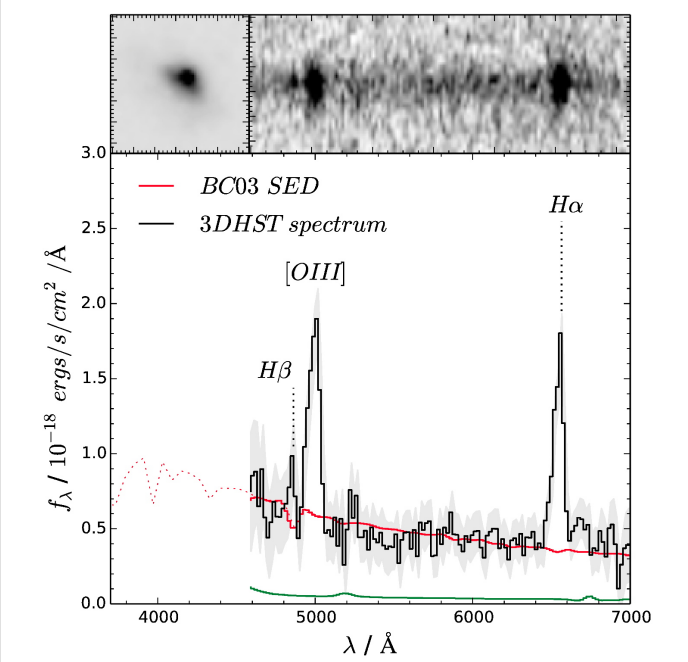

3D-HST GRISM
Spectroscopy
Victoria Bruce, Jim Dunlop
& Fergus Cullen
ASTRODEEP
ROYAL OBSERVATORY EDINBURGH
THE UNIVERSITY of EDINBURGH

Recap of ASTRODEEP Involvement with Grism Spectroscopy

- Local expert: Fergus Cullen, PhD student Edinburgh
  - independently developed 3D-HST pipeline
  - Mass-Metallicity Relation and FMR at z > 2

    Cullen et al. 2014, MNRAS, 440, 2300
  - Investigating metallicity, SFR, ionization state of emission lines galaxies at 1.3 < z < 2.3.

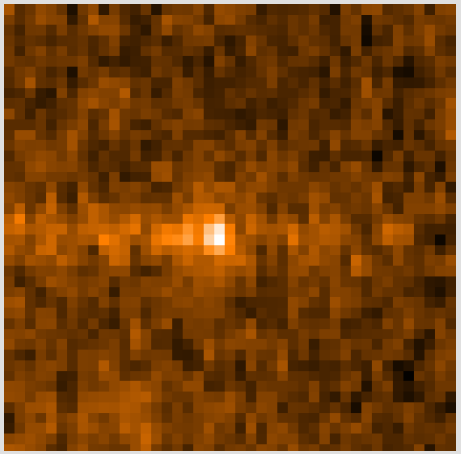


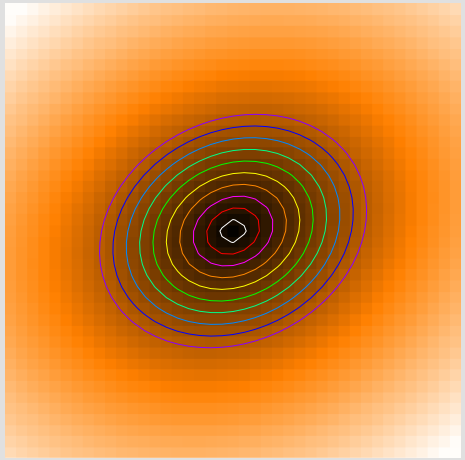
- Visit from Jonathan Trump last December:
  - Comparison of Jon and Fergus's pipelines
  - Cross-match between my M>$10^{11}M_\odot$ galaxies at 1.6<z<2.3 in CANDELS UDS and COSMOS and Jon's z-spec absorption line candidates led to ~30 matches.
  - Could be pushed further with spectro-photometric fitting.
  - Discussion of isophotal collapse method and implementation of first-stage diagonal collapse routine.

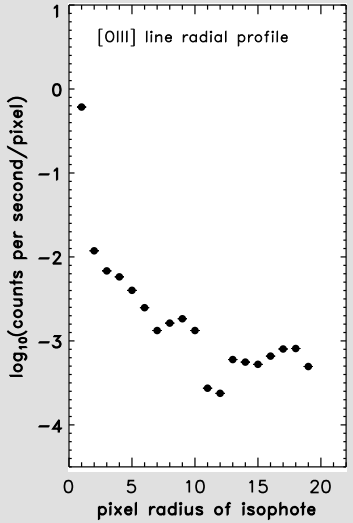
Line Profile Extraction

- Original 1-D collapse from 2-D aXe output spectrum, optimal weighting using the object morphological parameters (a,b,θ) determined from SExtractor as the extraction profile then collapsed along either : the direction perpendicular to the dispersion direction or along θ .

- New method: based on collapsing along elliptical aperture isophotes.

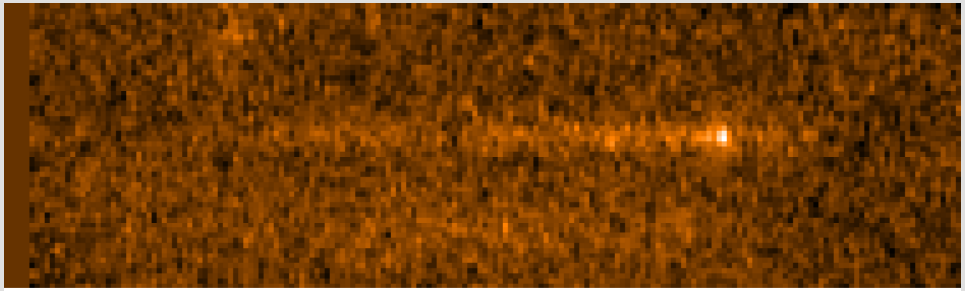




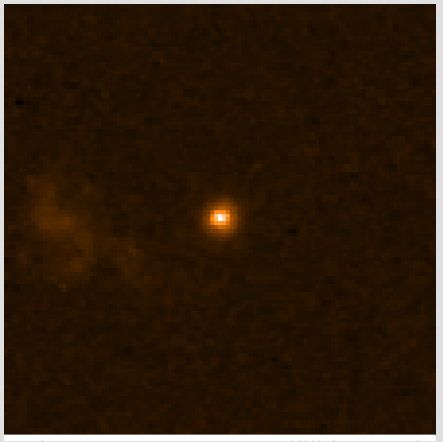


- Main advantage is that it avoids contaminating the central pixels with flux from the outer regions, whilst also improving the S/N in these outer regions.
- Allows for exploration of how centrally concentrated the line profile is in a spatially resolved sense. ➡ Also useful for AGN studies.

