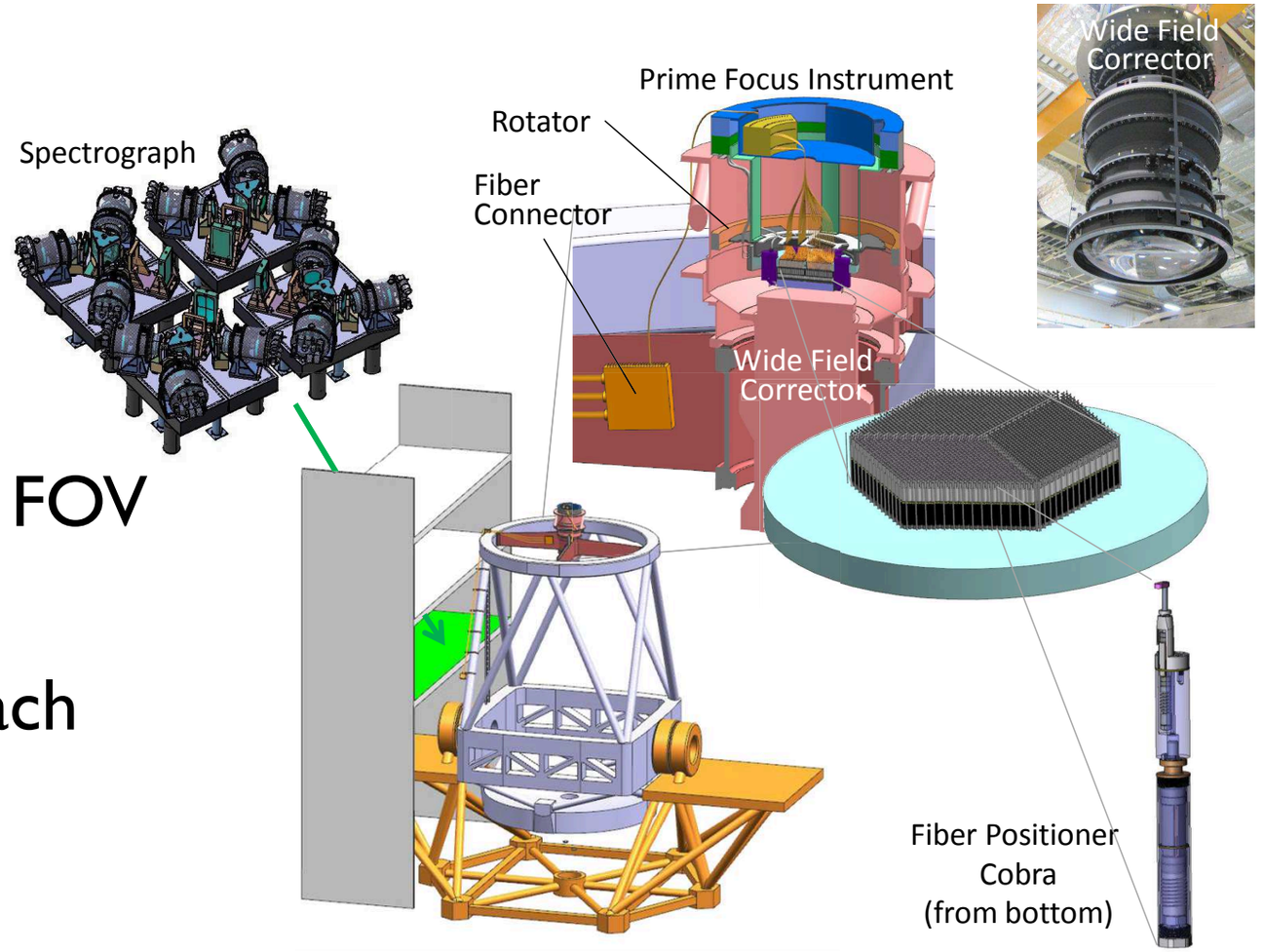
Galaxy Evolution & the Prime Focus Spectrograph

The Spectrographs



2400 fibers at prime focus, 1.3 deg^2 FOV

4 spectrographs; 600 1.13” fibers each

3 channels:

3800-6500A, R~2000

6500-10000A, R~3500

10000-12600, R~4500 (high resolution needed to work between night sky lines)

PFS: The Spectrograph(s)

Large redshift surveys

Calibration of photo z for weak lensing (Newman et al.)

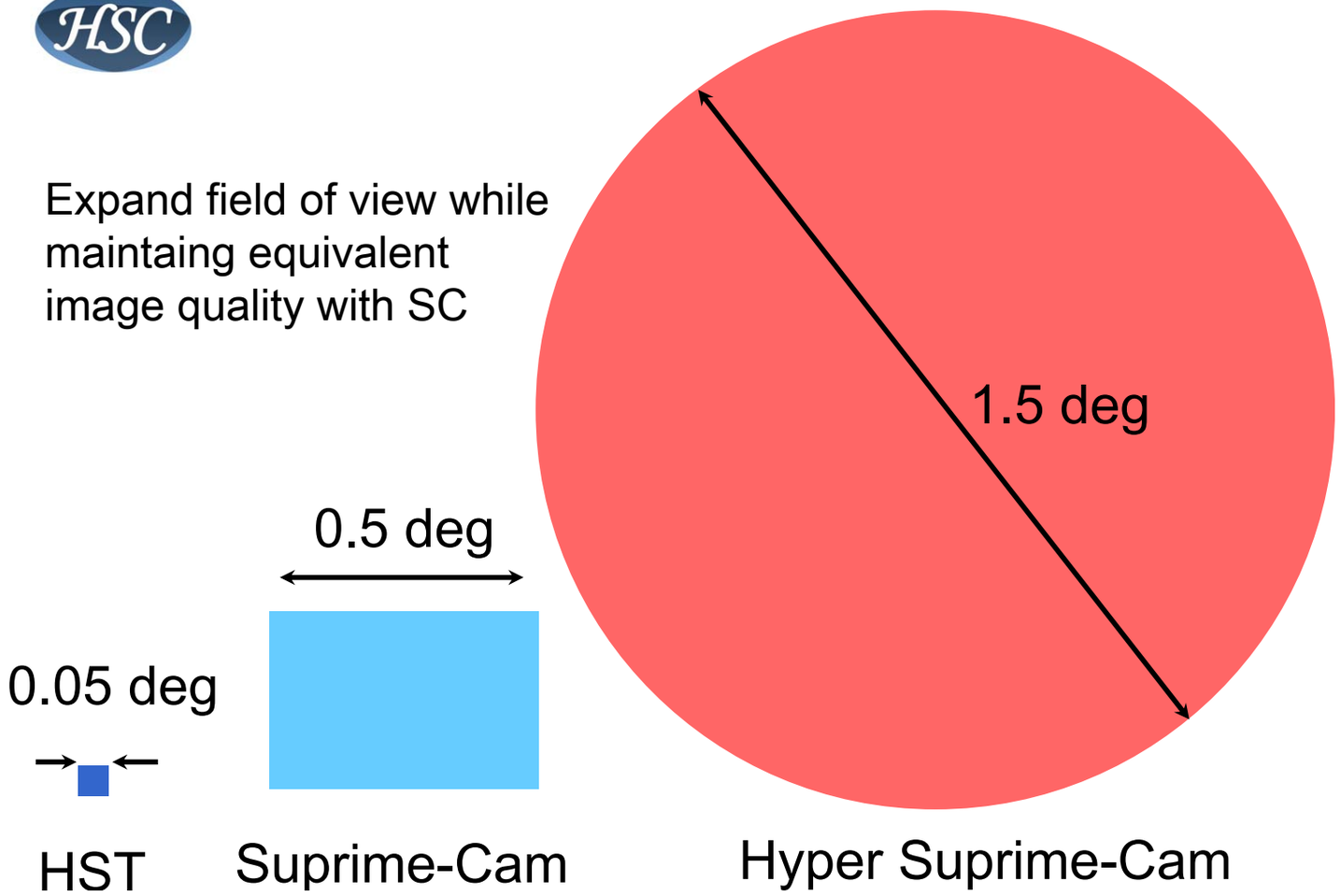
Time-domain (LSST) follow-up

Detailed study of nearby galaxies (in IFU mode…)

… and on and on …

PFS: The Survey
Hyper-Suprime Camera Imaging

Expand field of view while maintaing equivalent image quality with SC



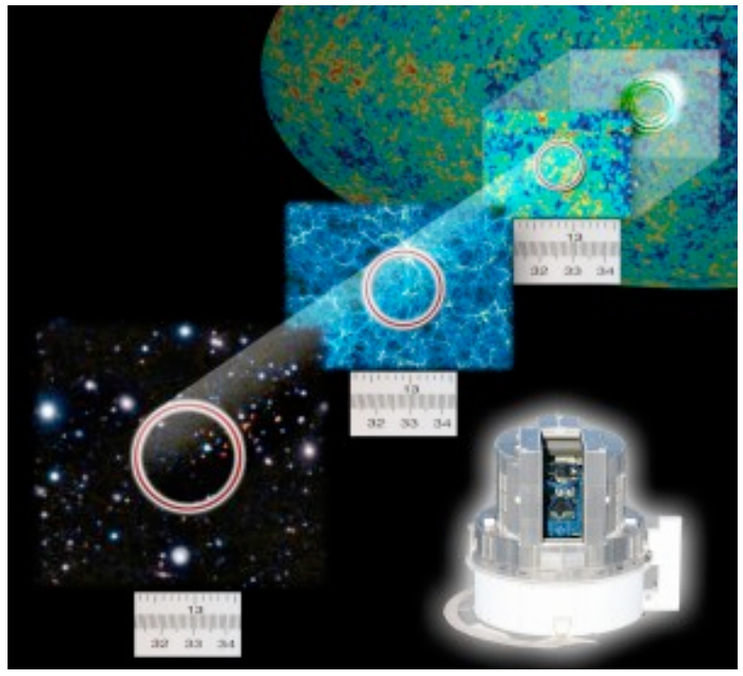
Three components:

