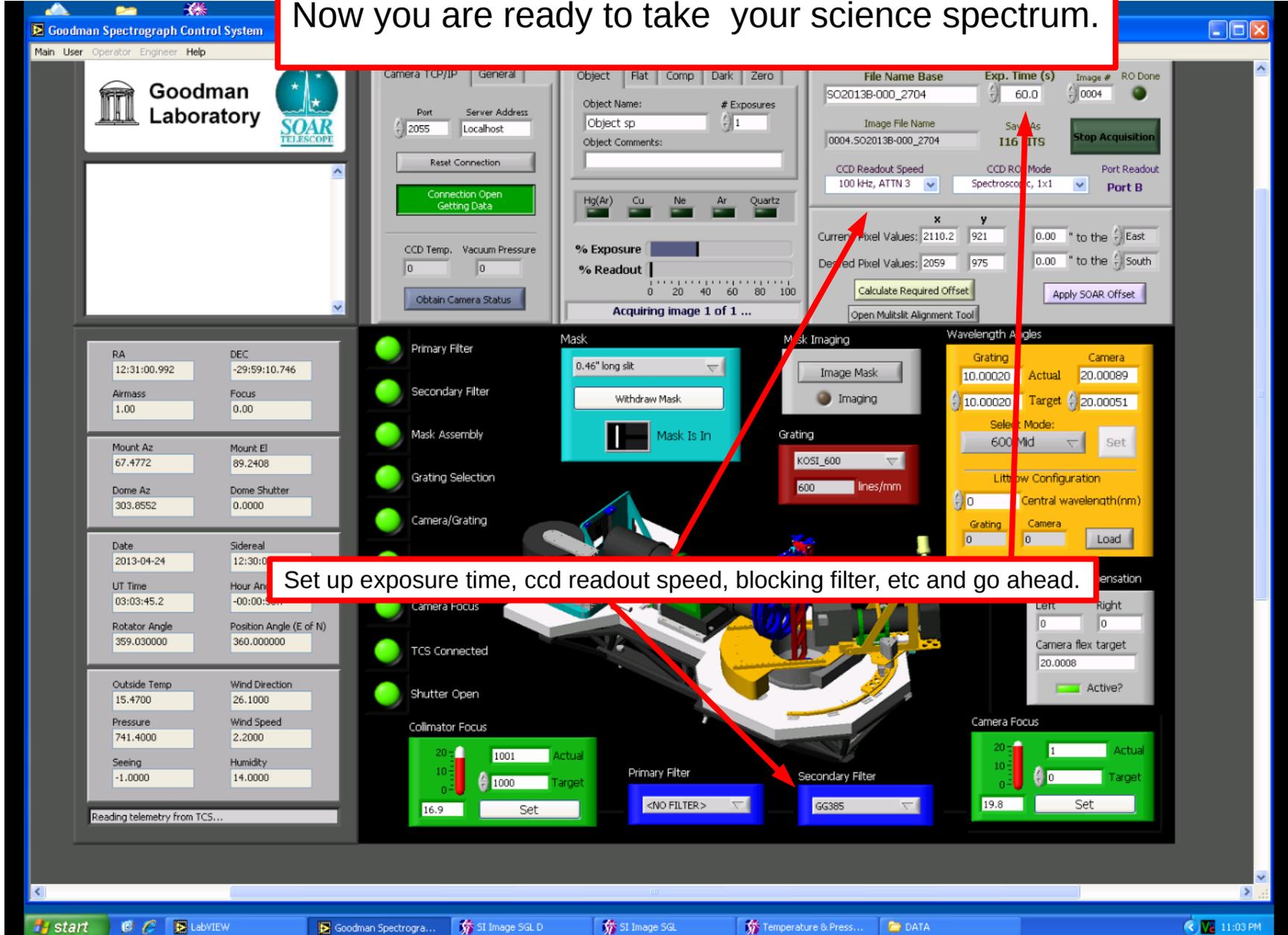
Procedure to center the target on the slit:

- 1) Click the "Withdraw Mask" button to remove the mask from the optical path; ✓
- 2) Click the "Image Mask" button in the window labelled "Mask Imaging" to set to imaging mode; ✓
- 3) Click the "Acquire Images" button to take an image in imaging mode; ✓
- 4) Go to the VNC of soaric7:N (IRAF) and measure the center of your target (Xc,Yc); ✓
- 5) Click on "Replace Mask" in the window labelled "Mask" to return the slit in the optical path and then click on "Acquire Images" to take an image of the slit in imaging mode; ✓
- 6) In the IRAF VNC, use the "imexam" task + "j" to fit a gaussian profile to the slit; ✓
- 7) Enter the centroid of the object in "Current Pixel Values" and the coordinates of the slit in "Desired Pixel Values"; ✓
- 8) Click on "Calculate Required Offset"; ✓
- 9) Tell the telescope operator (TO) you will move the telescope. Press "Apply SOAR Offset" button to offset the telescope; ✓
- 10) Click on "Acquire Images" to check if the object is aligned on the slit. ✓
- 11) Click the "Return" button in the window "Mask Imaging" to return to spectroscopic mode.

The screenshot displays the Goodman Telescope control interface. The top window, titled "Mask Imaging", shows parameters for file naming, exposure time (5.0 s), and image number (0004). It includes a "Calculate Required Offset" button and an "Apply SOAR Offset" button. Below this, the "Mask" window is visible, showing the "Image Mask" button highlighted with a red arrow. The "Mask" window also displays "Current Pixel Values" (2110.2, 921) and "Desired Pixel Values" (2059, 975). The bottom part of the interface shows a 3D model of the telescope and various control panels for filters and focus.

Click the "Return" button to move to spectroscopic mode.

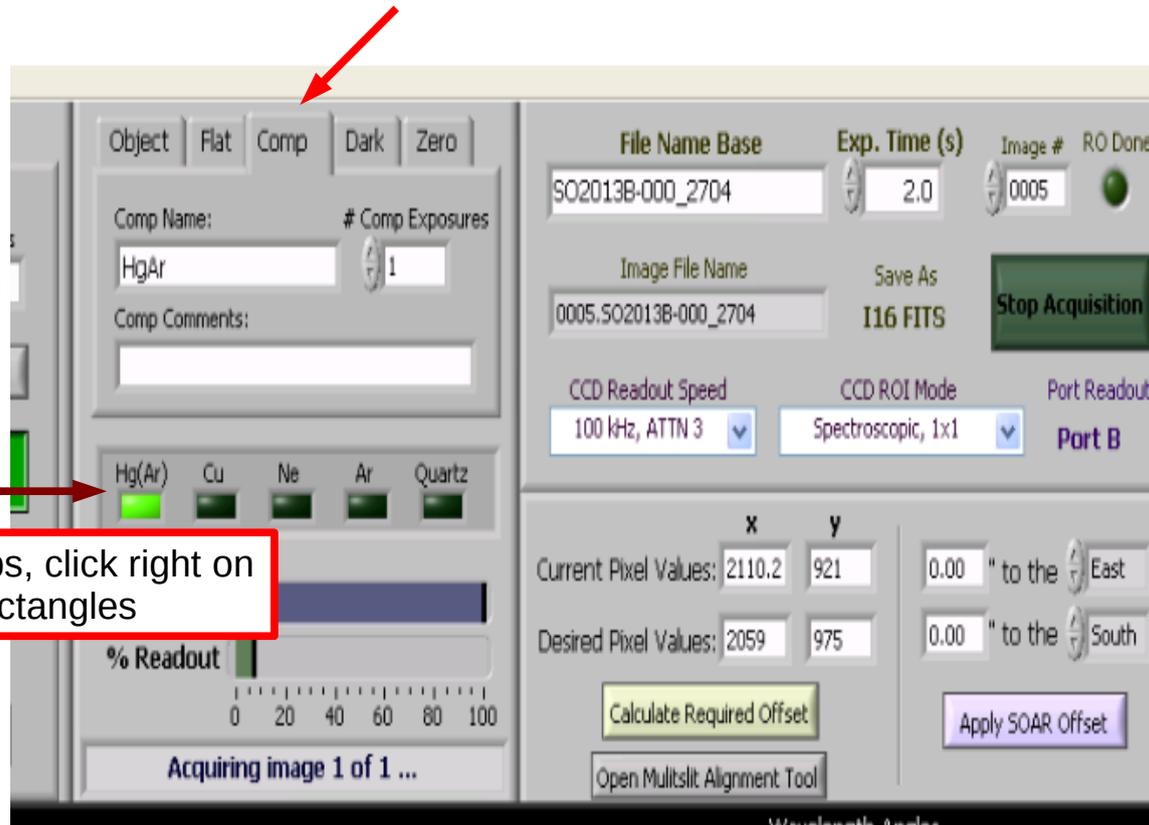
Now you are ready to take your science spectrum.