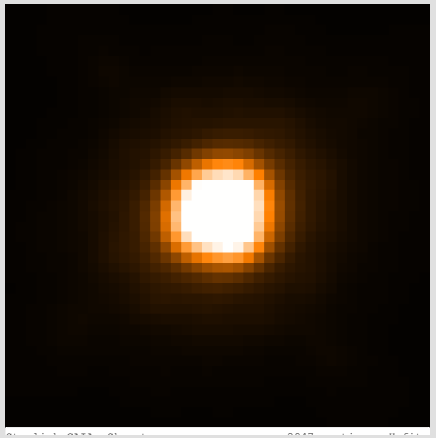
ID: 2947 zspec=2.193, bulge +PSF fit, $\log_{10}$SSFR=-8.91



H-band stamp

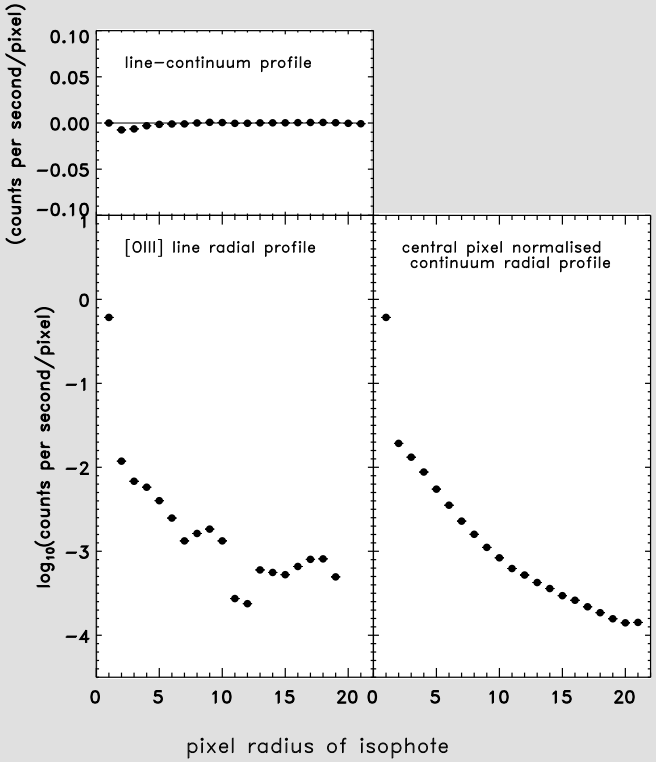


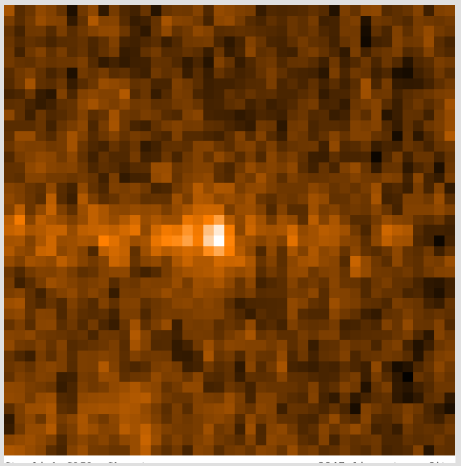
H-band continuum model

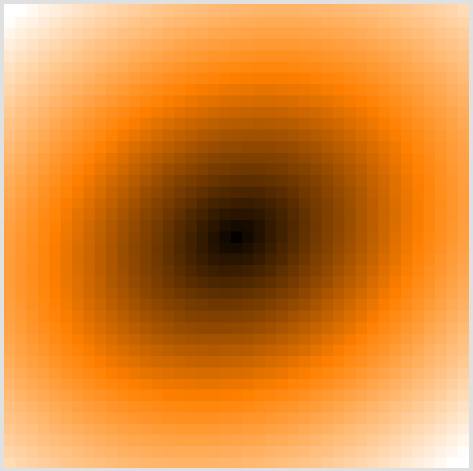


101 pixels

41 pixels







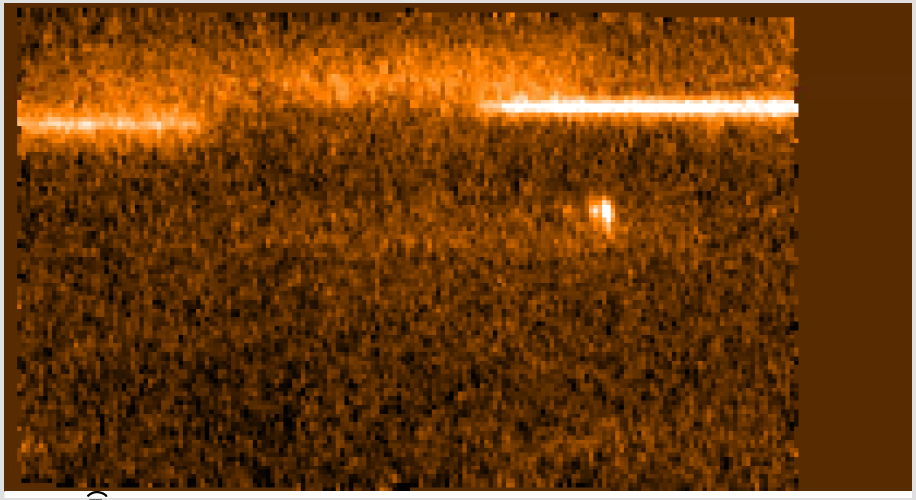
Line stamp

41 pixels

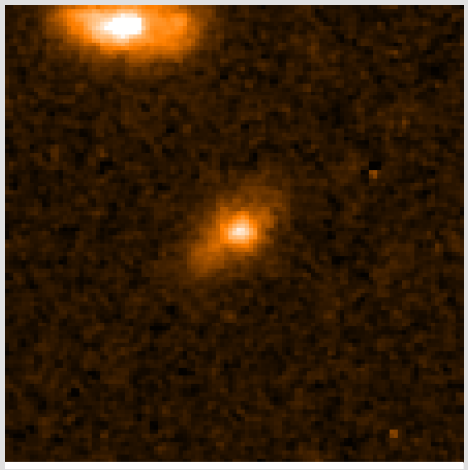
Elliptical isophote model

41 pixels

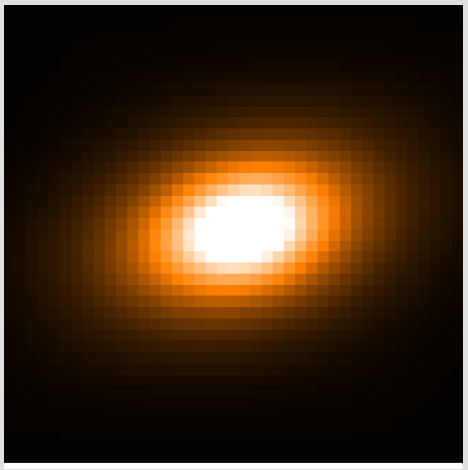
ID: 1320 zspec=2.166, disk fit, $\log_{10}$SSFR=-8.62