1400 deg^2 r=26 mag

27 deg^2 r=27 mag

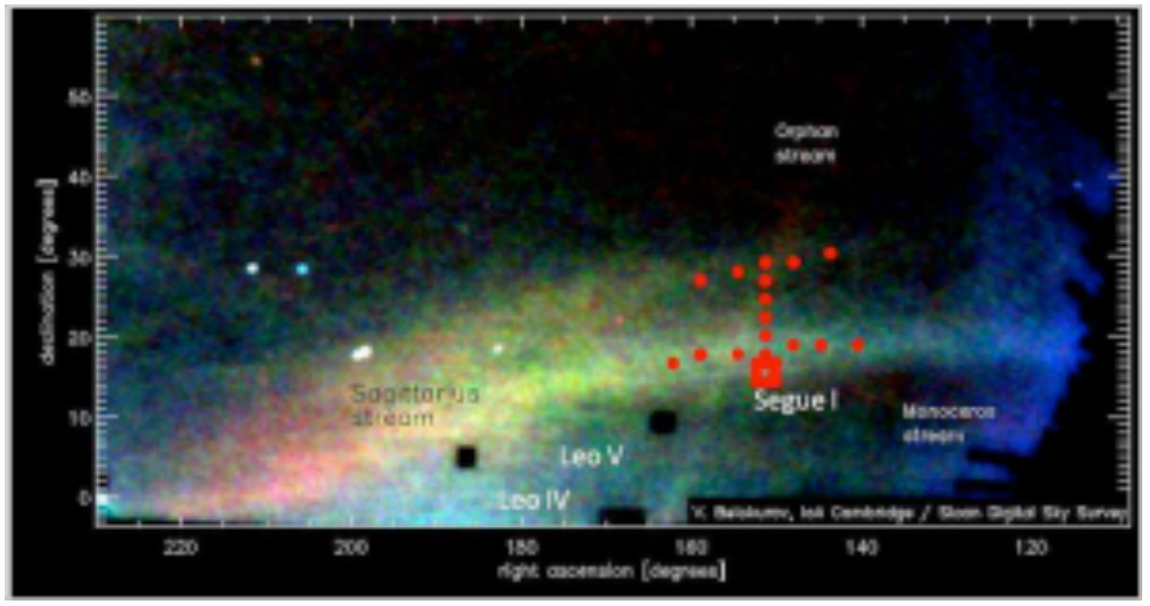
3.5 deg^2 r=28 mag

And NIR imaging from UKIRT from UofA to J~23.6, H~23.2, K=23.1 AB mag



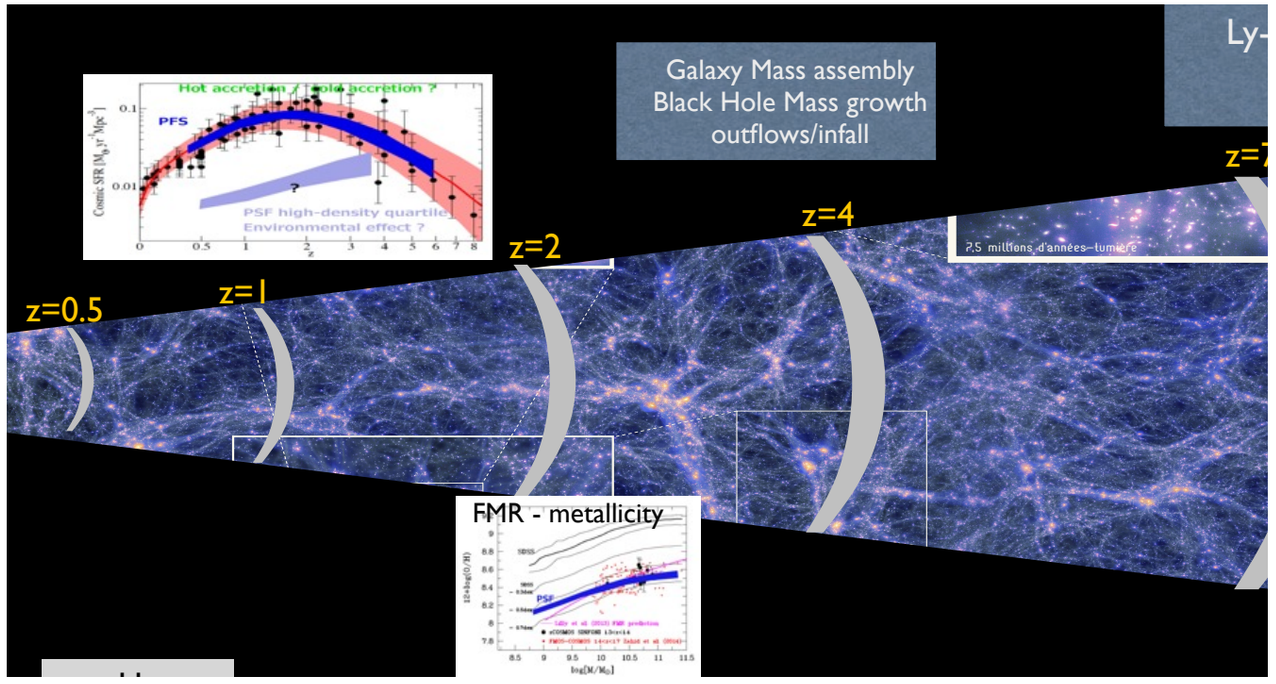
BAO: 1400 deg^2

Takada et al. 2013



Galaxy archeology: MW, M31 stars

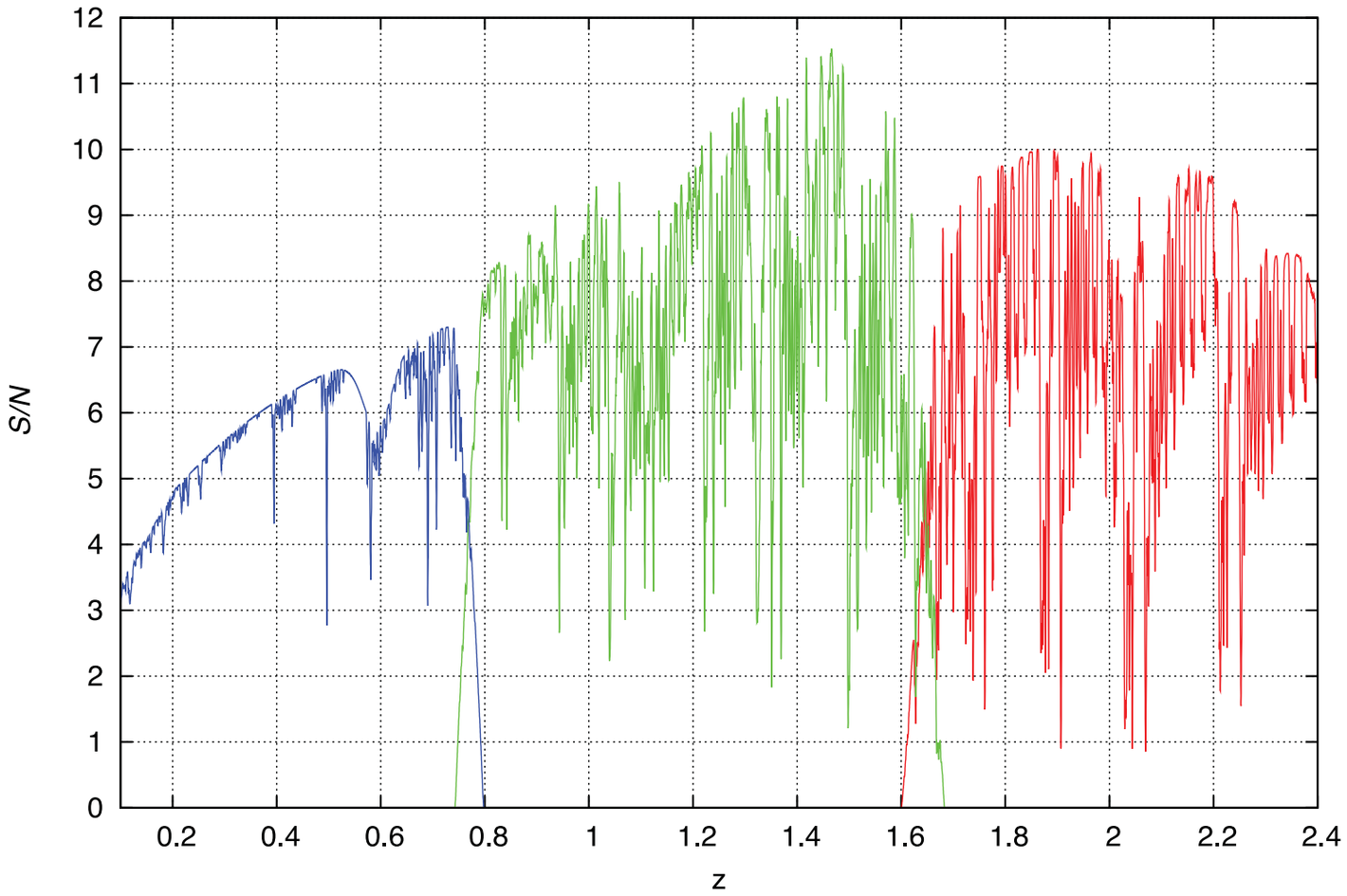
PFS survey planned to start in 2019

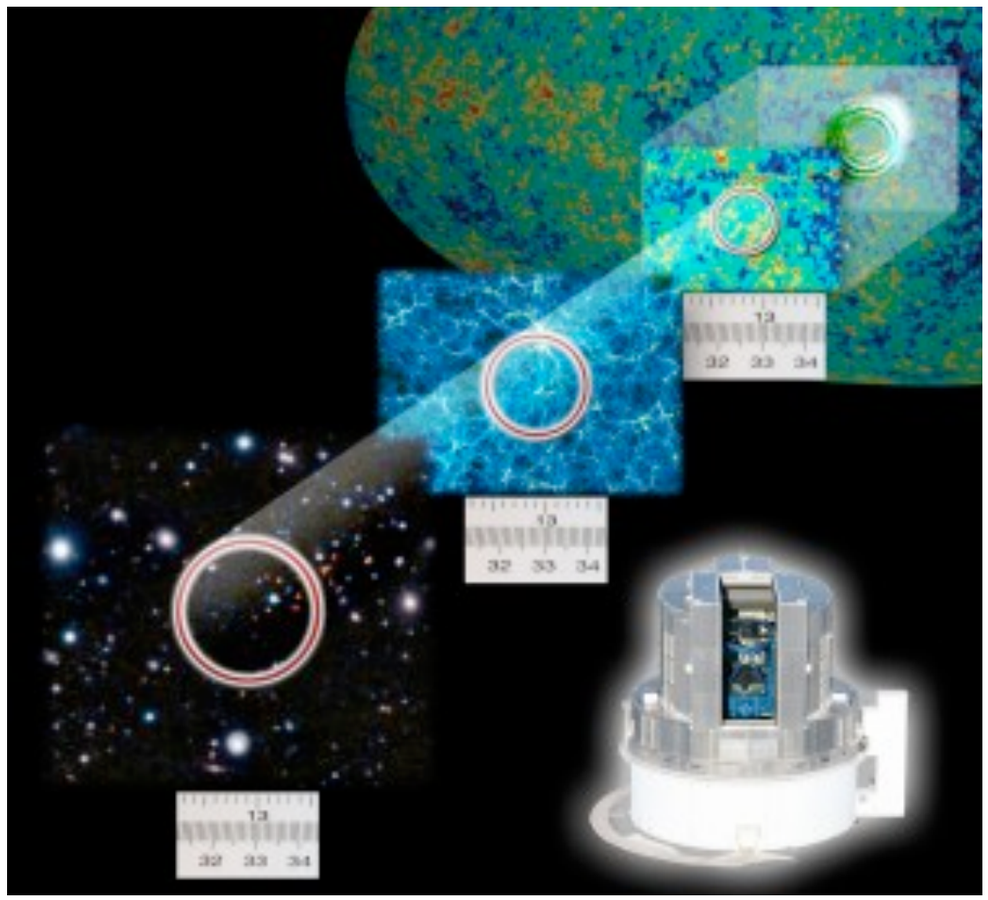


Galaxy Evolution

BAO

Takada et al. 2013



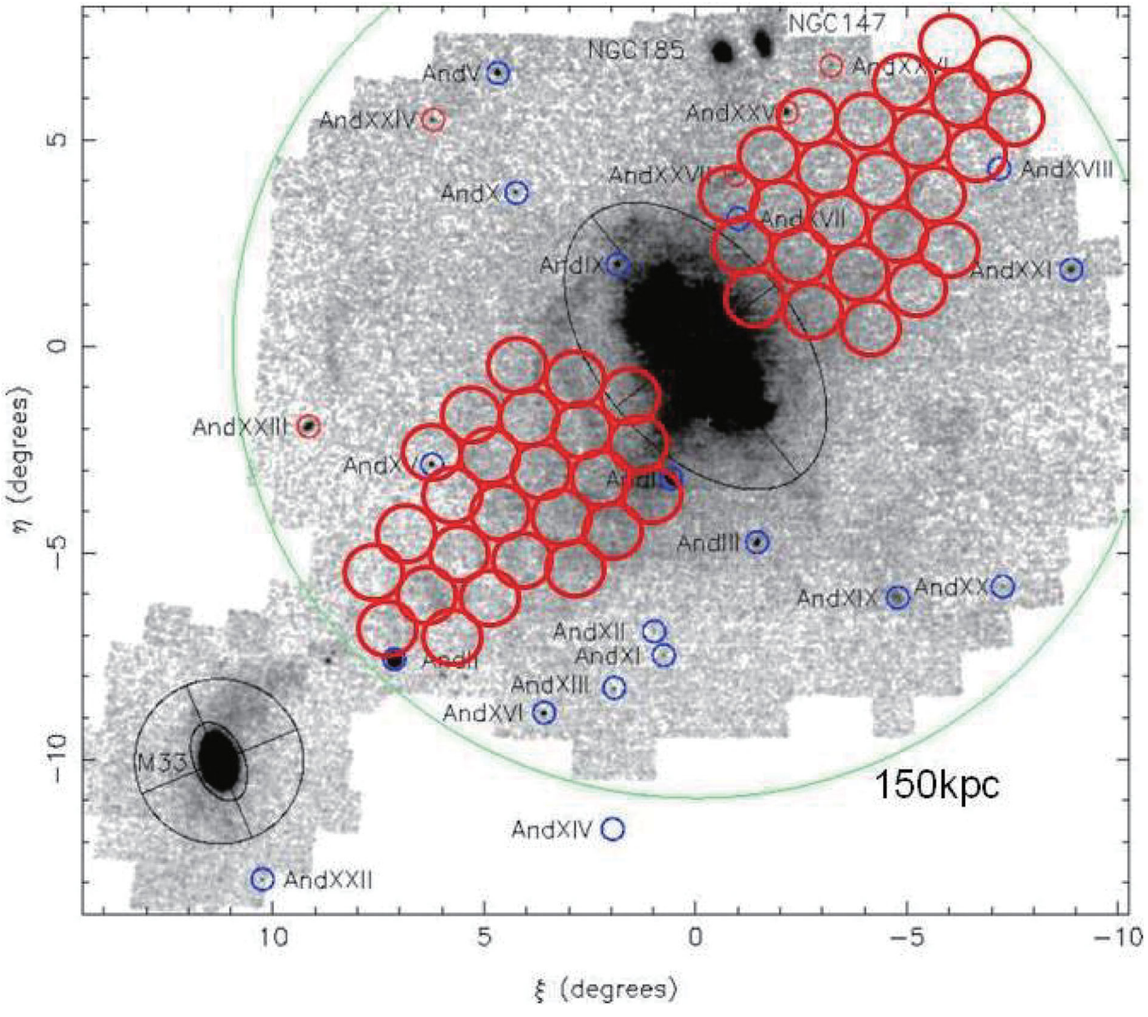