Set up exposure time, ccd readout speed, blocking filter, etc and go ahead.

To obtain a comparison lamp spectrum:

- 1) Ask the TO to stop guiding and to put the comparison mirror in the optical path;
- 2) Select the tab "Comp";
- 3) Turn on the desired lamp (or ask the TO to). Ex.: HgAr. More at [Goodman Comparison Lamps](#)
- 4) Go ahead and click on "Acquire Images".

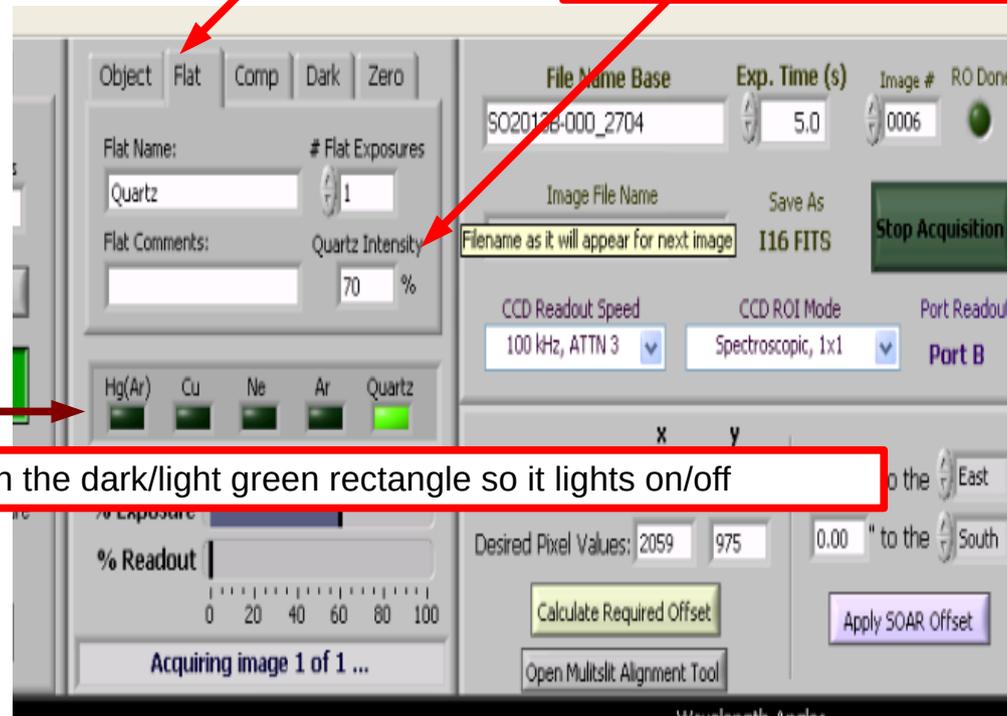


To turn on/off the lamps, click right on the dark/light green rectangles

To obtain a flat-field lamp:

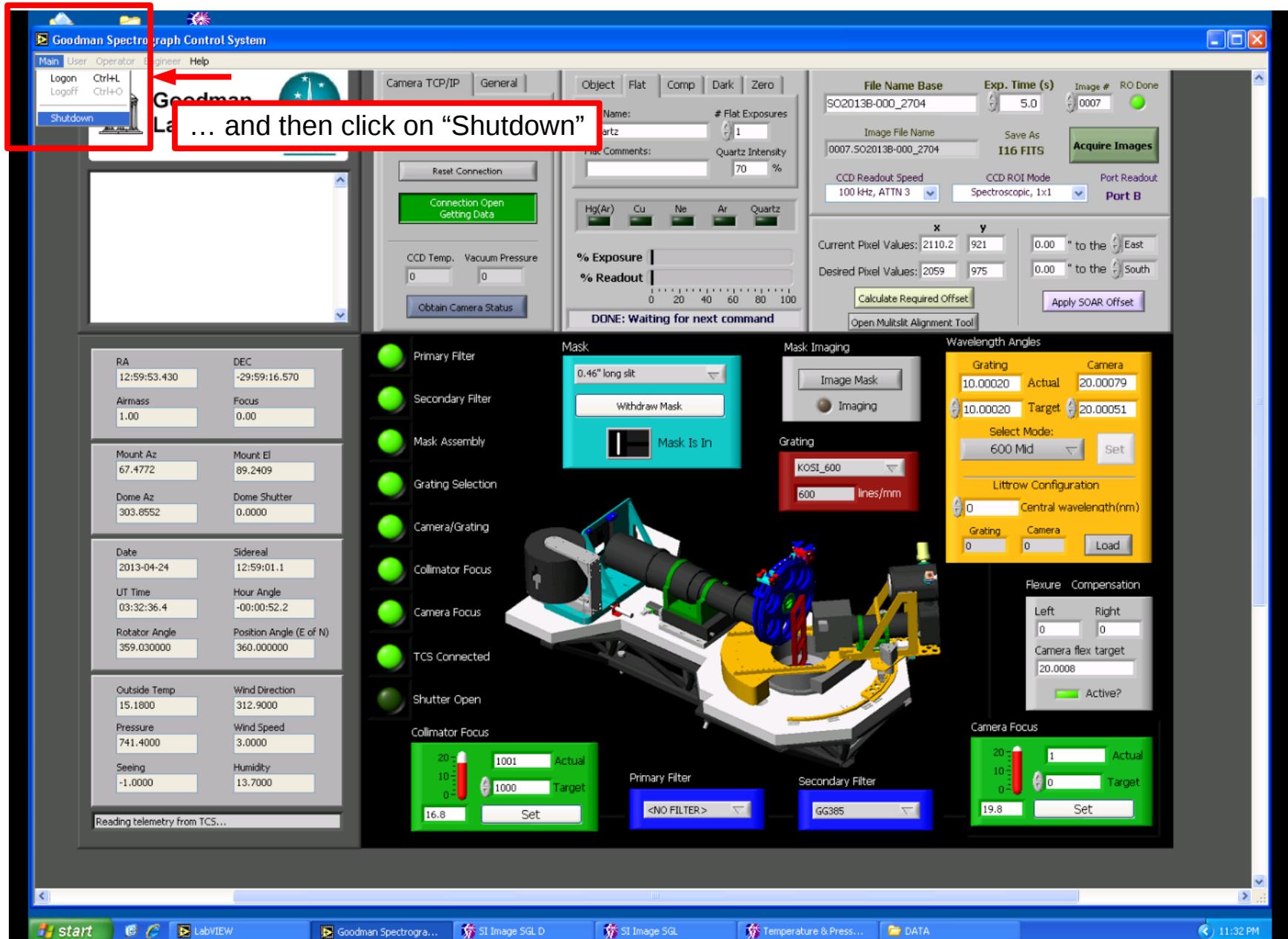
- 1) Ask the TO to stop guiding and to put the comparison mirror in the optical path;
- 2) Select the tab "Flat";
- 3) Adjust the intensity and then turn on the Quartz lamp (or ask the TO to).
- 4) Go ahead and click on "Acquire Images".

Adjust the intensity of the quartz lamp **before** turning it on.