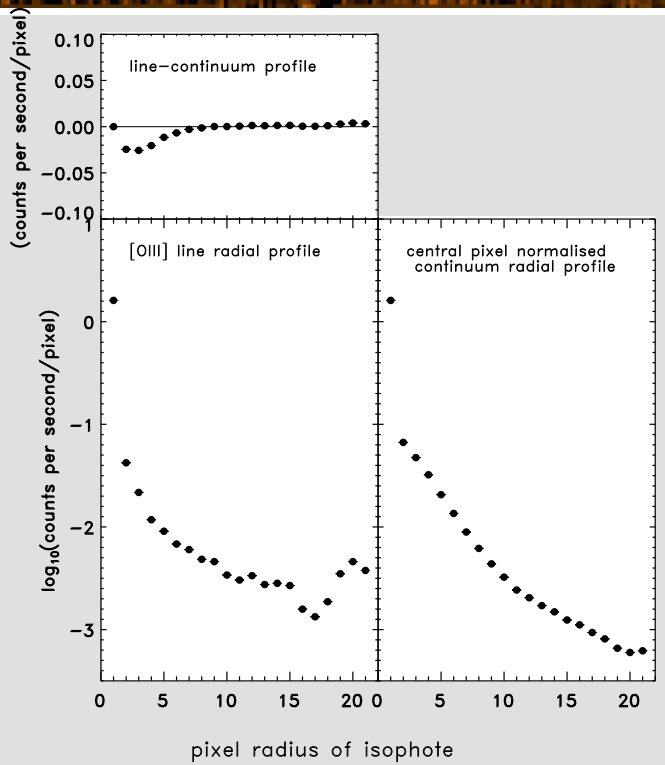


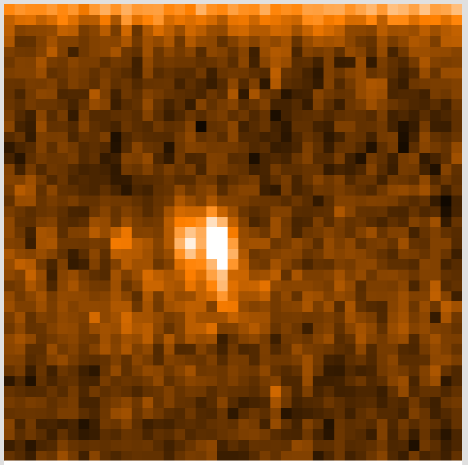
H-band stamp



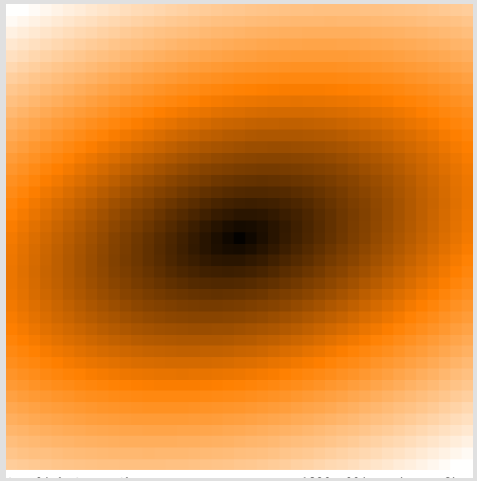
H-band continuum model





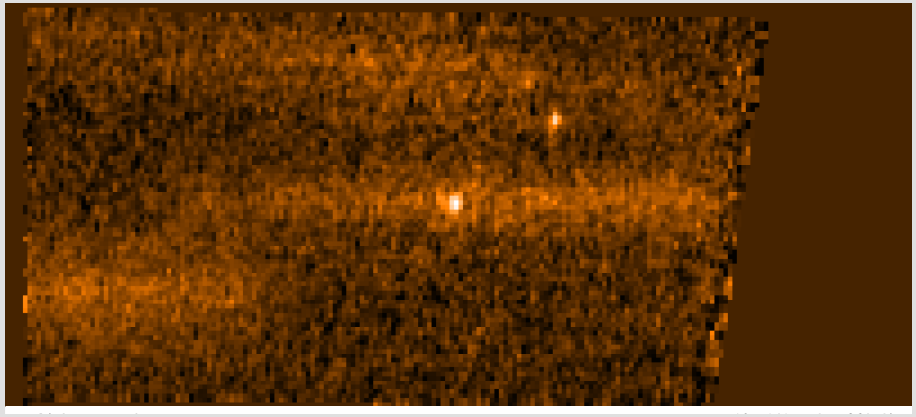


Line stamp

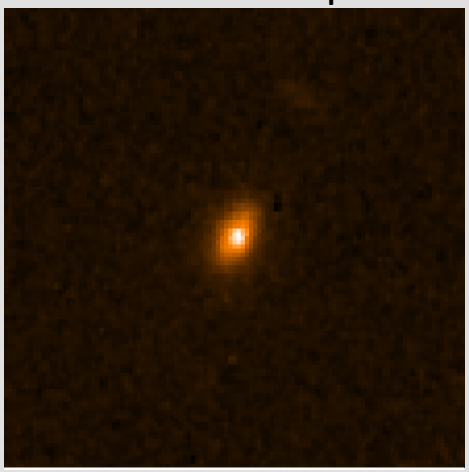


Elliptical isophote model

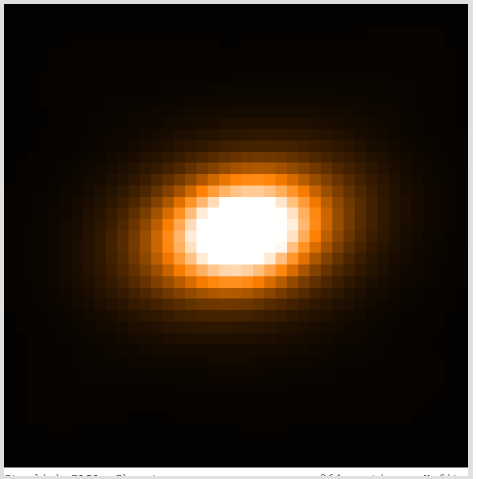
ID: 364 zspec=1.814, disk fit, $\log_{10}$SSFR=-8.57

