Semi-automated RSS MOS mask design

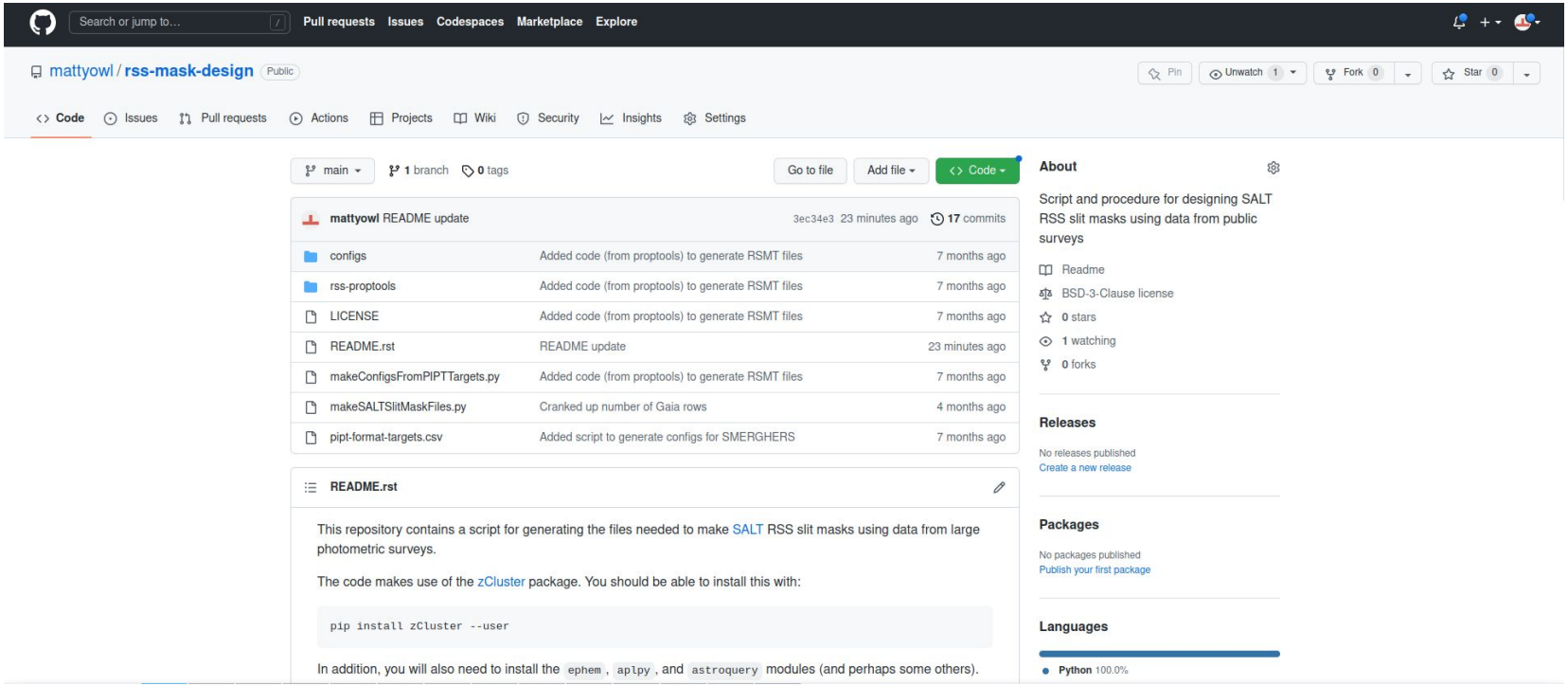
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG 1922 2022

Matt Hilton
Wits University / University of KwaZulu-Natal

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Semi-automated RSS mask design