To turn on/off the lamps, click on the dark/light green rectangle so it lights on/off





**Shutdown almost done!**

The screenshot displays the Goodman Spectrograph Control System interface. A central dialog box titled "Shutdown" is open, indicating that systems are returning to safe configurations. The dialog lists the following items to be shut down:

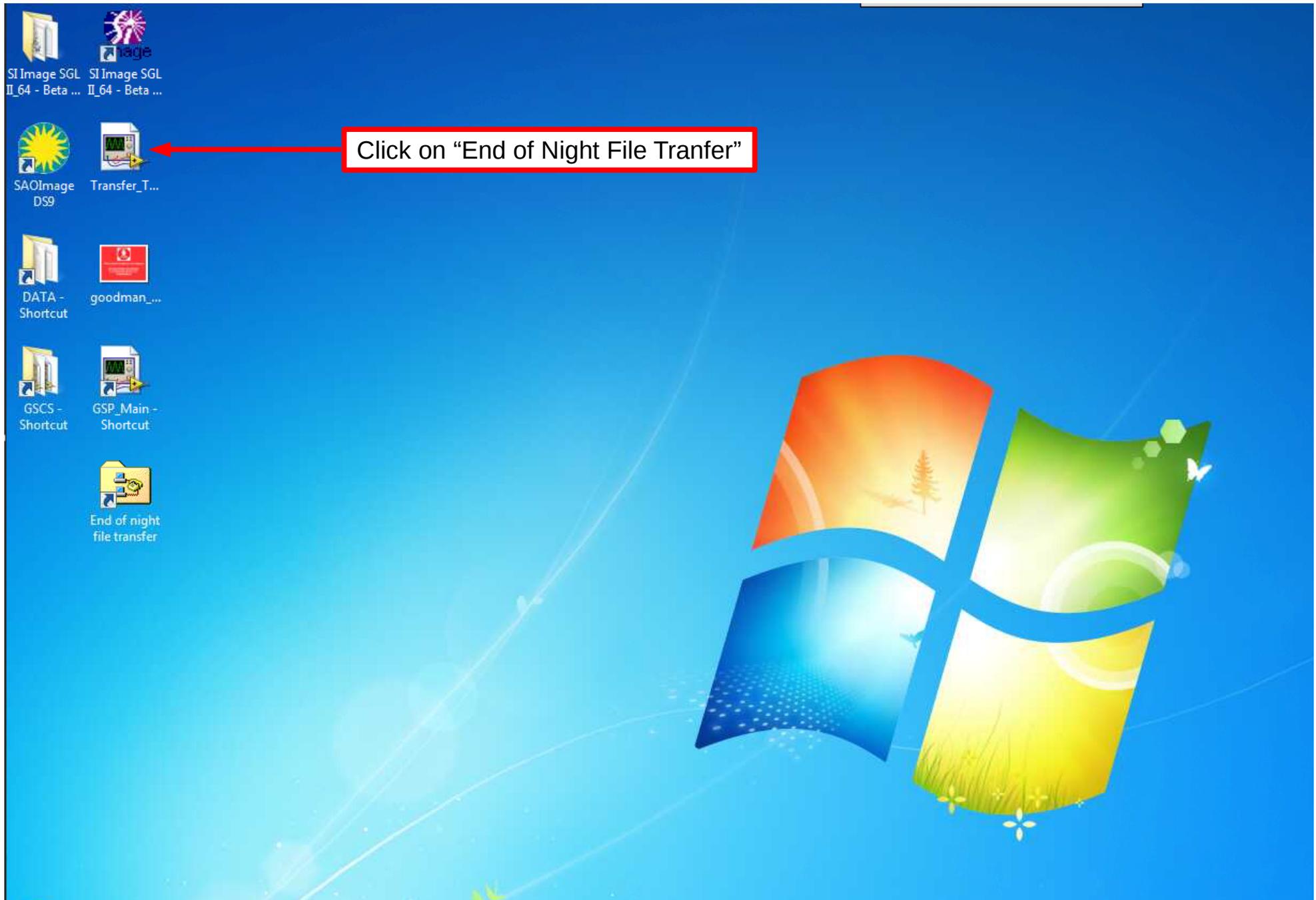
- Wavelength Assembly
- Grating Translation
- Slit Assembly
- Primary Filter Wheel
- Secondary Filter Wheel
- Collimator Focus
- Camera Focus
- TCS Link
- Logger
- SI Camera Module
- TCPServer

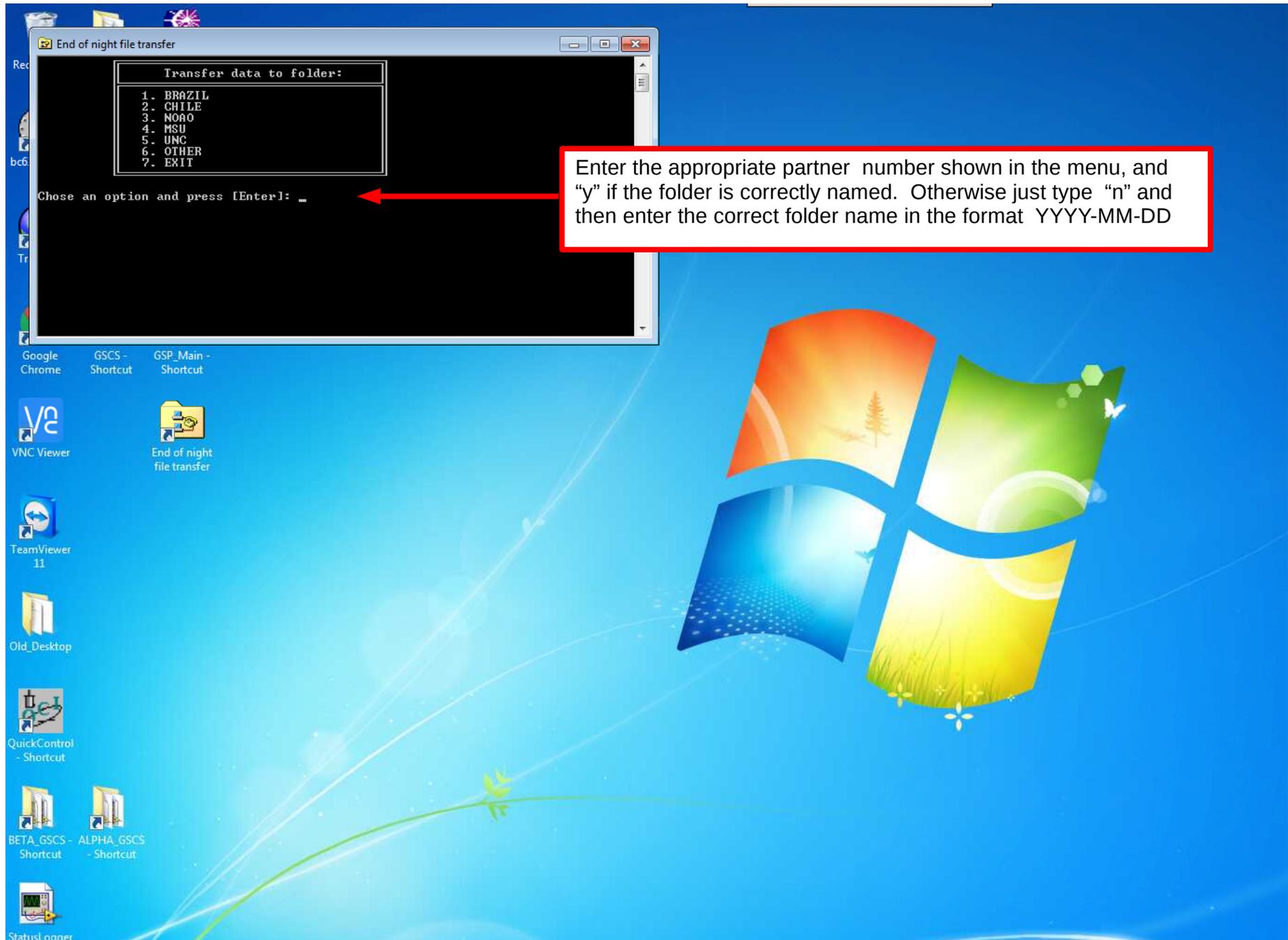
The background interface includes several control panels:

- Camera TCP/IP:** Port 2055, Server Address Localhost.
- Object/Flat/Comp/Dark/Zero:** Flat Name: Quartz, # Flat Exposures: 1, Quartz Intensity: 70%.
- File Name Base:** SO2013B-000\_2704, Exp. Time (s): 5.0, Image #: 0007.
- Image File Name:** 0007.SO2013B-000\_2704, Save As: 116 FITS.
- CCD Readout Speed:** 100 kHz, ATTN 3.
- CCD ROI Mode:** Spectroscopic, 1x1.
- Port Readout:** Port B.
- Current Pixel Values:** x: 2110.2, y: 921.
- Desired Pixel Values:** x: 2059, y: 975.
- Mask Imaging:** Image Mask, Imaging.
- Grating:** <NO GRATING>, 0 lines/mm.
- Wavelength Angles:** Grating: 11.75080 Actual, 20.74000 Target; Camera: 18.96342 Actual, 12.21000 Target.
- Flexure Compensation:** Left: 0, Right: 0, Camera flex target: 20.0008.
- Collimator Focus:** 16.9, 1001 Actual, 1000 Target.
- Primary Filter:** <NO FILTER>.
- Secondary Filter:** GG385.
- Camera Focus:** 19.8, 1 Actual, 0 Target.

