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di Fisica
e Astronomia
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Single line emitters in the HST/WFC3 Infrared Spectroscopic Parallel Survey (WISPs)

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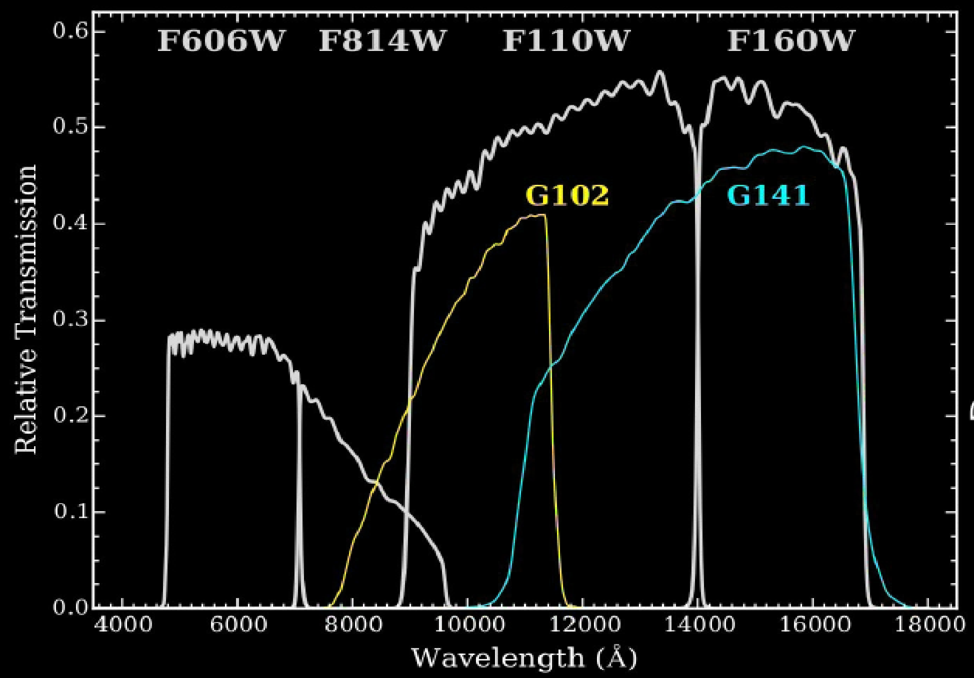
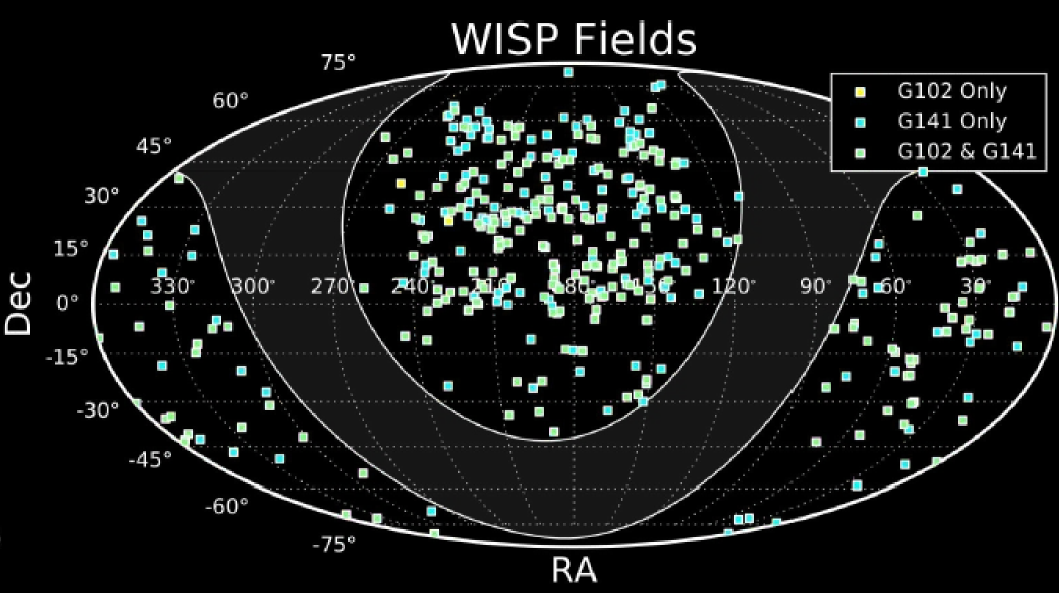
The WFC3 Infrared Spectroscopic Parallel survey

H. Atek et al. (2010)

- HST pure parallel
- large program (~2000 orbits)
- surveying the sky in both → { slitless spectroscopy and direct imaging





Slitless grism spectroscopy:
G102: 0.8 – 1.1 μm (R~210)
G141: 1.07 – 1.7 μm (R~130)