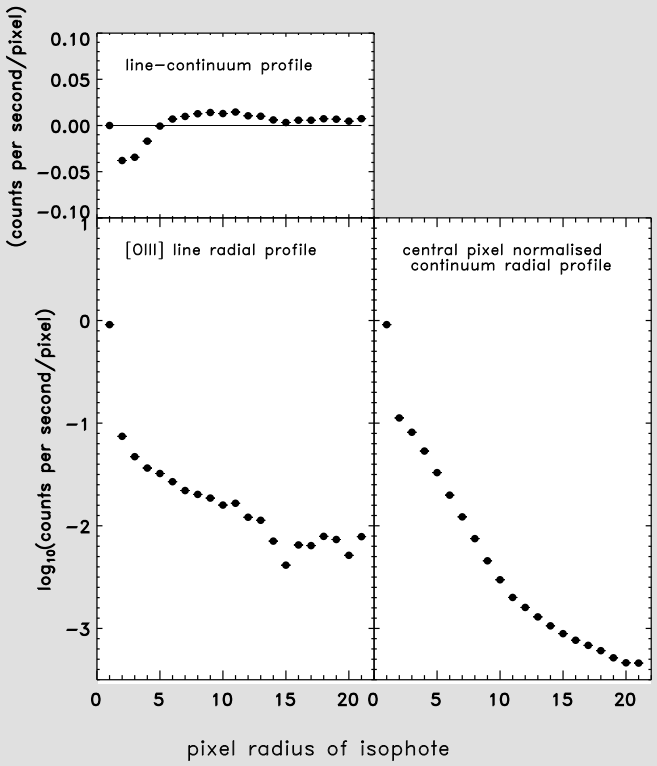


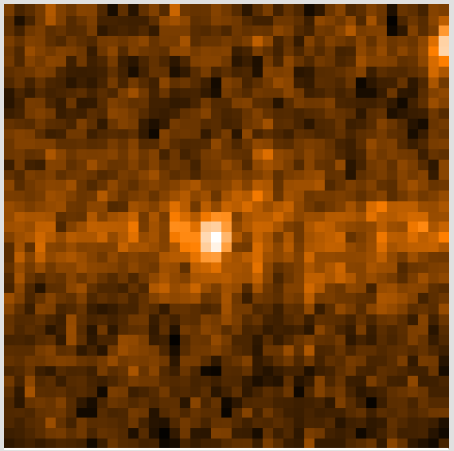
H-band stamp



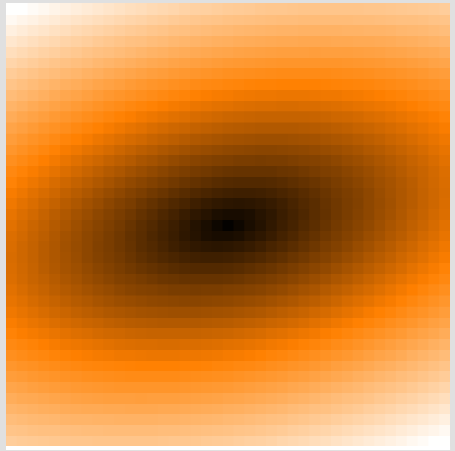
H-band continuum model





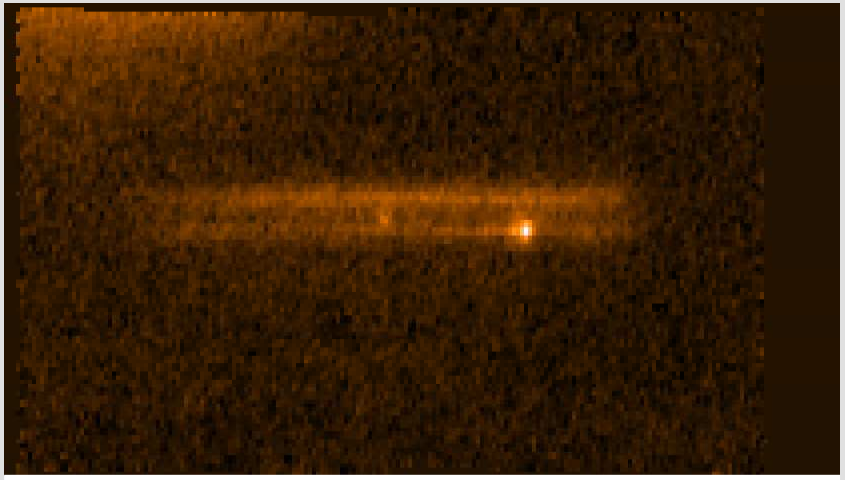


Line stamp

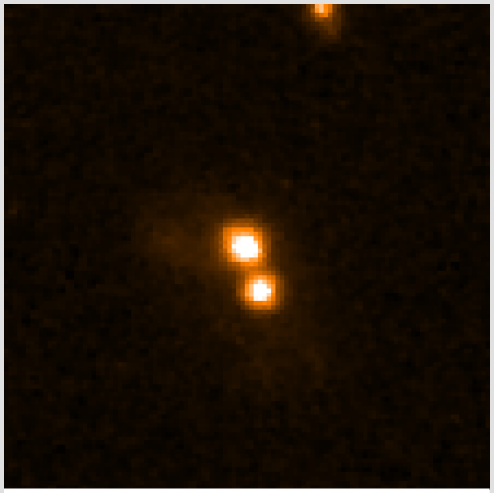


Elliptical isophote model

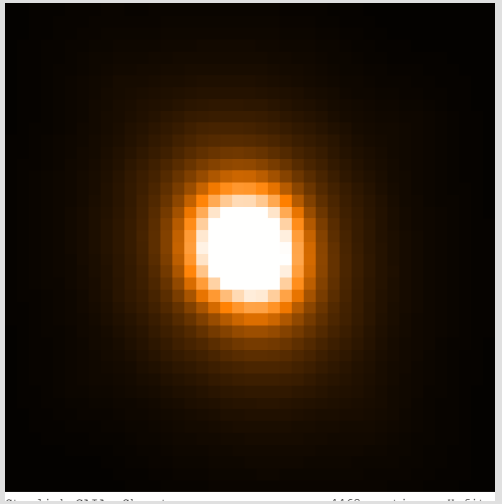
ID: 4462 zspec=2.092, bulge fit, $\log_{10}$SSFR=-9.26