The interface also shows environmental data (RA, Airmass, Mount Az, Dome Az, Date, UT Time, etc.) and a 3D model of the telescope and spectrograph assembly.

# Moving data to the backup directory





- Red light on the Goodman GUI shown in one or more mechanisms.
- How to abort an acquisition properly.
- The shutter does not close after stopping data acquisition.
- Light trails in bright stars in imaging mode.
- Images are not being transferred to the right folder on soaric7

The screenshot shows the Goodman Spectrograph Control System interface. A red light is illuminated on the 'Mask Assembly' indicator in the status bar on the left. The interface includes various control panels for telescope parameters, spectrograph settings, and environmental data.

**When red lights are being shown in one or more mechanisms:**

- 1) Report the problem to the TO and ask him to move the rotator to angle equal zero;
- 2) Log off/Shut down;
- 3) Ask the TO to turn off the Goodman Camera Electronics and wait ~5s to turn on it again;
- 4) Log in/Home the systems again.

If the problem persists, repeat the procedure described above. If a second attempt does not fix the problem, call the Support Scientist

The GUI displays the following data and controls:

- Telescope Parameters:** RA (22:31:11.470), DEC (-30:10:24.914), Airmass (1.00), Focus (0.00), Mount Az (67.4769), Mount El (89.2345), Dome Az (303.8552), Dome Shutter (0.0000).
- Time and Position:** Date (2013-04-24), Sidereal (22:30:24.1), UT Time (13:02:25.8), Hour Angle (-00:00:47.3), Rotator Angle (359.029000), Position Angle (E of N) (360.000000).
- Environmental Data:** Outside Temp (16.2200), Wind Direction (39.4000), Pressure (741.2000), Wind Speed (0.0000), Seeing (-1.0000), Humidity (14.3000).
- Status Bar:** Primary Filter (Green), Secondary Filter (Green), Mask Assembly (Red), Grating Selection (Green), Camera/Grating (Green), Collimator Focus (Green), Camera Focus (Green), TCS Connected (Green), Shutter Open (Green).
- Mask Control:** Mask (0.46" long slit), Withdraw Mask, Mask Is In.
- Grating Selection:** KOSI\_600, 600 lines/mm.
- Grating and Camera Settings:** Grating (10.00000 Actual, 19.99995 Camera), Target (10.00000, 20.00000), Select Mode (600 Mid), Litrow Configuration (Central wavelength (nm) 0).
- Flexure Compensation:** Left (0), Right (0), Camera flex target (20), Active? (Green).
- Collimator Focus:** 15.8, 1001 Actual, 1000 Target, Set.
- Primary Filter:** <NO FILTER>
- Secondary Filter:** GG385
- Camera Focus:** 18.8, 456 Actual, 455 Target, Set.

The screenshot displays the Goodman Spectrograph Control System interface. The window title is "Goodman Spectrograph Control System" and the user is logged in as "Main User Operator Engineer Help". The interface is divided into several panels:

- Top Left:** Goodman Laboratory logo and SOAR TELESCOPE logo.
- Top Center:** Camera TCP/IP settings (Port: 2055, Server Address: Localhost) and a "Connection Open Getting Data" button.
- Top Right:** Object selection (Flat, Comp, Dark, Zero), File Name Base, Exp. Time (s) (10.0), Image # (0001), and a "Stop Acquisition" button. A red arrow points to this button.
- Middle Left:** CCD Temp. (0) and Vacuum Pressure (0) with an "Obtain Camera Status" button.
- Middle Center:** Object Name, # Exposures (1), and Object Comments. Below are buttons for Hg(Ar), Cu, Ne, Ar, and Quartz.
- Middle Right:** CCD Readout Speed (400 kHz, ATTN 0), CCD ROI Mode (Spectroscopic, 1x1), and Port Readout (Port B). It also shows current and desired pixel values and a "Calculate Required Offset" button.
- Bottom Left:** RA (10:41:54.370), DEC (-29:59:30.602), Airmass (1.00), Focus (0.00), Mount Az (67.4761), Mount El (89.2478), Dome Az (24.5013), Dome Shutter (0.0000), Date (2013-04-26), Sidereal (10:40:46.7), UT Time (01:06:52.8), Hour Angle (-00:01:07.6), Rotator Angle (5.676000), Position Angle (E of N) (360.000000).
- Bottom Center:** Mask selection (<NO MASK>), Mask Imaging, Grating selection (<NO GRATING>), and Wavelength Angles (Grating: 20.73950, Camera: 12.20986, Target: 20.74000, 12.21000).
- Bottom Right:** Flexure Compensation (Left: 50, Right: 50, Camera flex target: 18.9913) and Camera Focus (Actual: 1, Target: 0, Set: 18.3).

A red box highlights the "Stop Acquisition" button with the text: "To abort an acquisition... 1) Click the 'Stop Acquisition' button during an exposure."

The screenshot displays the Goodman Spectrograph Control System (GSCS) interface. A central dialog box is open, reporting an error: "Error 57 occurred at TCP Read in Send TCP-IP Cmd and Get Ackn 3.vi->SIcamera\_Manager.vi". The dialog lists a possible reason: "LabVIEW: The network connection is busy." A red arrow points to the "Continue" button in the dialog. The background interface shows various control panels, including "Camera TCP/IP", "Object" settings, "File Name Base", "Exp. Time (s)", and "Wavelength Angles". A 3D model of the telescope is visible in the center.

**To abort an acquisition...**

- 1) Click the "Stop Acquisition" button during an exposure.
- 2) You will get an error message. Click on "**Continue**".

The screenshot displays the Goodman Spectrograph Control System interface. A central dialog box with a red 'X' icon and the title 'Error 57 occurred at TCP Read in Send TCP-IP Cmd and Get Ackn 3.vi->SIcamera\_Manager.vi' is overlaid on the main control panel. The dialog box contains the text 'Possible reason(s): LabVIEW: The network connection is busy.' and two buttons: 'Continue' (highlighted with a red arrow) and 'Stop'. The background interface includes various control panels for camera settings, object selection, file naming, and telescope parameters. A 3D model of the telescope is visible in the lower right quadrant of the main interface.

To abort an acquisition...

- 1) Click the "Stop Acquisition" button during an exposure.
- 2) You will get an error message. Click on "**Continue**".
- 3) A second error message will appear. Click on "**Continue**" again.