Emission lines measured for ~1518 arcmin^2

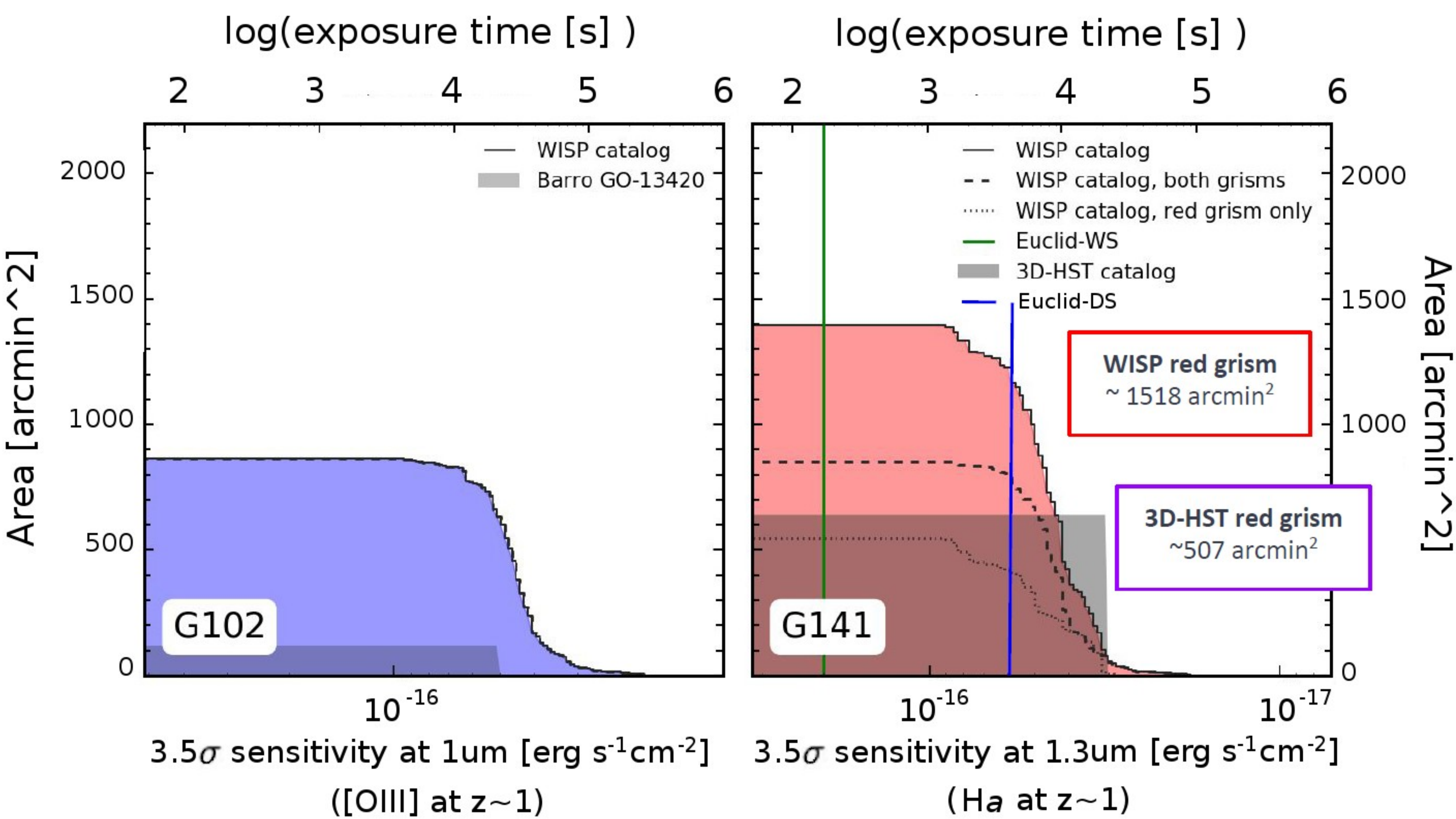
WISP

- ~ 2000 HST orbits
- 1518 arcmin^2 covered in G102 and G141 (total)
- Photometric coverage: F110W, F140W/F160W + UVIS, IRAC
- Coverage in randomly located pointings

3D-HST

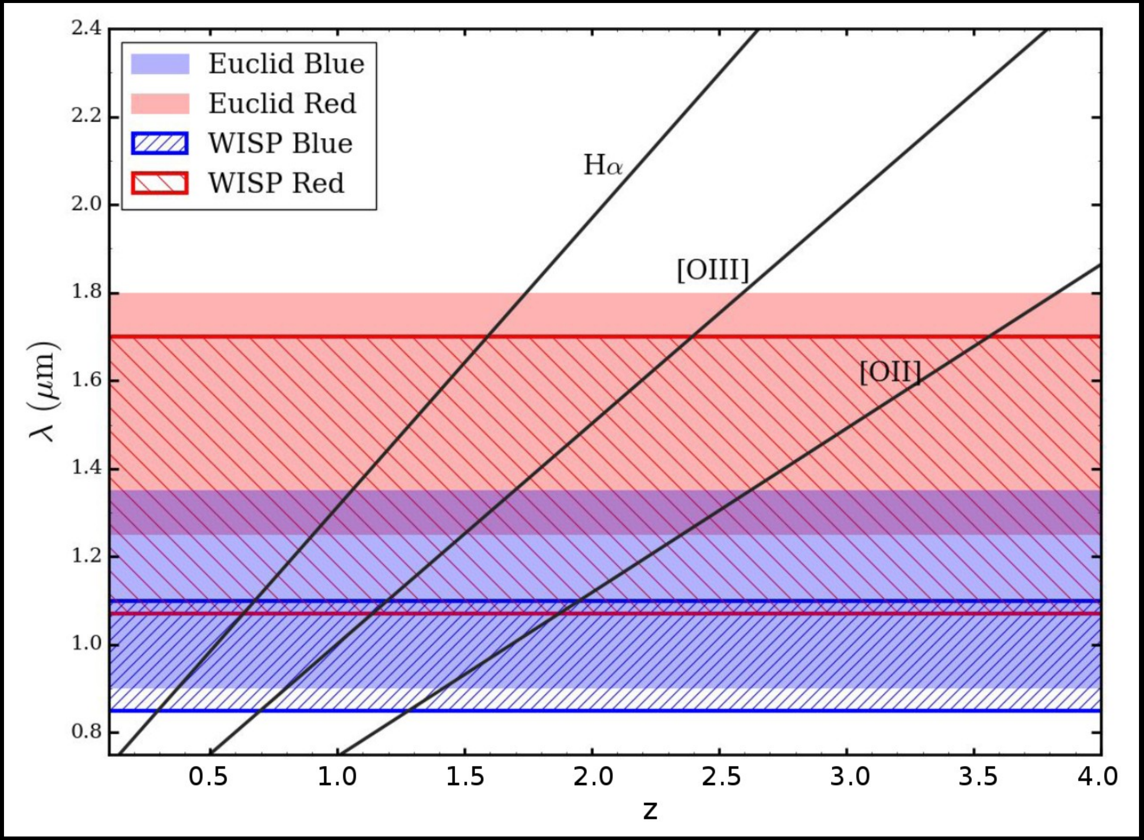
- ~ 248 HST orbits
- ~ 600 arcmin^2 covered in ONLY G141
- Photometric coverage: F140W + UVIS
- Main cosmological fields covered (AEGIS, COSMOS, GOODS, UDS)

WISP
The WFC3 Infrared Spectroscopic Parallel survey



HST Vs EUCLID:

	HST / WFC3	Euclid / NISP
Slitless Spectroscopy:	G102: 0.8 - 1.1 μm (R~210) G141: 1.07 - 1.7 μm (R~130)	Blue: 0.92 - 1.25 μm Red: 1.25 - 1.85 μm
Hα coverage:	**$0.22 \leq z \leq 1.6$**	**$0.9 \leq z \leq 1.8$** (Wide Survey)
[OIII] coverage:	**$0.6 \leq z \leq 2.3$**	**$1.5 \leq z \leq 2.7$** (Wide Survey)



WISP science goals

- Measure the star formation history using the gold standard Ha emission over the last 10 billion years;

- Study resolved growth of galaxies;

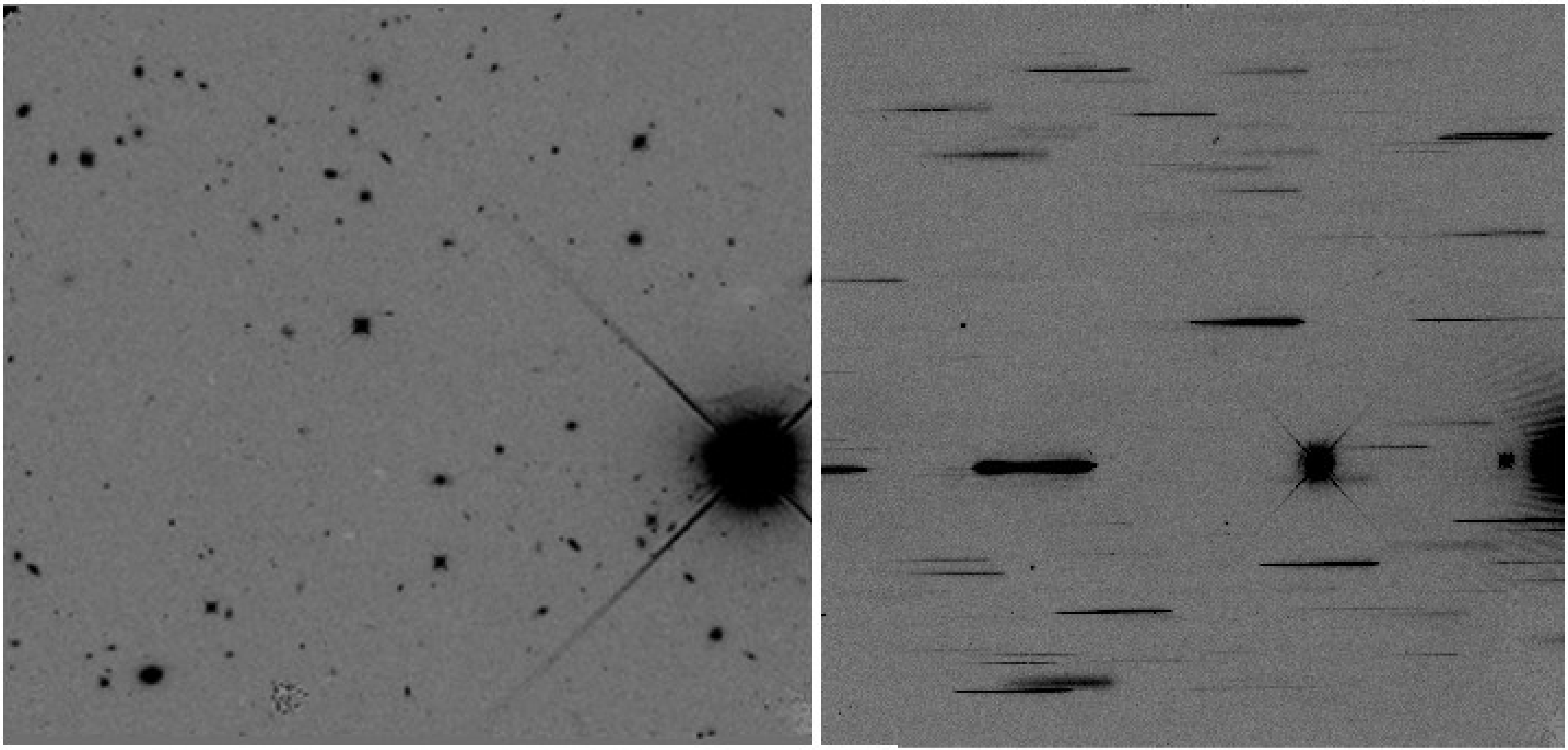
- Constrain the evolution of dust extinction (Hα/Hβ) and gas metallicity (OII and OIII strength) as a function of mass and luminosity;

