Prime Focus Spectrograph Observatory Filler Program: Galaxy & QSO Spectra from the May 2024 Engineering Run

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Prime Focus Spectrograph Observatory Filler Target Selection & Sky Distribution

The observatory filler category consists of the lowest priority targets that are observed when there are no other higher priority targets. The filler objects need to be uniformly distributed across the sky and be bright enough to be observed with a 900s exposure, along with a reasonably sufficient sky density. For the May 2024 engineering run, the targets were selected from the ELAIS-N1 field (a HSC-SSP deep survey field [1]) using Pan-STARRS1 Data Release 2 (PS1 DR2 [2]), assuming the following criteria:

➤ Circular area with a 2.5 degree radius centered at (RA, DEC) = (242.75, 55.0) deg - the ELAIS-N1 field.

➤ PS1 i-band signal-to-noise ratio (SNR) greater than 3 and magnitude brighter than 21.75.

➤ More than 1 detection in the PS1 i-band in different epochs.

➤ Fig 1 shows the sky distribution of objects from the PS1 survey and the PFS fiber distribution overlapped. Fig 2 shows the cumulative sky number density of galaxies and stars in the PS1 survey area.

➤ In total 1409 science targets were observed during the filler run, of which 1000 were galaxies and 409 were point sources (stars/QSOs). Extended objects and point sources were distinguished using the PS1 point source catalog [3].

➤ Of the science targets 80 had existing spectroscopic redshifts from SDSS. In addition we manually determined the redshifts for 95 further emission line galaxies. Fig. 3 shows their redshift distribution.

➤ Fig. 4 shows the i-band SNR of all objects from the PFS spectra, directly calculated by taking the average SNR (per wavelength unit) in the i-band.
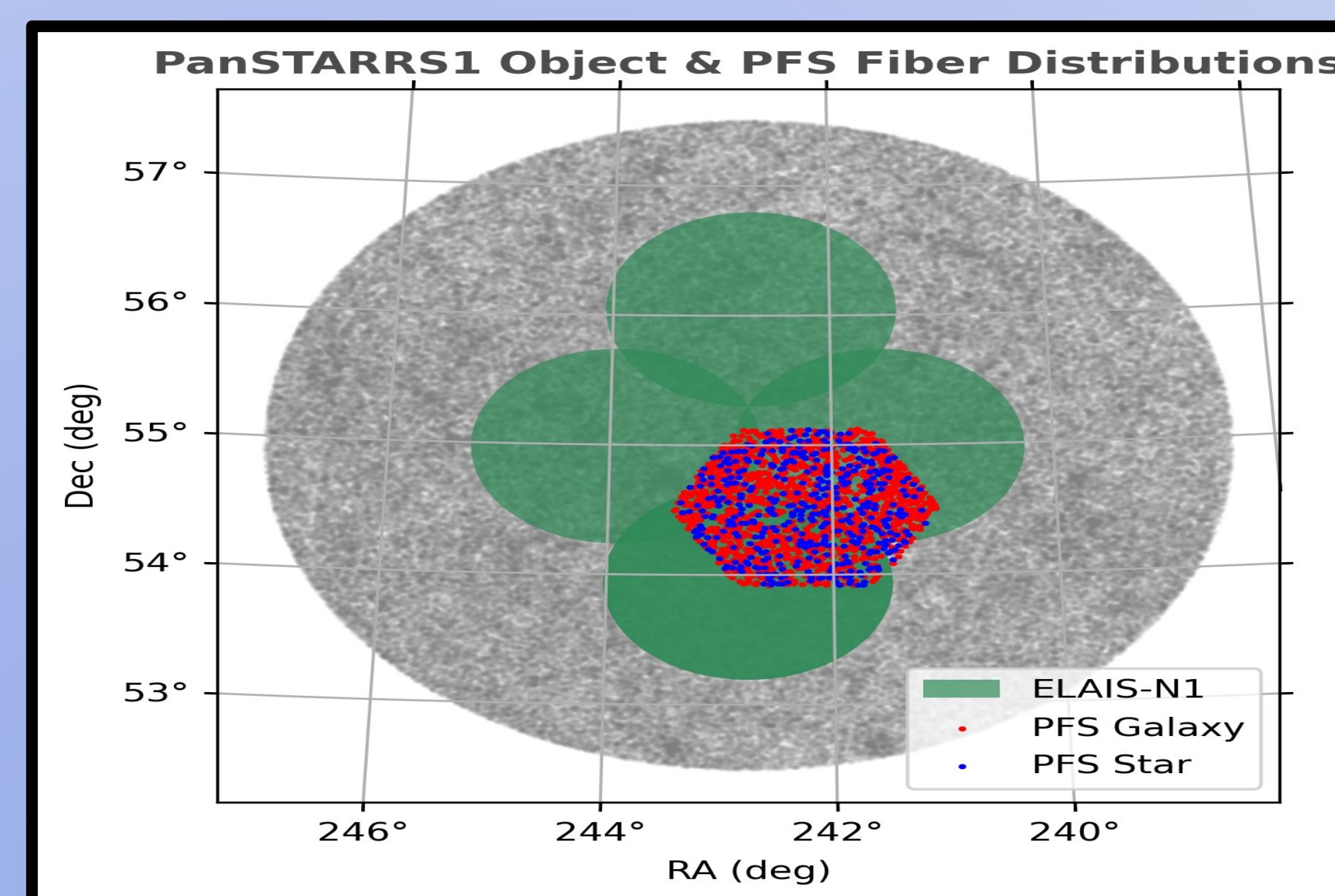