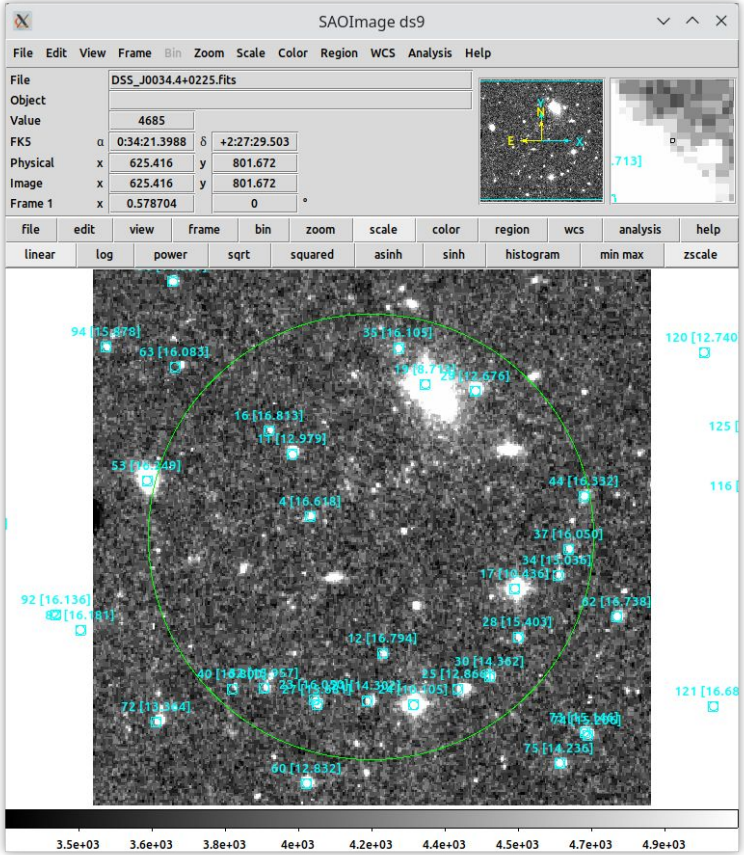
- See https://github.com/mattyowl/rss-mask-design for a package that produces slit mask files using public photometric surveys (e.g. DECaLS) and colour, mag cuts



Workflow

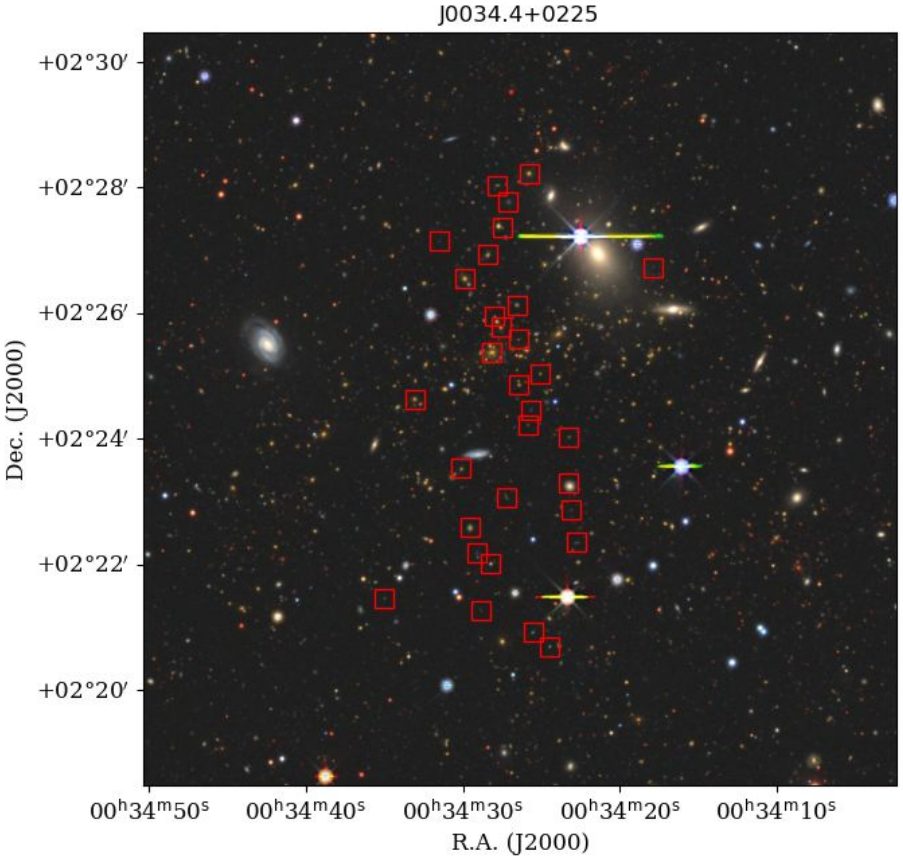
- The `README.rst` file in the repository explains the workflow
- Briefly:
  - create an initial config file that defines things like the mask centre coords, initial colour-mag cuts etc. (use helper script for doing this for many targets)
  - run the script to fetch catalogs and images:
    - e.g. `python3 makeSALTSlitMaskFiles.py configs/J0034.yml`
  - inspect the DSS image to choose 4 alignment stars [taken from GAIA], and add their IDs to the config file
    - e.g. `ds9 MaskFiles_J0034.4+0225/DSS_J0034.4+0225.fits -regions MaskFiles_J0034.4+0225/brightStars.reg`
  - run the script again, then inspect the output and adjust the config until you are happy:
    - colour-mag diagram
    - colour images of each mask with selected objects highlighted
  - upload the output .rsmt mask file to PIPT

