Overview

The QL Tool produces quick-look products, but there are some straightforward steps allowing users to use these as a starting point for their science quality reductions

Important Notes

In going from the raw 2D images to the 1D extractions produce by the QL Tool:

- The x axis is flipped so that increasing wavelength runs in the same direction as increasing x
- The spectra are then trimmed to remove overscan, etc.

Remember: the WLC is only good to a couple of A. No rectification or spectral tracing has been performed. The arc extraction is the single, *central* row, and may not correpsond to the same spatial location as your science target.

For IRAF users

Since most observers seem to have their own scripts from the old version of the spectrograph, the easiest way to reduce the data is to use the QL wavelength-calibrated outputs as a reference for an IRAF reduction of the raw data.

This assumes familiarity with reducing longslit data in IRAF. Phil Massey's guide is an excellent reference: http://iraf.noao.edu/iraf/ftp/iraf/docs/spect.ps.Z

i.e.

- Perform all the pre-processing steps as you would normally on the raw 2D data.
- When you are ready to wavelength calibrate an arc, do so as follows:
    - Use the QL output as a reference. For example, a useful way is to plot the ascii wavelength solution in some interactive plotting window, like python.
    - Then simply, select a few bright, well-spaced lines, hover the cursor over them, and read off the wavelength coordinate.
    - Now, run **IRAF - twodspec - identify** on the corresponding raw 2D image. Select the same line and input its wavelength as just read off the plot. The solution is good to within a couple of Angstroms, and there are sufficient lines in the arcs that this should work well. *Hint: remember that the raw and 1D Extracted spectra are flipped. A good trick is to reverse the plot window in IRAF with 'w' 'e' 'e' by selecting from bottom right to top left*
    - Repeat for several lines.
    - When happy, automatically add all the lines (press "https://topswiki.saao.ac.zal"https://topswiki.saao.ac.za).

- python plot window next to IRAF identify window
- After flipping IRAF identify window in x, it is now straightforward to match lines by eye
- After matching ~5 lines, fitting, and pressing 'l' to auto-identify the rest

- Once you have identified the lines in one aperture, repeat for every nth pixel (probably every 5th pixel is fine, the tilt is about 0.06 pixels per pixel) using **reidentify**.
- Run **fitcoords** on the database produced by reidentify
- Run **transform** on the image using the fitcoords database to produce a wavelength-calibrated, rectified 2D arc.
- This solution may now be copied to other images and science data extracted in the standard way!

- images pre(top)- and post(bottom)- rectification and WLC

You may download the linelists used for the automatic wavelength calibration, or use your own: CuAr, CuNe

Advanced notes for users wishing to code up their own routines using these output files

After flipping, the spectra are then trimmed to remove overscan, etc. The exact values for these are stored in:
/usr/local/etc/qlgui/pars.json
"https://topswiki.saao.ac.zabadMax0"https://topswiki.saao.ac.za: 98,
"https://topswiki.saao.ac.zabadMin1"https://topswiki.saao.ac.za: 2145,
in python 0-based numbering.

i.e. in python, to reproduce the same transformation, one would do:
from astropy.io import fits
import numpy as np im2D = fits.getdata('image.fits')
im2D = np.fliplr(im2D[:,::-1])[:,98:2145]
fits.writeto('outimage.fits',im2D)
This image could then be used for a fresh extraction using IRAF or the user's preffered package, and will be one-to-one pixel aligned with the [approximate] WLC from the 1D extracted arc.

In IRAF, the equivalent would be:
imcopy a0361665[-*,*] test.fits
imcopy test.fits[99:2146,*] out65.fits
[Note the 1-based indexing]

MORE DETAILS TO FOLLOW