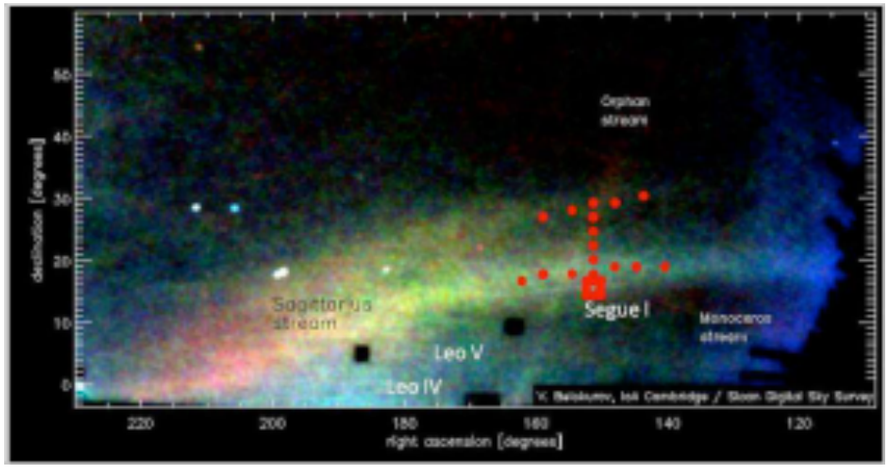
1400 deg^2

0.8 < z < 2.4; 9 Gpc^3

~4000 [OII] emitters/pointing

Galaxy Archeology





10^6 MW stars in thick disk, halo, streams to V~22; Also Andromeda halo multi-alpha element abundances and radial velocities

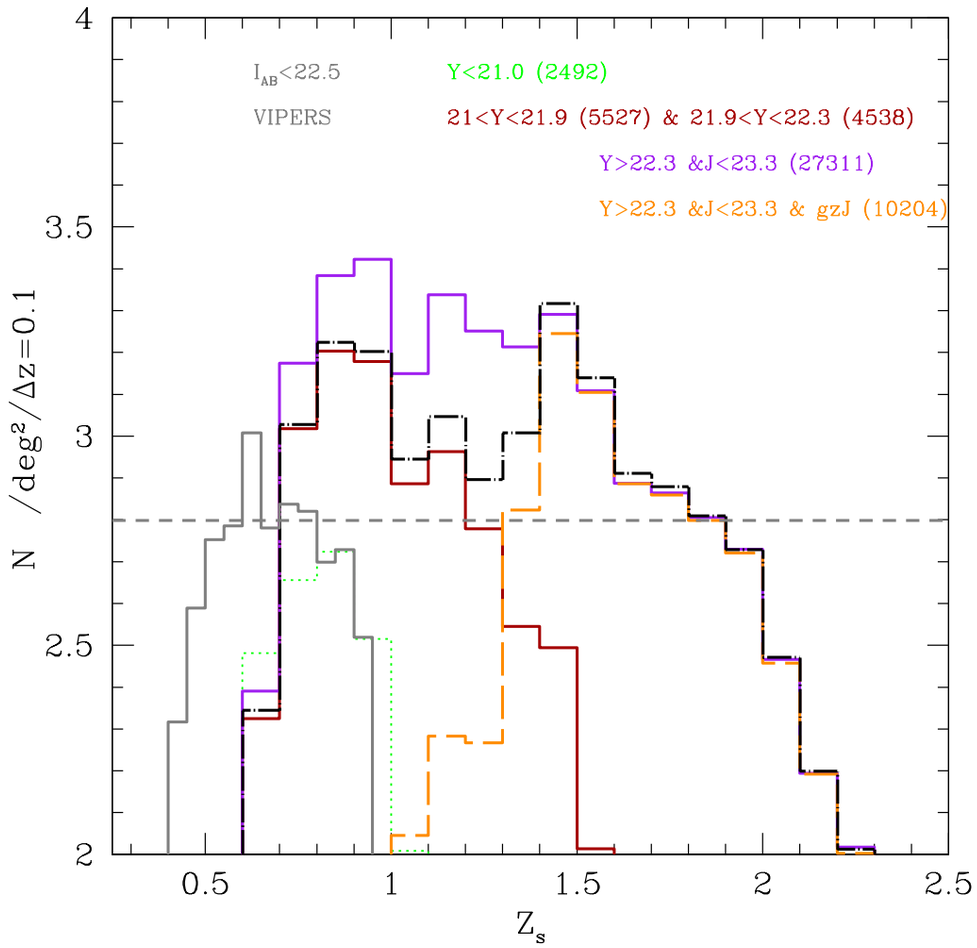
PFS-Galaxy Evolution will chart the formation and evolution of typical galaxies from early building blocks at reionization through the peak epoch of star formation and black hole growth.

