RSS MOS pipeline

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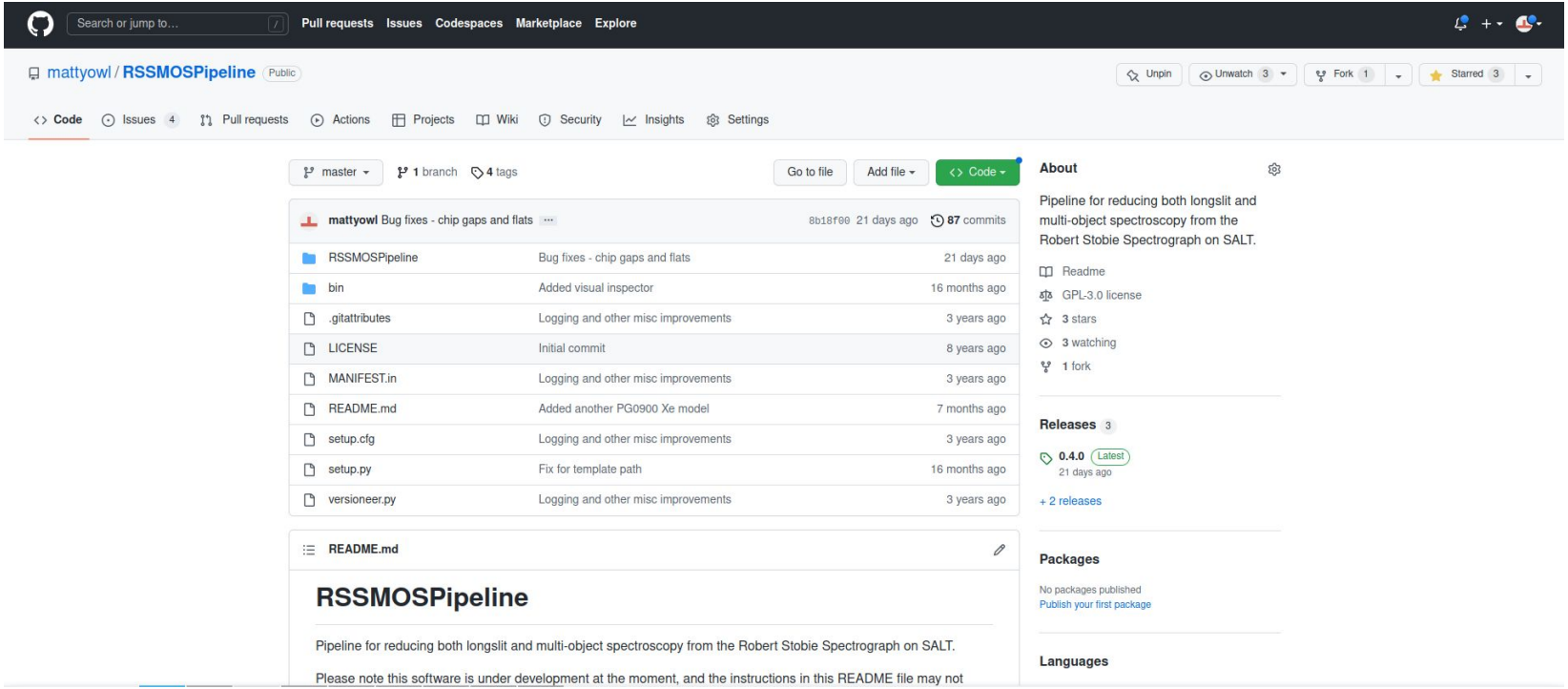
RSS MOS pipeline

- See: https://github.com/mattyowl/RSSMOSPipeline
- Or: `pip install RSSMOSPipeline --user`



What does it do?

