ISIS Spectroscopy Processing

1. Image Acquisition
   1. Use Fit format
   2. Bias, darks and Flats - 70% saturation
   3. Calibration Lamp
      1. Use several exposures stacked to capture faint lines
   4. Reference star
   5. Target star
      1. Don't change focus!
   6. Use DAT and PNG files as standard
2.  "Settings" tab
   1. Select "Aply600 with calibration module" from drop down list. (First use only).
   2. Set Working Directory
      1. Note: all files - Target, Bias (offset), Darks, Flats, Calibration lamp and comparison star (if needed) should be stored here.
      2. ALL FILENAMES should end in "-" prior to file number extension e.g. "Starname- ". ISIS will automatically look for the subsequent files in the set of exposures.
   3. Ensure Gnuplot and database directory should also be input on very first use
   4. Note users Observatory settings on first use.
3.  "Masters" tab
   1. Insert your "Offset" (Bias) images. e.g. "Bias-"
      1. The number of files found in the working directory will be displayed. Press the grey button to refresh.
      2. Insert chosen name of master bias file in orange box
      3. Press "Go"
   2. Insert your "Dark" images. e.g. "Dark-"
      1. The number of files found in the working directory will be displayed. Press the grey button to refresh.
      2. Insert chosen name of master dark file in orange box
      3. Insert name of master bias image (computed above) in yellow box
      4. Press "Go"
   3. Insert your "Cosmetic" images. e.g. "Defect-"
      1. The number of files found in the working directory will be displayed. Press the grey button to refresh.
      2. Insert chosen name of defect file in orange box
      3. Insert name of master dark image (computed above) in yellow box
      4. Select "Threshold value". This sets the limit at which pixels are considered 'hot'. The higher the value the fewer 'hot' pixels are detected.
      5. Press "Go"
   4. Insert your "Flat" images. e.g. "Flat-"
      1. The number of files found in the working directory will be displayed. Press the grey button to refresh.
      2. Insert chosen name of master flat file in orange box
      3. Insert name of master dark image (computed above) in yellow box
      4. Insert name of master bias image (computed above) in yellow box
      5. Press "Go"
4.  "Image"
   1.  Use the Directory/File button to select the first file in the target sequence
   2. Press "Display".
      1. Use the scroll bars to the right/lower panel to locate your spectral image.
      2. You may need to use the "Threshold" sliders at the bottom of the frame to enlighten the image.
      3.  Use the blue left/right arrows to scroll through your images.
      4. Tick the "Graticule" tickbox
      5. Double click on the spectrum to set the position of the reticule
      6. Press Next

you will be forwarded to the next tab and your selections will be committed to the process

1.  "General"
   1. The name of your target should have been carried through to the orange "Root Name" box
   2. Insert your chosen target name in the green "Object" box (this is what will appear in the file header).
   3. "Generic Name" (file name without the file number); Bias (Offset); Dark and Flat master files should all have been carried forward to this tab.
      1. Also, the number of target files should also be displayed
   4. Insert your (Aply) Calibration lamp image.
      1. This will not have been inserted so overwrite anything in this box.
   5. Check the "Spectral Calibration" box
      1. Select the "Aply600 with calibration module" from "Pre-Defined Mode" drop down box in upper-right "Spectral Calibration" panel.
   6. Insert the pixel size of your camera
      1. This may need to be amended from the real value later in the process.
   7. Inset your cosmetic Defect file name (From the "Masters" tab
   8. Leave Instrument Response filename empty at first attempt/run-through
   9. Insert your name, observatory and instrument details here. Leave the "R" box empty at this stage
   10. Insert a "-" into the "Object" and "Calibration" Suffix boxes in the lower right panel. Leave the "Prefix" box empty.
   11. Press Next
       1. you will be forwarded to the next tab and your selections will be committed to the process
2.  "Calibration"
   1. The first "Image to Process" and the "Calibration Image" filenames should have been carried forward into the top left boxes.
   2. Press "Display" for the target image'
      1. Find your spectral image in the frame using the scroll buttons and, if necessary, the threshold sliders (as before).
   3. If necessary check the "Graticule" box to display the binning zones
   4. If necessary double click on the spectrum to position the binning zones
      1. The Binning Zones width and position can be adjusted by pressing the Binning Zone Adjustment button.
   5. Set the "Tilt" input by...
      1. Draw (Click, hold and drag) a box horizontally around the length of the spectral image to encompass the target image.

Press "Tilt" button on right of frame - and a value will be recorded in the "Tilt Angle" box

* 1. Select the "Calibration Image" by Pressing the "Display" button top left
  2. Set the "Smile" input by...
     1. Draw (Click, hold and drag) a box vertically around the length of a bright spectral line. As much as possible.

Press "Smile" button on right of frame - and values will be recorded in the "Smile Y" and "Radius" boxes.

* 1. Identify the 5852.49 A emission line in the calibration lamp image by...
     1. This is the first very bright line working from the left hand side of the image
     2. Double click on the bright emission line where the horizontal central axis graticule line crosses it.

This identifies the line location for the software from which the spectral dispersion is calculated

* + 1. This records a value in the "X Coordinate" and "Vertical Coordinate" boxes
  1. Press Next
     1. you will be forwarded to the next tab and your selections will be committed to the process

1.  "Go"
   1. The Instrument, Observatory and Observer details should have been carried forward from the "General" tab
   2. Press the "Go" button to commence the processing.
      1. The progress of the software process can be seen in the window as frames are loaded and calculations performed.
      2. At the end of the process a Resolution value is given - this is inserted in the "R" value in the General tab.
      3. Use the scroll bar to examine the Primary Dispersion (RMS) calculation to ensure acceptable values (< 0.2)
   3. Press Display Profile
      1. You will be forwarded to the "Profile" tab
2.  "Profile"
   1. The spectrum curve will be displayed.
      1. A file name is given for the Fits file created by the process.
      2. At present this is uncorrected for instrument response
   2. OPTION Press "Database" from the right-hand button stack. This opens a dialogue box.
      1. Select an appropriate comparison spectrum from the database
      2. Save as a reference
      3. (Re)Display the target star spectrum
      4. Press "Compare" button and reload the Reference spectrum saved above.
      5. Similarities and differences may be identified.
   3. Calculate your camera/instrument response by...
      1. Press "Response" button from righthand stack which opens a dialogue box.
      2. Select an appropriate comparison spectrum from the database
      3. Press "Response"
      4. Three traces will be seen - Blue is the processed target spectrum; Red is the database comparison; and Green is the computed response.

Note that is the spectra are out of line a value can be entered into the "Shift" box and alignment can be obtained by trial and error. (Nb it is possible to revisit the 'pixel size' in the General tab to "trial and error" input values that make the curves a better match. Re-run the whole process again from here).

Once completed press the "OK" button.

This leaves the computed 'response' curve for the camera

* + 1. Press "Continuum" from the right hand stack. this opens a dialogue box.

Use the "Automatic" and slider button to obtain a rough fit for the response curve

Smooth the curve by Double Clicking segments of the line until satisfied that a much simplified smooth 'curve' is generated.

Save this, named as a 'response' file for this star/camera.

Insert this filename here and re-run the whole process

Don't forget to Press Next to progress through the tabs.

1.  "Profile" tab second visit
   1. Crop the image to achieve a good curve
   2. Goto "Gnuplot" tab
2. "Gnuplot"
   1. Ensure top left dialogue "Plot" panel has valid ranges and that both "Automatic" tick-boxes are checked.
   2. Press "Plot" button to see the result.