**Warning:** this procedure should be used only if you really need to!

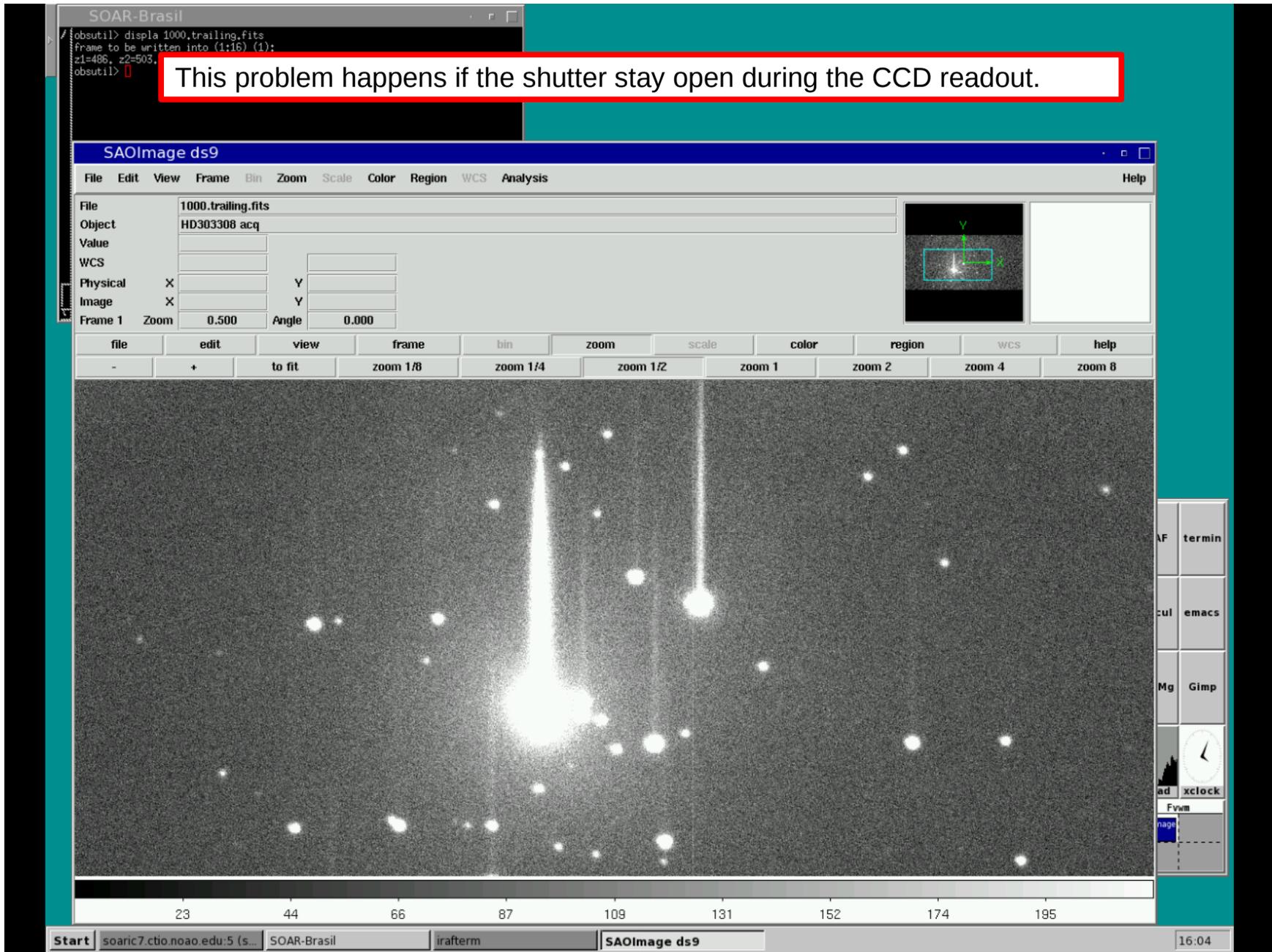
**Never click on "Stop" in the small error pop-up window.** If you do, the GUI will get frozen and you will have to do a full shutdown and exit of the GUI, and start it up again.

If the shutter does not close after stopping the data acquisition, just take one short exposure to force the shutter to close.

The screenshot shows the Goodman Laboratory SOAR Telescope control software. Key sections include:

- System:** Goodman Laboratory logo, SOAR TELESCOPE logo, and a "Just-In-Time Advice" window.
- Camera TCP/IP:** Port 2055, Server Address Localhost, Connection Open button.
- Object:** Object Name, # Exposures (1), Object Comments.
- File Name Base:** image, Exp. Time (s) 10.0, Image # 0002, RO Done (green).
- Grating:** 20.73950 Actual, 12.20997 Camera, 20.74000 Target, 12.21000 Camera.
- Shutter Status:** Shutter Open (green indicator).
- Collimator Focus:** 15.7 Actual, 0 Target.
- Primary Filter:** <NO FILTER>
- Secondary Filter:** <NO FILTER>
- Camera Focus:** 18.3 Actual, 0 Target.
- Flexure Compensation:** Left 50, Right 50, Camera flex target 18.9913.

This problem happens if the shutter stay open during the CCD readout.



To fix the problem, check if the shutter is working in "Triggered Acq." mode on the SI Image SGL software (for the **Blue Camera**). For the **Red Camera** the mode is "Light"

Select "Triggered Acq." for the Blue Camera or "Light" for the Rec Camera, and acquire another image.

Region Statistics		Max	5968.00
Red Cursor	Min	479.00	
X Offset	P-P	5489.00	
Y Offset	Mean	1170.54	
	RMS Noise	1521.09	

SI Image SGL

File Edit Operate Math Image Correction View Window Help

Cur 0	1.0	0.0	484.0
Cur 1	199.0	0.0	485.0

Continuous Off

Acquire Image 1 Triggered Acq.

Acquire Image 2 Light Exposure

Exposure Time 01.000 Acq. Time 02:06.6

%Hist. 1

Acquisition Mode Single Image

CCD Settings CCD Status

Display Image 1

Image 1: 0014.focus\_600m.fits

Image 2:

Z Scale B

Region Statistics	Max	5968.00
Red Cursor	Min	479.00
X Offset	P-P	5489.00
Y Offset	Mean	1170.54
	RMS Noise	1521.09

start LabVIEW Goodman Spectrogra... Transfer\_To\_SOARIC... SI Image SGL D SI Image SGL Temperature & Press... DATA 10:27 AM

If the problem persists, follow the "Starting SI Image SGL D" procedure as described in the Goodman Startup/Shutdown Guide for the appropriate Camera

To fix the problem, check if the shutter is working in "Triggered Acq." mode on the SI Image SGL software (for the Blue Camera). For the Red Camera the mode is "Light"

Select "Triggered Acq." for the Blue Camera or "Light" for the Rec Camera, and acquire another image.

The screenshot shows the SI Image SGL software interface. The top panel displays acquisition parameters for two cameras: Cur 0 (1.0, 0.0, 484.0) and Cur 1 (199.0, 0.0, 485.0). The acquisition mode is set to "Single Image". The "Acquire Image 1" button is highlighted. The "Acquisition Mode" dropdown is set to "Single Image". The "Exposure Time" is 01.000 and the "Acq. Time" is 02:06.6. The "Region Statistics" table is visible at the bottom right:

Region Statistics	Max	5968.00
Red Cursor	Min	479.00
X Offset	P-P	5489.00
Y Offset	Mean	1170.54
	RMS Noise	1521.09

**WARNING: DO NOT** close the “SI Image SGL D” window. Only minimize the window, **NEVER** click on the red X, or Exit in the “File” menu.

The screenshot shows the 'SI Camera CCD Settings' dialog box. The 'Configuration' tab is selected, displaying the following options:

- Camera Settings:** Serial (0), Parallel (1100), CCD ROI (visualized as a red box on a graph), Origin (0), Length (4142), Binning (1).
- Readout Mode:** Mode 8: 400 KHz - Attn 0, with a dropdown menu to 'Select Camera Readout Mode'.
- Port/Amplifier:** B
- Buttons:** Save to Settings File, Open Settings File, Use Saved Configuration Parameters (checkbox), Power On Defaults (Read EEPROM, Write to EEPROM), Cooler ON, Add New Mode, Save Mode, Delete Last Mode, Print Settings.

