Dark Cosmology Centre

VISTA NB118 narrow-band observations: First results

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Based on Milvang-Jensen et al., in prep.

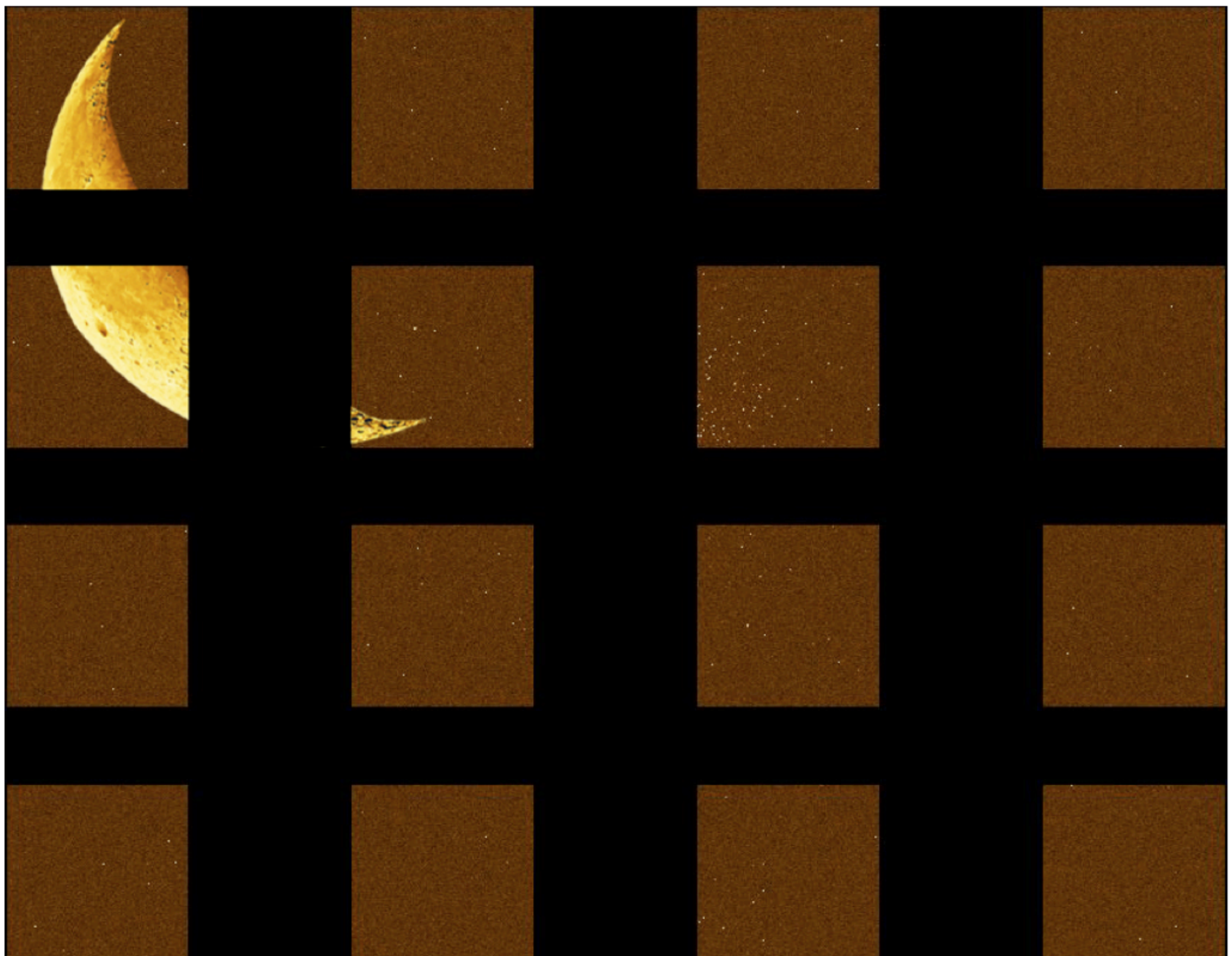
ESO Survey workshop, 17 Oct 2012

Narrow-band imaging

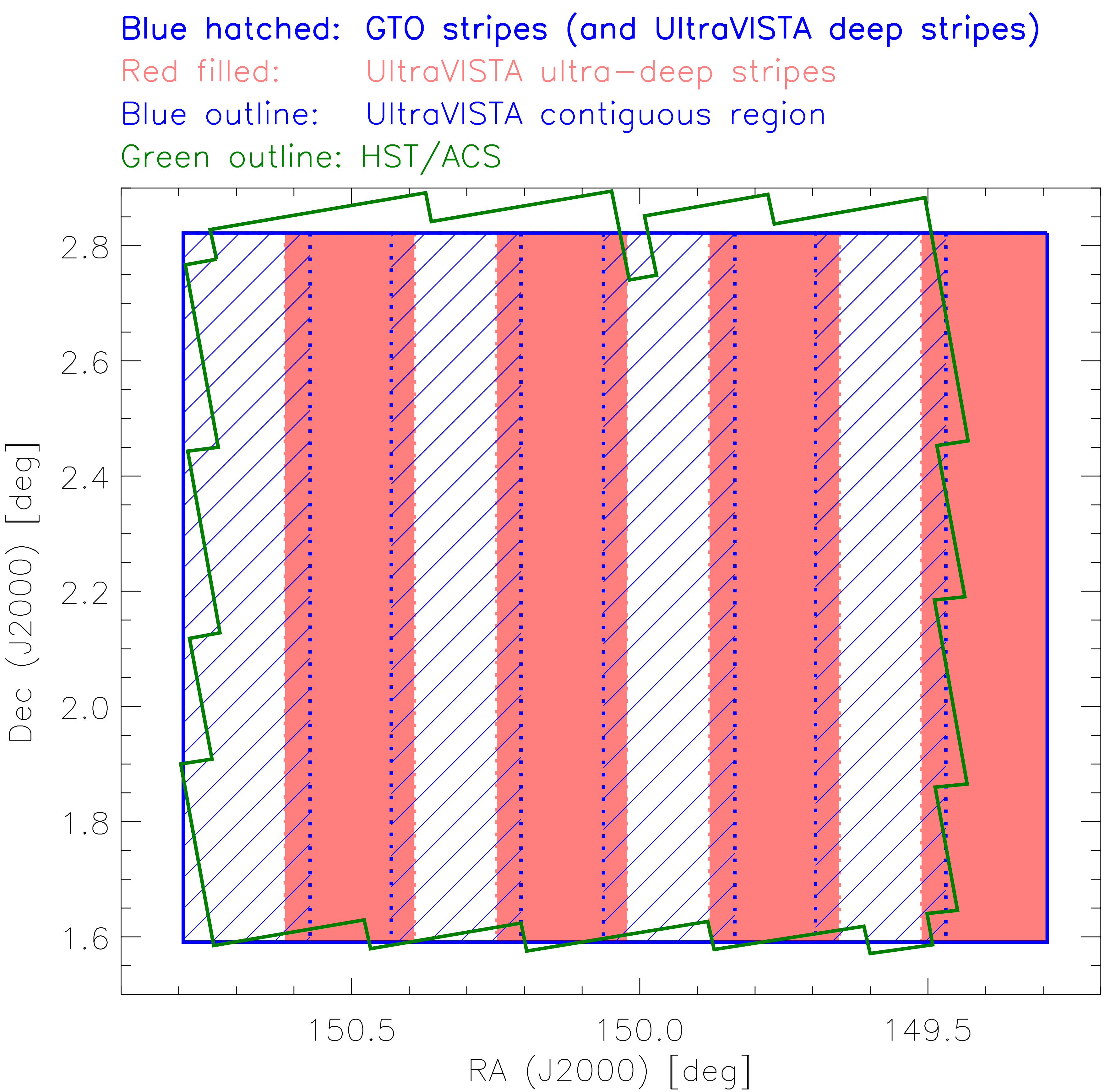
- Method to select emission-line objects (galaxies, AGN) at specific redshifts
- Choose window in the telluric sky-line spectrum
- 1.185 μm window (NB118) corresponds to:
  - $z=0.8$ Hα
  - $z=1.4$ [OIII], $z=1.45$ Hβ
  - $z=2.2$ [OII]
  - $z=8.8$ Lyα
- VISTA: opportunity for wide & deep NB118 survey