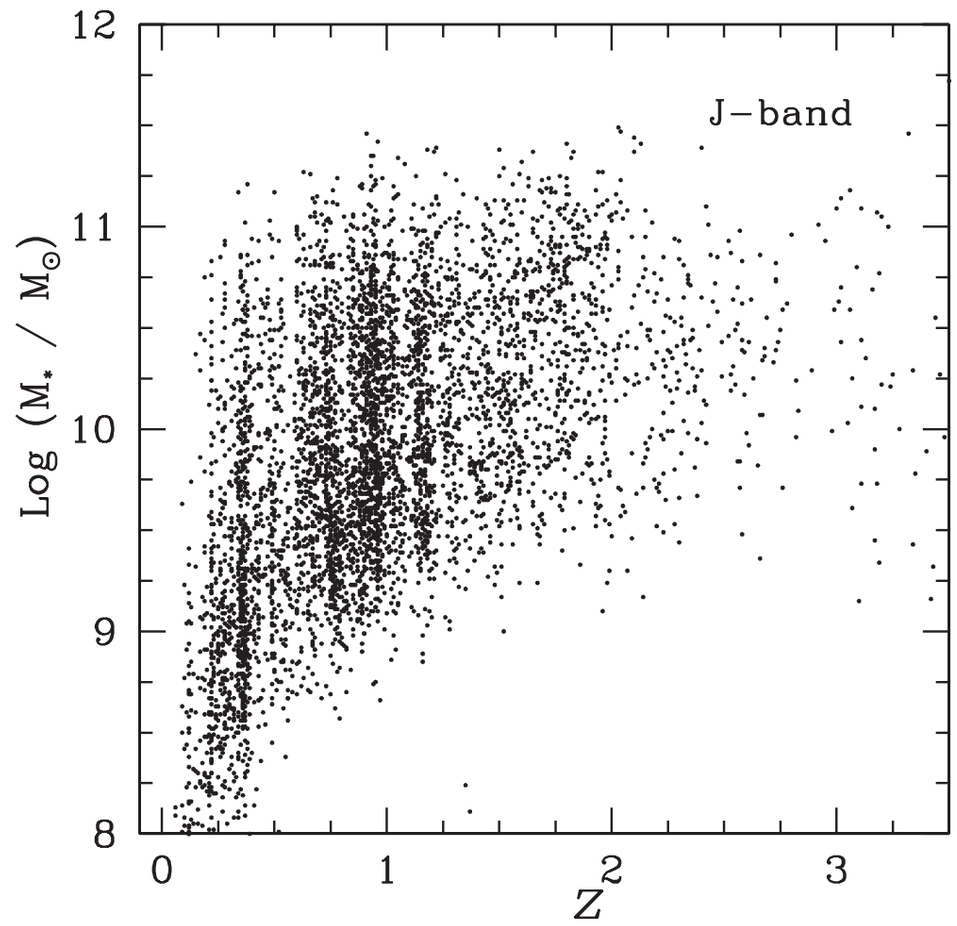
Exploit the multiplexing capability of PFS to establish the physical drivers of star formation within the evolving cosmic web

Utilize the wide wavelength coverage of PFS to determine the cosmic history of galaxy mass, chemical abundance, black hole mass and assess the impact of gas accretion, merging, and feedback

Uncover the evolution of the IGM from reionization to the present

Continuum-Selected Galaxies 0.5 < z < 1.8





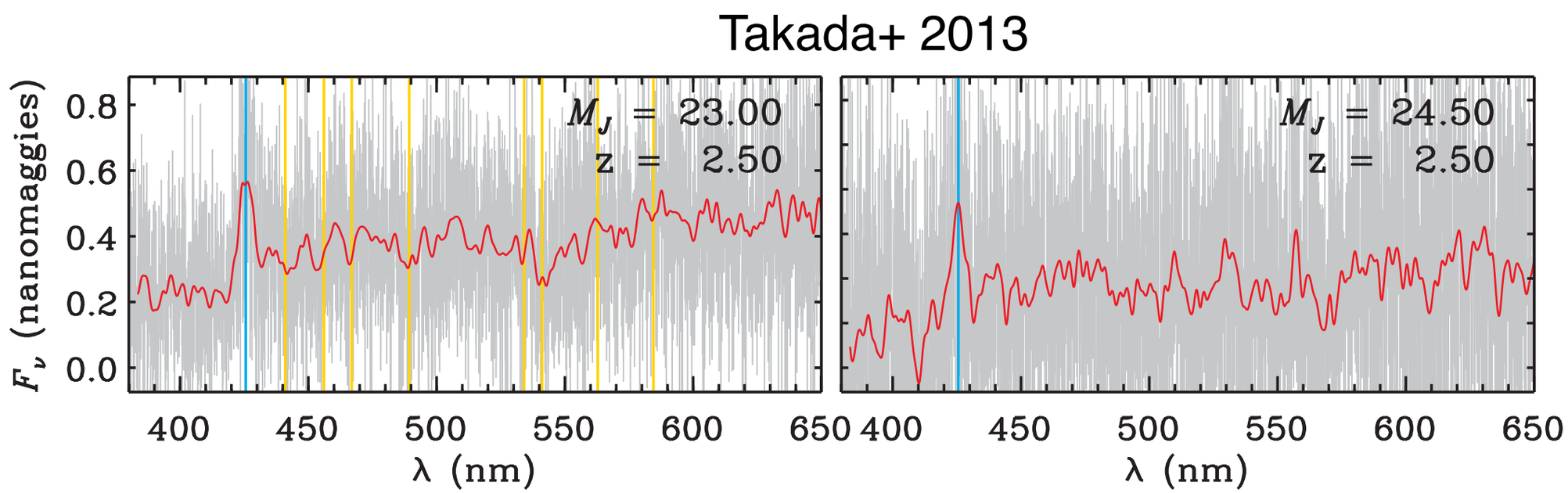
400k galaxies 0.5 < z < 2

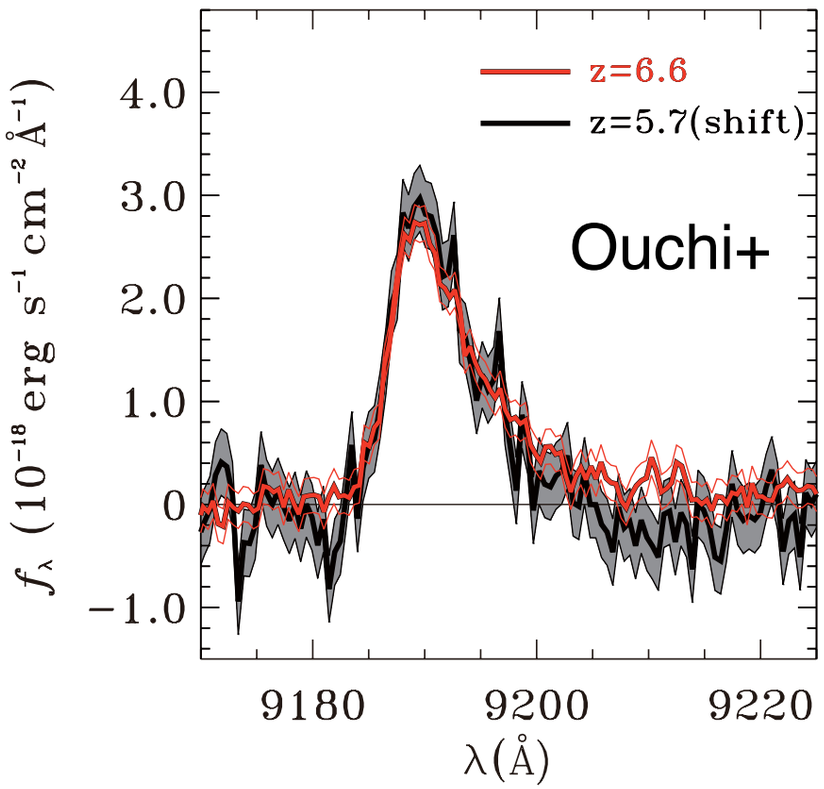
J_{AB} ~23.3 mag (~rest-frame V); 3 hr integrations

~24k galaxies/PFS pointing (z > 1)

[OII] to 1e-17 erg/s/cm² (5σ)