- A fully automated* pipeline, written in pure python, for extracting wavelength calibrated 1d spectra from RSS MOS or longslit observations
- To see available options for the main pipeline script, run `rss_mos_reducer -h`
- Steps:

    - make master flats
    - cut into slitlets (using the master flat if MOS) or pseudo-slits (by identifying object traces in longslit data)
    - apply the flat field
    - find the 2d wavelength solution and rectify 2d spectra
    - extract and stack all the 1d spectra (or stack the 2d spectra and extract 1d spectra)

(* if a reference wavelength calibration model has already been made - see the `README.md` file in the repository for the current list)

How to run

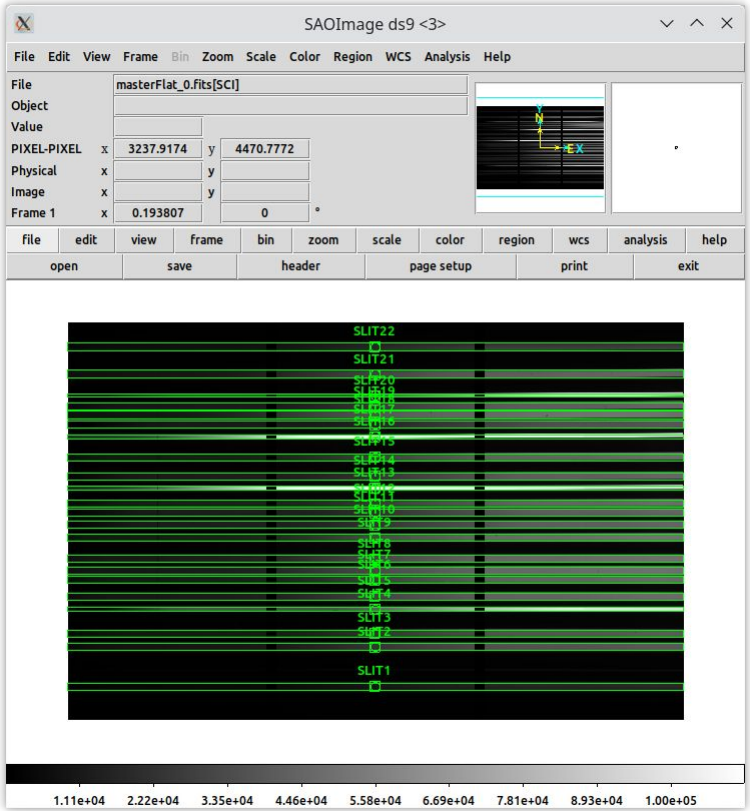
- Download the `product` data for your observations - if you want to play with some MOS data, there are a couple of masks worth of cluster observations here: https://www.dropbox.com/s/61d1hhuww48tt2v/J0034RSSData.tar.gz?dl=0
- Check what masks are available:
  - e.g. `rss_mos_reducer product reduced list`

```
2022-11-15 07:37:49,139 - RSSMOSPipeline - INFO - started: 2022-11-15T07:37:49.139582
2022-11-15 07:37:49,139 - RSSMOSPipeline - INFO - parameters: Namespace(rawDir='product', reducedDir='reduced', maskName='list', threshold=0.1, longslitThreshold=2.0, iterativeMethod=False, subFrac=0.8, exclude
Masks='', extensionsList='all', skipDone=False)
2022-11-15 07:37:49,139 - RSSMOSPipeline - INFO - Reading image headers (cache file location: product/imageInfo.pkl)
Found 3 masks:
    ACT-CL_J0034.4+0225_P002131N01      True    /home/matty/.local/lib/python3.10/site-packages/RSSMOSPipeline-0.4.0+0.g8b18f00.dirty-py3.10.egg/RSSMOSPipeline/data/modelArcSpectra/RefModel_PG0900_Ar_2x2_1.pick
le
    ACT-CL_J0034.4+0225_P002131N02      True    /home/matty/.local/lib/python3.10/site-packages/RSSMOSPipeline-0.4.0+0.g8b18f00.dirty-py3.10.egg/RSSMOSPipeline/data/modelArcSpectra/RefModel_PG0900_Ar_2x2_1.pick
le
    EG21_PL0400N001
```

