

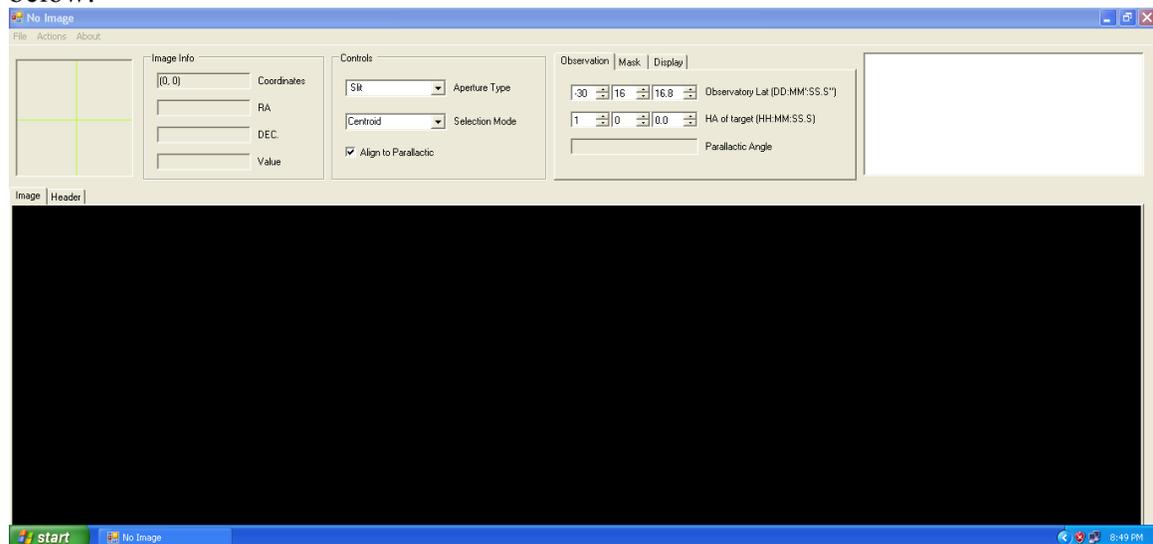
Goodman Slit Mask Design Software

Summary

The slit mask designer software for the Goodman Spectrograph is meant to be intuitive to use and this manual will test that notion by summarizing only the bare basic procedure for using it. To start, you need an image with WCS information in the header. This image may be one taken by the Goodman Spectrograph in imaging mode, or one extracted from the digitized sky survey. If the former, you will have to add astrometric information by uploading it to astrometry.net, but first load it into the slit designer software which will prepare it for astrometry.net by changing some non-standard header characters. Once you load an image with WCS information in into the designer, you will follow the instructions in this manual to choose your targets, and set the mask position and alignment. Finally, you will generate g-code files that can be sent to SOAR for cutting the masks.

Using the Program

The beta release version of the software comes as a zipped directory. Unzip it and run the file SlitDesigner.exe from within the directory. The program should look like the screen below:

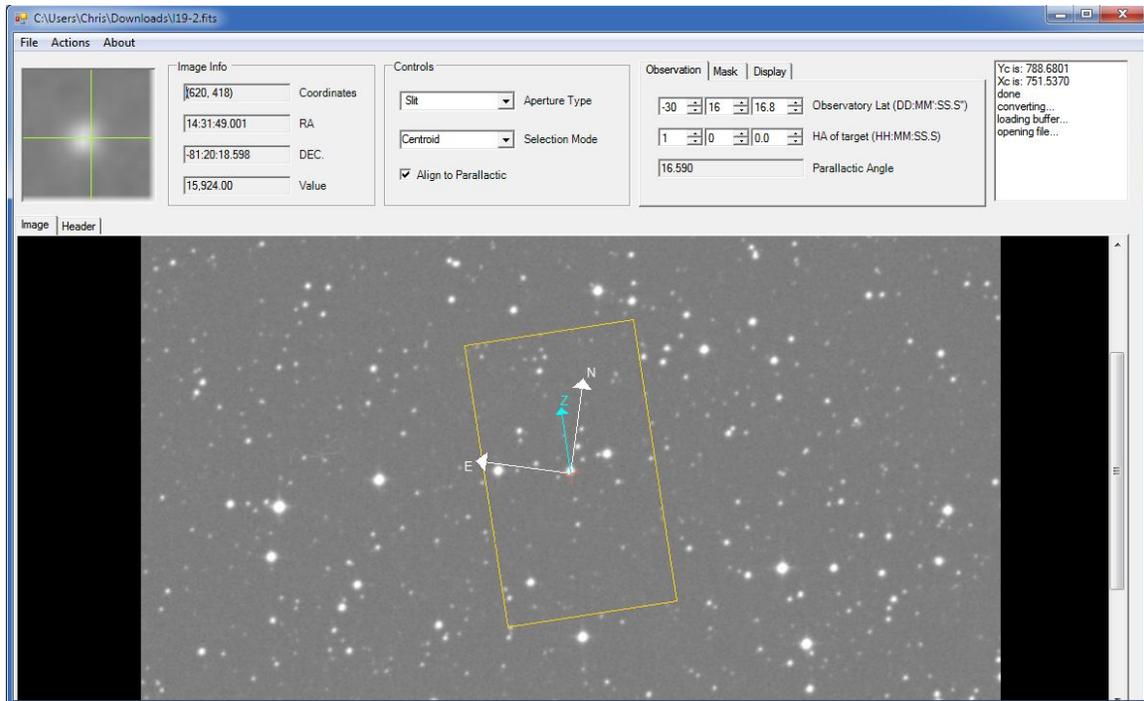


Go to the file menu and choose "Open Image", and you will be allowed to choose the fits image file you want to use to build your slit mask. If the file is a raw image from the Goodman Spectrograph, the program will ask if you want to prepare it to be sent to astrometry.net. You should do this, submit the file to astrometry.net, and then open the image file returned. The program will now see WCS information and allow you to design a mask.

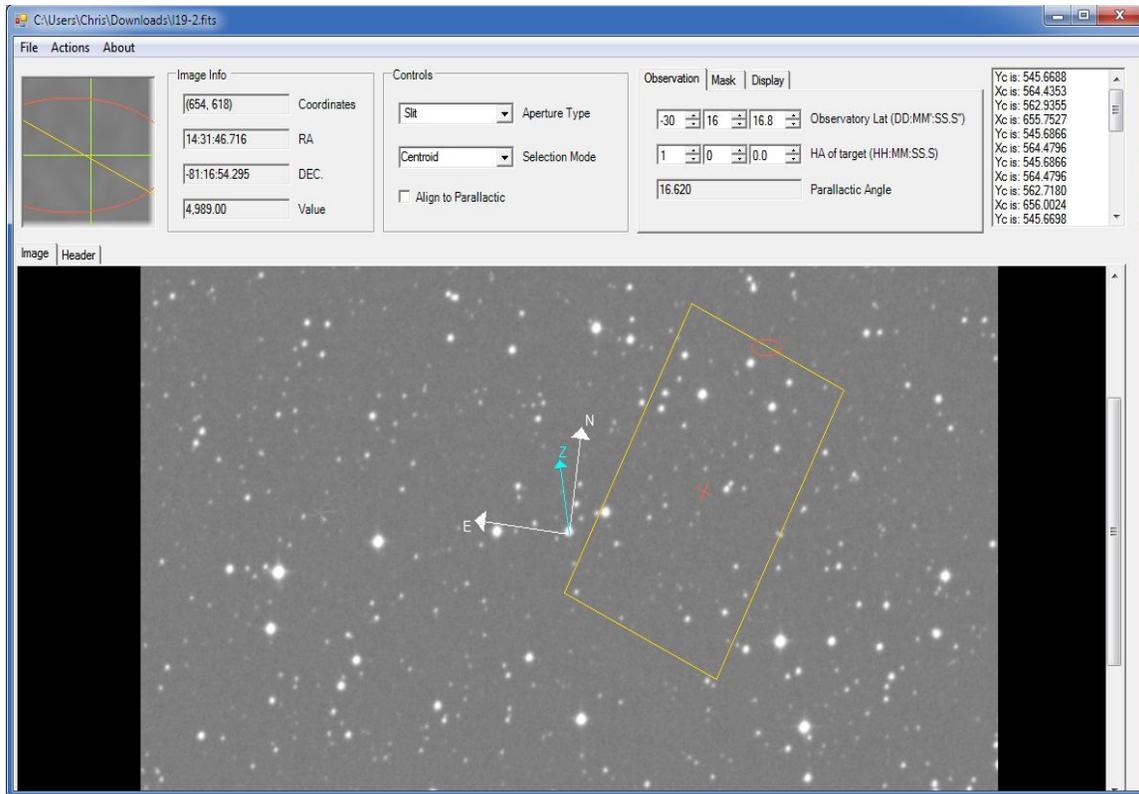
NOTE: Goodman images are flipped East to West from DSS images. This means that masks made with DSS images will need to be flipped in the holder 180 degrees.