- Constrain the stellar population and size evolution of the most massive galaxies;

- Identify highly luminous $z>6$ Lyα emitters and link to the history of reionization;

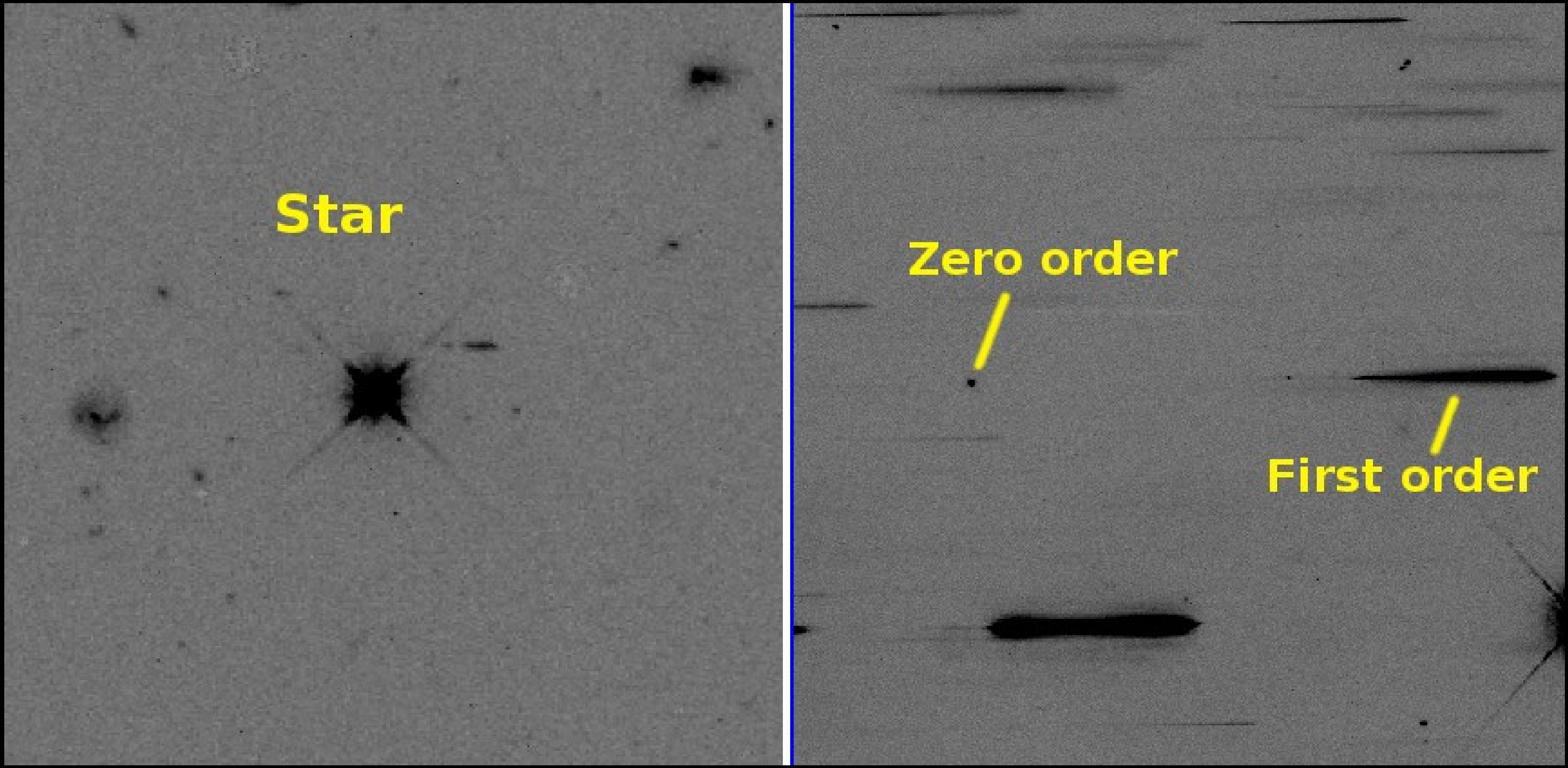
- Constrain the evolution of the OIII/OII ratio at $1.2<z<2.5$ (i.e. the evolution of the escape fraction of the ionizing radiation)