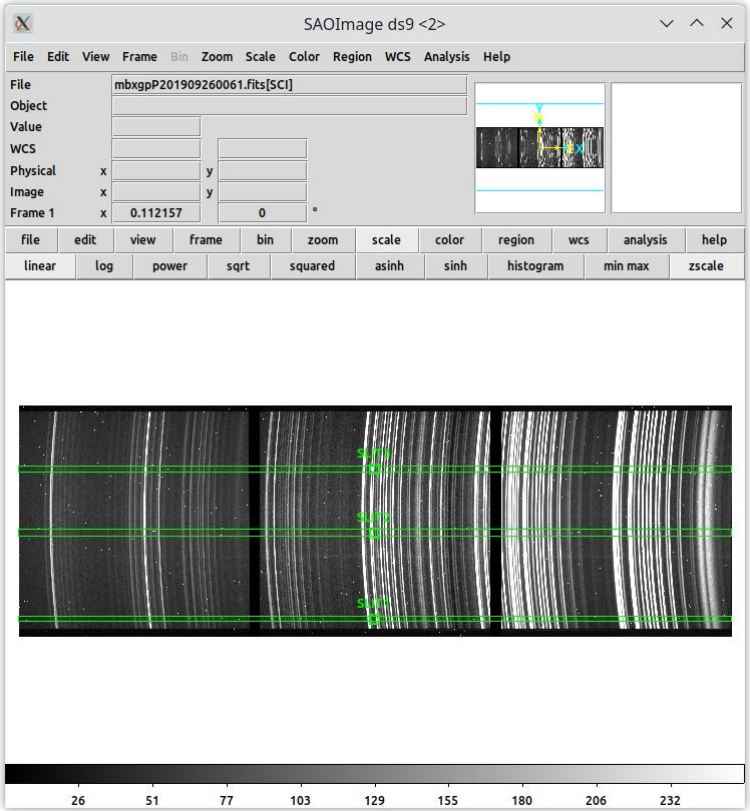
- Reduce your chosen mask (in this case has 4 x exposures):
  - `rss_mos_reducer product reduced ACT-CL_J0034.4+0225_P002131N01` [takes 11 min on my laptop]
- Or to use iterative sky subtraction:
  - `rss_mos_reducer product reduced ACT-CL_J0034.4+0225_P002131N01 -i` [takes 14.5 min on my laptop]
- You can also do, e.g., `rss_mos_reducer product reduced all`

Slit or object identification

Check on master flats (MOS)



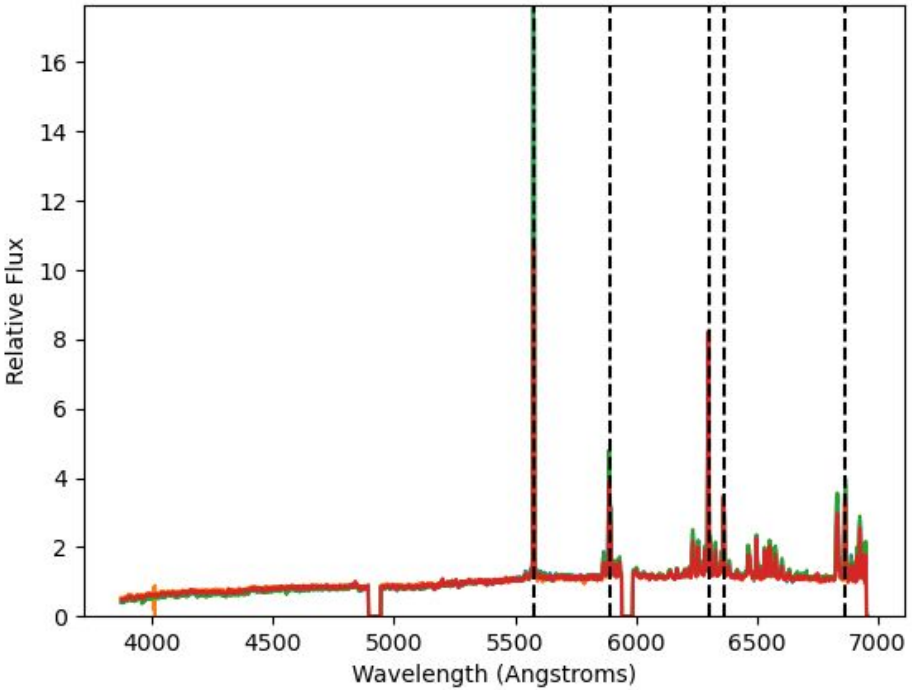
or object frames (longslit)