The Slitmask Area Controls



The yellow frame in the main program window represents the usable area of the slit mask, with the spatial dimension of the spectrograph aligned to the long side of the rectangle. If you cannot see it, be sure you have not clicked the “header” tab at the top of the image window. The frame can be moved around in the field by right clicking and dragging the red + in its center. It can also be rotated, but the program defaults to the assumption that you want the rotation of the mask to align the slitlets to the parallactic angle. This is a good idea, especially until the atmospheric dispersion compensator (ADC) for SOAR is finished. Correct alignment requires that you enter the latitude of the observatory (SOAR is there by default) and the hour angle at which you want to observe the target. These are available on the “Observation” tab of the rightmost box on the menu bar. If you are unsure when you will reach a target field during the night, you can make several versions of the mask at different choices and pick the appropriate one when observing.

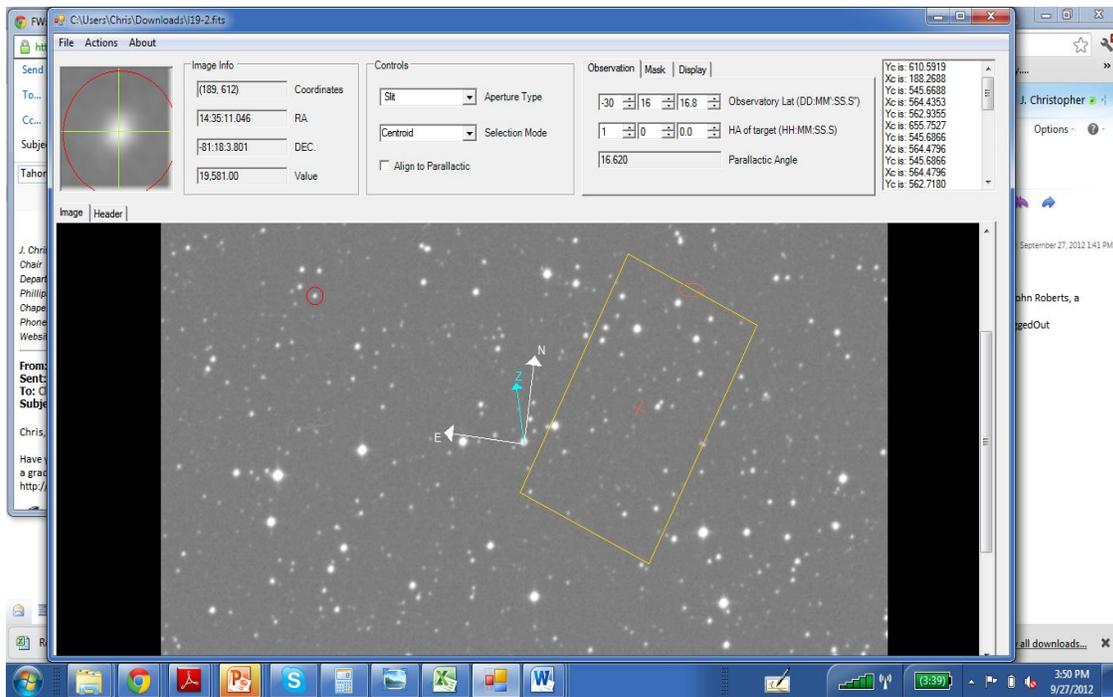


NOTE: Right now the usable area in the program overlaps with the mask holders. This will be corrected in the future. For now, do not place slits or boxes near the edges of the usable field.