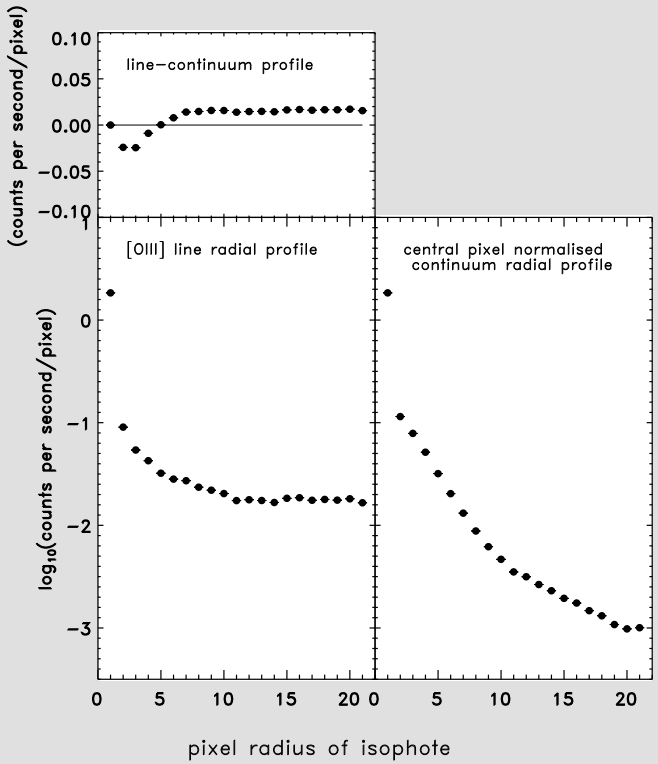


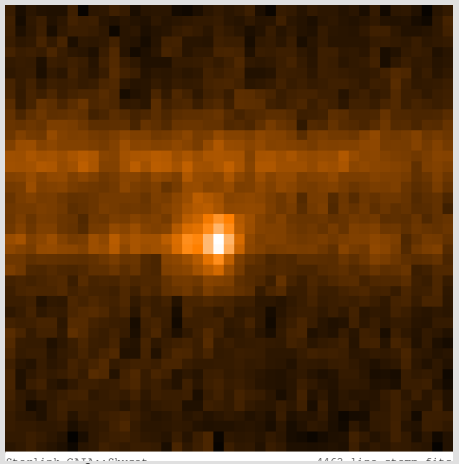
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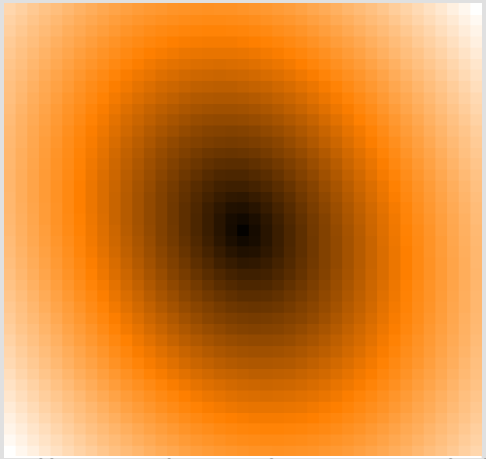
H-band continuum model







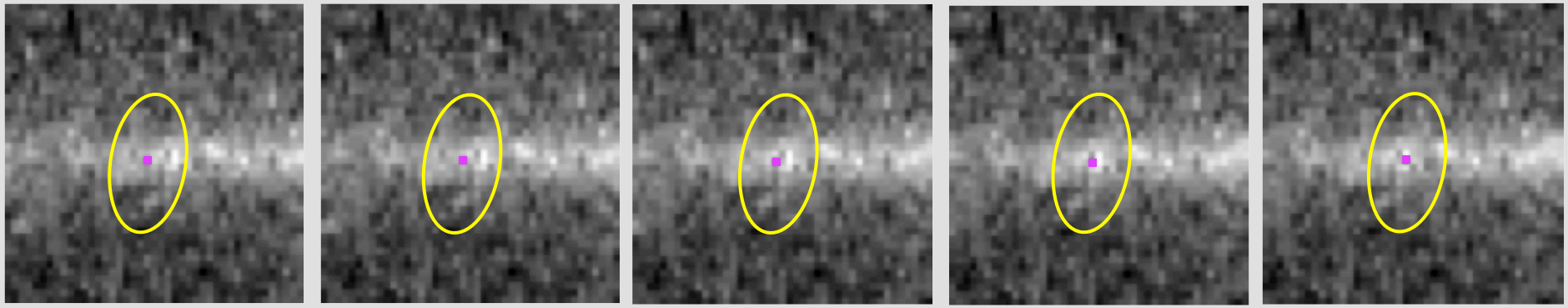
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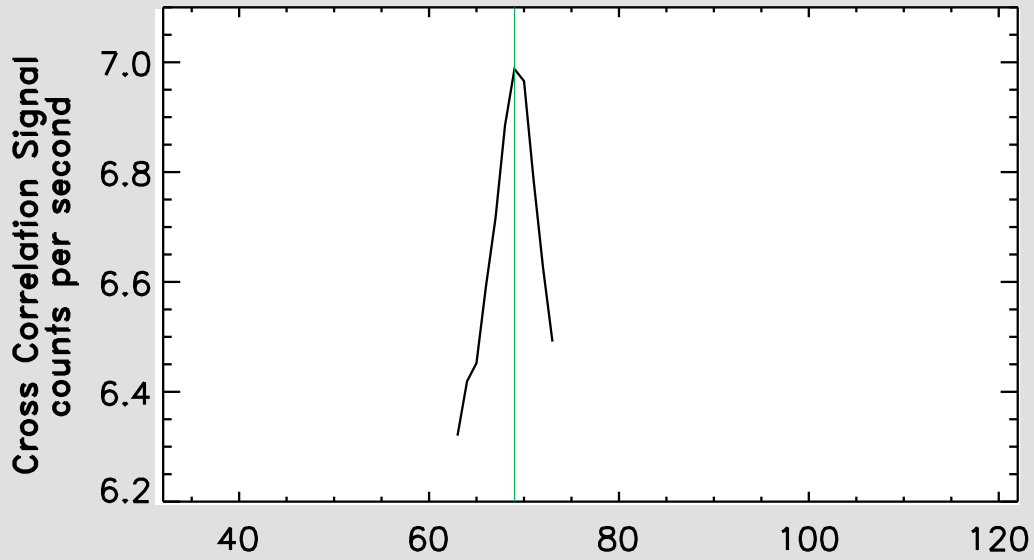