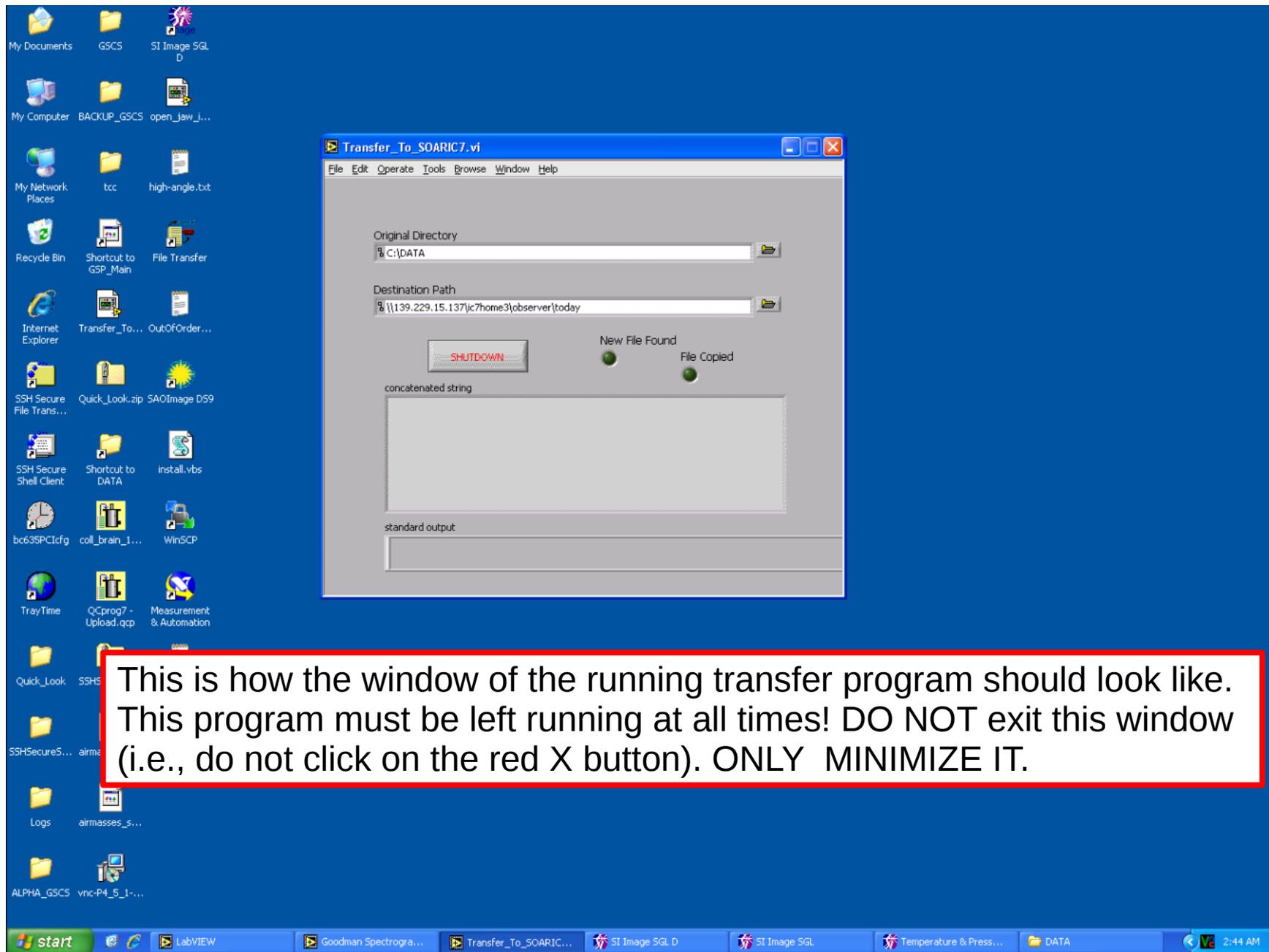
The background LabVIEW window shows a graph with a vertical axis from 0 to 4142 and a horizontal axis from 0 to 40. The taskbar at the bottom includes 'LabVIEW', 'Goodman Spectrogra...', 'Transfer\_To\_SOARIC...', 'SI Image SGL D', 'SI Image SGL', 'Temperature & Press...', and 'DATA'. The system clock shows 10:29 AM.

This program controls the CCD cooling so it must be always running

## Images are not been transferred to soaric7

If images are not been trasferred to /home3/observer/today/ on soaric7:

- 1) Click the “Transfer\_To...” icon on Desktop;
- 2) Click the run button (white arrow) on the “LabVIEW” window.



# Focus sequence in spectroscopic mode

Adapted by D. Sanmartim from L. Fraga's Guide

**Suggested setup:**

- CDD Readout Speed of "400 kHz, ATTN 0";
- Put the "CCD ROI Mode" in "Spectroscopic, 1x1";
- Use the narrowest slit (0.46");

The screenshot displays the SOAR Telescope control software interface. A red box highlights the suggested setup parameters: CDD Readout Speed of "400 kHz, ATTN 0" and CCD ROI Mode of "Spectroscopic, 1x1".

**Control Panels:**

- Object/Flat/Comp/Dark/Zero:** Buttons for object selection.
- File Name Base:** "image", Exp. Time (s): "1.0", Image #: "0001", RO Done:
- Image File Name:** "0001.image.fits", Save As: "116 FITS", **Acquire Images** button.
- CCD Readout Speed:** "400 kHz, ATTN 0" (indicated by a red arrow).
- CCD ROI Mode:** "Spectroscopic, 1x1" (indicated by a red arrow).
- Port Readout:** "Port B"
- Current/Desired Pixel Values:** x: 0, y: 0, 0.00 " to the East/North.
- Buttons:** Calculate Required Offset, Apply SOAR Offset, Open Multislit Alignment Tool.
- Status:** DONE: CCD readout speed changed

**Telescope Parameters:**

- RA:** 03:14:10.479, **DEC:** 18:31:04.419
- Airmass:** 13.37, **Focus:** 0.00
- Mount Az:** 67.4770, **Mount El:** 1.5649
- Dome Az:** 303.8552, **Dome Shutter:** 0.0000
- Date:** 2013-04-24, **Sidereal:** 22:09:50.8
- UT Time:** 12:41:55.8, **Hour Angle:** -05:04:19.6
- Rotator Angle:** 359.029000, **Position Angle (E of N):** 360.000000
- Outside Temp:** 16.0500, **Wind Direction:** 81.9000
- Pressure:** 741.1000, **Wind Speed:** 0.0000
- Seeing:** -1.0000, **Humidity:** 14.4000

**Mask Assembly:**

- Primary Filter:** 0.46" long slit (indicated by a red arrow)
- Secondary Filter:** GG385
- Mask Imaging:** **Image Mask** button, **Imaging** radio button
- Grating:** KOSI\_600, 600 lines/mm
- Wavelength Angles:** Grating: 10.00000, Actual: 19.99998, Camera: 20.00000, Target: 20.00000. Select Mode: 600 Mid. Litrow Configuration: 0 Central wavelength(nm). Grating: 0, Camera: 0, **Load** button.
- Flexure Compensation:** Left: 0, Right: 0, Camera flex target: 20, **Active?**
- Collimator Focus:** 20-0-1000 Actual, 1000 Target, 16.2 Set
- Camera Focus:** 20-0-1000 Actual, 0 Target, 18.8 Set

**3D Model:** A 3D rendering of the telescope's internal components, including the collimator, mask assembly, and camera.

**Taskbar:** Windows taskbar showing "start", "LabVIEW", "Goodman Spectrogra...", "Transfer\_To\_SOARIC...", "SI Image SGL D", "SI Image SGL", "Temperature & Press...", "DATA", and system time "8:41 AM".

Goodman Spectrograph Control System

Main User Operator Engineer

Goodman Laboratory SOAR TELESCOPE

Port: 2055 Server Address: localhost

Reset Connection

Connection Open Getting Data

CCD Temp. Vacuum Pressure: 0 0

Obtain Camera Status

Comp Name: # Comp Exposures: 1

Comp Comments:

Hg(Ar) Cu Ne Ar Quartz

% Exposure % Readout

0 20 40 60 80 100

DONE: CCD readout speed changed

Image File Name: 0001.image.fits Save As

0001.image.fits

CCD Readout Speed: 400 kHz, ATTN 0

Current Pixel Values: 0

Desired Pixel Values: 0

Calculate Required Offset

Open Multislit Alignment Tool

Apply SOAR Offset

Imaging, 1x1  
Imaging, 2x2  
Imaging, 3x3  
✓ Spectroscopic, 1x1  
Spectroscopic, 2x2  
Spectroscopic, 3x3  
Slicer  
Slit Imaging/Alignment  
Set user-defined ROI...  
Custom Mode

RA: 03:14:34.520 DEC: 18:31:04.593

Airmass: 13.37 Focus: 0.00

Mount Az: 67.4770 Mount El: 1.5649

Dome Az: 303.8552 Dome Shutter: 0.0000

Date: 2013-04-24 Sidereal: 22:10:14.8

UT Time: 12:42:19.8 Hour Angle: -05:04:19.6

Rotator Angle: 359.029000 Position Angle (E of N): 360.000000

Outside Temp: 16.0500 Wind Direction: 81.9000

Pressure: 741.1000 Wind Speed: 0.0000

Seeing: -1.0000 Humidity: 14.4000

Reading telemetry from TCS...

Primary Filter: 0.46" long slit

Withdraw Mask

Mask Is In

Mask Imaging: Imaging

Grating: KOST\_600

600 lines/mm

Wavelength Angles: Grating: 10.00000 Actual: 19.99988 Camera: 20.00000 Target: 20.00000

Select Mode: 600 Mid

Littrow Configuration: Central wavelength(nm): 0

Grating: 0 Camera: 0

Flexure Compensation: Left: 0 Right: 0

Camera flex target: 20

Active?