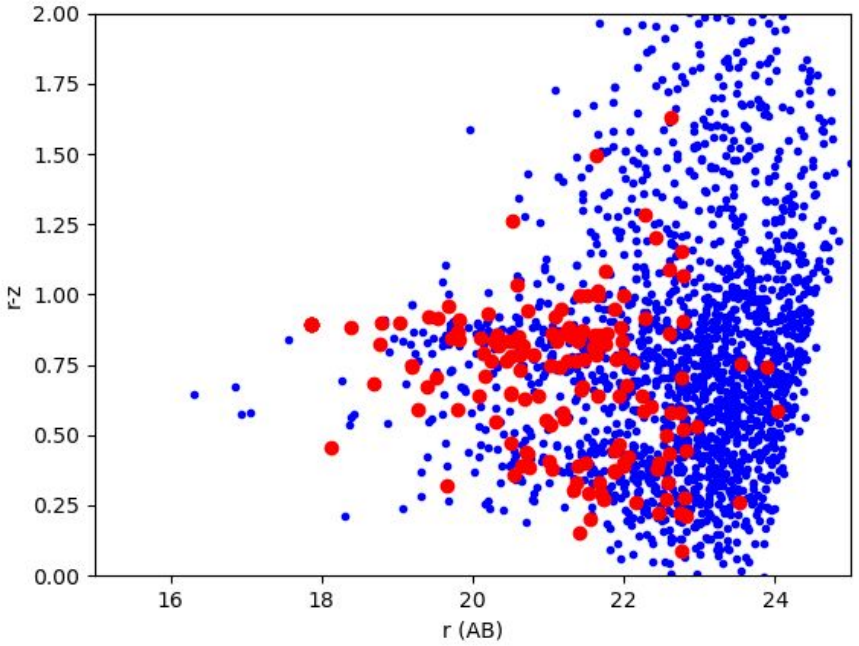
Selecting alignment stars




```yaml
# Parameters file for use with makeSALTSlitMaskFiles.py

# Cluster/field name/centre coords
# Output from the script will be written to MaskFiles_<name>/
name: 'J0034.4+0225'
RADeg: 8.610
decDeg: 2.408

# Mask meta data, needed for final output
proposer: 'Matt Hilton'
proposalCode: '2022-1-MLT-005'

# The format of the galaxy catalog file - either "FetchDR8", "FelipeS82", "FelipeDR8", "MattFITS", or "zCluster"
catalogFormat: "zCluster"

# Path to the galaxy catalog file - OR the database, if catalogFormat is 'zCluster'
galaxyCatalogFile: "DECaLSDR9"

# Below specify arbitrary cuts on catalog for top priority targets to put slits on
targetCuts:
    - 'r > 17'
    - 'r < 22'
    - 'r-z < 1'

# Cuts below are used to specify secondary targets, these are used when no more of
# the galaxies that pass targetCuts can be placed in a mask
fillerCuts:
    - 'r > 17'
    - 'r < 23'

# Slit dimensions
slitLengthArcsec: 9.0
slitWidthArcsec: 1.5

# Minimum gap to leave between slits
safetyArcsec: 1.0

# List of object IDs in the galaxy catalog to include in every mask (e.g., the BCG)
alwaysIncludeIDs: [5059]

# Slit length for the above - if this was a BCG, might want a longer slit, for example
alwaysSlitLengthArcsec: 10.0

# Reference stars, for slit mask alignment - these should be selected from brightStars.reg
# To make brightStars.reg without making slit mask files, run the script with refStarIDs=[]
refStarIDs:
    - 16
    - 34
    - 32
    - 28

# Fluffy stuff
CMDCol: "r-z"

# Number of masks to make - objects will not overlap between masks unless they are in alwaysIncludeIDs
numMasks: 6
```