Elliptical isophote model

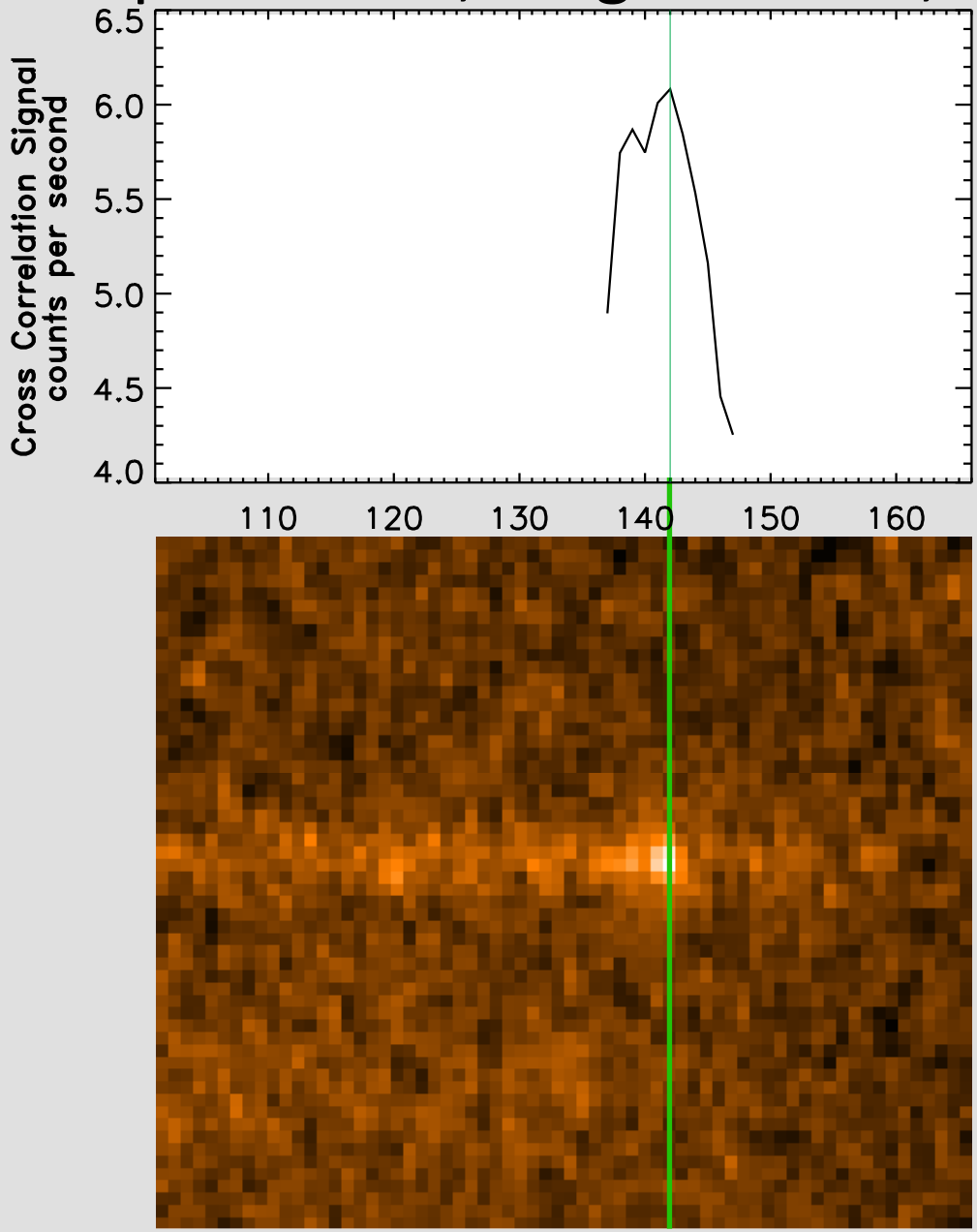
Line Searching Technique

- Use morphology information of the line to aid in detection – similar to a cross-correlation approach.
- Useful for higher redshift Lyα line searches and for simulations for EUCLID.





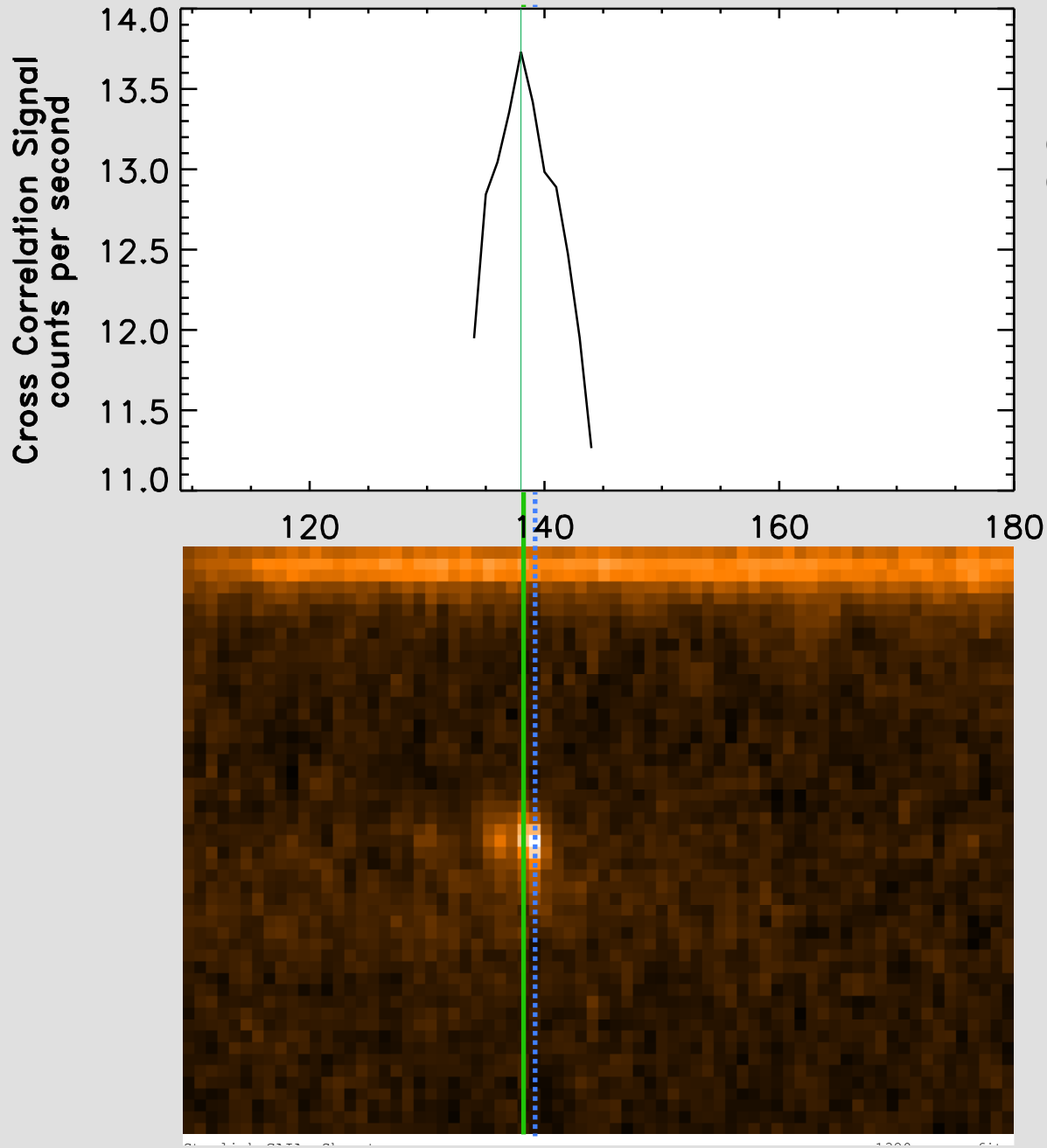
ID: 2947 zspec=2.193, bulge +PSF fit, $\log_{10}$SSFR=-8.91