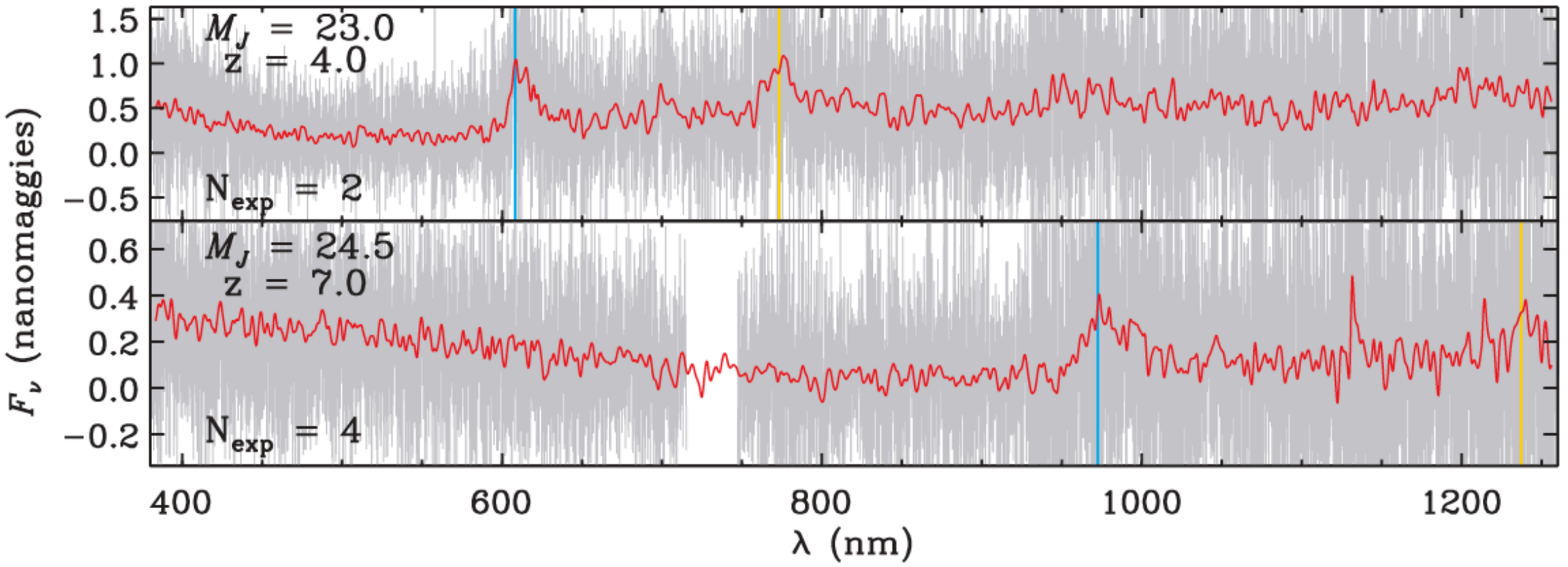
Drop-outs and LAEs



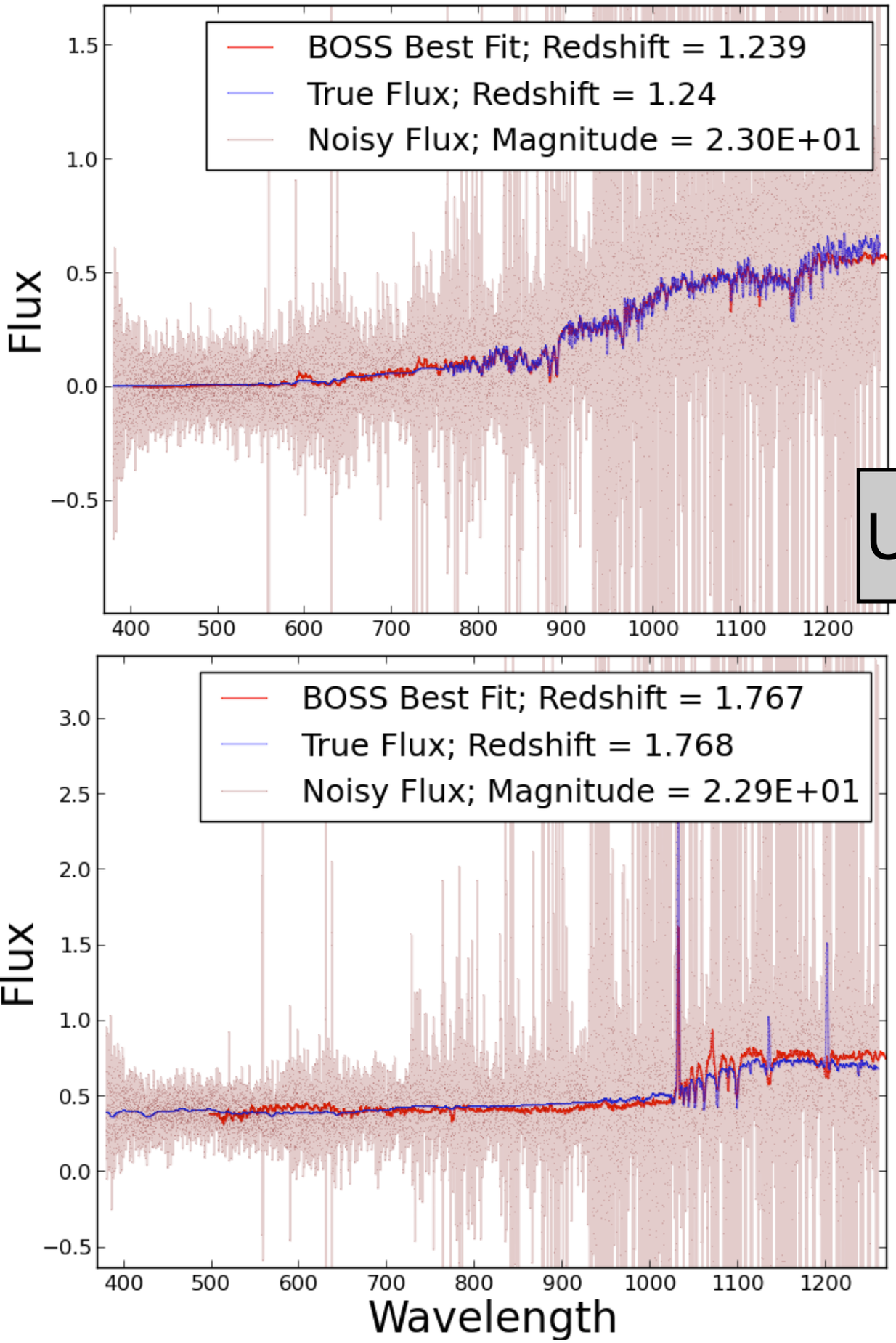


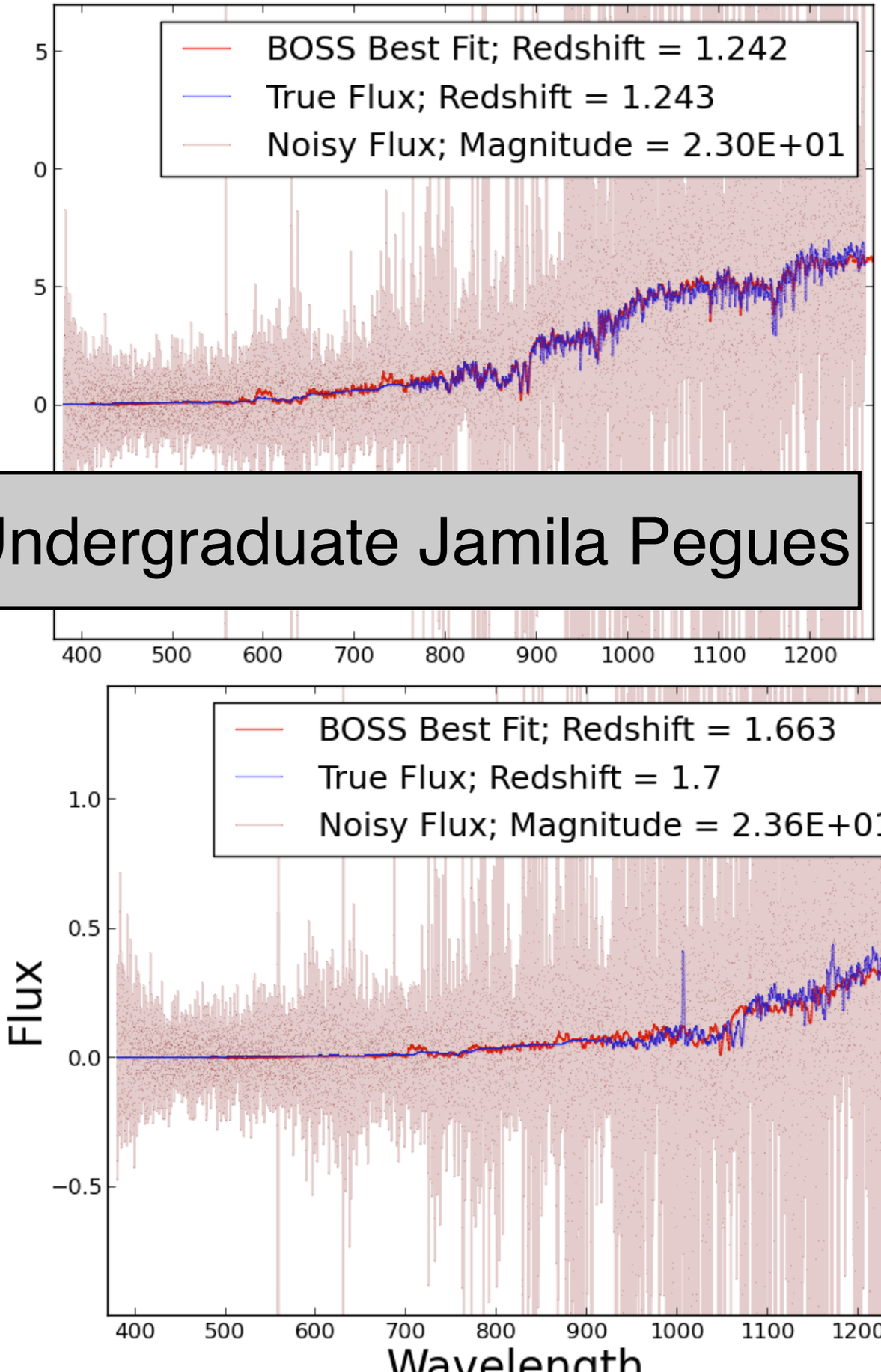
200k galaxies 2 < z < 6
Drop-outs and LAEs
20 deg²
Lya to 0.8e-17 erg/s/cm²/A (5σ)