The VIRCAM pawprint (0.6 sq. deg.): 16 detectors, requiring 16 filters

The NB118 filters were provided by DARK
Used in UltraVISTA and in a GTO programme



VISTA coverage of the COSMOS field



NB118 data:

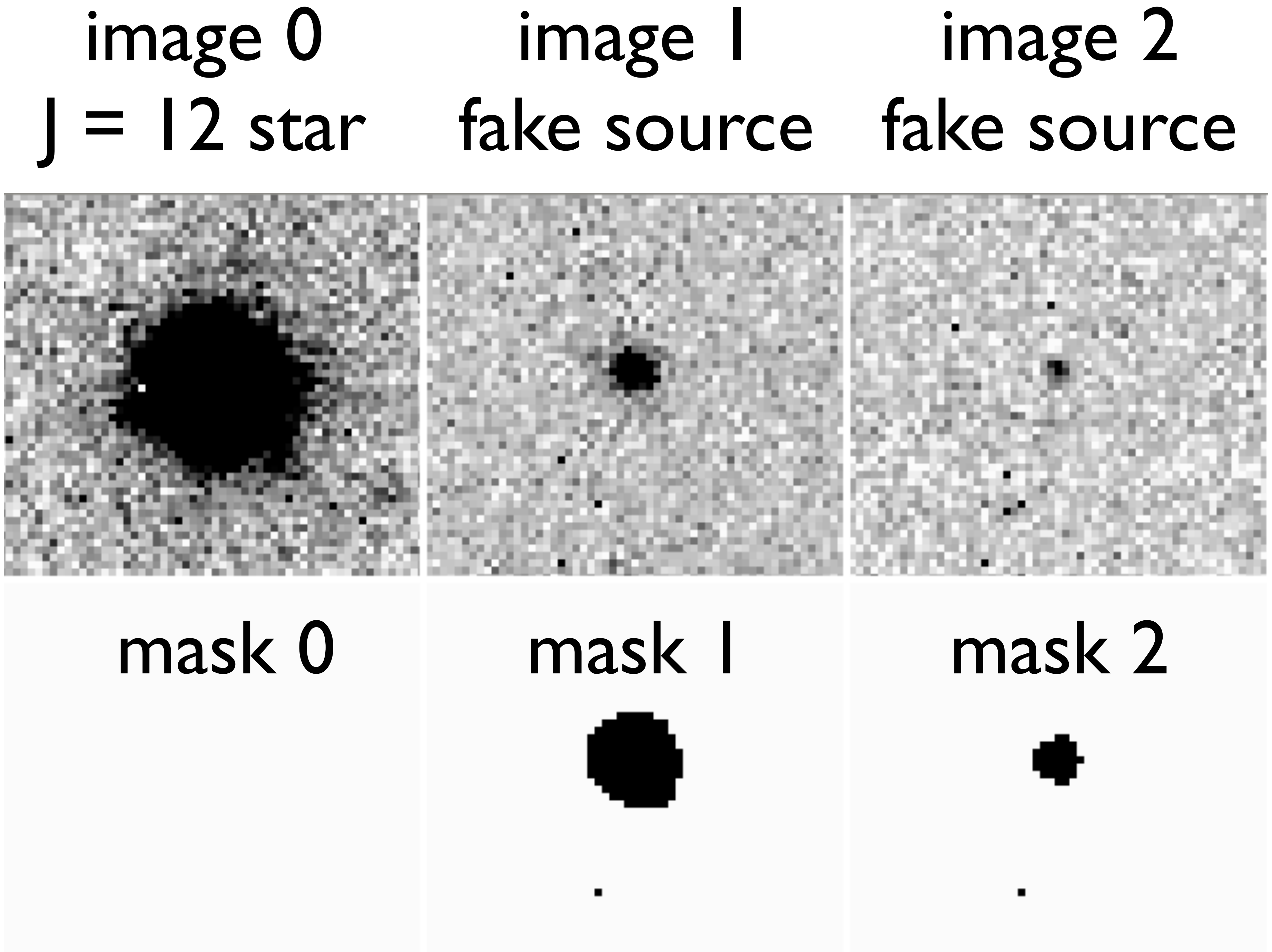
GTO	13.4 h/px
UltraVISTA DR1	6.6 h/px
UltraVISTA final	112 h/px

This talk: NB118 GTO data

Reduction of NB118 images

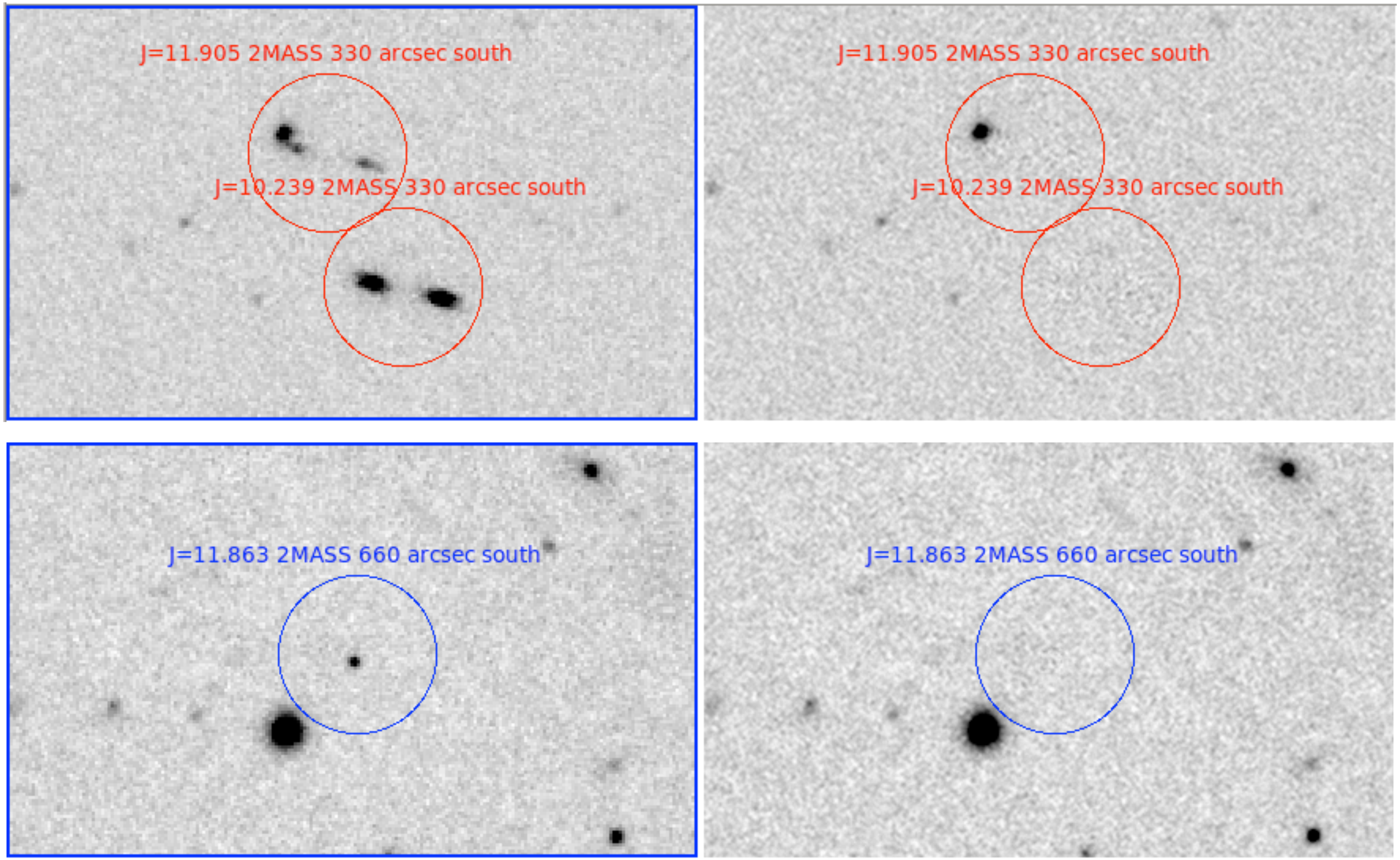
- Single-image reduction done by CASU
- Sky subtraction and stacking done at Terapix (McCracken et al. 2012)
- Persistent images (fake sources) successfully removed by masking in the individual images (Milvang-Jensen et al., in prep.)