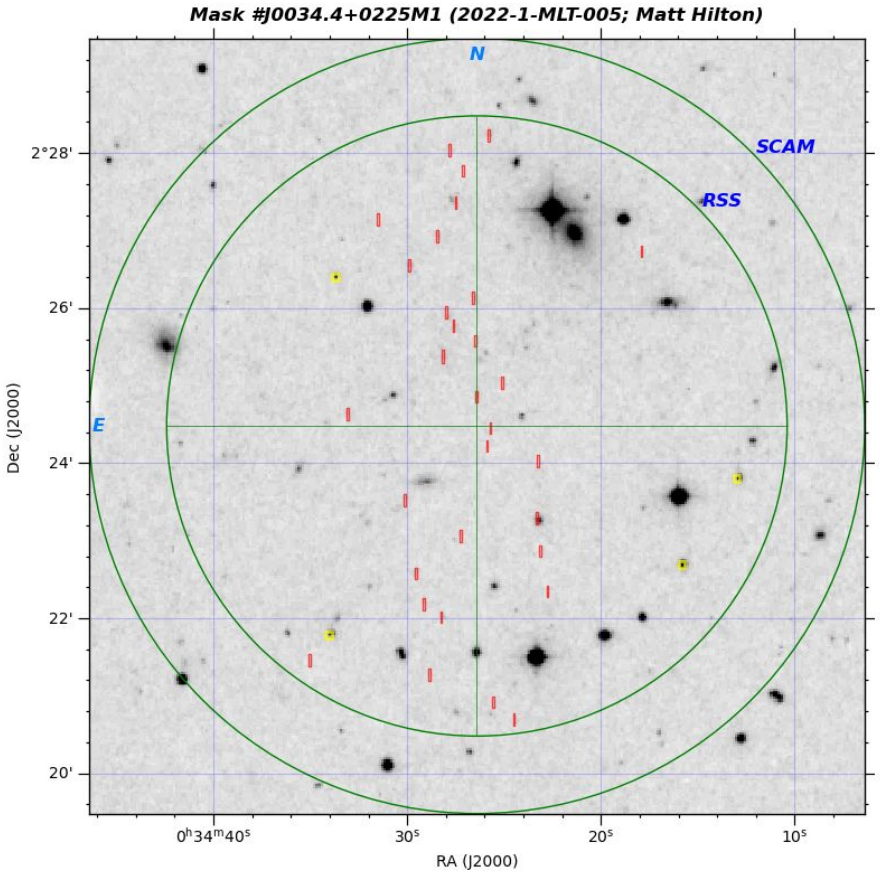
Examples of output





CMD shows selected objects in 6 x masks

Examples of output



Some notes:

- `*.rsmt` slit mask files are written into the `RSMTFiles/` directory - this makes use of code from pySlitMask.py
- Gaia is being used for the alignment stars in this version - this should work for DECaLS since they are on the same astrometric system but may not for other catalogs
- The code only uses the following position angles (PA):
  - PA = 180 deg for dec > -35 degrees
  - PA = 0 deg for dec < -35 degrees