

TAKING A SPECTRUM

1. Image the field

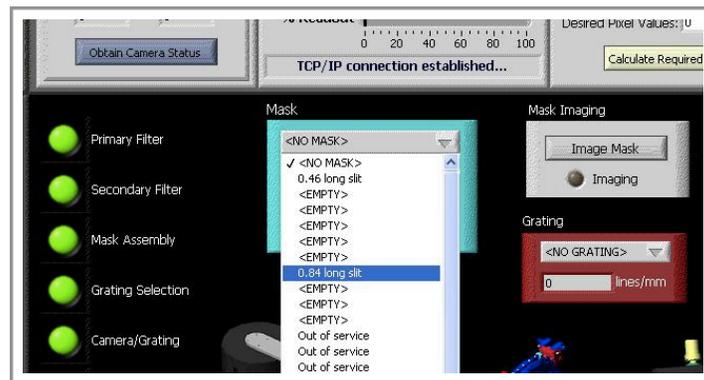
Take an image of the field. (refer to "[TAKING AN IMAGE](#)" document if needed)

2. Measure target position

Find the target in the field, and note the (x,y) pixel location at the center of the target. This can be accomplished by simply looking at the image and hovering the mouse over the target or by running a centroiding algorithm (in IRAF, run *imexam*, and hit the 'r' key while hovering over the target with mouse). We highly recommend using a centroiding algorithm for aligning to small slits.

3. Load a slit mask

Select a slit mask from the drop-down menu in the *Mask* subpanel and wait for the indicator light to turn green. It will take several seconds to retrieve the slit mask and load it into the beam path.



4. Image the slit

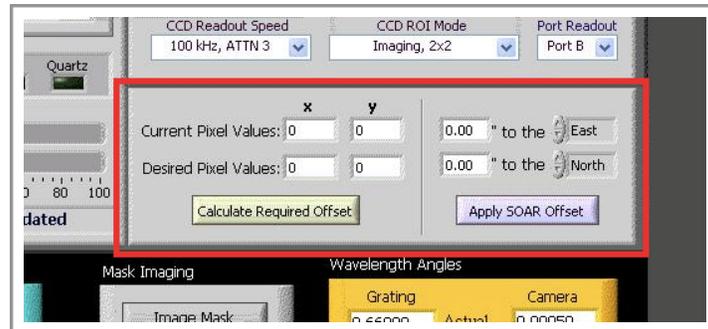
Using the same ROI setup as Step 1, take an image of the slit. Note that a longer exposure time may be required here than was used for the field if the slit is especially narrow.

5. Measure slit position

Find the slit in the image and note the (x,y) coordinates where you would like to place the target. Again, we highly recommend using a centering algorithm to do this (in IRAF, run *imexam*, and hit the 'j' key while hovering over the slit).

6. Move the star on the slit (offset the telescope)

More than likely, the image of the star will not fall directly in the slit. To align the two, offset the SOAR telescope using the controls in the lower right-hand corner of the *Camera Control* subpanel:



- i) Enter the current coordinates of the target in the x & y boxes labelled *Current Pixel Values*
- ii) Enter the coordinates of the slit in the x & y boxes labelled *Desired Pixel Value*
- iii) Press the ***Calculate Required Offset*** button to convert the (x,y) coordinates to angular distances in the NSEW directions. Offset values (in arcseconds) will appear in the boxes to the right.
- iv) Press the ***Apply SOAR Offset*** button to offset the telescope by the calculated amount. PLEASE TELL THE OPERATORS before you do this so they can monitor the telescope control system during the offset.

7. Image the slit & check the alignment

Take an image, and check to be sure your target is properly aligned on the slit. If it is not, repeat steps 1-6 until satisfied.

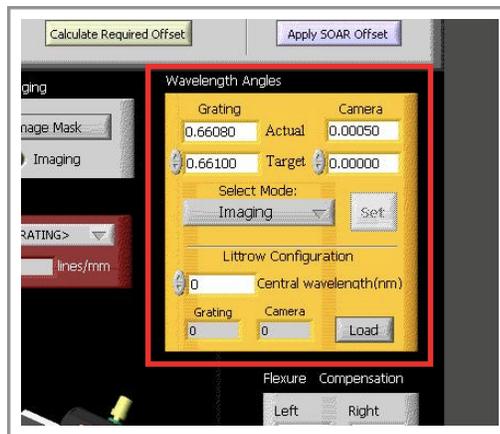
8. Insert a grating

In the *Grating* subpanel, select the grating of your choice from the drop-down menu, and wait for the *Grating* indicator light to turn green.



9. Set the camera and grating angles

In the *Wavelength Angles* subpanel, set the desired angles for the camera and grating.



These angles will determine the range of wavelengths that falls on the CCD chip. There are three ways to do this:

i) *Use a standard mode (highly recommended):*

Click on the drop-down list in the *Wavelength Angles* subpanel, and select one of the standard modes. Selecting a standard mode from the drop-down menu will automatically move the camera and grating to their proper angles. can be found in the document, “STANDARD SPECTROSCOPIC MODES.”

ii) *Use a non-standard, wavelength-centered mode:*

In the *Central Wavelength* input box under *Littrow Configuration*, type in the wavelength (in nm) you would like to optimize the system for (centered on the spectrum) and click the **Load** button. The GSCS will compute the required camera and grating angles and display them in their corresponding *Target* boxes near the top of the subpanel. As this calculation depends on the grating to be used, the grating must already be selected at the time of this calculation. Selecting *Custom* from the *Select Mode* drop-down menu and then clicking **Set** will move the camera and grating to these positions.

iii) *Determine your own parameters:*

To use custom camera and grating angles:

Select *Custom* from the drop-down menu on the *Wavelength Angles* panel. Type the desired angles into the *Target* input boxes for the camera and grating. Click **Set**, and wait for the *Camera/Grating* indicator to turn green.

10. Remove unwanted obstructions

In the *Primary Filter* panel, select *<NO FILTER>* from the drop-down menu, and wait for the *Primary Filter* indicator to turn green. The same applies to the *Secondary Filter* panel.

11. Set CCD region of interest

In the camera control panel, select one of the pre-defined spectroscopic modes from the ROI drop-down menu: *Spectroscopic 1x1*, *Spectroscopic 2x2*, etc. To define a custom ROI, select *Set user-defined ROI*.

You are now ready to take spectra with the Goodman Spectrograph.

Tips & Suggestions

- when aligning a target to an extremely narrow slit, keep the images un-binned to improve the accuracy of your position measurements and telescope offset.
- be careful about binning (see “[SETTING THE BINNING](#)”):
 - **Spatial (Parallel) Direction** -- bin according to the seeing so that there are at least two pixels covering the seeing FWHM. For example, if the seeing is 1”, then the FWHM of the seeing disk covers 6.7 pixels (the pixel scale is 0.15” per pixel). Thus, one could consider binning up to 3 pixels in the spatial direction.
 - **Dispersion (Serial) Direction** -- bin according to the slit size so that there are at least two pixels covering the slit FWHM. For example, the 1.68” slit covers 11 pixels, so one could bin up to 5 in the dispersion direction, and the slit would be resolved over two pixels.
- if resolution is of utmost importance to you, consider running a focus test with a comparison lamp. Take comparison lamp spectra at varying camera focus values and find the value that minimizes the FWHM of the spectral lines.