Persistence in single images



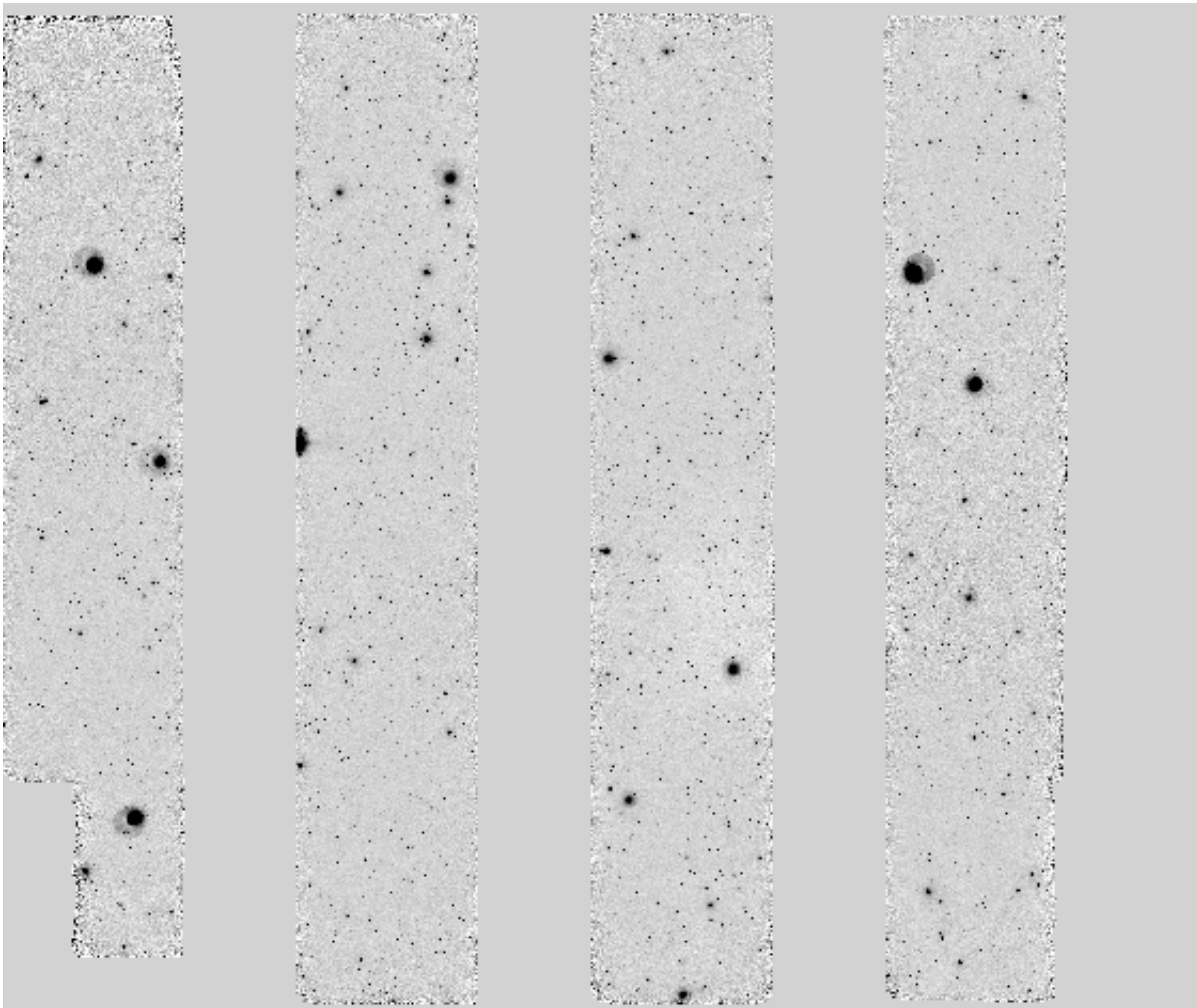
Persistence in the stack

Stack without masking | Stack with masking

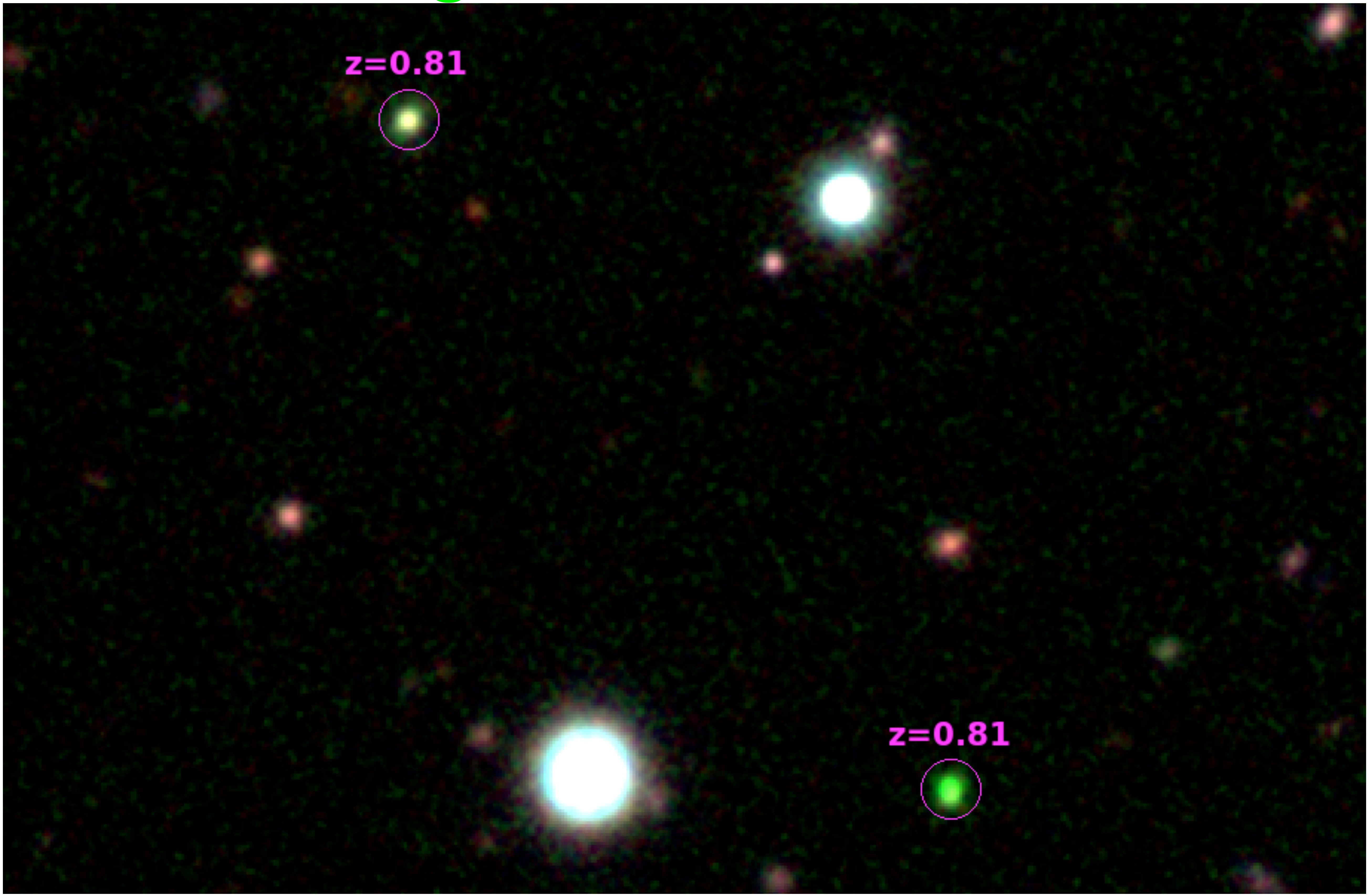