Collimator Focus: 20 - 1001 Actual 1000 Target 15.9 Set

Primary Filter: <NO FILTER>

Secondary Filter: GG385

Camera Focus: 20 - 0 Actual 0 Target 18.7 Set

start LabVIEW Goodman Spectrogra... Transfer\_To\_SOARIC... SI Image SGL D SI Image SGL Temperature & Press... DATA 8:42 AM

Aiming to save time we can read a smaller region of the CCD by using a central ROI of 200 pixels. In "CCD ROI Mode" select "Custom Mode".

Customizing the CCD ROI to a central region of ~200 pixels.  
 1) In "CCD ROI Mode" select "Custom Mode";  
 2) Edit the "Parallel Origin" and "Parallel Length" to 1900 and 200, respectively;

The screenshot shows the Goodman Spectrograph Control System interface. A dialog box titled "CCD Format Parameters" is open, prompting the user to enter CCD formatting parameters. The dialog box contains the following fields and options:

- Serial Origin: 0
- Parallel Origin: 1100
- Serial Length: 4142
- Parallel Length: 1896
- Serial Binning: 1
- Parallel Binning: 1

Buttons in the dialog box include "Lock to Imaging Region", "Lock to Spectral Region", "Lock ROI Around Coord.", "Set Parameters", and "Cancel". The ROI Preview shows a dashed yellow circle on a black background. The background interface includes various control panels for telescope parameters, CCD settings, and environmental data.

Customizing the CCD ROI to a central region of ~200 pixels.

- 1) In "CCD ROI Mode" select "Custom Mode";
- 2) Edit the "Parallel Origin" and "Parallel Length" to 1900 and 200, respectively;
- 3) Click on "Set Parameters" to confirm the new parameters.

The screenshot displays the Goodman Spectrograph Control System interface. A central dialog box titled "Please enter CCD Formatting Parameters:" is open, showing fields for Serial Origin (0), Parallel Origin (1900), Serial Length (4142), Parallel Length (200), Serial Binning (1), and Parallel Binning (1). A "ROI Preview" window shows a dashed green circle and a solid black horizontal line representing the ROI. Red arrows point to the "Parallel Origin" and "Parallel Length" fields. The background interface shows various control panels, including "Wavelength Angles", "Flexure Compensation", and "Camera Focus".

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- 2) Edit the "Parallel Origin" and "Parallel Length" to 1900 and 200, respectively;
- 3) Click on "Set Parameters" to confirm the new parameters.

The screenshot displays the Goodman Spectrograph control software interface. The interface is divided into several panels:

- Top Left:** Status and environmental data panels showing RA, DEC, Airmass, Focus, Mount Az, Mount El, Dome Az, Dome Shutter, Date, Sidereal, UT Time, Hour Angle, Rotator Angle, Position Angle (E of N), Outside Temp, Wind Direction, Pressure, Wind Speed, Seeing, and Humidity.
- Top Center:** Acquisition parameters including File Name Base (image), Exp. Time (s) (1.0), Image # (0001), RO Done, Image File Name (0001.image.fits), Save As (116 FITS), CCD Readout Speed (400 kHz, ATTN 0), CCD ROI Mode (Set user-defined ROI...), Port Readout (Port B), Current Pixel Values (0, 0, 0.00), Desired Pixel Values (0, 0, 0.00), and buttons for Calculate Required Offset and Apply SOAR Offset.
- Top Right:** Wavelength Angles panel showing Grating (600 Mid), Actual (10.00010), Target (20.00000), and Litrow Configuration (Central wavelength (nm) 0).
- Center:** A 3D model of the spectrograph with various control buttons and indicators, including Mask (0.46" long slit), Mask Imaging, Grating (KOSI\_600, 600 lines/mm), Primary Filter (<NO FILTER>), Secondary Filter (GG385), Collimator Focus (15.8), and Camera Focus (18.8).
- Bottom Right:** Flexure Compensation panel showing Left (0), Right (0), Camera flex target (20), and Active? (Active).

To do the focus sequence start by setting the camera focus value to -2000. On the "Camera Focus" panel enter -2000 in "Target" and click on "Set". Wait until "-2000" appears in the "Actual" indicator box.

The screenshot displays the Goodman Spectrograph Control System interface. A red box highlights the instructions for the focus sequence. The interface includes several panels:

- Top Panel:** Contains fields for Name Base, Exp. Time (s) (1.0), Image # (0001), and RO Done. It also has buttons for "Acquire Images" and "Save As" (116 FITS).
- Left Panel:** Displays RA (03:17:08.571), DEC (18:31:05.637), Airmass (13.37), Focus (0.00), Mount Az (67.4770), Mount El (1.5649), Dome Az (303.8552), Dome Shutter (0.0000), Date (2013-04-24), Sidereal (22:12:49.9), UT Time (12:44:53.6), Hour Angle (-05:04:19.5), Rotator Angle (359.029000), Position Angle (E of N) (360.000000), Outside Temp (15.9800), Wind Direction (78.6000), Pressure (741.1000), Wind Speed (0.0000), Seeing (-1.0000), and Humidity (14.4000).
- Center Panel:** Shows a 3D model of the telescope and spectrograph. It includes a "Mask" section with a dropdown for "0.46" long slit" and a "Withdraw Mask" button. Below the model are "Primary Filter" (set to "<NO FILTER>") and "Secondary Filter" (set to "GG385").
- Right Panel:** Contains "Wavelength Angles" with Grating (10.00010), Actual (19.99991), Target (20.00000), and Select Mode (600 Mid). It also has a "Litrow Configuration" section with Central wavelength (nm) (0) and a "Flexure Compensation" section with Left (0) and Right (0) values.
- Bottom Panel:** Features a "Camera Focus" panel with a target of -1500 and an actual value of -1494. It also includes a "Collimator Focus" panel with a target of 1000 and an actual value of 1001.

Focus sequence in spectroscopic mode

Adapted by D. Sanmartim from L. Fraga's Guide

Turn on the comparison lamp (HgAr) and take an image sequence by varying the camera focus value in steps of 300.

The screenshot displays the Goodman Spectrograph Control System interface. Key sections include:

- Top Panel:** Object selection (Flat, Comp, Dark, Zero), File Name Base (focus\_600m), Exp. Time (2.0), and Image # (0001).
- Comparison Lamp:** Hg(Ar) lamp is turned on, indicated by a green light.
- Grating Selection:** KOSI\_600 (600 lines/mm) is selected.
- Wavelength Angles:** Grating is set to 10.00000, Actual is 19.99995, and Target is 20.00000.
- Camera Focus:** A control panel shows the current focus value at 18.7, with a target of -1500.
- Telescope Parameters:** RA (22:20:26.928), DEC (-29:46:57.582), and other astronomical coordinates are displayed.
- Filter Selection:** Primary Filter is set to <NO FILTER> and Secondary Filter is GG385.

Using "display" or "implot" check if the first image is ok (it should show emission lines with high signal.)

The screenshot displays the SOAR-Brasil terminal window and the SAOImage ds9 software interface. The terminal window shows the following commands and output:

```

ecl> display 0001.focus_600m.fits
Frame to be written into (1:16) (1):
z1=481, z2=510,6233
ecl> implot 0001.focus_600m.fits
    
```

The SAOImage ds9 window shows the file `0001.focus_600m.fits` loaded. The interface includes a menu bar (File, Edit, View, Frame, Bin, Zoom, Scale, Color, Region, WCS, Analysis) and a toolbar with various zoom and fit options. A small thumbnail of the image is visible in the top right of the main window. The main image area shows a dark field with a horizontal strip of light, and a green circle highlights a specific region of interest.

Overlaid on the right side is the `irafterm` window, which displays the output of the `implot` command. The plot shows the spectrum of the region of interest, with the x-axis labeled "Column (pixels)" ranging from 0 to 4000 and the y-axis showing intensity from 0 to 6000. The plot displays several sharp emission lines, with the most prominent ones around 2000 and 4000 pixels. The text in the window indicates: "NDAO/IRAF V2.14.1 soar\_brazil@soaric7.ctio.noao.edu Wed 09:54:03 24-Apr-2013 Line 100 of 0001.focus\_600m.fits".

At the bottom right, a taskbar shows several application windows, including `IRAF termin`, `calcul emacs`, `FileMg Gimp`, `xload xclock`, and `FWM`.