Quasars



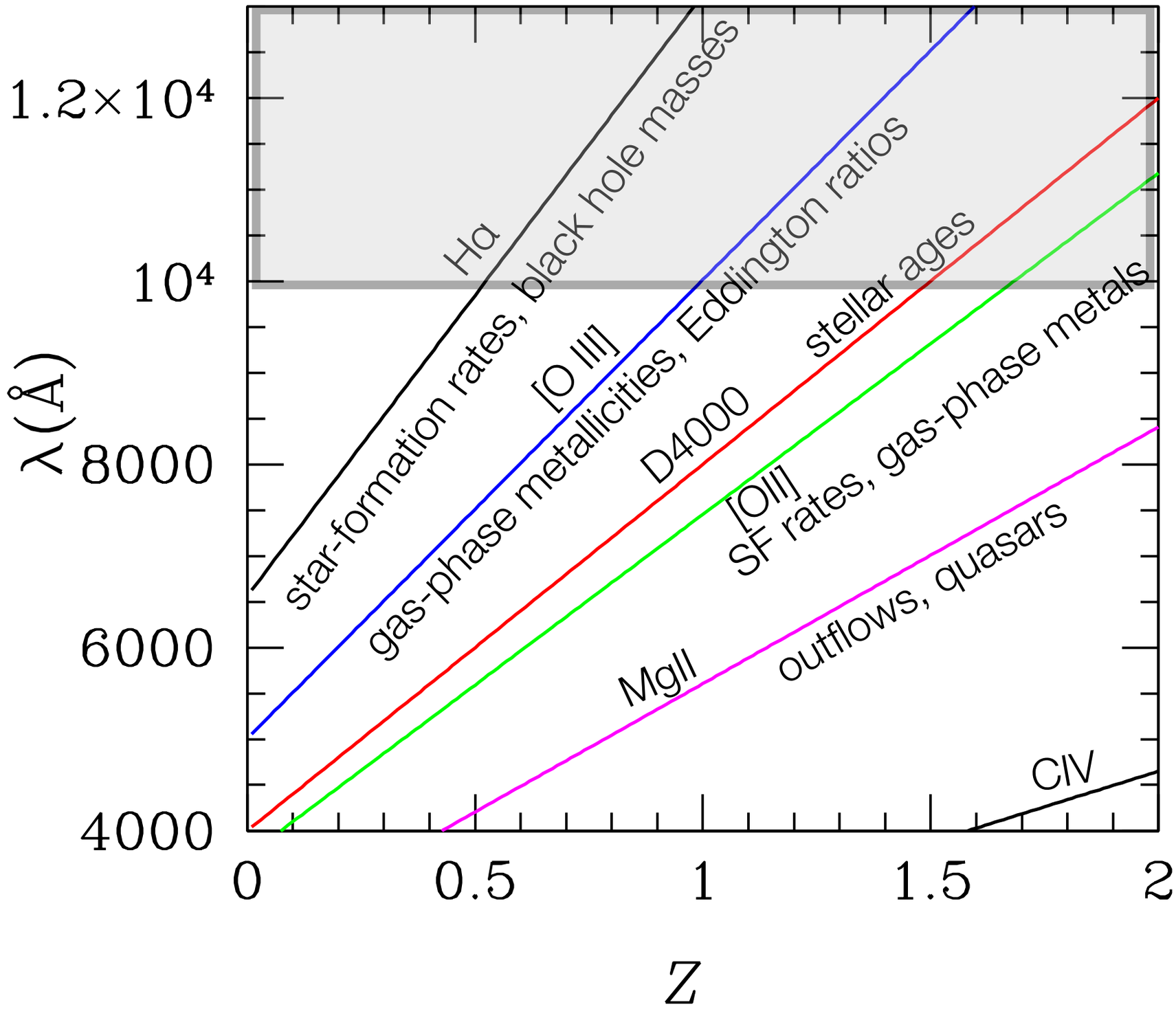
~100 QSOs deg^2 3 < z < 7, J < 25 mag





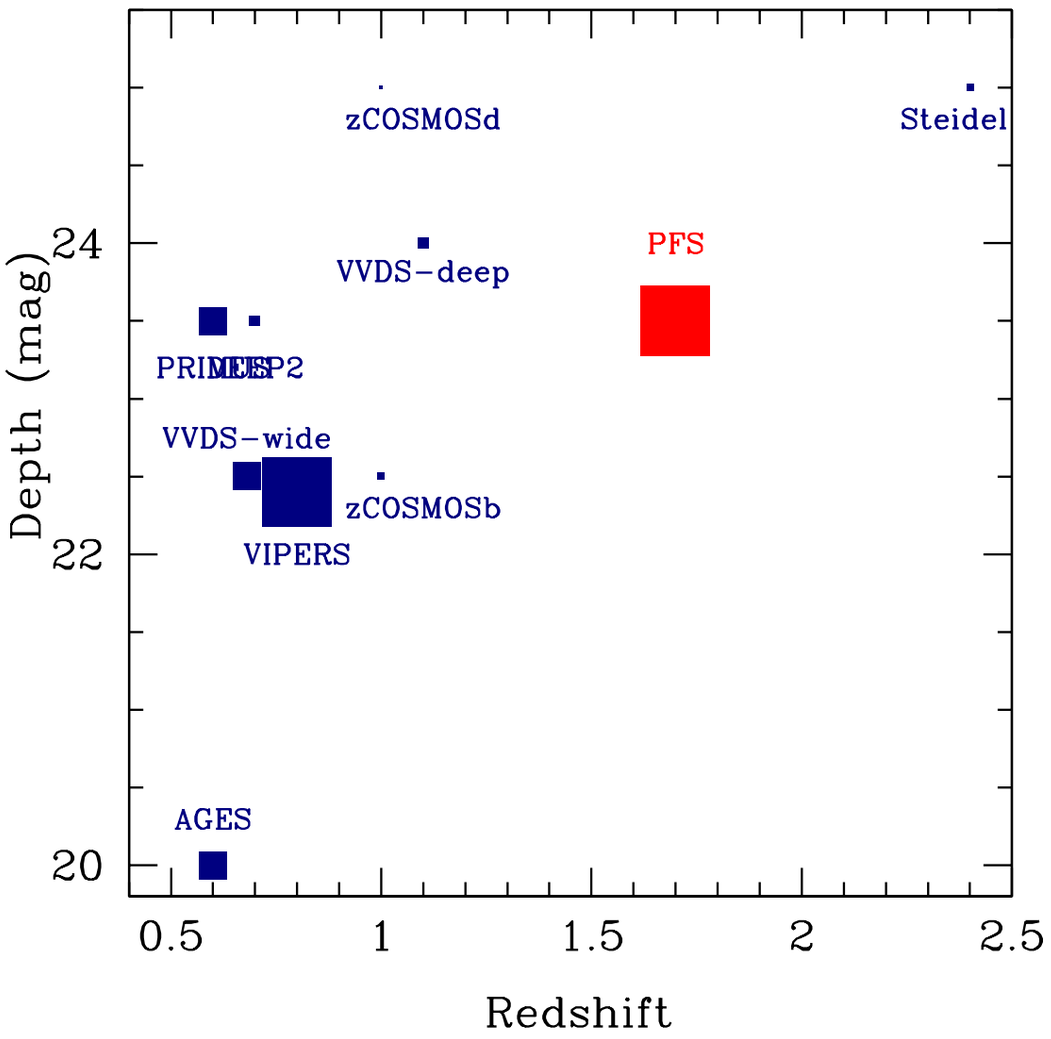
Undergraduate Jamila Pegues

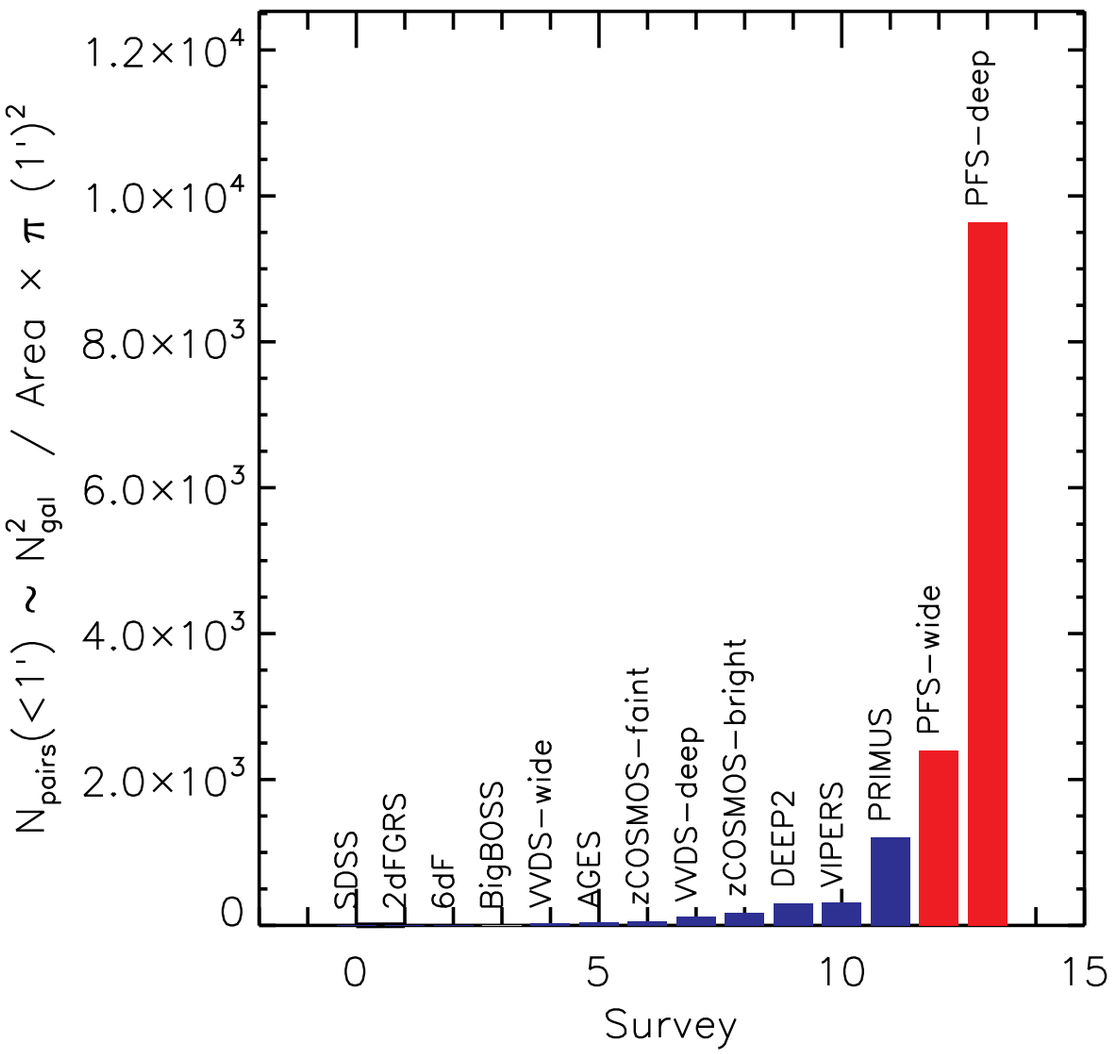
Wide Wavelength Coverage = Lots of Astrophysics