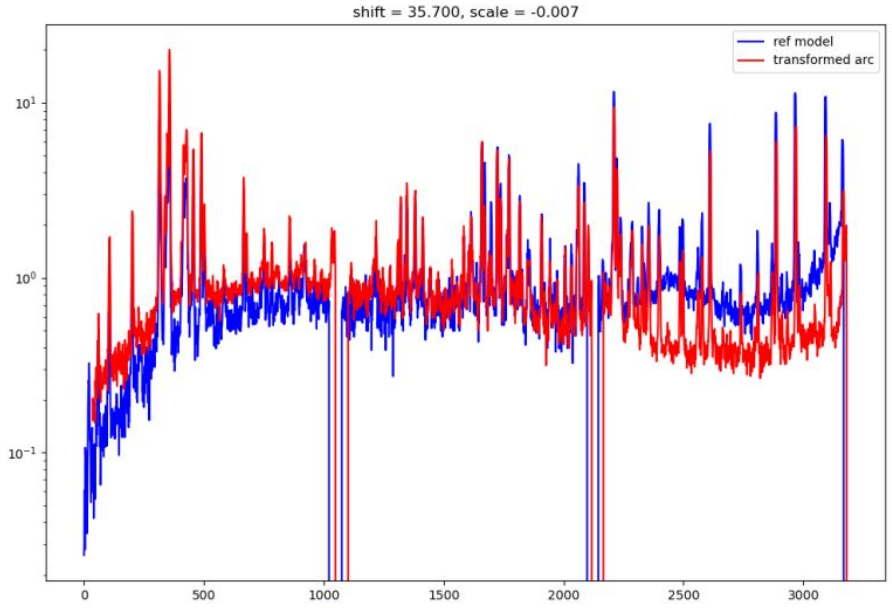
Diagnostics

- Log file is written to the current working directory
- Sky line based wavelength calibration check results:
  - e.g. `reduced/ACT-CL_J0034.4+0225_P002131N01/diagnostics/skyWavelengthCalibCheck.csv`
- Number of arc features identified per slit:
  - e.g. `reduced/ACT-CL_J0034.4+0225_P002131N01/diagnostics/wavelengthCalibDiagnostics.csv`
- The `diagnostics/` directory also contains plots of:
  - comparison of transformed arc with ref model arc spectrum
  - transformed arc spectra with labelled features
  - wavelength calibration model prediction with arc lines wavelengths marked
  - sky spectra with known sky line positions marked
  - etc.

