

Notes on Flat Field Correction of Spectrum Images taken using a Slitless Spectrograph (eg Star Analyser)

Flat correction is useful for slit spectrographs. * I also used to attempt to flat correct Star Analyser spectra though no longer recommend it. The problem is spectroscopic flats are a mixture of position and wavelength dependent effects. With a slit spectrograph the position of a particular wavelength in the flat is fixed and defined by the position of the slit so a conventional flat taken through the spectrograph can be used but in a slitless system any particular wavelength can end up at any location across the flat image and it is not straightforward to untangle this interaction

Professional slitless systems also have this problem and the solution for them is to build up a 3D flat ie a separate "flat" for each location in the image. This is impractical for amateurs so the advice I generally give now is:-

Take a flat (eg of the twilight sky at the zenith) with the grating in place just to check for any potential issues, particularly if small scale eg dust and try to remove these or locate your spectra away from them.

Keep the optics as clean as possible to minimise dust donuts and place your reference star and target at the same location in the field. The instrument response will then take care of any large scale flat field issues, eg vignetting

If you want to explore the potential errors due to not taking a flat or you are forced to measure spectra at different positions in the field then I can suggest taking spectra at different locations and seeing how much the spectrum changes for your particular setup. (You could even if you want produce different instrument responses for use in different areas of the field)

* Note that with slit spectrographs, as well as removing conventional flat defects, doing a flat field correction is useful for removing any small scale features in the instrument response (eg ripples in the camera response). Unfortunately with slitless systems, these cannot be removed using a flat so must be included in the instrument response measured using a reference star.

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