WISP data



Direct exposure **Grism exposure**

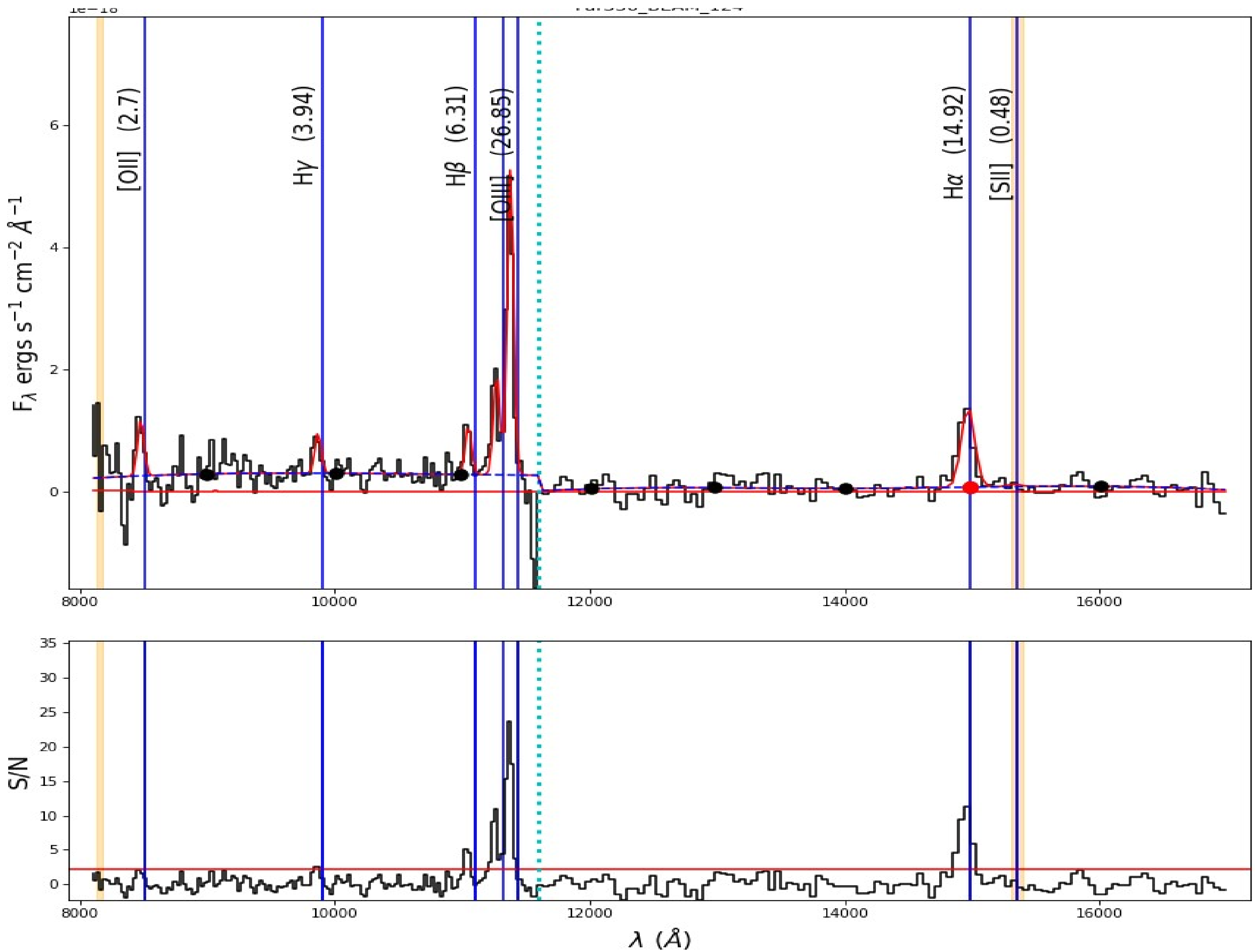
WISP data



Direct exposure

Grism exposure

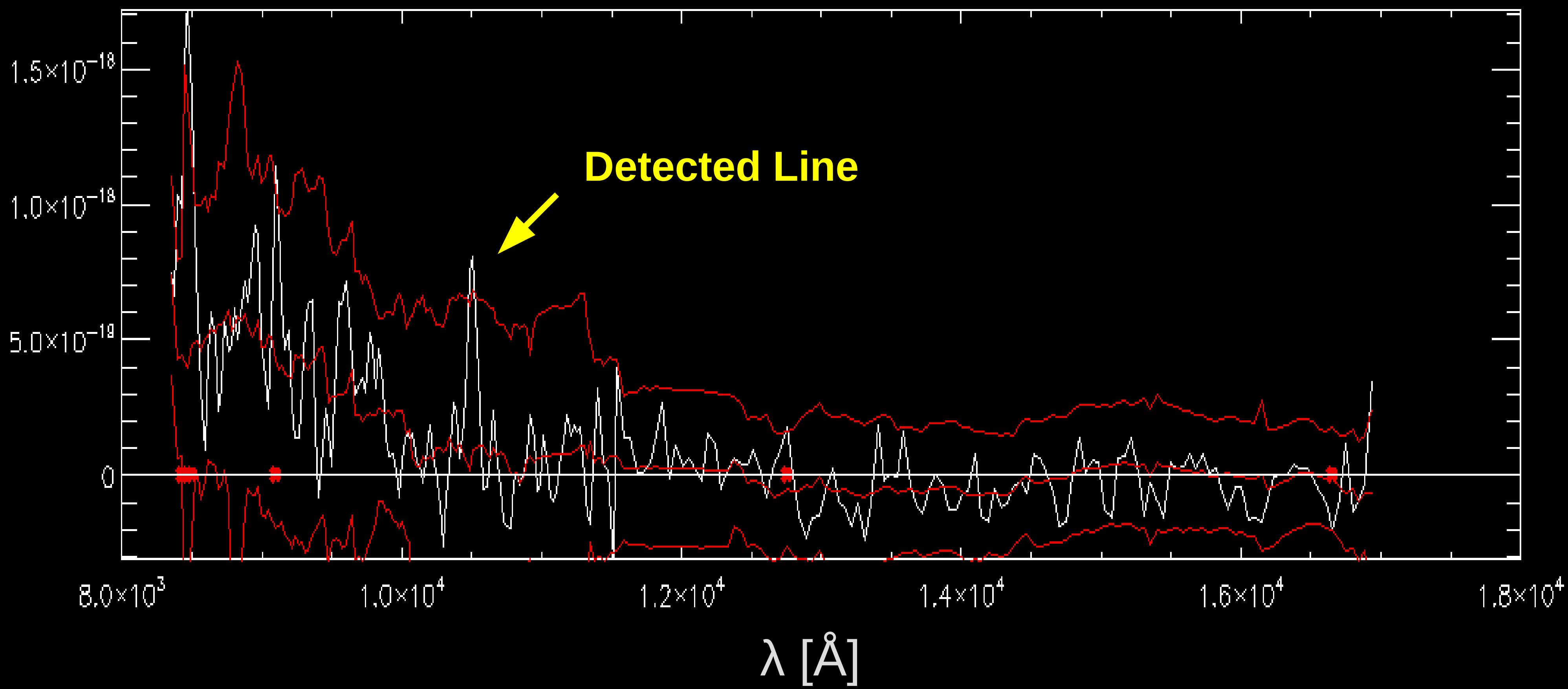
WISP data



Many line emitters identified between z~0.3 and z~2.5...

WISP data

… but in many cases, identifying lines is not so easy.
In particular when only one line is detected.



There is additional information that can be used to identify a line:

1) Apparent Magnitude (F110W);

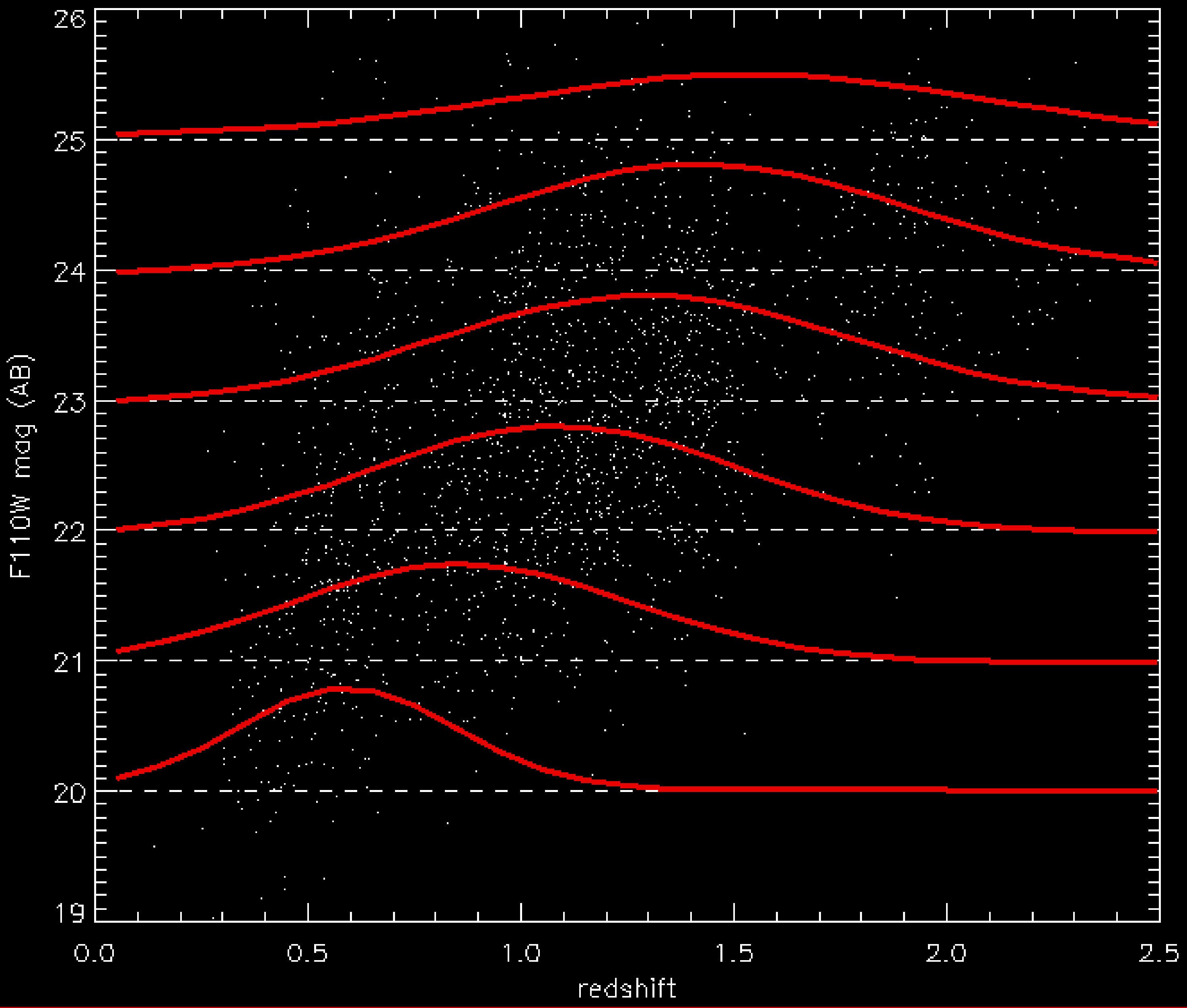
2) Apparent Size (F110W);