Fig 1: PS1 sky distribution of objects, with ELIAS-N1 field and PFS fiber distribution superimposed.
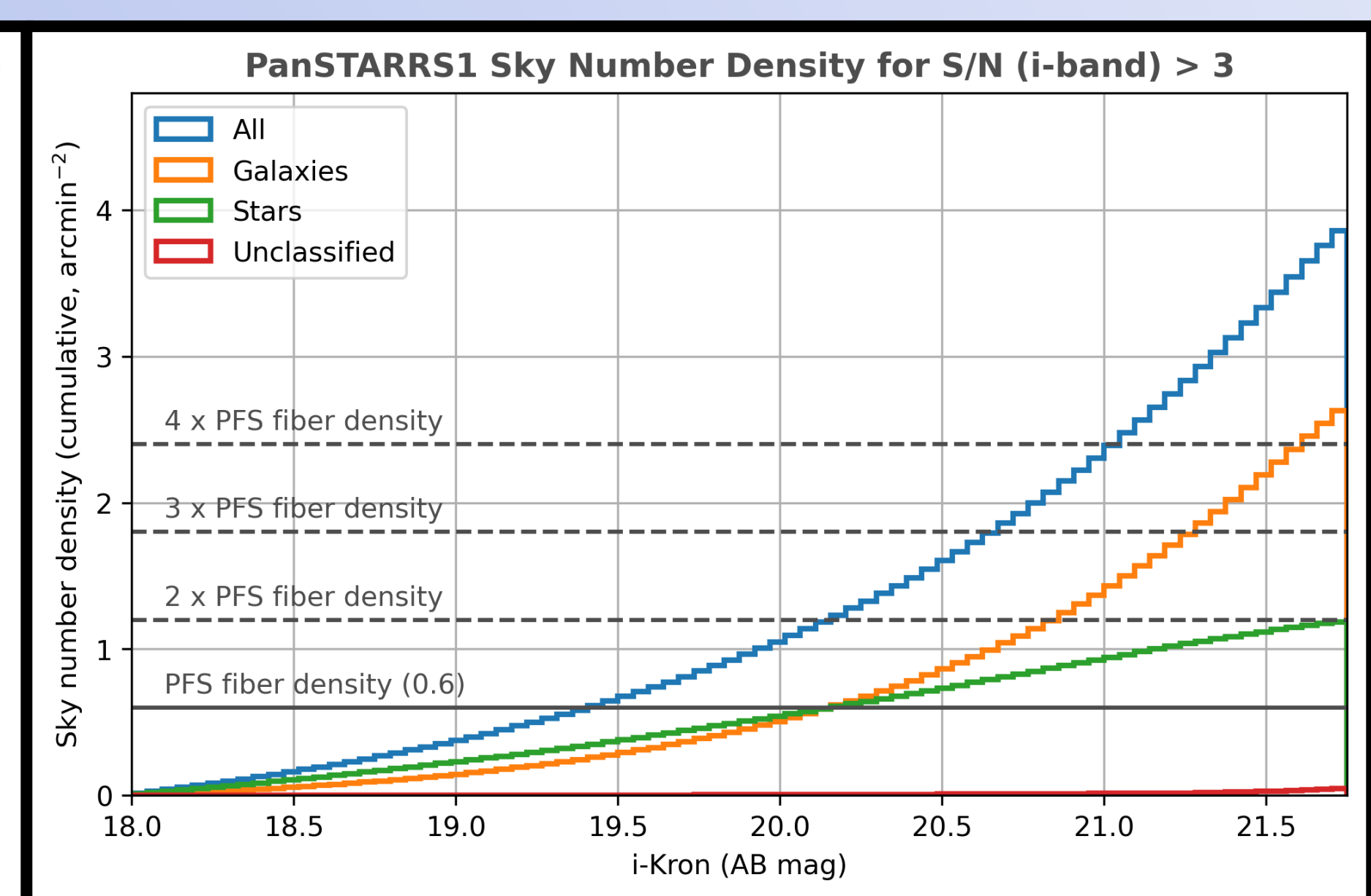