The screenshot displays two main windows: SOAR-Brasil and irafterm. The SOAR-Brasil window shows a table of focus measurements for various images and a selected image (0011) at a focus of 398. The irafterm window shows a plot of Profile Width vs. Focus with a red arrow pointing to the minimum width at a focus of 455. Below the plot is a grid of 15 profile plots, each with its corresponding focus and width values. A red box highlights the values 3.29 and 398 in the first row of the grid.

Image	Focus	Width
0001, focus_600m.fits	-1.E3	8.29
0002, focus_600m.fits	-1.E3	8.20
0003, focus_600m.fits	-1.E3	8.00
0004, focus_600m.fits	-999.	7.64
0005, focus_600m.fits	-798.	7.04
0006, focus_600m.fits	-599.	6.24
0007, focus_600m.fits	-398.	5.31
0008, focus_600m.fits	-199.	4.52
0009, focus_600m.fits	0.	3.92
0010, focus_600m.fits	200.	3.54
0011, focus_600m.fits	398.	3.29
0012, focus_600m.fits	597.	3.36
0013, focus_600m.fits	797.	3.67
0014, focus_600m.fits	998.	4.29

Best FWHM in 455 with width of 3.27

Using "specfocus" in the "obsutil" package we can estimate the Best Average Focus of the instrument. On IRAF:

```
cl> obsutil
cl> specfocus *.focus_600m.fits focus="CAM_FOC" slit1=50 slit2=150
```

For the 0.46 arcsec wide slit you should expect a FWHM~3 pixels at the best focus.

The screenshot displays the Goodman Spectrograph Control System interface. On the left, there is a status panel with Goodman Laboratory and SOAR Telescope logos, and a table of environmental and telescope parameters. The top right contains acquisition settings like File Name Base, Exp. Time, and Image #. The center features a 3D model of the telescope with various control panels overlaid, including Mask, Mask Imaging, Wavelength Angles, and Camera Focus. A red box highlights the instruction: "Go back to the position -2000 and then enter the Best Average Focus: 455." A red arrow points from this box to the Camera Focus control panel, which shows an actual value of -1495 and a target value of 455.

Parameter	Value
RA	22:29:43.197
DEC	-30:10:24.104
Airmass	1.00
Focus	0.00
Mount Az	67.4769
Mount El	89.2345
Dome Az	303.8552
Dome Shutter	0.0000
Date	2013-04-24
Sidereal	22:28:55.9
UT Time	13:00:57.8
Hour Angle	-00:00:47.2
Rotator Angle	359.029000
Position Angle (E of N)	360.000000
Outside Temp	16.3800
Wind Direction	15.7000
Pressure	741.2000
Wind Speed	0.0000
Seeing	-1.0000
Humidity	14.3000

The screenshot displays the Goodman Spectrograph Control System interface. At the top left, the Goodman Laboratory logo and SOAR Telescope branding are visible. The main interface is divided into several sections:

- Top Left:** Goodman Laboratory logo and SOAR Telescope logo.
- Top Center:** Camera TCP/IP settings (Port: 2055, Server Address: localhost) and a green "Connection Open Getting Data" button.
- Top Right:** Acquisition parameters including File Name Base (focus\_600m), Exp. Time (2.0 s), Image # (0015), and an "Acquire Images" button. It also shows CCD Readout Speed (400 kHz) and CCD ROI Mode (Spectroscopic, 1x1).
- Middle Left:** A list of status indicators with green lights, including Primary Filter, Secondary Filter, Mask Assembly, Grating Selection, Camera/Grating, Collimator Focus, Camera Focus, TCS Connected, and Shutter Open.
- Middle Center:** A 3D model of the telescope and spectrograph assembly.
- Middle Right:** Wavelength Angles panel with Grating (KOSI\_600) and Camera (19.99995) settings.
- Bottom Left:** Collimator Focus panel with a slider and "Set" button.
- Bottom Center:** Filter selection panels for Primary Filter (<NO FILTER>) and Secondary Filter (GG385).
- Bottom Right:** Camera Focus panel with a slider and "Set" button.

Annotations on the image include a red box with the text "Don't forget!!" pointing to the "Hg(Ar)" button in the "Comp" section, and a larger red box at the bottom with the text "When you finish the the focus sequence don't forget to turn off the comparison lamp!".

Don't forget!!

When you finish the the focus sequence don't forget to turn off the comparison lamp!

Focus sequence in imaging mode

Adapted by D. Sanmartim from L. Fraga's Guide

Run a focus sequence just as explained for spectroscopy mode (varying focus in steps of 300), but using the imaging mode configuration with the slit in the optical path.

Use the "Slit Imaging/Aligmente" CCD ROI Mode!

The screenshot shows the Goodman Laboratory control software interface. Key components are highlighted with red boxes and arrows:

- Top Right:** "CCD ROI Mode" dropdown menu is set to "Slit Imaging/Alignment".
- Center:** "Quartz" lamp indicator is highlighted.
- Mask Selection:** "0.46" long slit" is selected in the "Mask" dropdown.
- Grating Selection:** "Imaging" is selected in the "Select mode:" dropdown.
- Bottom Center:** "Primary Filter" is set to "<NO FILTER>" and "Secondary Filter" is set to "y".
- Bottom Right:** "Camera Focus" is set to "19.9".

Text boxes with arrows provide instructions:

- "Use the 'Quartz' lamp!" points to the Quartz indicator.
- "Use the 0.46" slit" points to the Mask dropdown.
- "Run one focus sequence for each filter you are using in your science!" points to the filter selection area.
- "Put the instrument in imaging mode!" points to the Select mode dropdown.

GUI setup for a focus sequence in imaging mode

The screenshot displays the Goodman Laboratory SOAR Telescope control interface. The interface is organized into several functional panels:

- Top Left:** Goodman Laboratory logo and SOAR Telescope branding.
- Top Center:** Camera TCP/IP settings (Port: 2055, Server Address: Localhost) and a 'Connection Open Getting Data' button.
- Top Right:** Acquisition parameters including File Name Base (focus\_img), Exp. Time (3.0), Image # (0026), and an 'Acquire Images' button.
- Middle Left:** Telemetry data for RA, DEC, Airmass, Focus, Mount Az, Mount El, Dome Az, Dome Shutter, Date, Sidereal, UT Time, Hour Angle, Rotator Angle, Position Angle, Outside Temp, Wind Direction, Pressure, Wind Speed, Seeing, and Humidity.
- Middle Center:** Mask control panel with a 'Mask Is In' indicator and a 3D model of the telescope's mask assembly.
- Middle Right:** Mask Imaging and Grating Selection controls, including a 'Grating' dropdown set to '<NO GRATING>' and 'Lines/mm' input.
- Bottom Left:** Collimator Focus control with a slider and 'Set' button.
- Bottom Center:** Primary and Secondary Filter selection dropdowns.
- Bottom Right:** Camera Focus control with a slider and 'Set' button.

The Windows taskbar at the bottom shows the system is running LabVIEW, Goodman Spectrogra..., Transfer\_To\_SOARIC..., SI Image SGL D, SI Image SGL, Temperature & Press..., and DATA, with the time set to 3:53 PM.

SOAR-Brasil

```
obsutil> imexan 002*.focus_img.fits
display frame (1): (1):
z1=479, z2=497, 6413
z1=479, z2=497, 4296
z1=479, z2=496, 4322
z1=477, z2=495, 9937
z1=479, z2=496, 0951
```

irafterm

```
NOAO/IRAF V2.14.1 soar_brazil@soaric7.ctio.noao.edu Wed 16:55:55 24-Apr-2013
0025.Focus_Img.fits: Lines 955-959
```

SAOImage ds9

File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help

File 0025.focus\_img.fits

Object

Value >496.095

WCS

Physical X 201.164 Y 959.924

Image X 201.164 Y 959.924

Frame 1 Zoom 0.153 Angle 0.000

file edit view frame bin zoom scale color region wcs help

- + to fit zoom 1/8 zoom 1/4 zoom 1/2 zoom 1 zoom 2 zoom 4 zoom 8

23 44

Start soaric7.ctio.noao

irafterm

Pixel Value

Column (pixels)

955-959: center=201.028 peak=1369.44 sigma= 1.301 fwhm= 3.063 bkg= 485.

IRAF termin

calcul emacs

FileMg Gimp

xload xclock

Equation-Block

We can estimate the best average focus also by using the “specfocus” from “obsutil”.  
On IRAF type:  
c/ obsutil  
c/ specfocus \*.focus\_img.fits focus="CAM\_FOC" slit1=900 slit2=1000