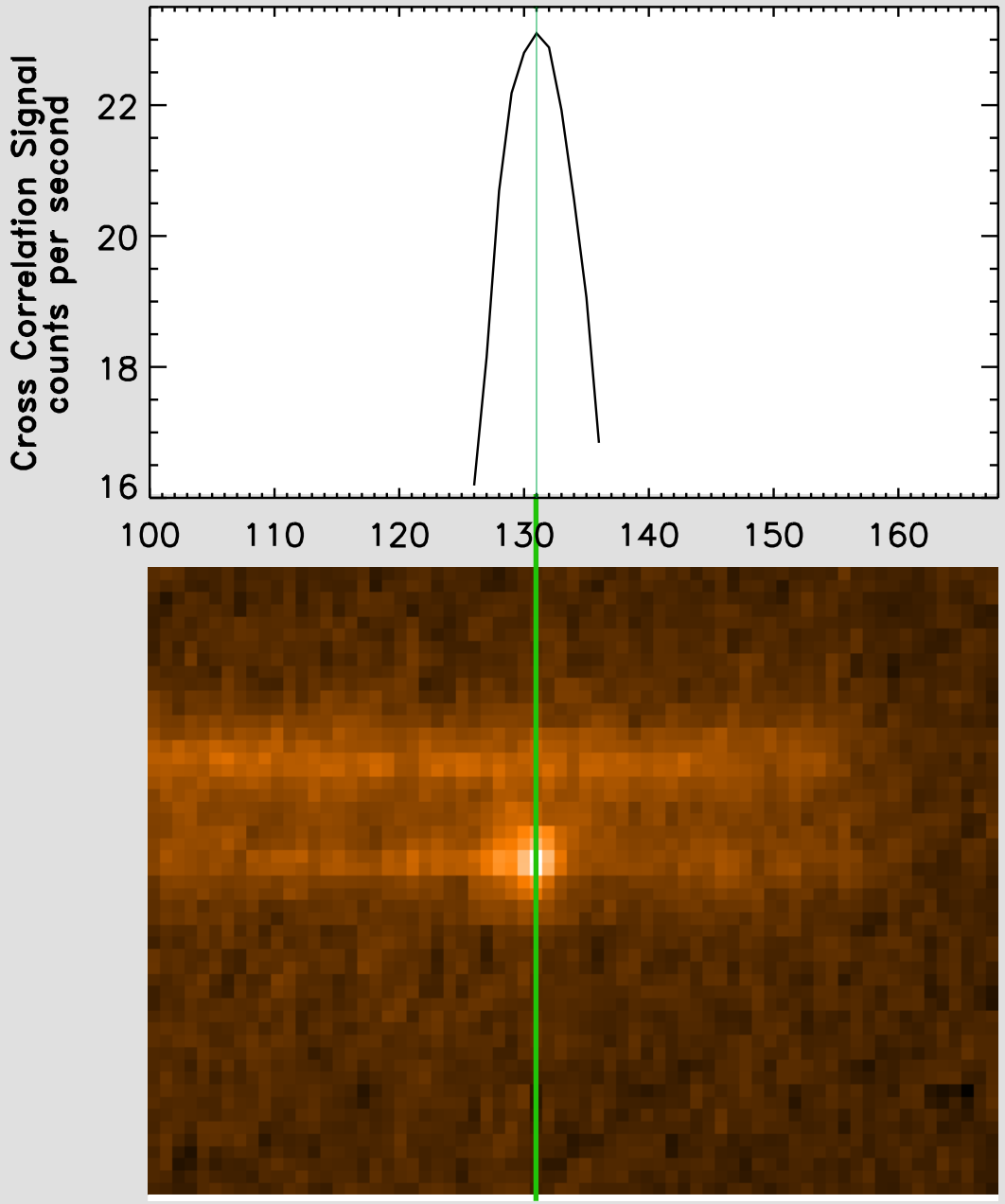
central x pixel from cross-correlation

central x pixel from redshift info

ID: 1320 zspec=2.166, disk fit, $\log_{10}$SSFR=-8.62



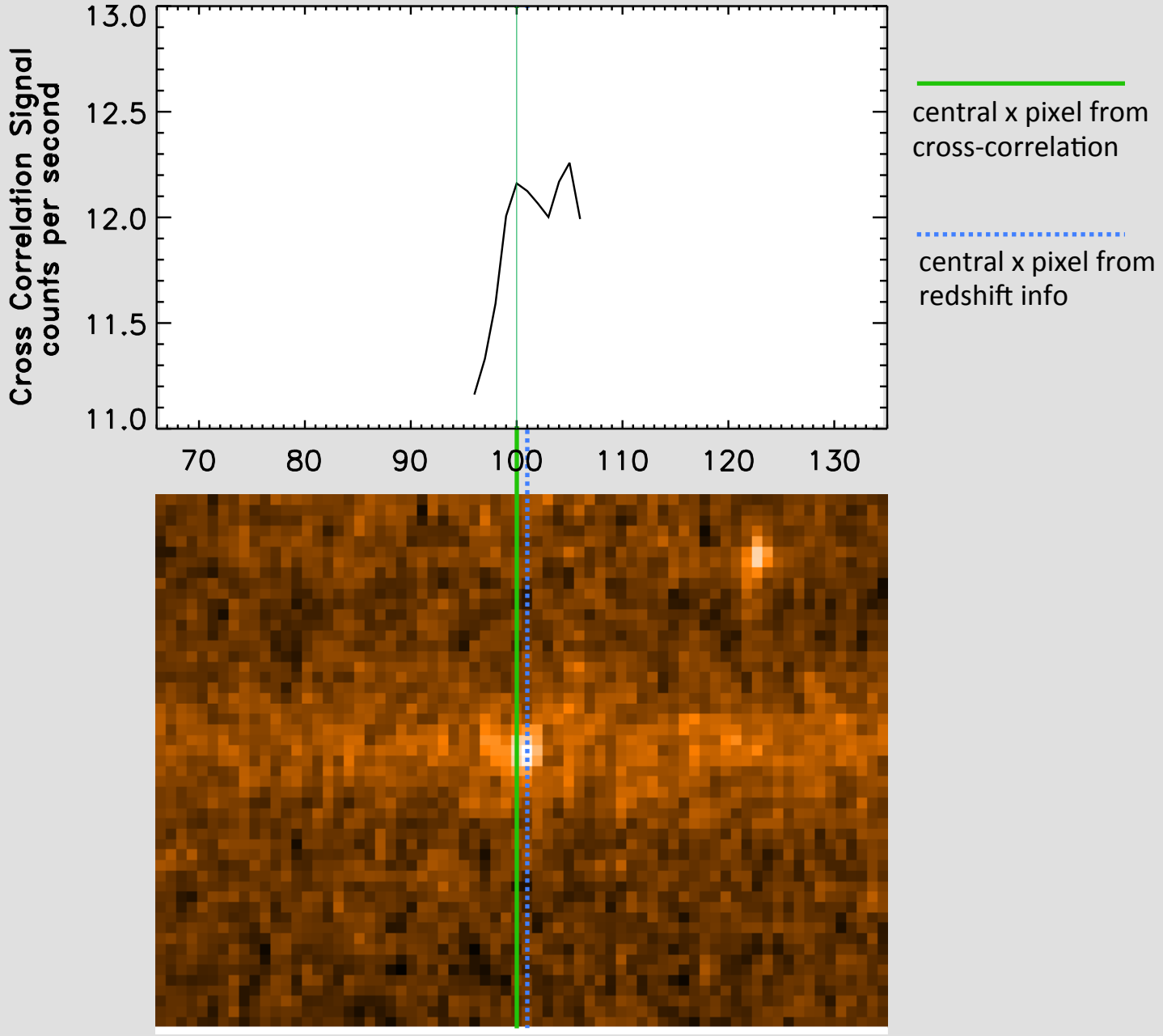
ID: 4462 zspec=2.092, bulge fit, $\log_{10}$SSFR=-9.26



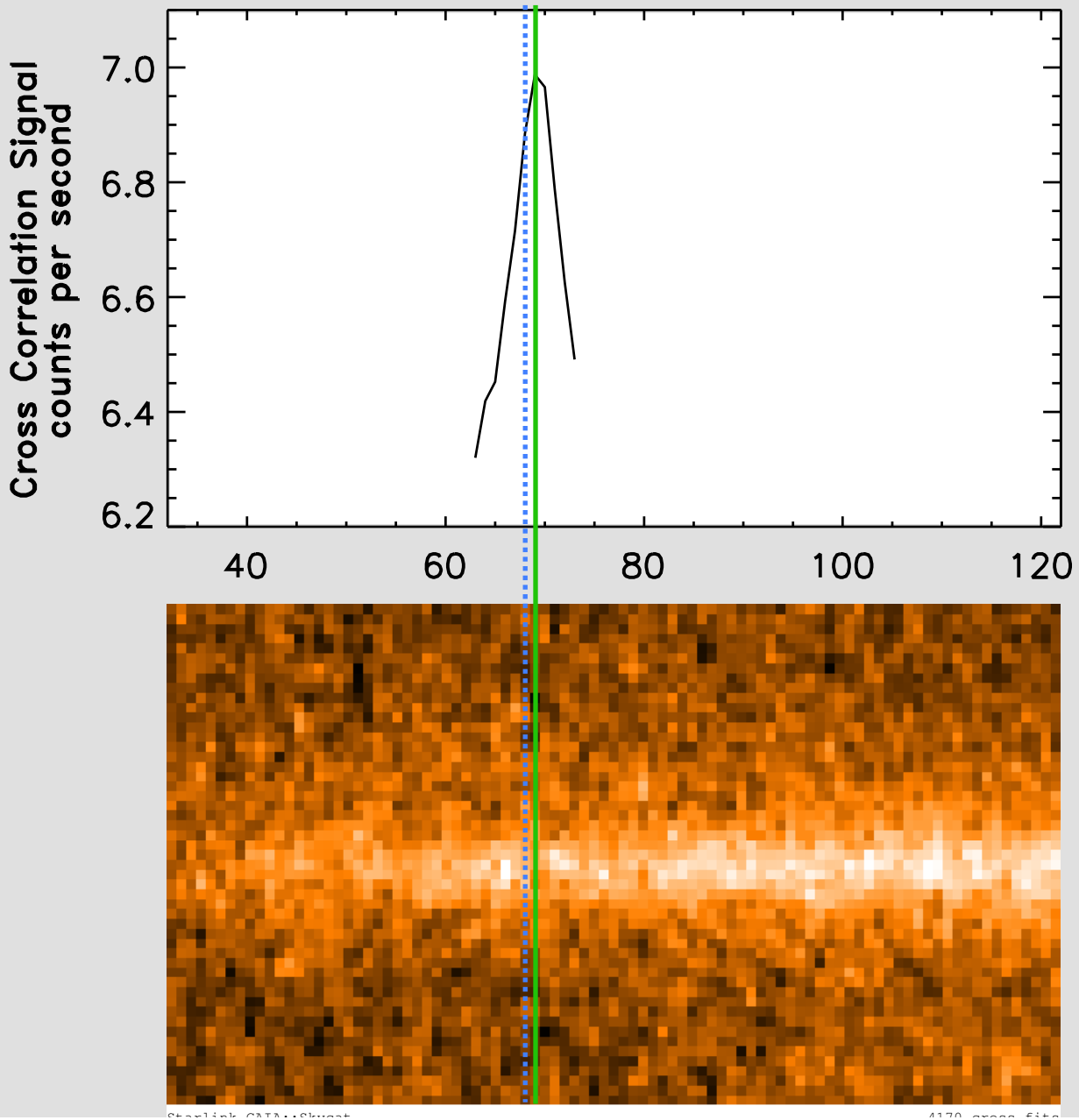
central x pixel from cross-correlation

central x pixel from redshift info

ID: 364 zspec=1.814, disk fit, $\log_{10}$SSFR=-8.57



ID: 4170 zspec=1.508, disk+PSF fit, $\log_{10}$SSFR=-9.39



Summary

- We've been working on utilising the morphological information about the galaxies during the 1D collapse of the 3D-HST grism spectroscopy.
- Useful for: compact/extended line profile analysis, for AGN studies for example; line searches at high redshift.
- Still working on full implementation including : better centroiding, sub-pixel flux in isophotes, contamination, continuum subtraction.
- Potential future work: including a bulge/disk optimal extraction.