Ly α at z~2.3 where [OII] is lost, so no z gaps at all!

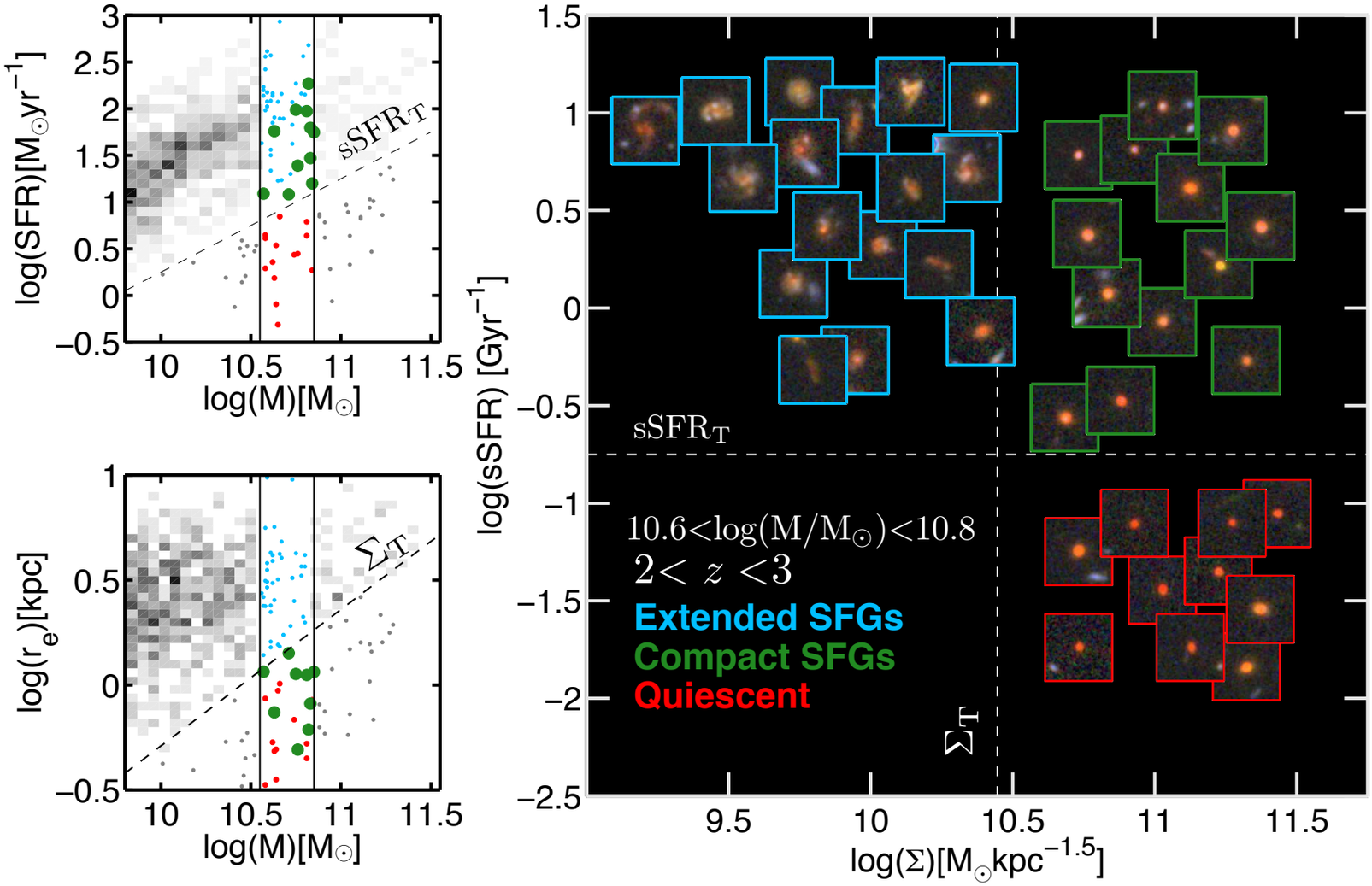
Wide Area and Dense Sampling = Environments





WFIRST: Morphologies

Barro et al. 2014

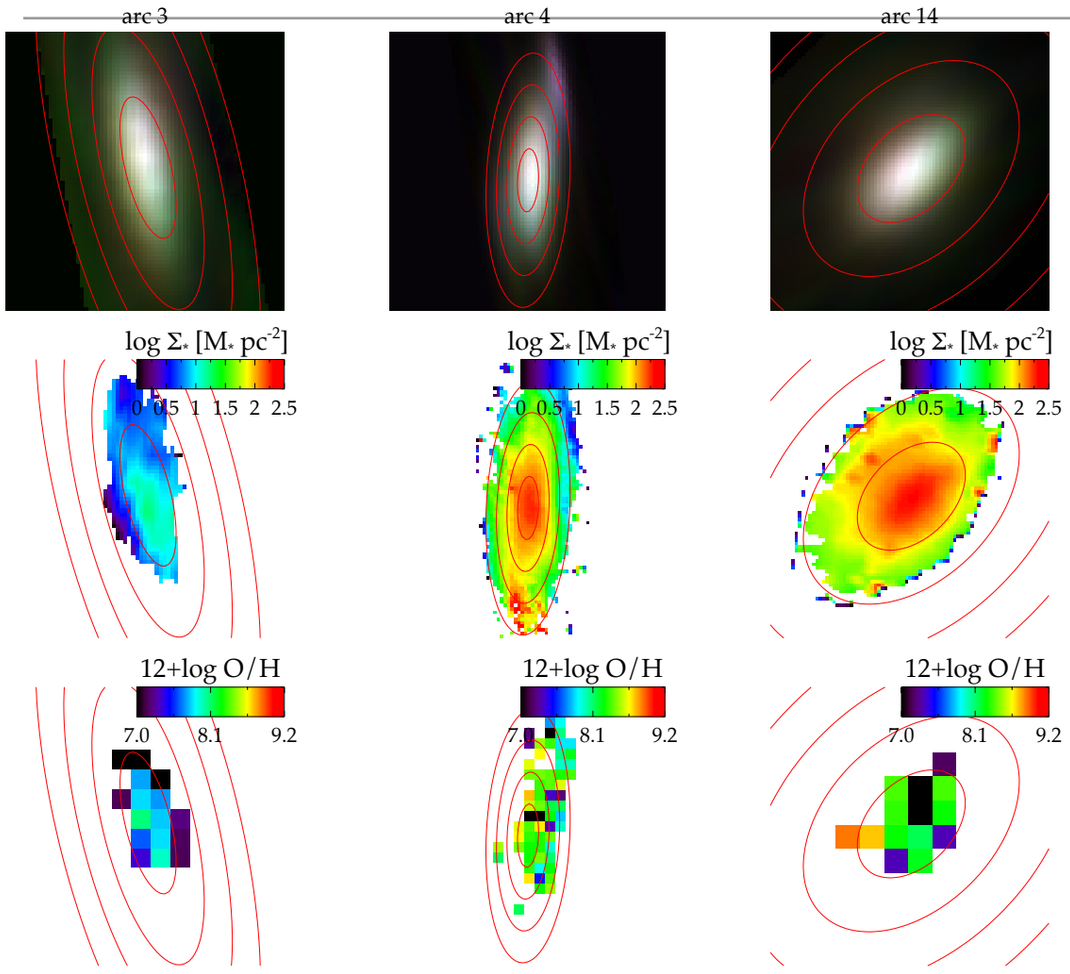


CANDELS observations look in detail at relation between structure and star formation rates