Masking important for non-random offsets or few images

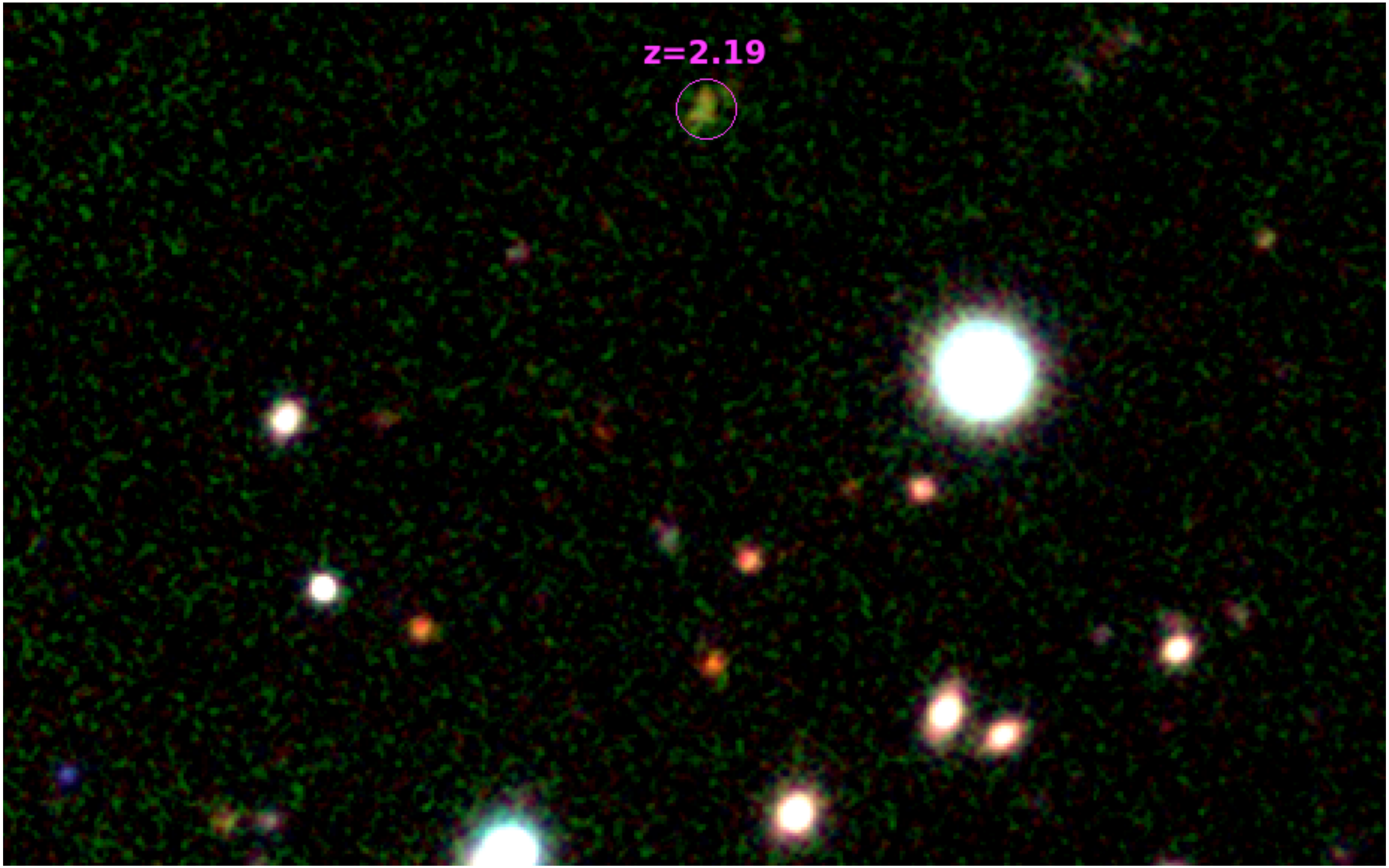
GTO NB118 stack



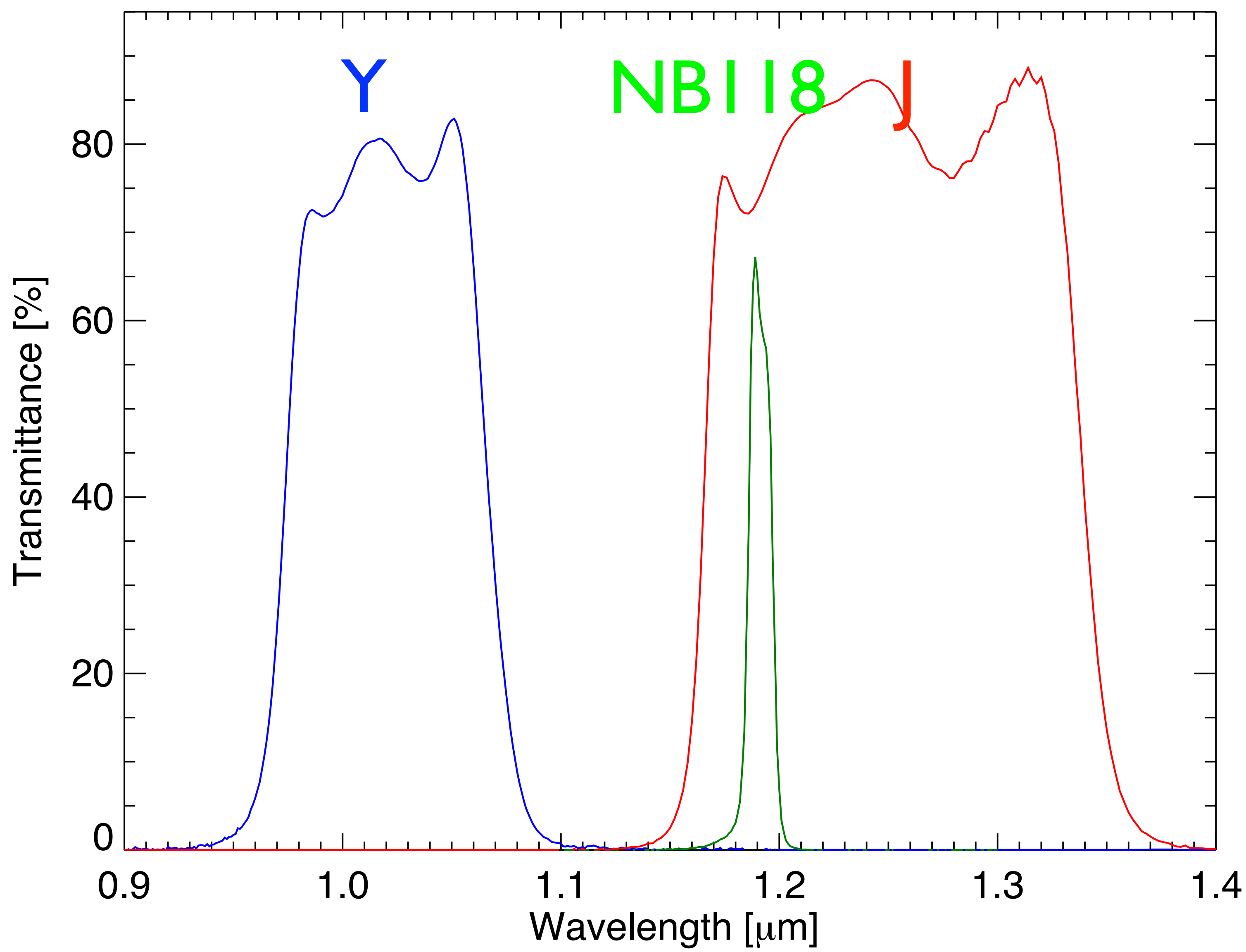