If you want to rotate the box freely, as might be the case if you are trying to separate objects so their spectra don't overlap, uncheck the "align to parallaxic" box in the controls section of the menu bar. Now an ellipse appears at the top of the rectangle (see image below) and you can rotate by right clicking and dragging it around

Identifying your targets

To identify your targets, set the Aperture Type to "Slit", put the mouse on each target, and right click. A red circle will appear. If the "Selection Mode" in the controls box is set to "Centroid" the program will automatically try to center the circle on the object (see below). For manual placement, select "Manual" instead of "Centroid", the zoom window in the upper left helps identify the right pixel for centering. The targets need not be inside the slit mask frame, but if they are they will be auto-assigned slitlets. Moving the frame over selected stars changes the red circles into slitlets for any objects whose spectra will not overlap on the camera. To remove targets, right click on the center of the circle. Choosing "Box" for the aperture type before selecting targets will also identify the objects with a red circle, but these will be assigned boxes when they lie within the slit mask frame. Boxes are useful for assigning alignment stars that will assist in aligning the slit mask to the sky.



It is possible to save targets (and the mask design) to a mask file (.msk). From the File menu choose “Save Mask”. Choose “Load Mask” to reload the targets from the file. This feature also offers a way to load multiple targets from a list. The .msk file is in a text format, so putting targets lists into the format used by the .msk files will allow them to be read.

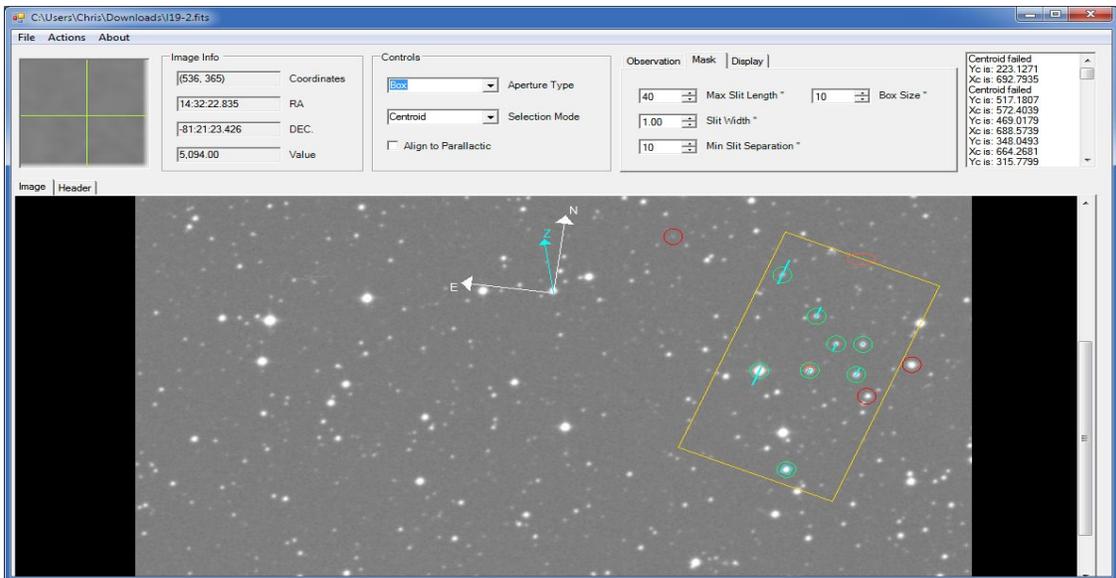
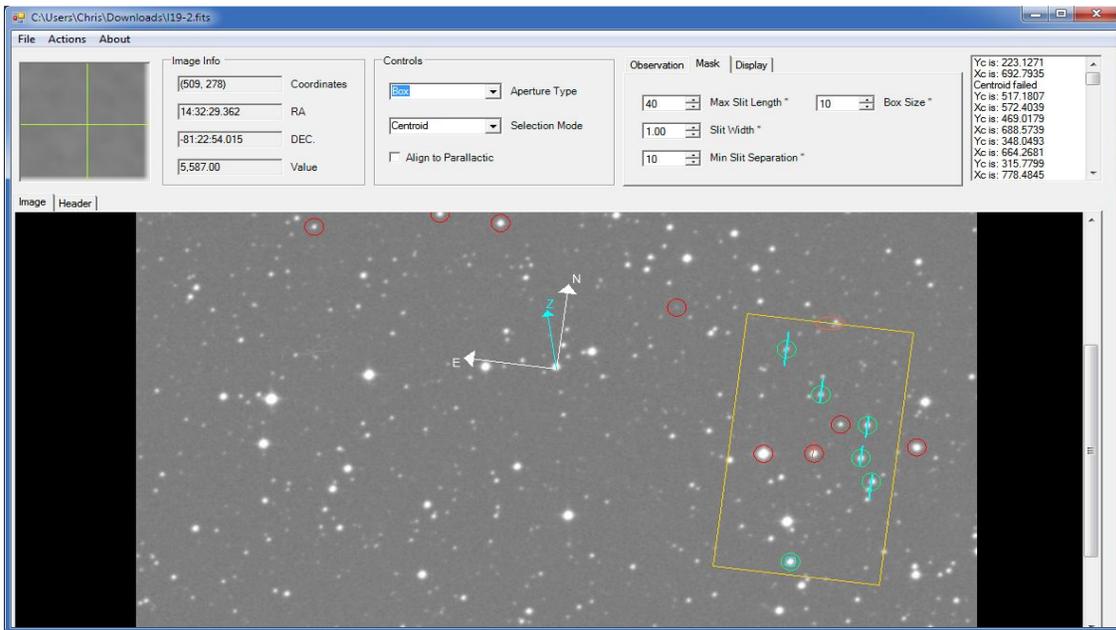
NOTE: The Parallax Angle, Hour Angle and Slit/Box Properties DO NOT update to what you had set in the original mask file. Make sure these parameters are set correctly before you re-save the mask file.