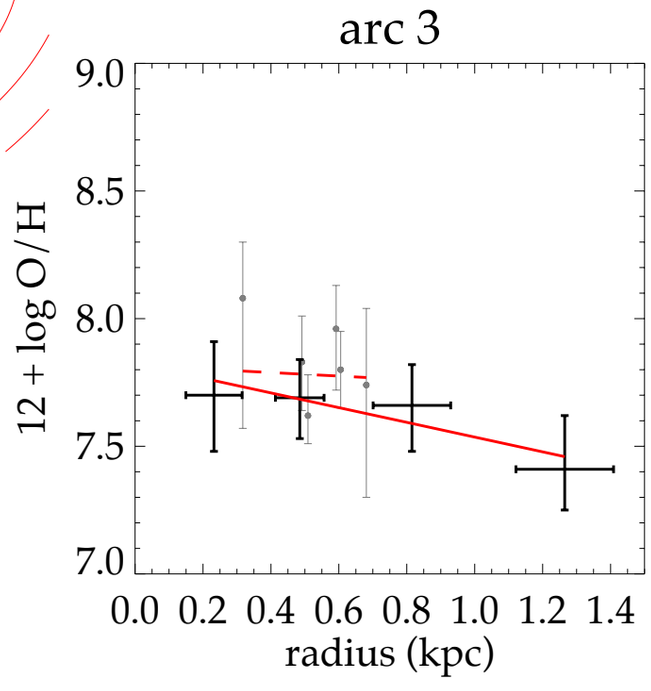
100s of galaxies so far

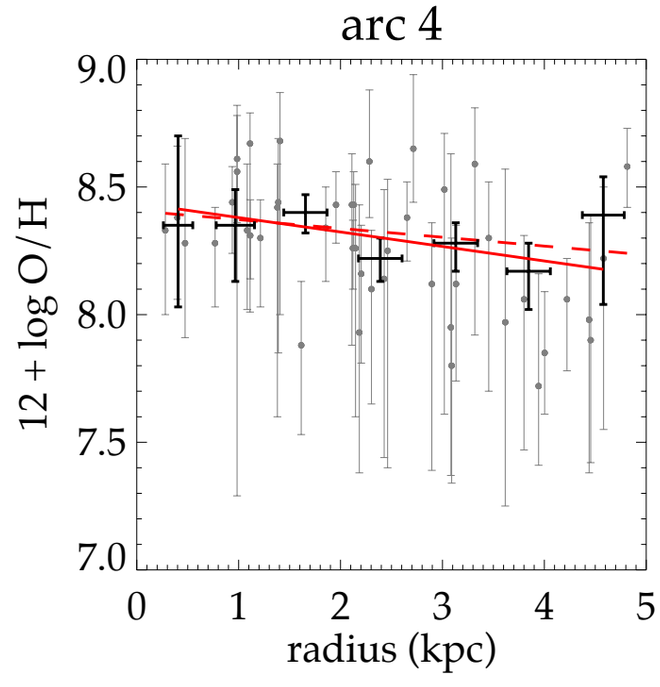
What shuts galaxies off?

WFIRST IFU: Stellar population gradients

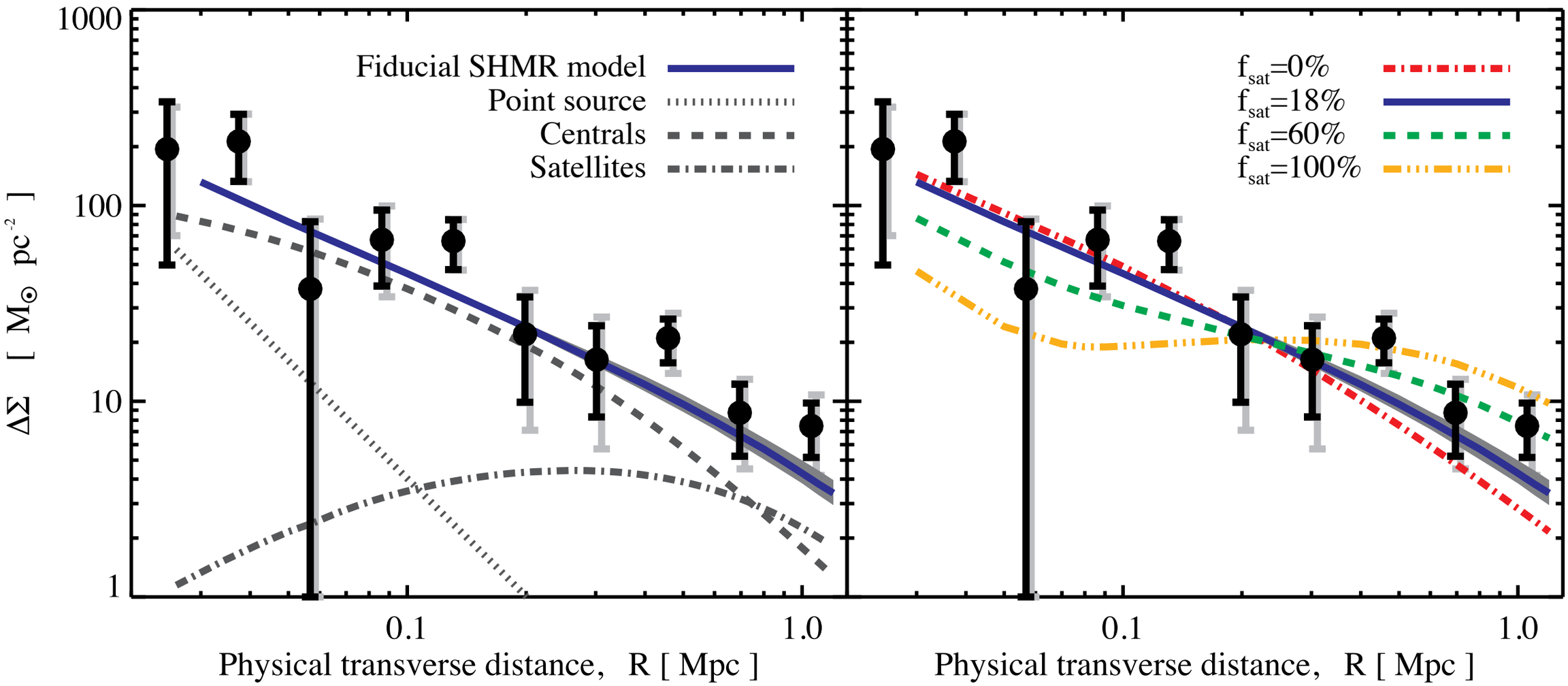


Jones et al. 2014
Lensed galaxies, metallicity gradients





WFIRST: Weak Lensing



Leauthaud et al. 2014
AGN not found in special DM halo masses for their stellar mass

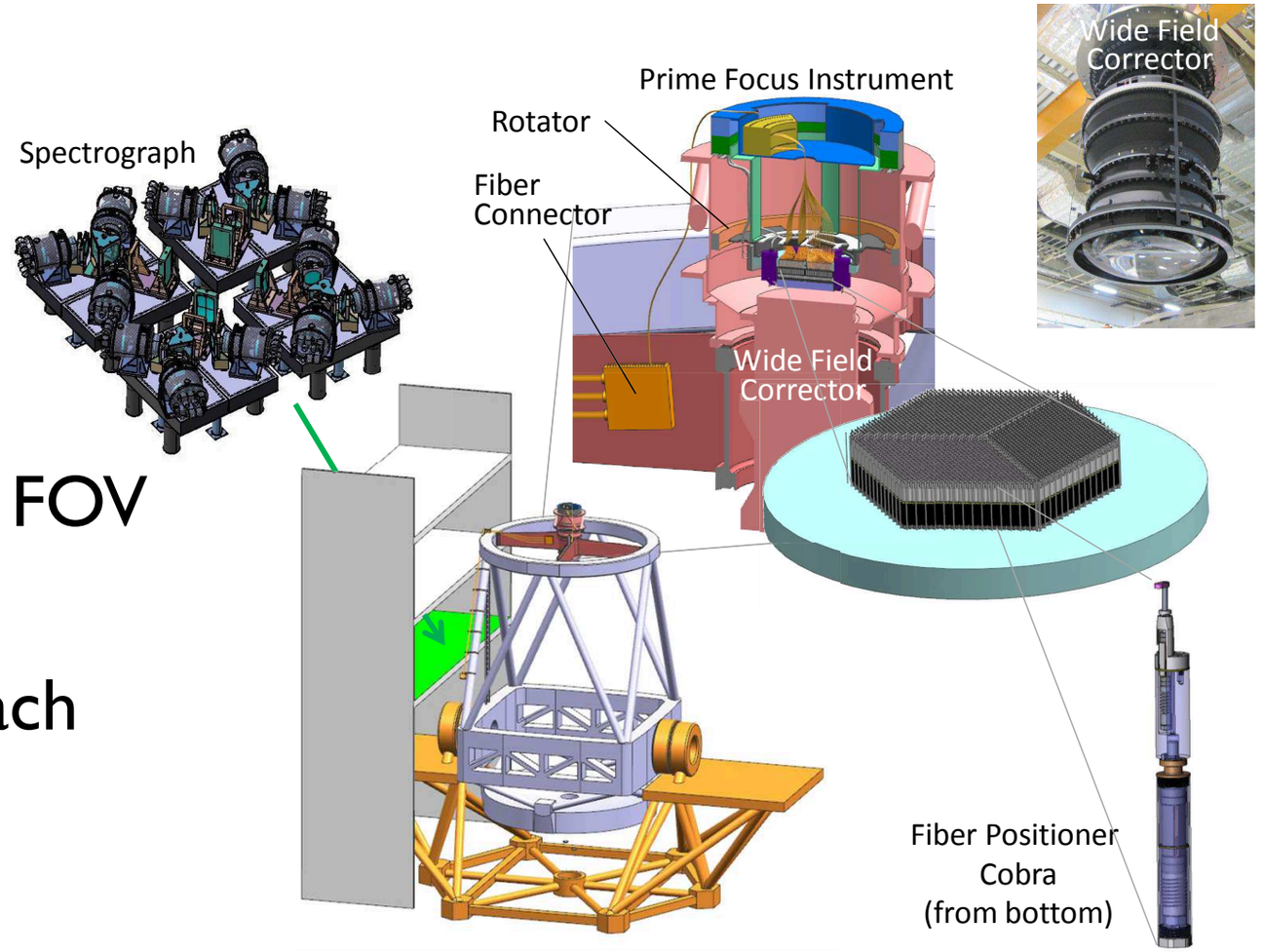
What can PFS do for WFIRST?

- **2000 emission-line objects/deg^2 over HLS (e.g., the cosmology survey) to get redshifts?**

- **Or sparse-sampled continuum-selected sources to complement grism spectra over wide area?**

- **Or our current design, deep and dense for calibration, etc?**

The Spectrographs



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