Diagnostics



sky lines check

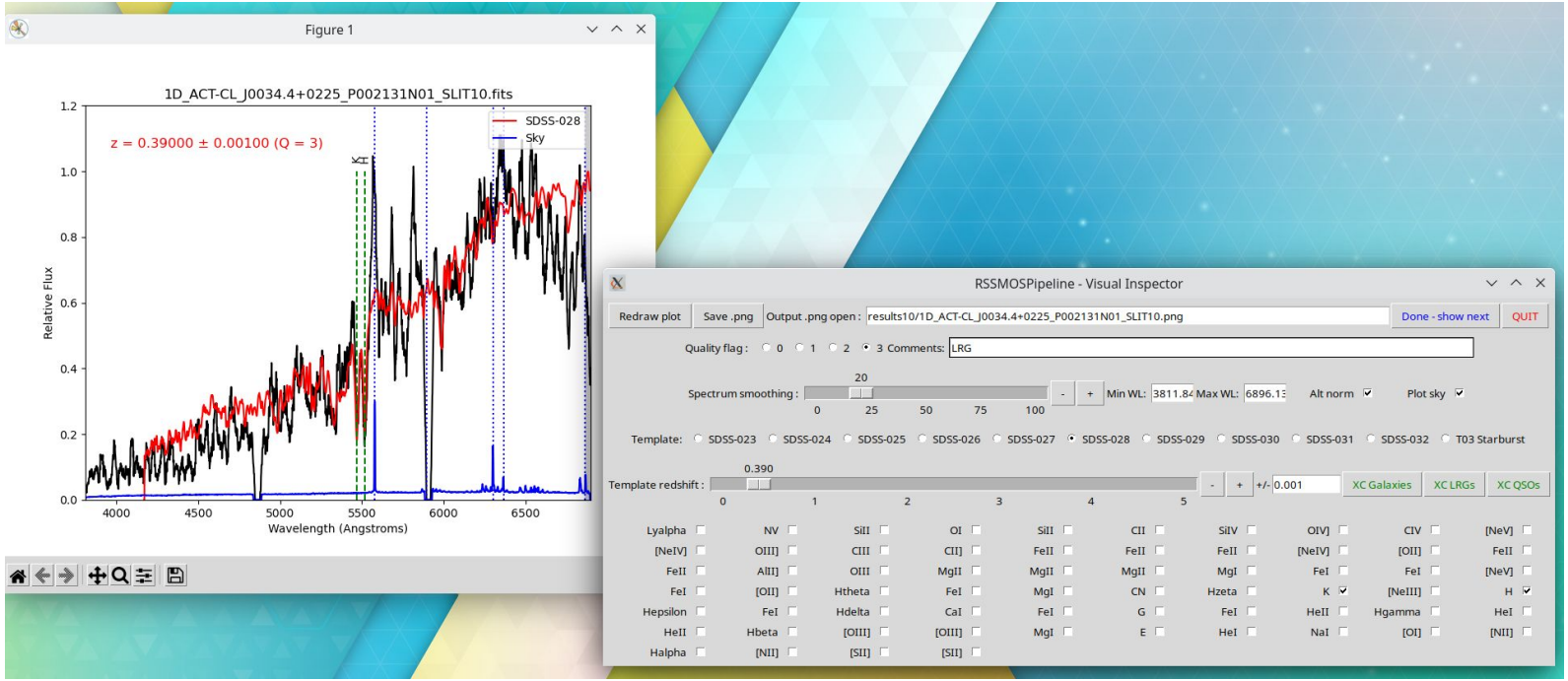


comparison of transformed arc with ref model

Inspecting spectra

Tool for plotting spectral with templates overlaid (ancient code) - e.g.

```
cd reduced/ACT-CL_J0034.4+0225_P002131N01/1DSpec_2DSpec_stackAndExtract/
rss_mos_visual_inspector 1D_ACT-CL_J0034.4+0225_P002131N01_SLIT*.fits results
```



Final comments

- Caveat:
  - Published results using this pipeline (to my knowledge) only concern getting redshifts of galaxies (see Hilton et al. 2018, 2021)
- Things that could be done:
  - Implement spectrophotometric calibration
  - Parsing slit mask XML file, to help with finding slits, and adding RA, dec coords to headers of 1D spectra
  - Parallelisation (not much benefit versus effort)
  - Make a more modern visual spectrum inspector, and add new cross correlation redshift code (or find one to use instead)
  - More docs
- Bugs:
  - Feel free to contact me with bug reports / requests for help (e.g. adding extra ref arc models)
  - The code *should* be fairly easy to hack away at and improve - it's pure python