Assigning slitlets to targets

Slitlets are automatically assigned to targets that fall within the mask frame according to rules that are set on the ‘Mask’ tab on the menu bar. The maximum slit length will be used unless it runs into the slit for another object. The minimum separation between slits can be adjusted to make sure all slits have adequate sky background included and do not cut off light from the star. On this tab it is possible to set the slit width, and the size of any objects that were selected with the Box aperture type.

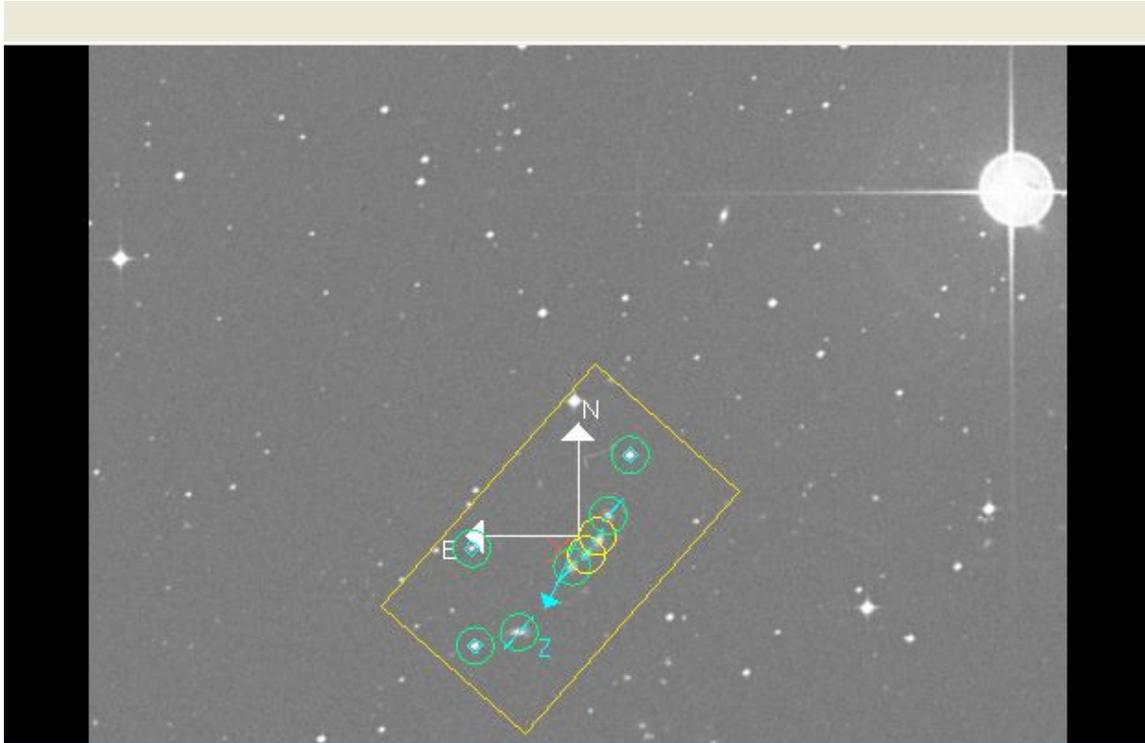
When you open a new image and assign new slits, the parameters of your previous slits are not remembered but the input boxes have the previous parameters in there. You have to change the value of the slit width either up or down one then back to the previous value if you want to keep it the same.