Fig 2: PS1 cumulative sky number density as a function of i-band magnitude. Also shown is the PFS fiber density.
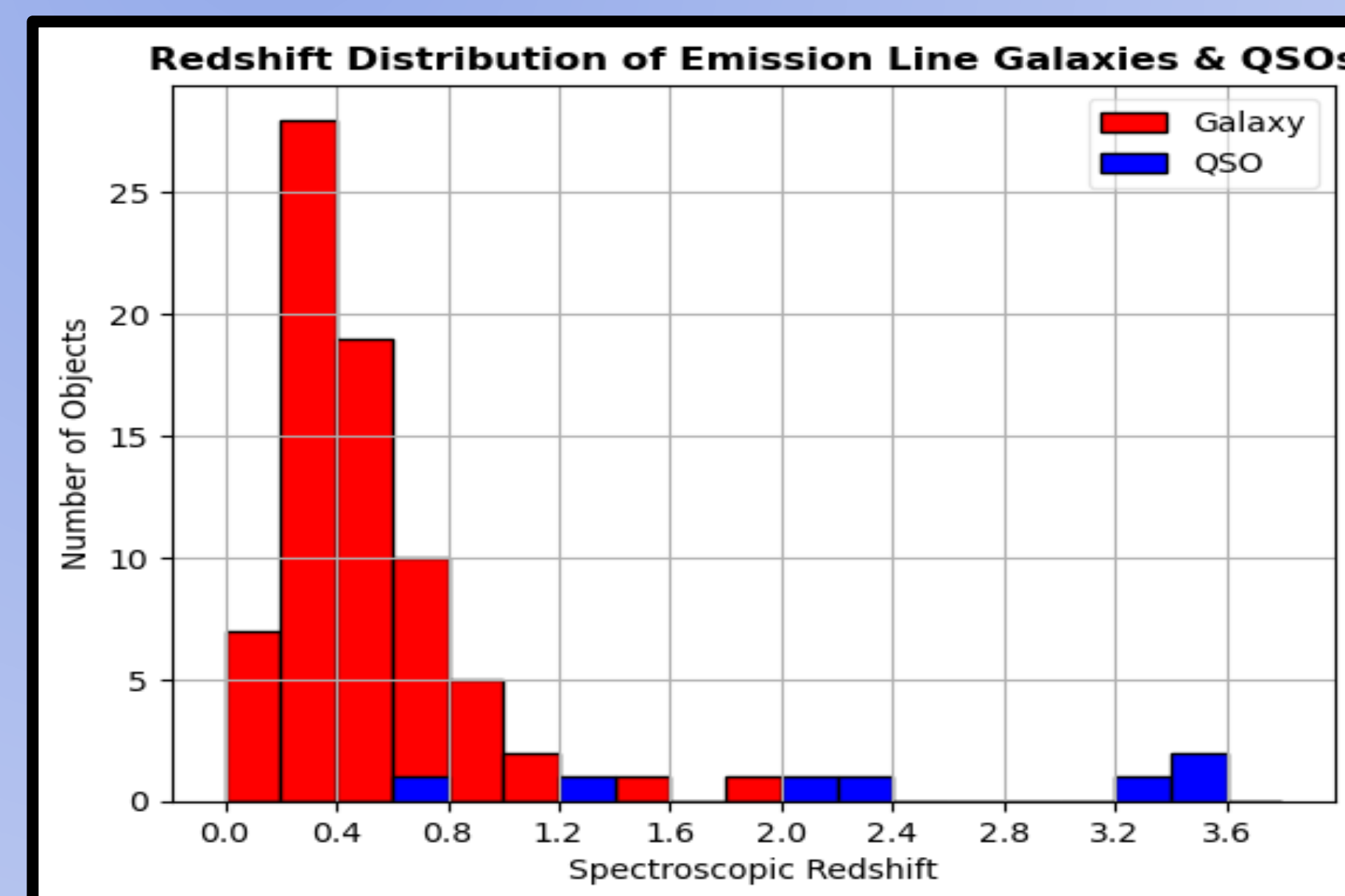

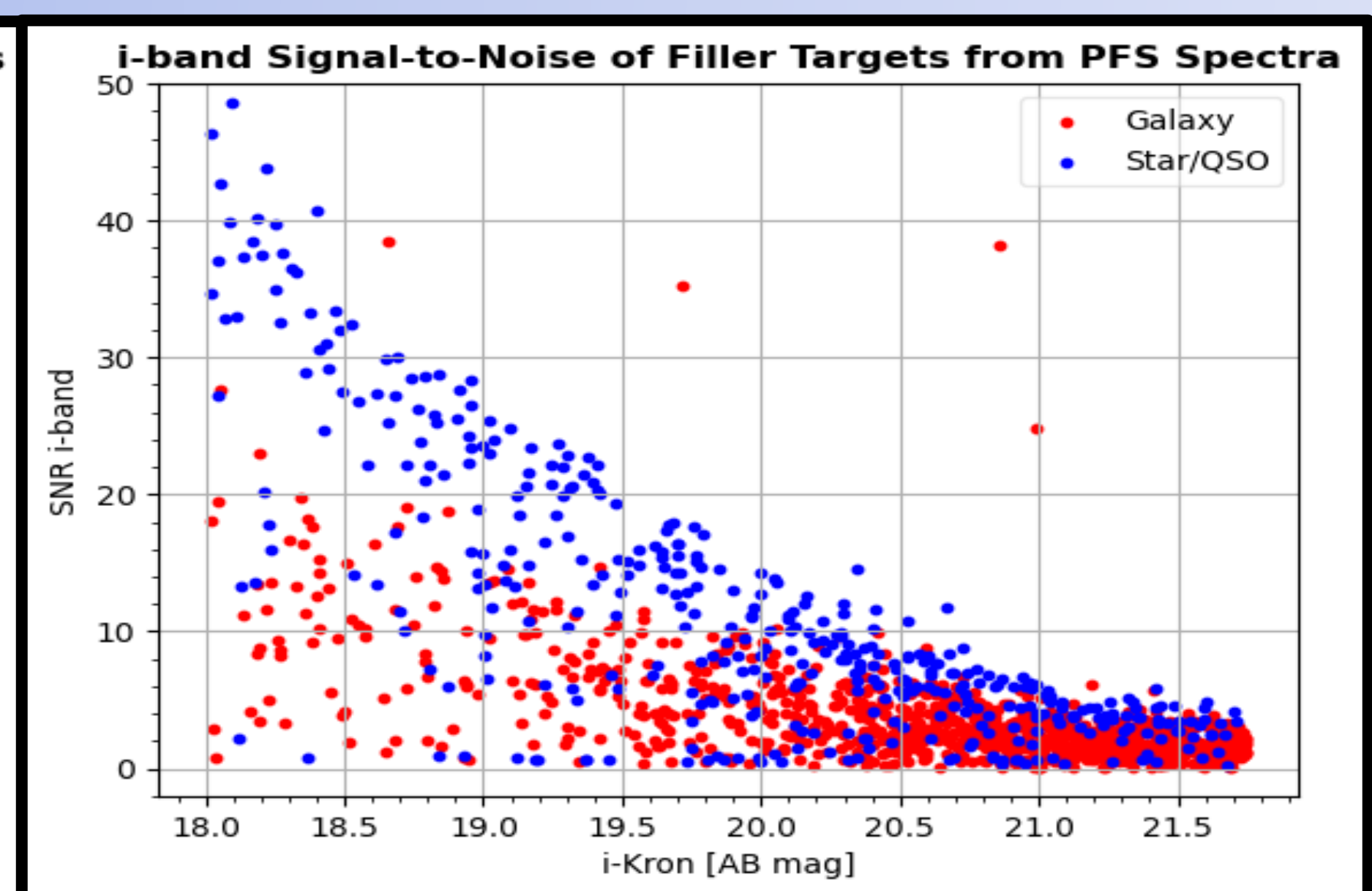Fig 3: Spectroscopic redshift distribution of 175 sample objects.