3) Line flux ratios;

4) Photometric redshifts (SED fitting).

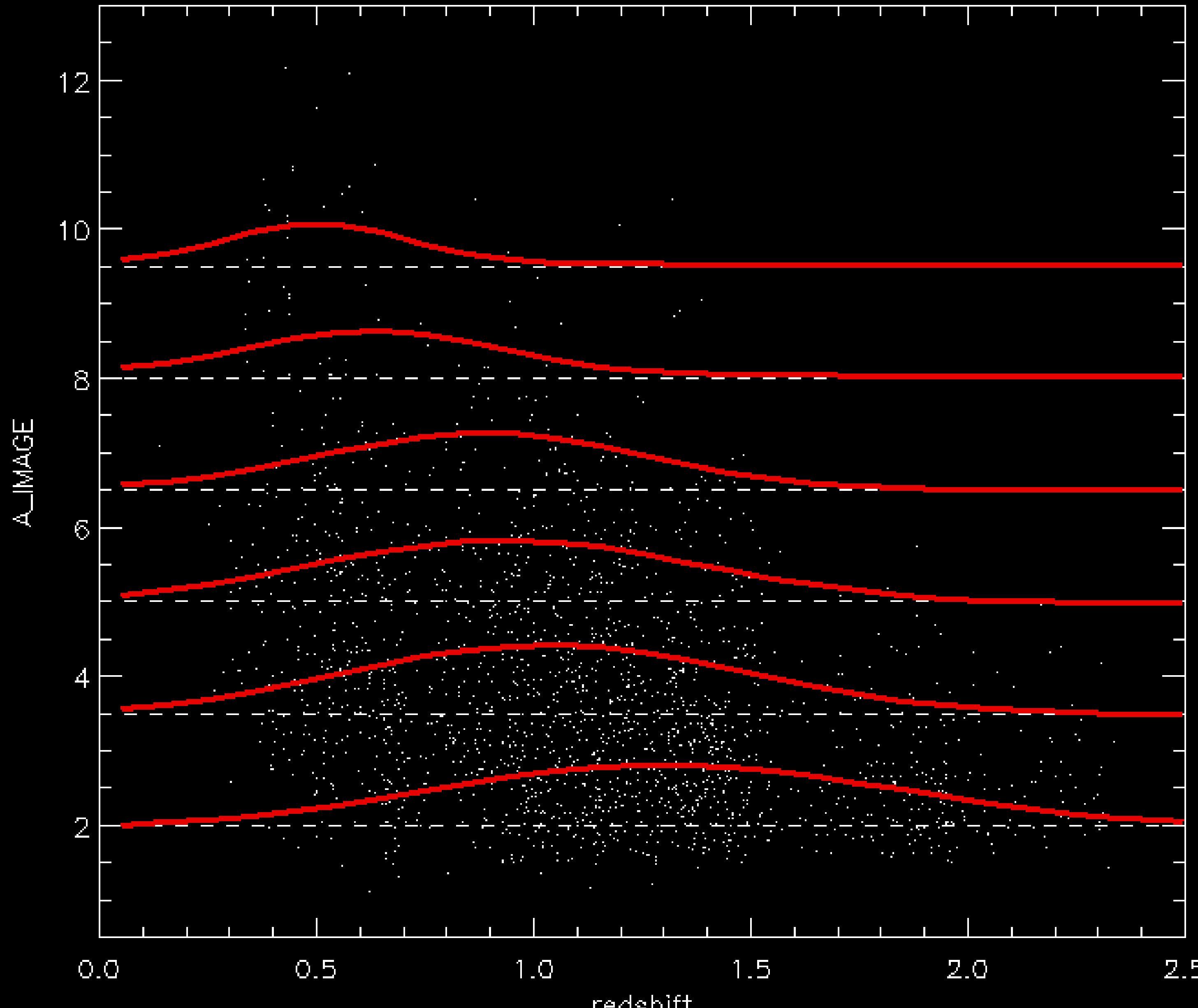
There is additional information that can be used to identify a line:

1) Apparent Magnitude (F110W)



There is additional information that can be used to identify a line:

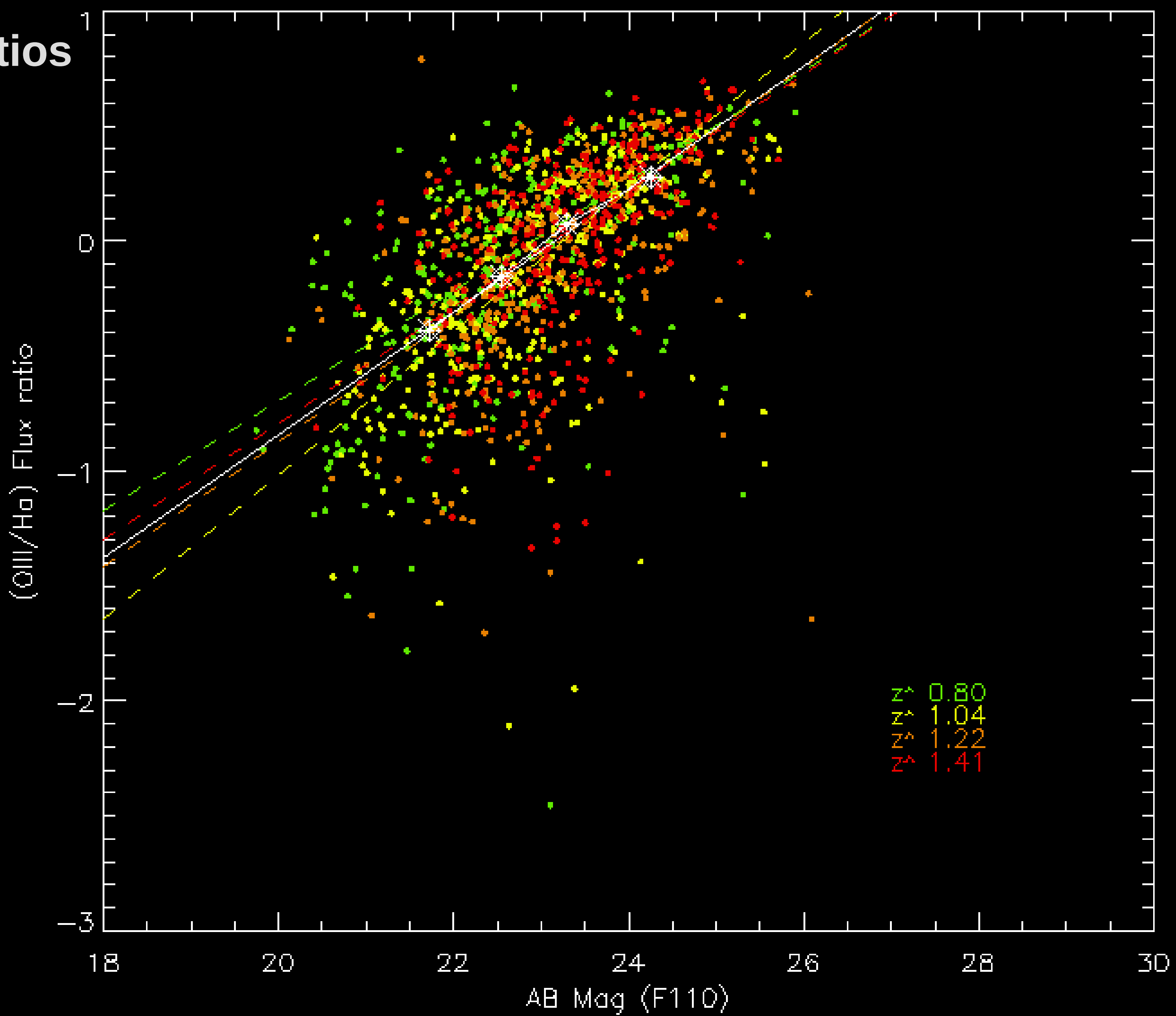
2) Apparent Size (F110W)



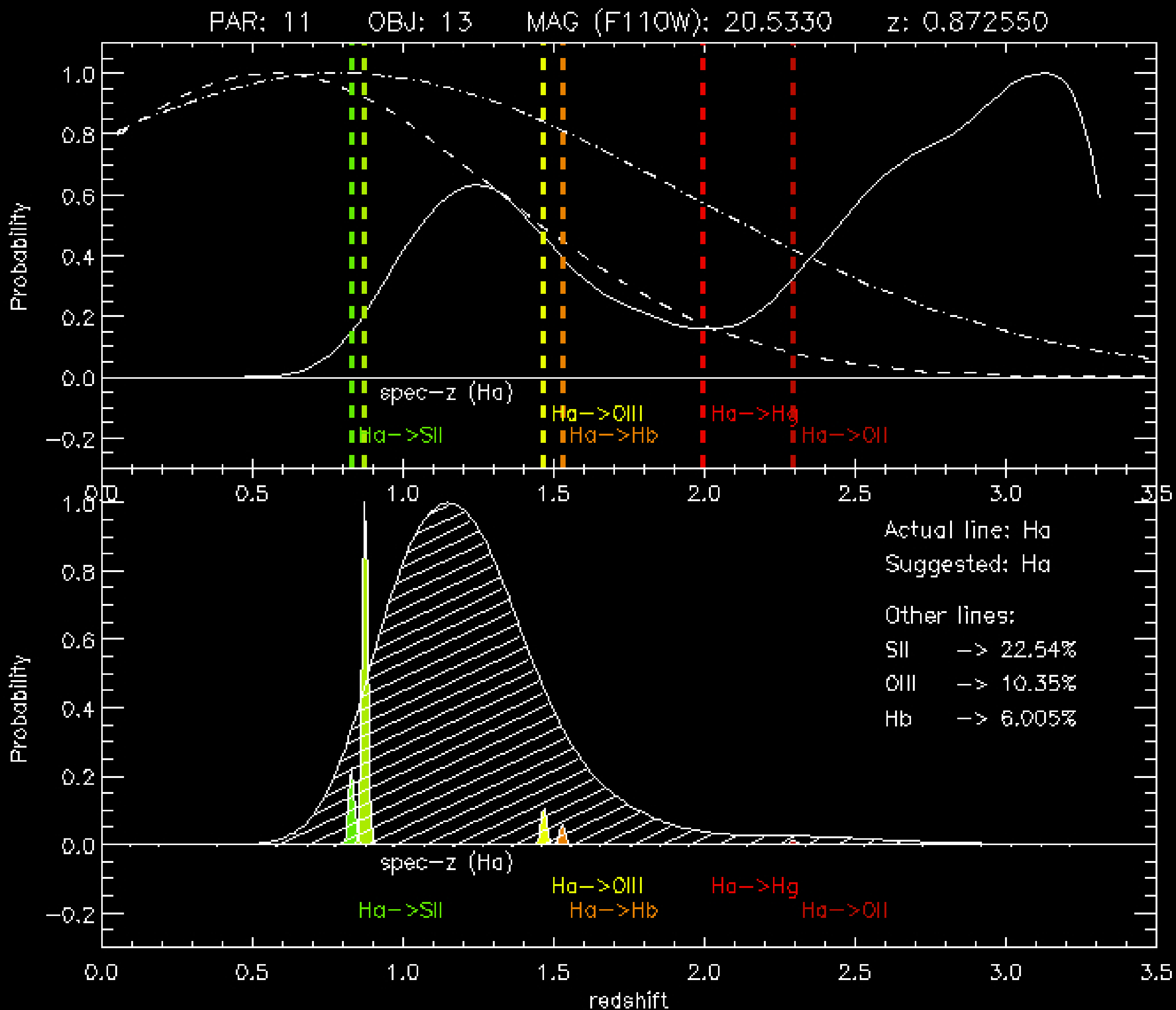
There is additional information that can be used to identify a line:

3) Line flux ratios

OIII / Hα



All the previous information can be combined into an unique PDF



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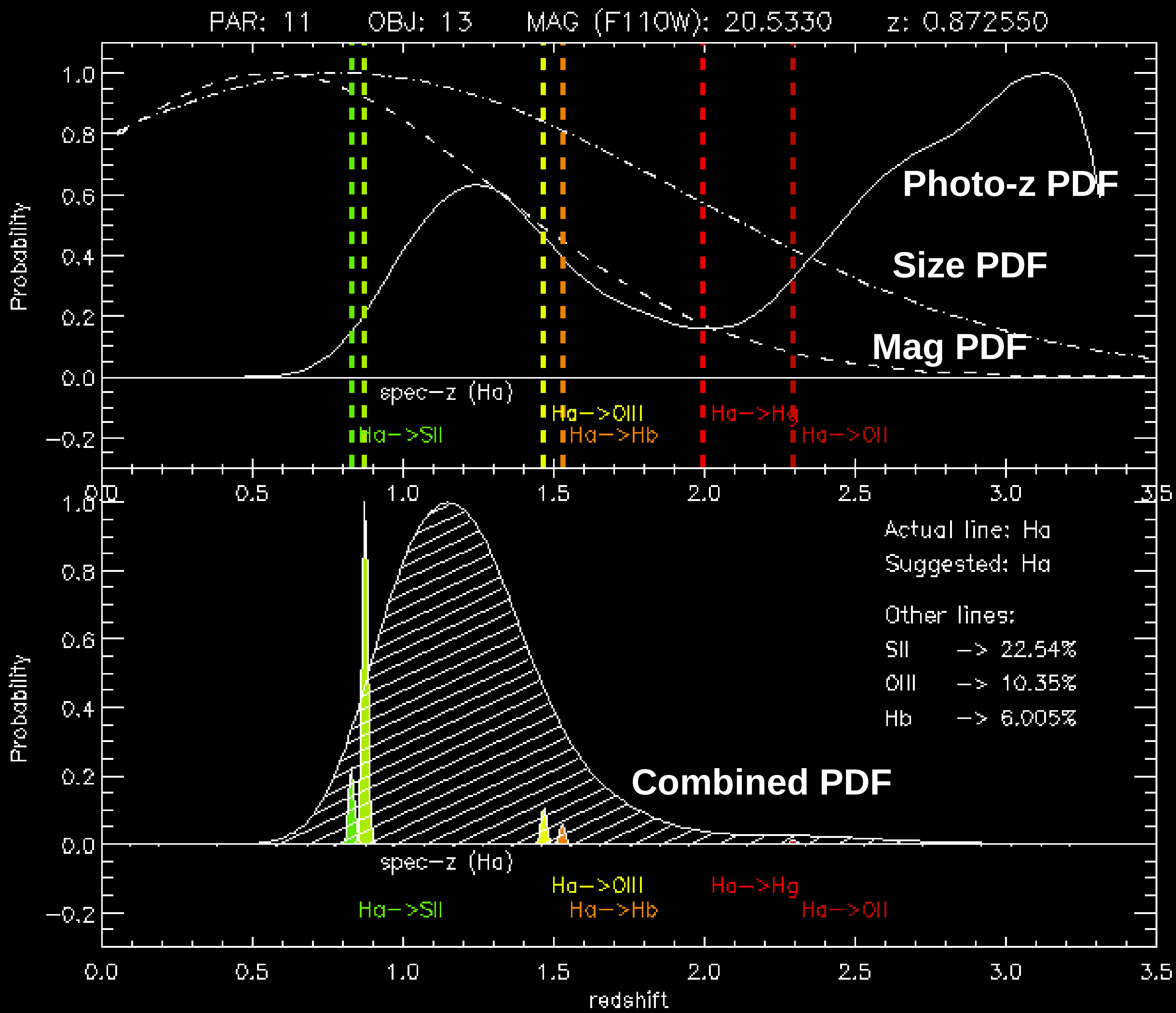

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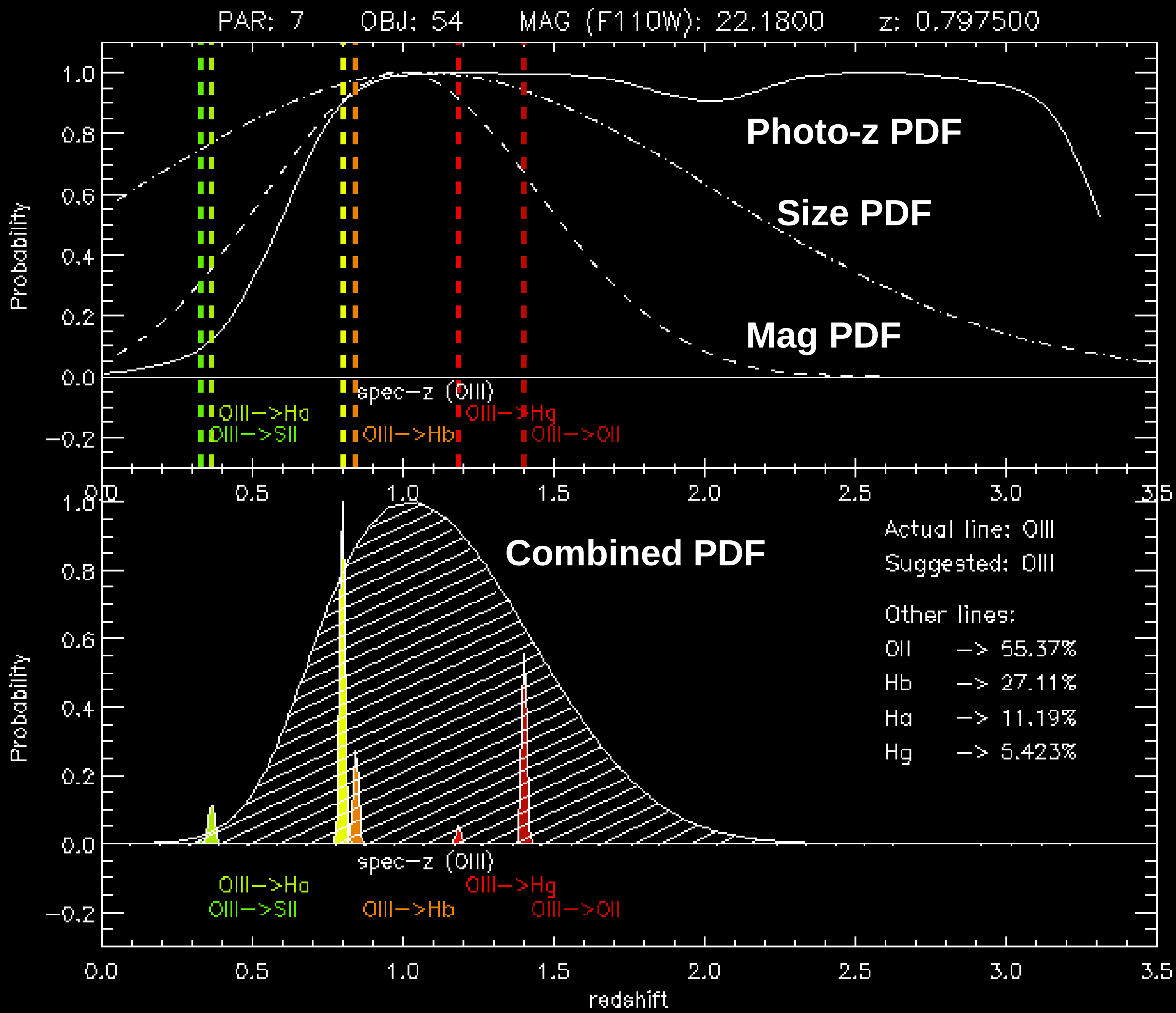


Results:

Overall precision (lines correctly recovered / total): 78%

(The precision of the default choice (Hα) would be: 53%)

Line	Correctly recovered	Wrongly recovered	Completeness	Contamination
Hα	848	128	87 %	18 %
OIII	553	251	69 %	19 %
OII	25	14	64 %	78 %

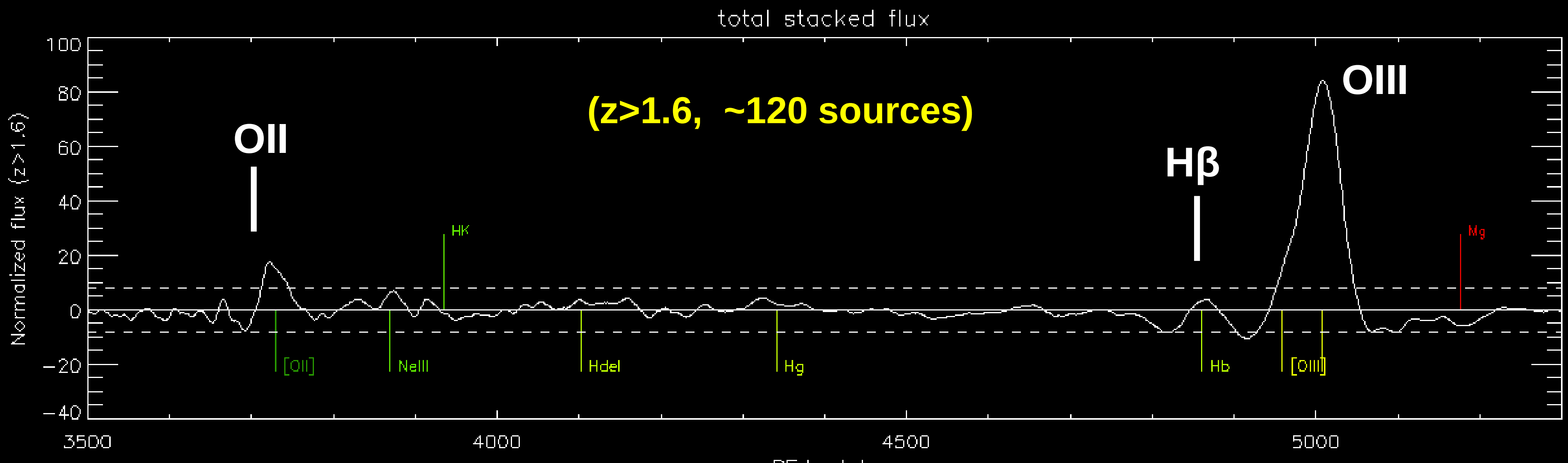
Tests performed on a WISP "*gold*" sample:

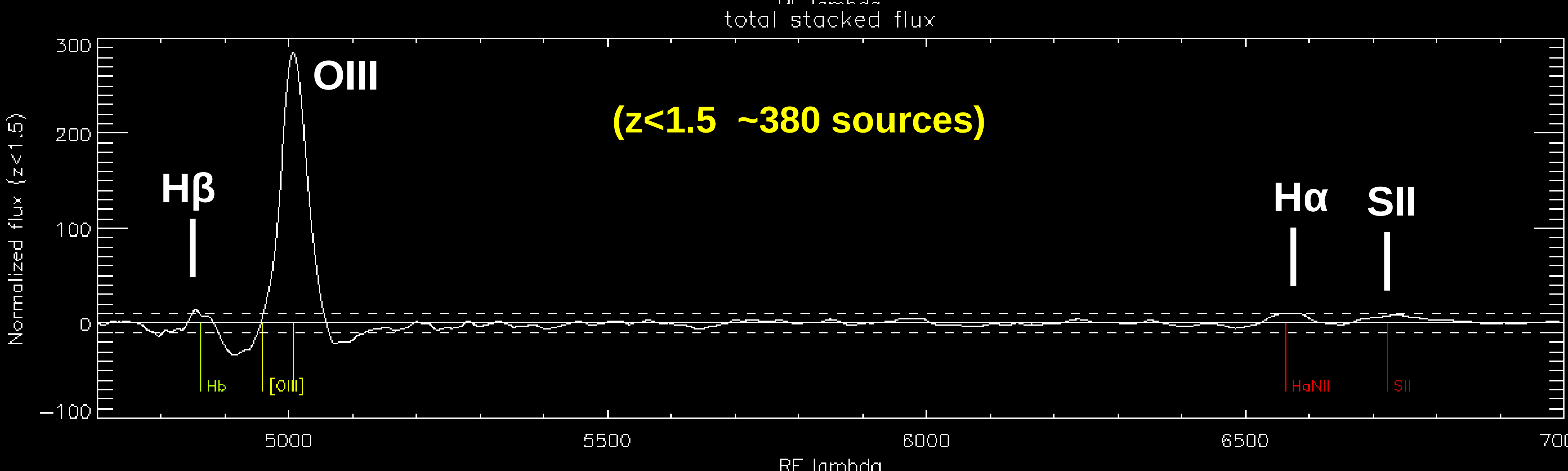
→ 2 or more lines detected (>2σ);

→ Agreement among the WISP reviewers.

Further test: stacking

Lines originally identified as Hα but classified as OIII by the software





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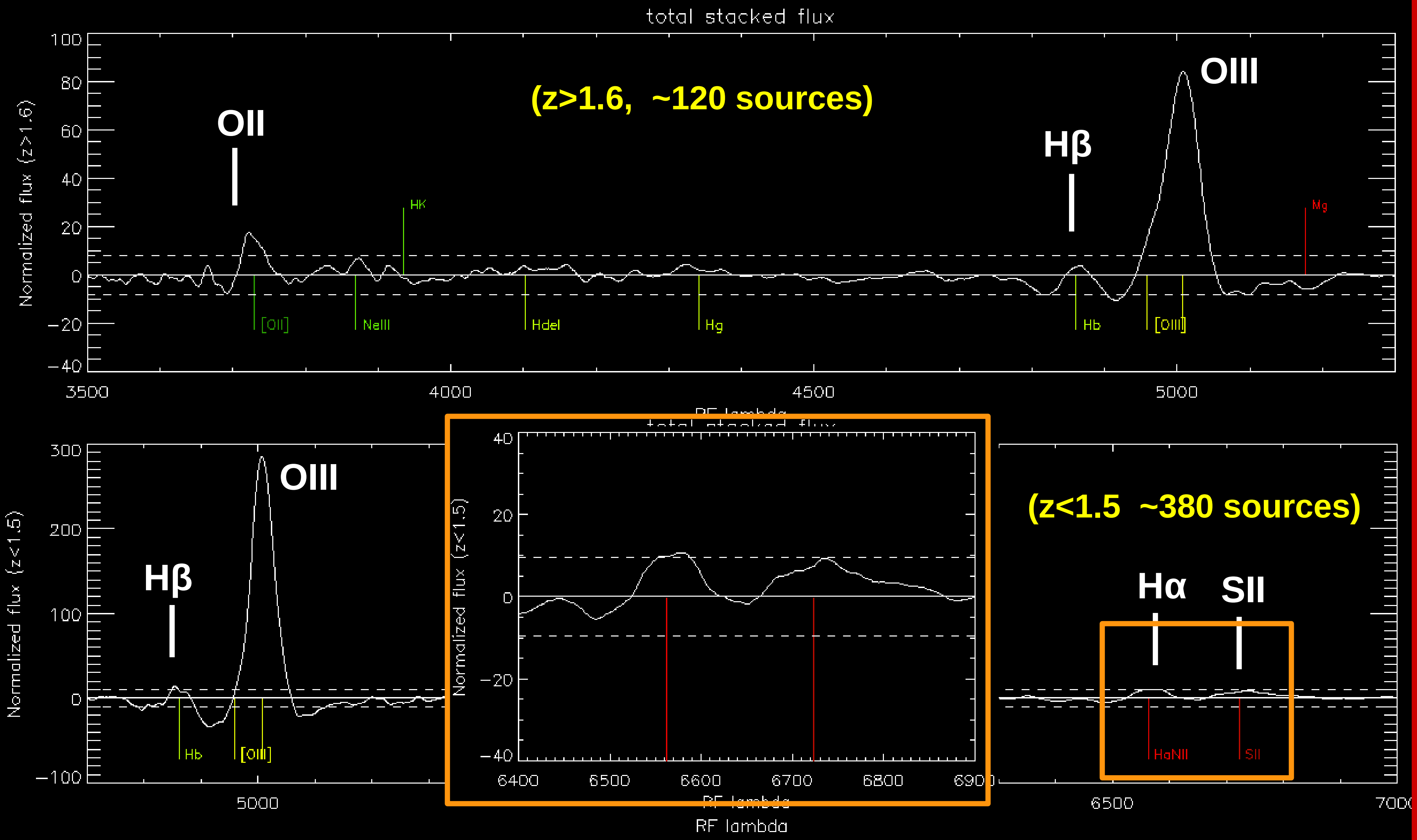

Conclusions:

- The WISP survey is an useful pathfinder for future missions such as Euclid and WFIRST.

- The emission line detection and identification pose a significant challenge.

- The contamination also plays an important role in slitless spectroscopy

- For the correct identification of emission lines, the combination of many observative quantities should be considered more sistematically.

- Here we presented an example of such an approach.