Blue = Y, green = NB118, red = H



Blue = Y, green = NB118, red = H



Continuum subtraction using Y and J



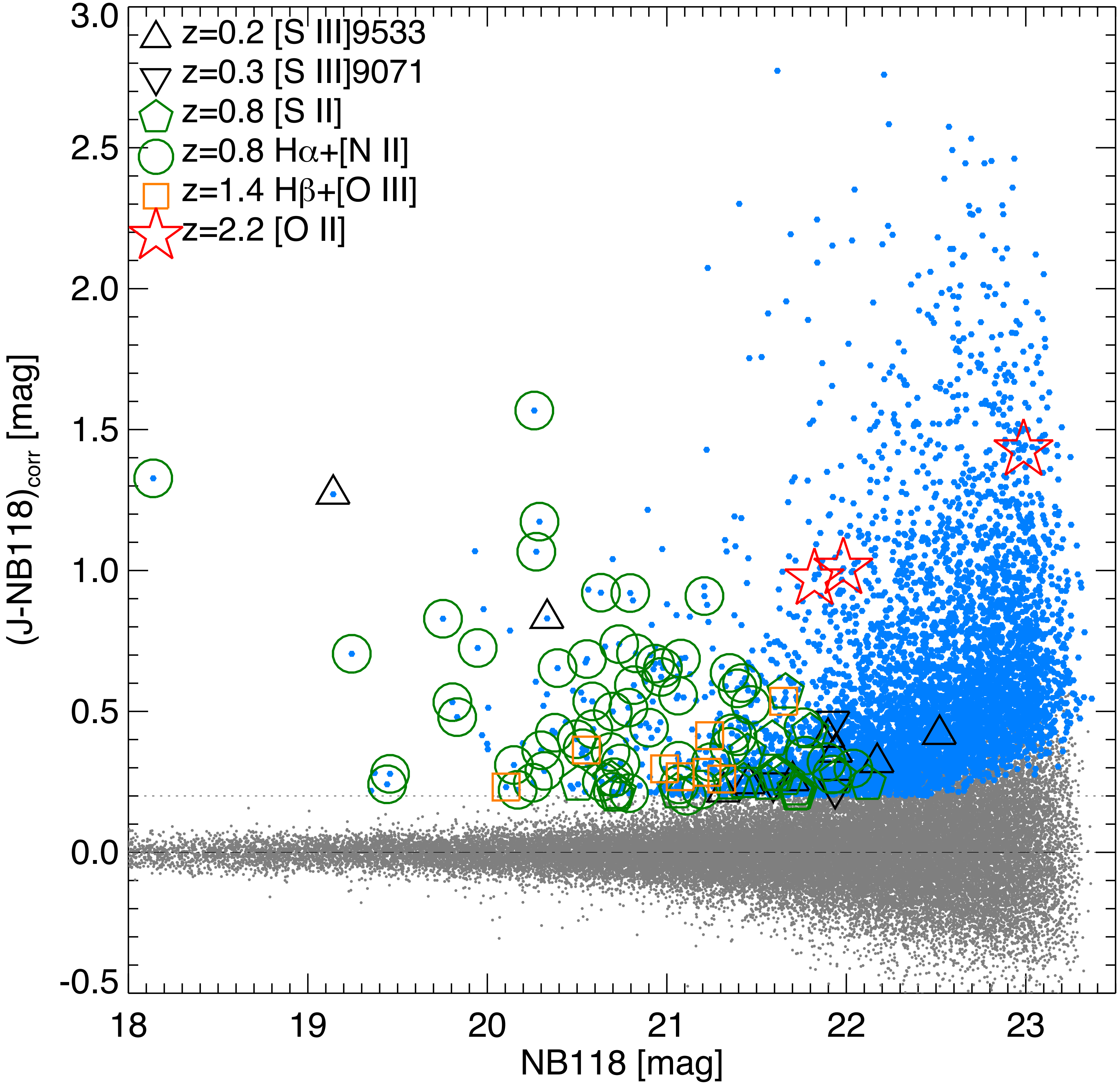
Narrow band excess in magnitudes:

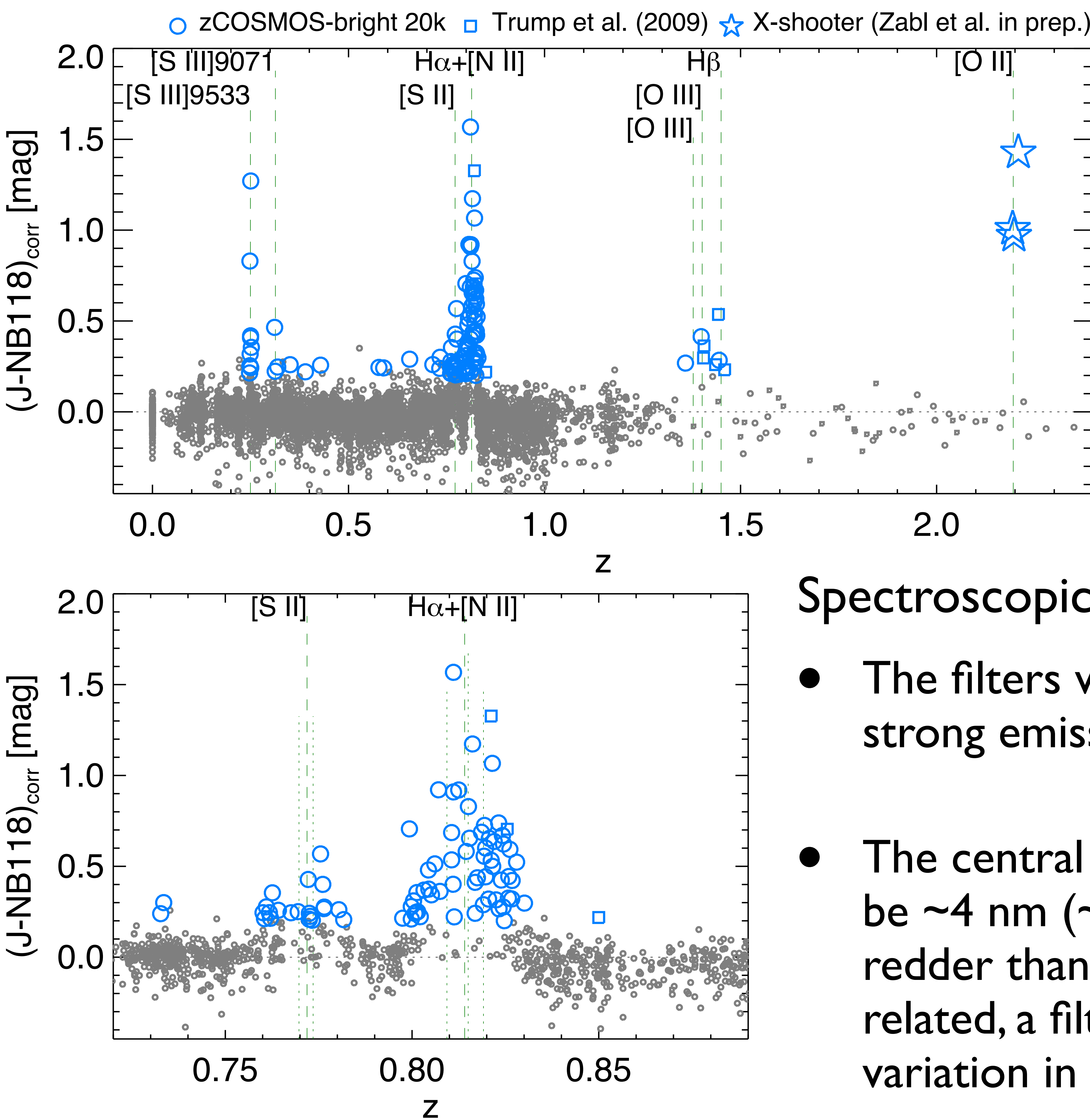
$$(J-NB118)_{corr} \equiv (J-NB118) + 0.39 \cdot (Y-J)$$

where (Y−J) corrects for a continuum slope

Colour-magnitude plot

Blue points: significant narrow-band excess

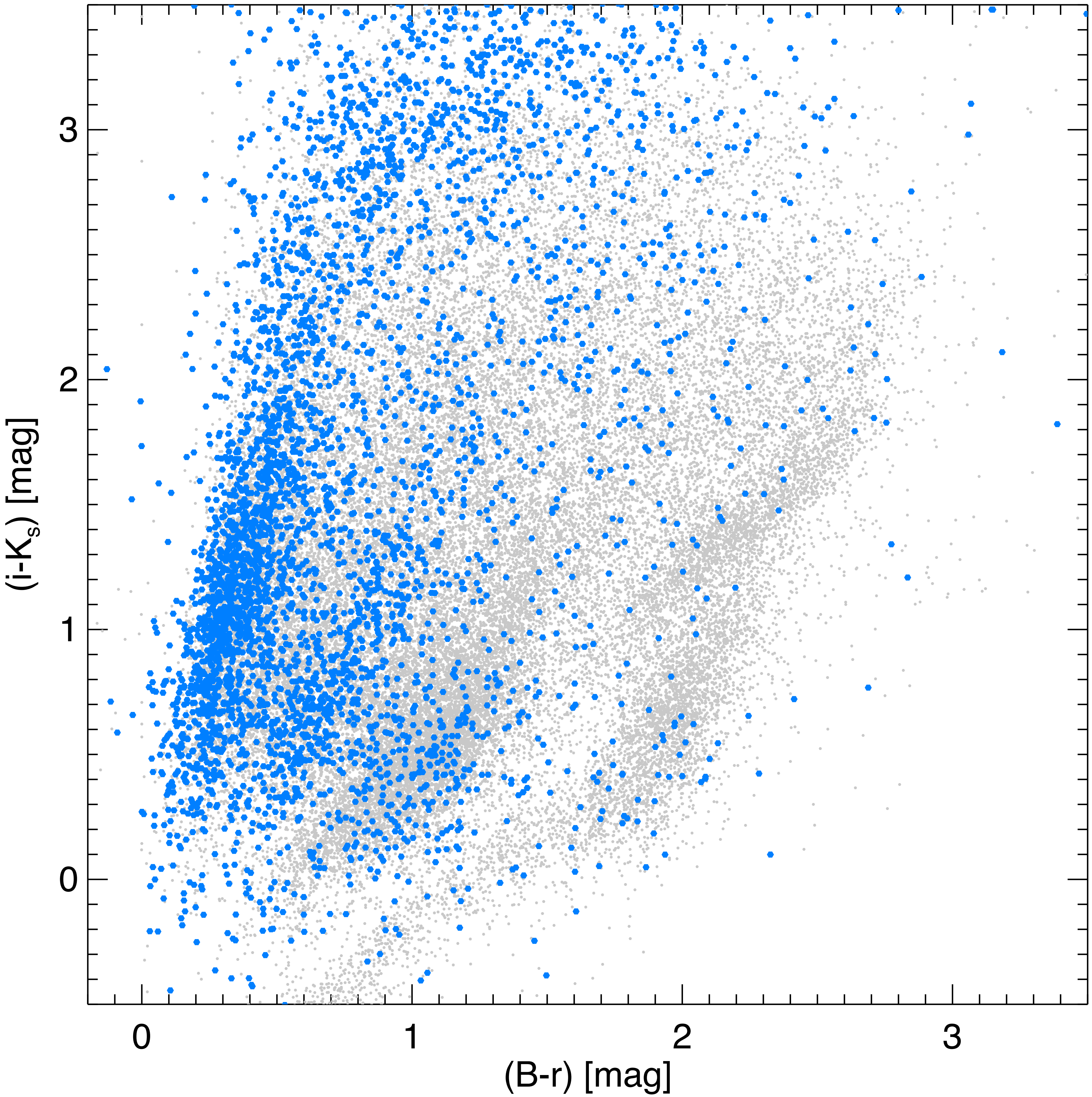




Spectroscopic redshifts indicate

- The filters work, selecting strong emission lines
- The central wavelengths may be ~4 nm (~25% of FWHM) redder than predicted. Possibly related, a filter to filter variation in sky level is seen