Fig 4: PFS i-band SNR of all galaxies and point sources.

Prime Focus Spectrograph Galaxy Spectra

To demonstrate the quality of the PFS filler data, the following are sample spectra of 6 emission-line galaxies with strong H-alpha, H-beta and [OII] emission lines, along with the CaII H+K absorption lines, which are individually highlighted. The spectra shown are fully reduced, flux and wavelength calibrated using the PFS 2D pipeline. Data from all PFS arms have been merged to create the full optical spectra, apart from the NIR arm data. Also shown are the noise spectra calculated from the covariance data.
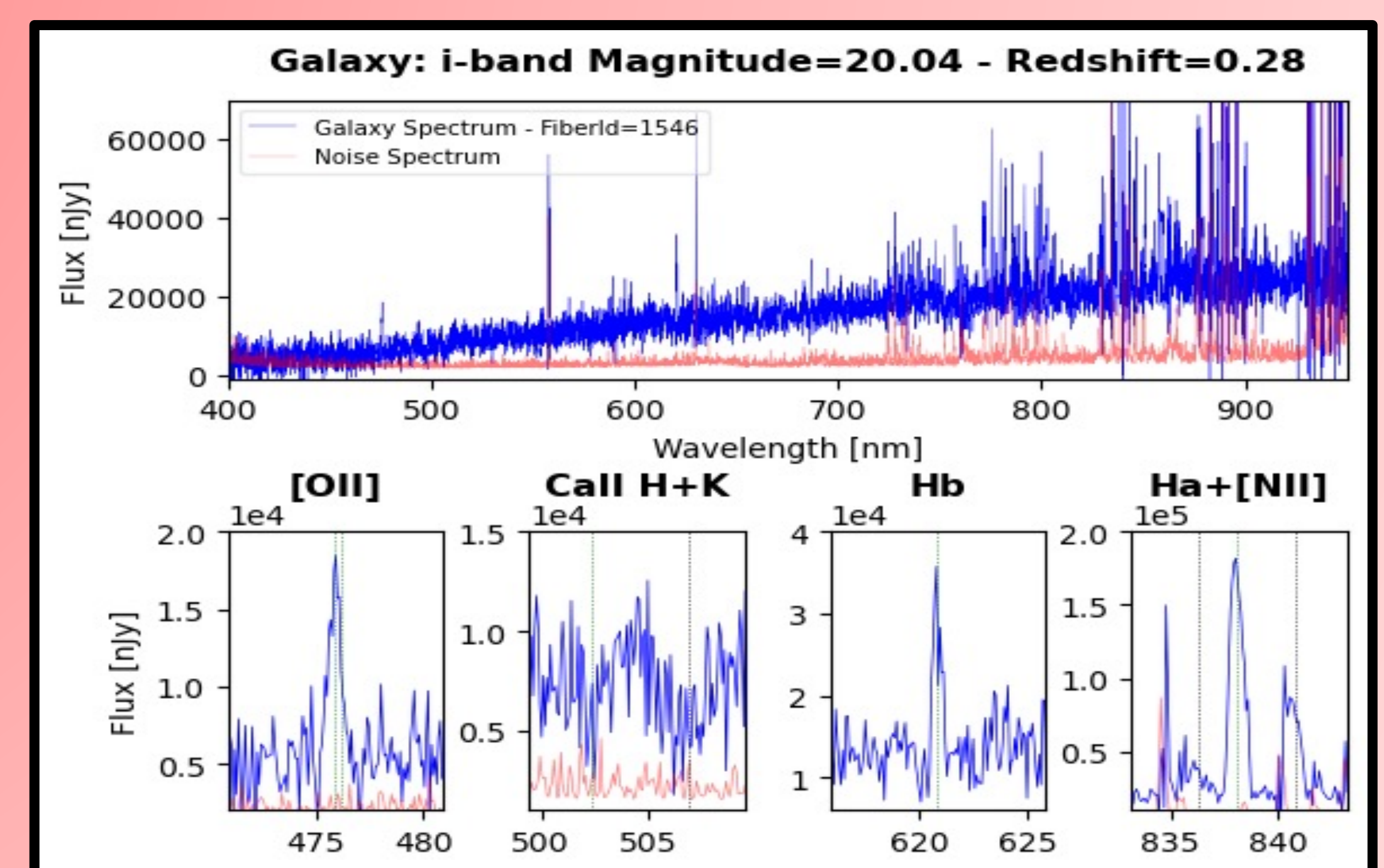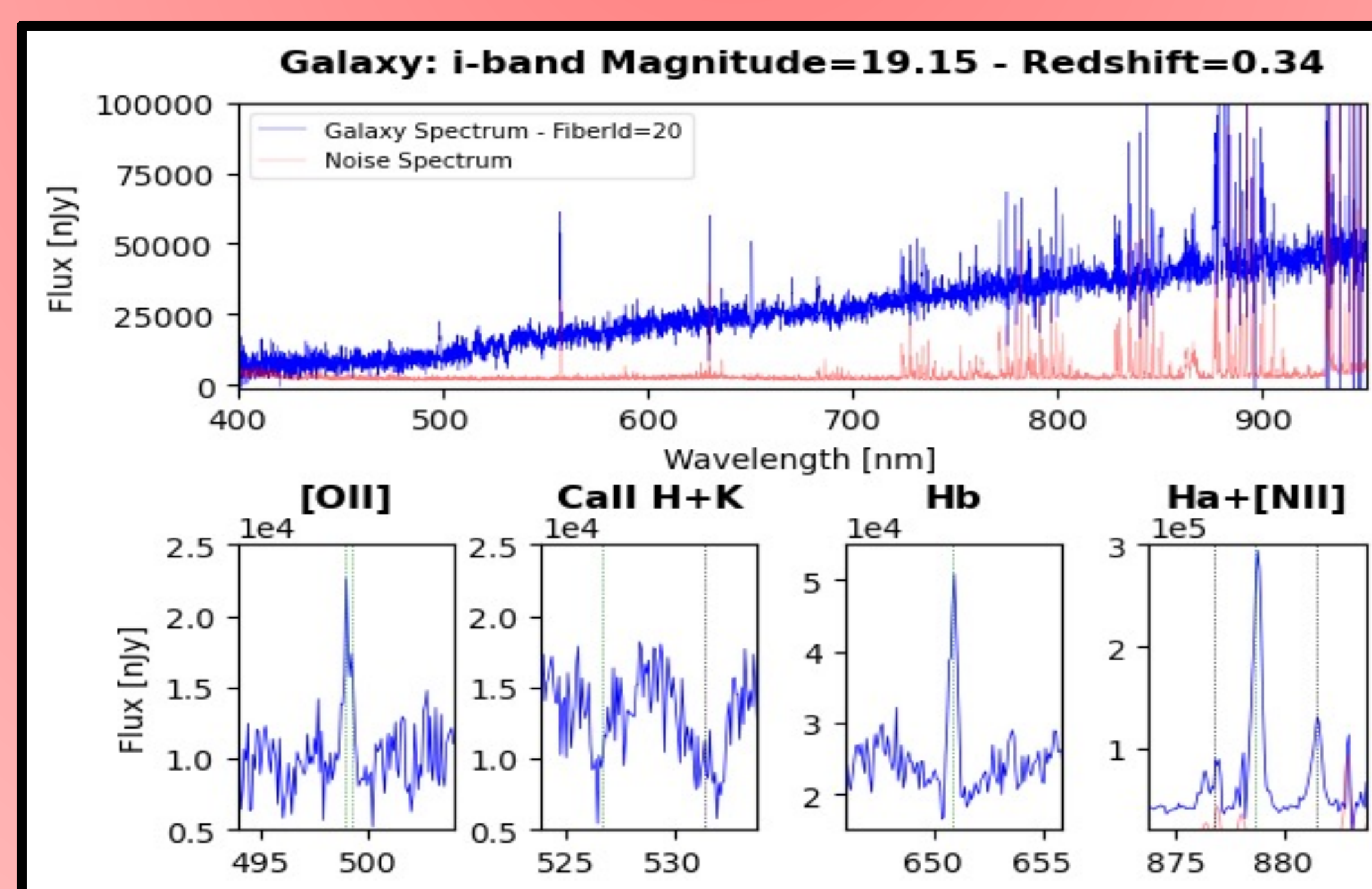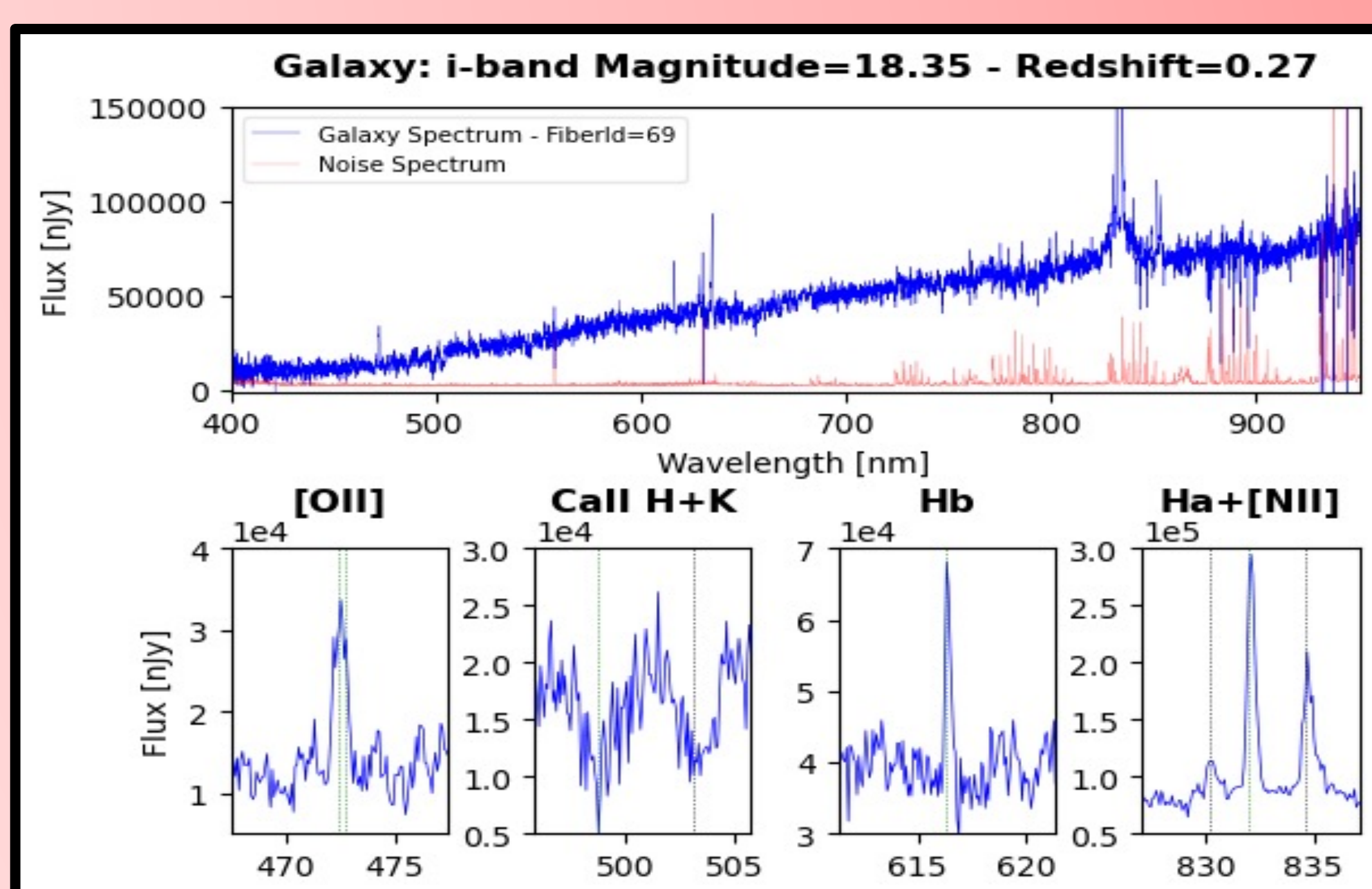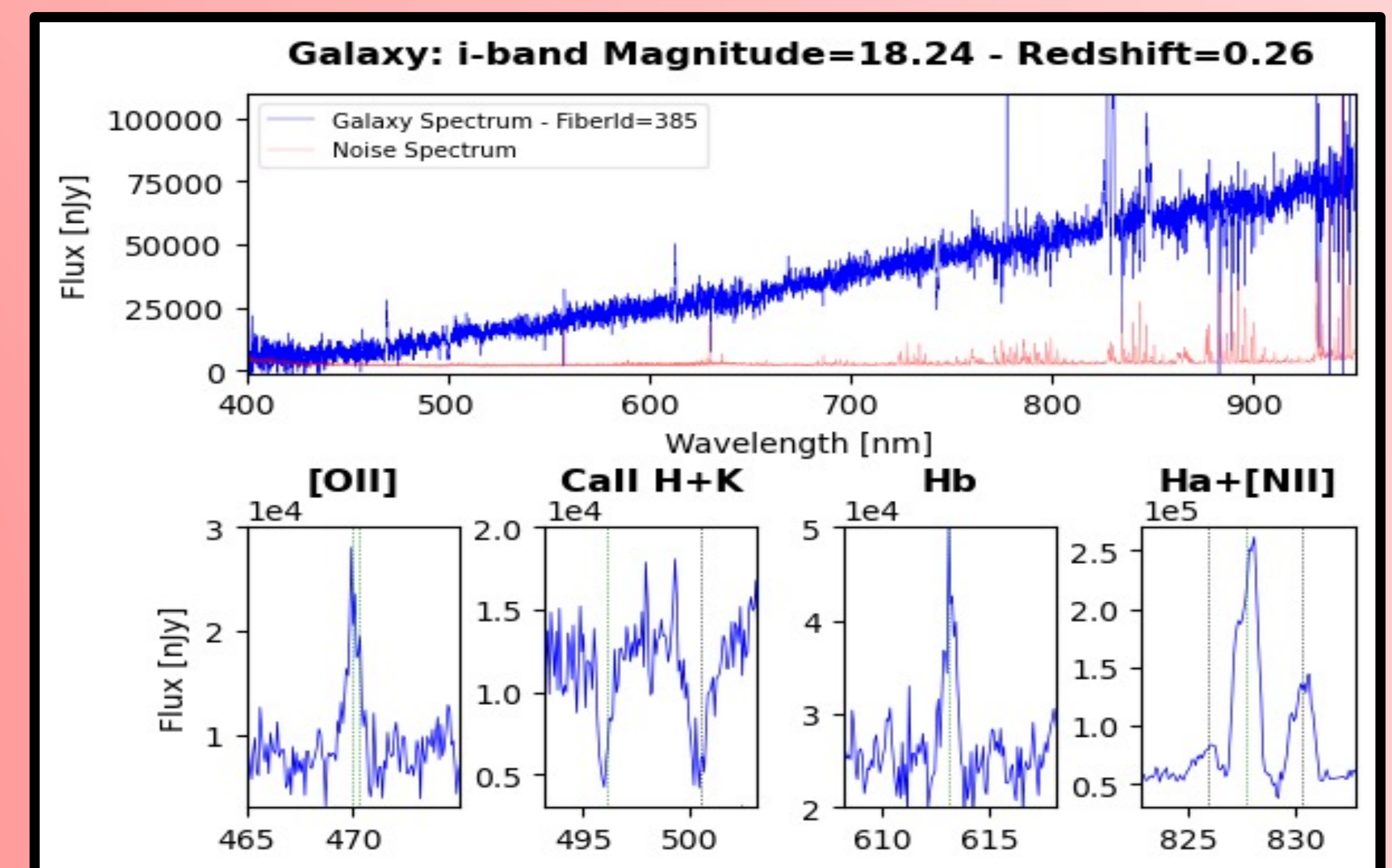