Stars that are in conflict for spectral rows on the CCD will not be assigned slits. Sometimes it is possible to get more stars assigned by slightly rotating the frame (see below). Remember that this requires unchecking the “Align to Parallax” box.



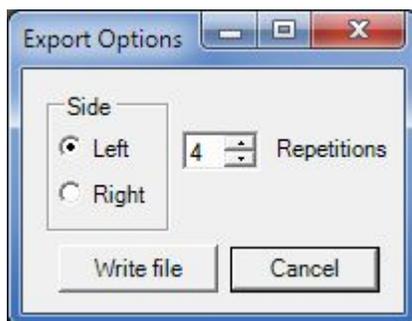
Alignment Boxes

In the Controls section of the Designer, you can change the Aperture Type to Box. This allows you to choose three relatively bright stars to use for aligning the mask on the objects. The boxes should not be arranged in a line. An 'L' shape is ideal (see below).



Generating the cutting file

To generate the file for the laser cutter, choose “Export G-Code” from the File menu. A requester like the one below will pop up. The Goodman Spectrograph uses the mask cutting frame for the Gemini instrument FLAMINGOS, which can accommodate two Goodman masks. Choosing left or right side will determine on which side the mask will be cut. It is most efficient of material to make half of your masks left and half of them right. The number of laser repetitions should not be changed from 4 unless SOAR personnel have told you to do so. Clicking ‘Write File” will write the file out as a text g-code (gerber format) file compatible with the Gemini laser cutter. The filename convention is that the last 5 characters before the extension are the design position angle of the mask in 1/10 degrees and an L or an R for left or right. Please do not change these characters as assigned by the program. The L/R is needed for the machine operator to cut efficiently, and you will want the position angle when it is time to set up at the telescope.



Generating an Image of Your Mask on the Field

You can generate a .emf file which will be an image of your field with the mask overlaid by choosing File → Export EMF. This can be useful during observing, so you don't have to reload the Slit Design software.

Generating a Mask File

You can generate a .msk file which will allow you to reload your masks at a later time by choosing File → Save Mask.

NOTE: The Parallaxic Angle, Hour Angle and Slit/Box Properties DO NOT update to what you had set in the original mask file. Make sure these parameters are set correctly before you re-save the mask file.

Sending Your Cutting File and Image of Mask

You should send your files at least **ONE MONTH** ahead of your run. The following files should be sent to goodman_mos@ctio.noao.edu:

FITS file used to generate your mask

G-code files

.emf files

.msk files

A screenshot of your mask overlaid on the field

Other Features

For very crowded fields, the first mask made will not have slitlets for all the objects. To speed up the making of subsequent masks, selecting “Remove Slits” from the Actions menu will unmark all of the objects with valid slits, allowing additional objects to be assigned slitlets. (try this feature and it will be clear why it is useful). Be careful not to save the mask file after this step, or the removed objects will be lost (I think).

If the “Show Labels” box on the Display tab is unchecked, the compass rose that also shows parallactic angle will disappear. If the .msk file has object names, they will show up next to each object. To put object names in the .msk file, add the field:

```
NAME = G29-38
```

to the record for the object, and the label “G29-38” will appear next to the object whenever “Show Labels” is checked on the Display tab.

The image info box shows the pixel coordinates of the cursor, and the RA and DEC of the cursor calculated from the WCS header information. The bottom box shows the pixel flux value in ADU. Clicking the Header tab will switch the main window view to the FITS header.

Finally, the text screen on the right hand end of the menu bar shows the pixel values of centroids and may display centroid errors if the algorithm fails (e.g. on an extended or binary object).

Missing features:

We want to be able to write a gerber file to engrave the mask identifier on the mask itself, to avoid confusion at the telescope. We are awaiting more information to implement.