Colour-colour plot: $(i-K_s)$ vs $(B-r)$

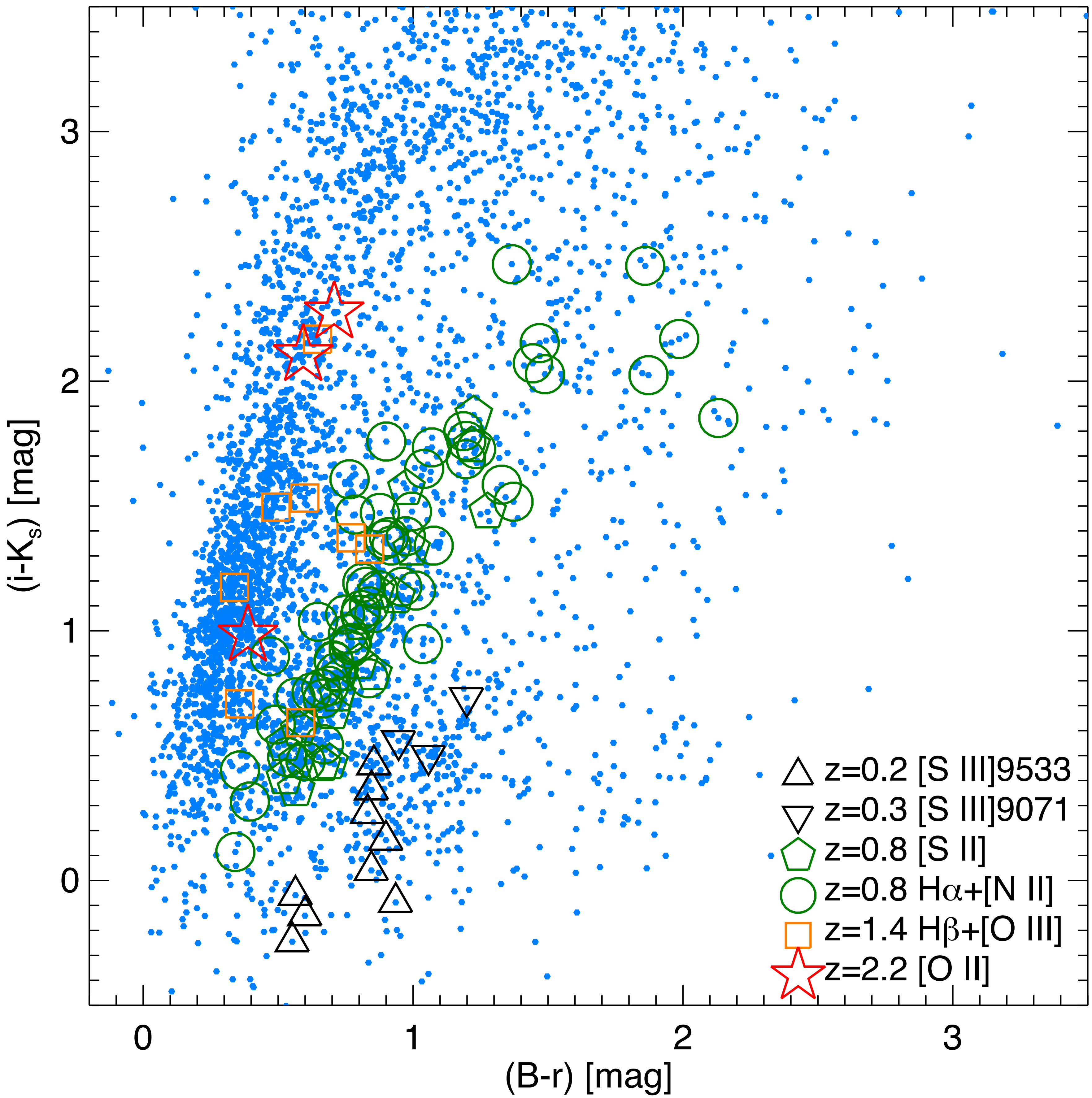


Blue: NBexcess

Grey: other

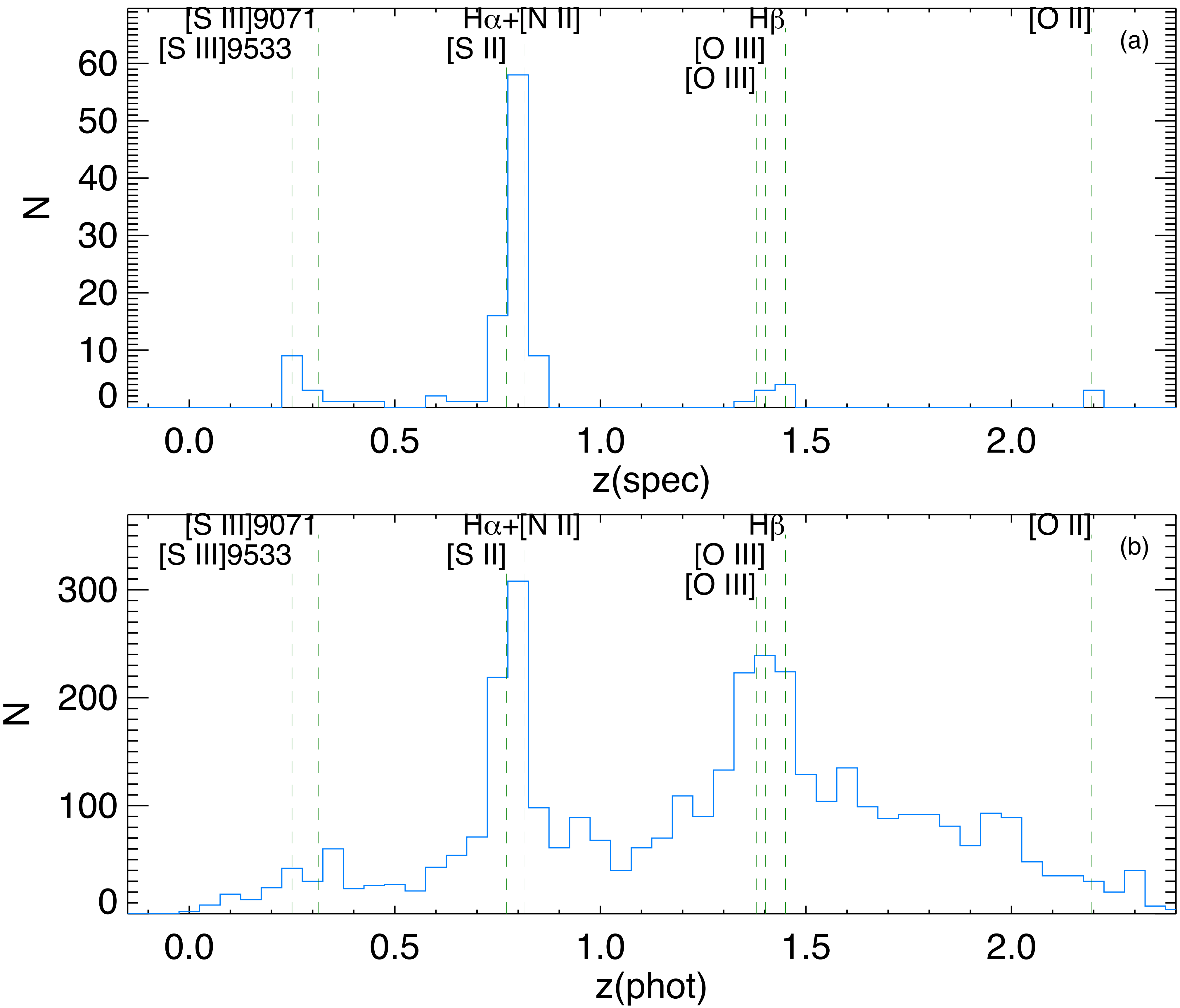
idea: Sobral et al. 2009

Colour-colour plot: $(i-K_s)$ vs $(B-r)$



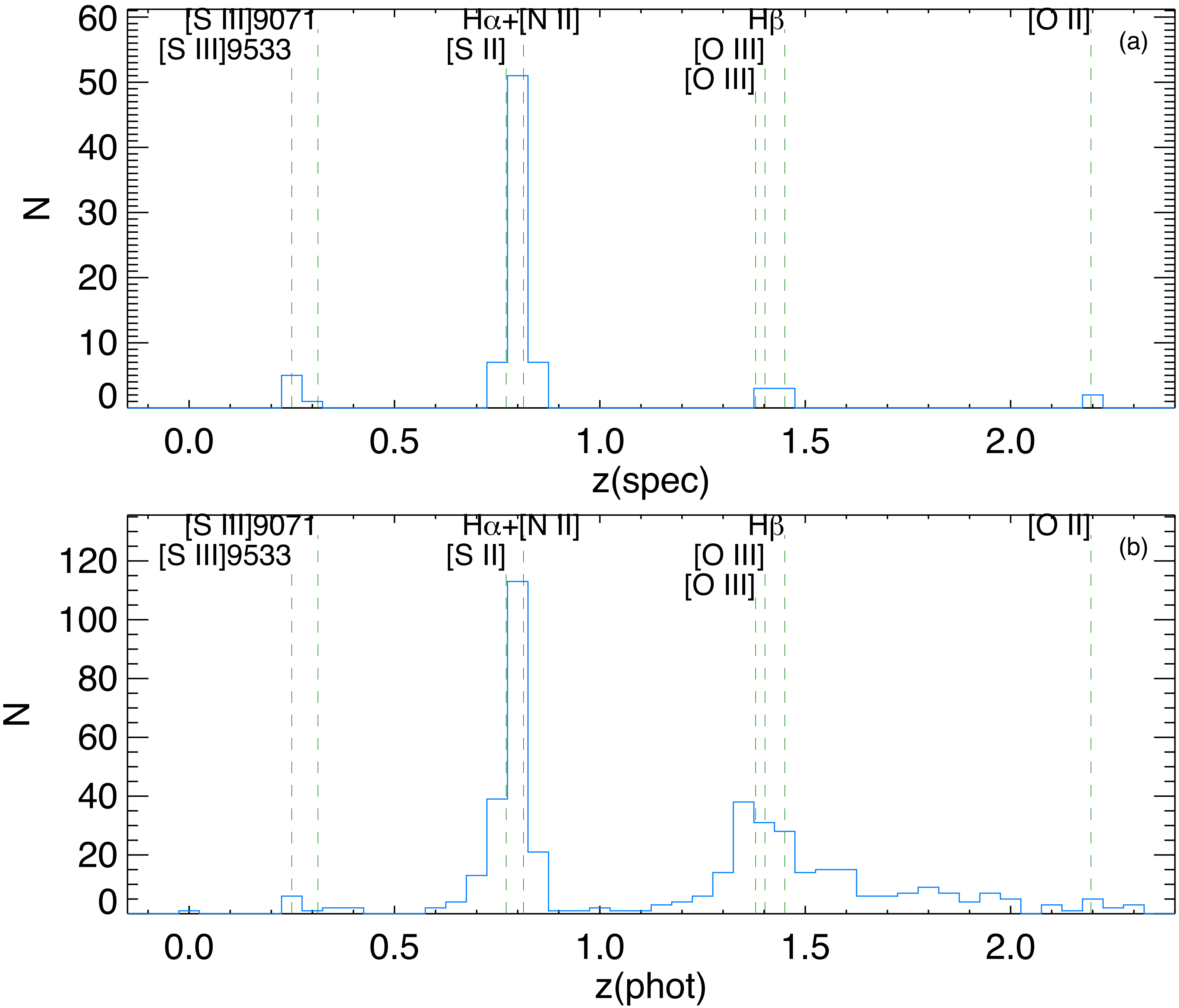
Blue: NBexcess
Grey: other

z(spec) vs z(phot): 4.5σ selection



Note: photo-zs (O. Ilbert) computed without knowing NB118

z(spec) vs z(phot): 10σ selection

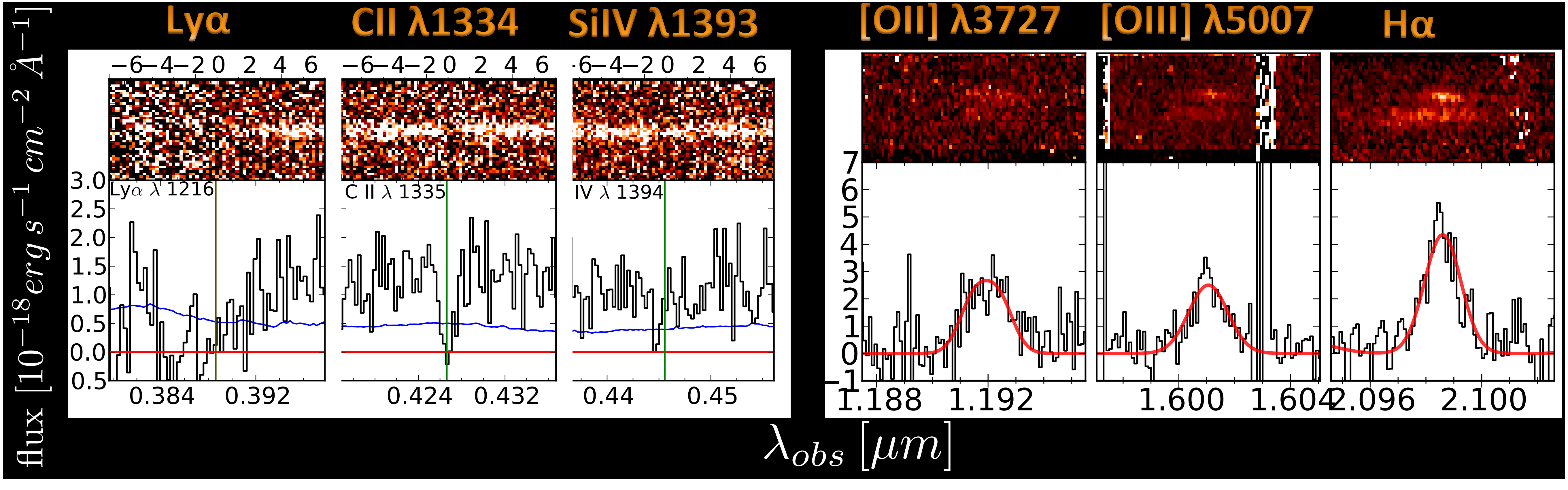


Note: photo-zs (O. Ilbert) computed without knowing NB118

Spectroscopic follow-up

- z=2.2 [OII] sample is great for spectroscopic follow-up: Lyα, [OII], Hβ, [OIII], Hα, [NII], etc., plus a number of absorption lines, are accessible

- 3 NB118-excess sources with z(phot)≈2.2 observed with X-shooter (see poster by J. Zabl). All 3 were indeed z=2.2 [OII] emitters



AGN

- Among the spectroscopic sample, the NBexcess objects are almost exclusively star-forming galaxies, except for z=1.45 Hβ where the majority are AGN
- The time-domain of UltraVISTA should allow reverberation mapping (→black hole masses), where NB118 traces the broad-line emission and $YJHK_s$ trace the continuum

Summary

- The current VISTA NB118 data provide a large sample of z=0.8 Hα, z=1.4 [OIII]/Hβ and z=2.2 [OII] emitters
- The different emitters can be identified via colour-colour or photo-z selection, thanks to the ~30 photometric bands in COSMOS
- z=2.2 [OII] sample is great for spectroscopic follow-up: Lyα, [OII], Hβ, [OIII], Hα, [NII], plus more, accessible from the ground
- In the future, z=8.8 Lyα emitters can be detected in the NB118 UltraVISTA data