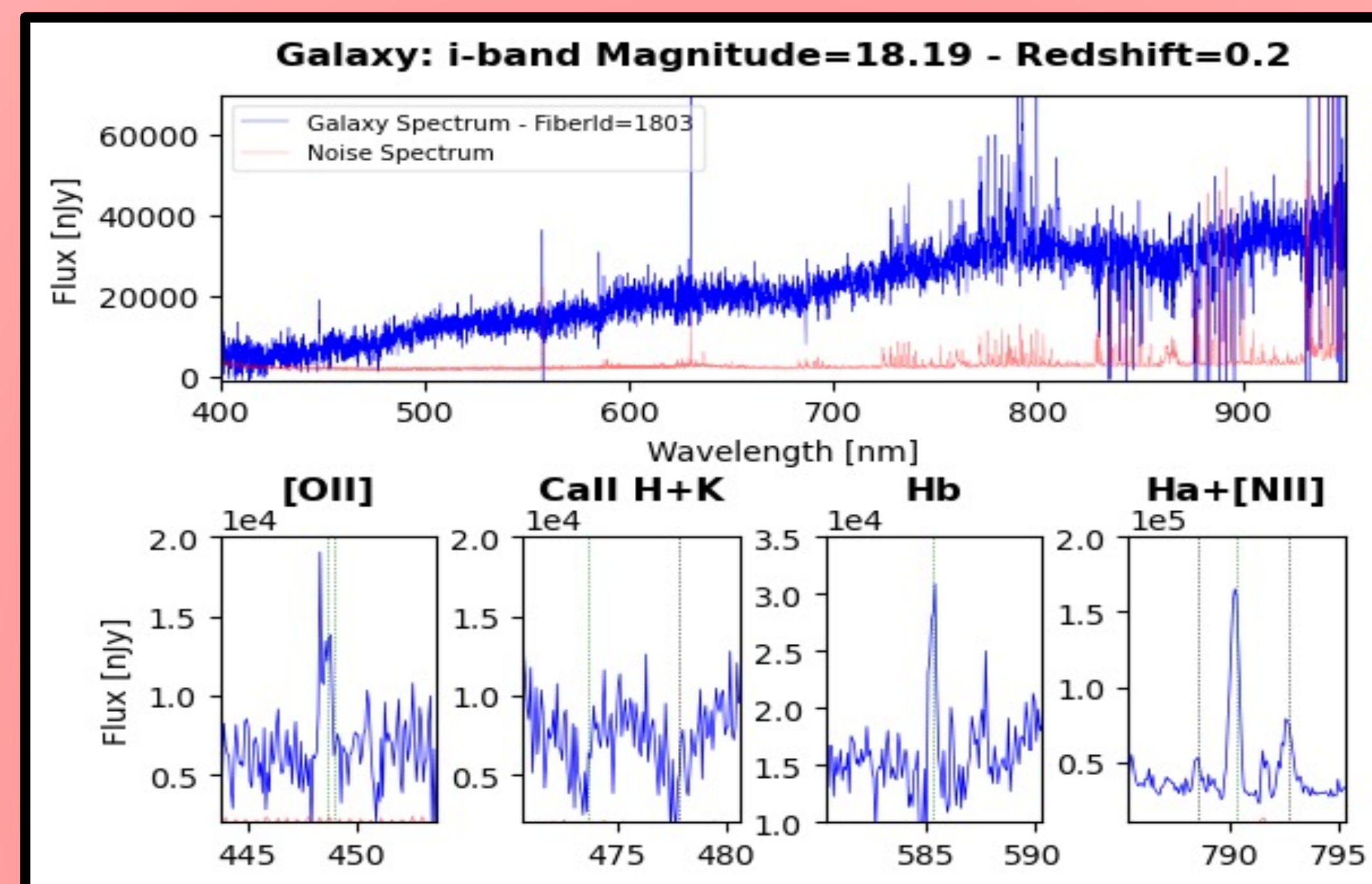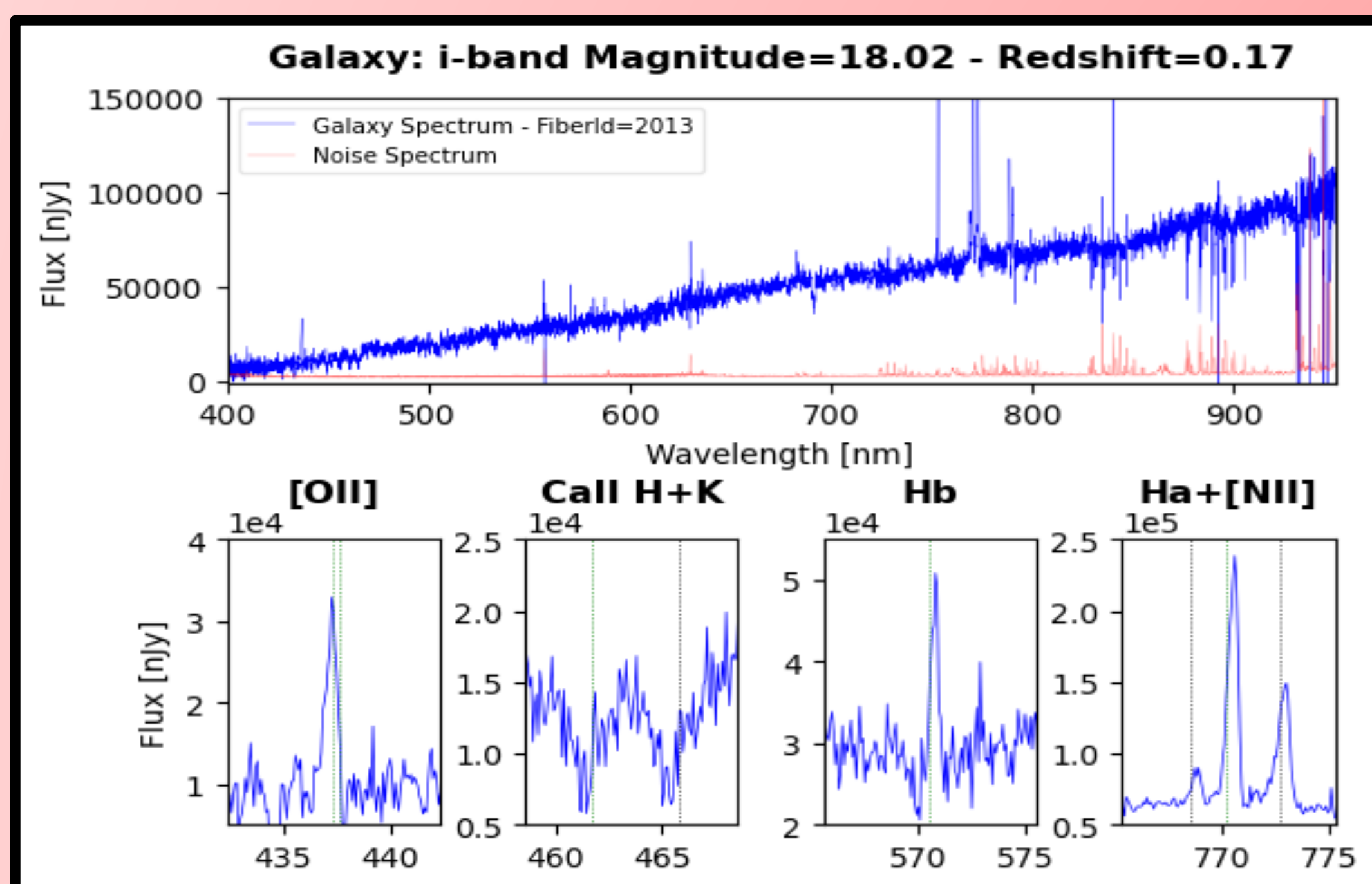
Prime Focus Spectrograph QSO Spectra

The following are two QSO spectra with pre-existing SDSS redshifts, for which the Ly-alpha emission line is individually highlighted. Currently there are only a handful of QSOs identified in the filler sample based on pre-existing spectroscopic redshifts, but we expect this number to increase once redshift computations of most objects in the filler sample are completed using the PFS 1D pipeline.
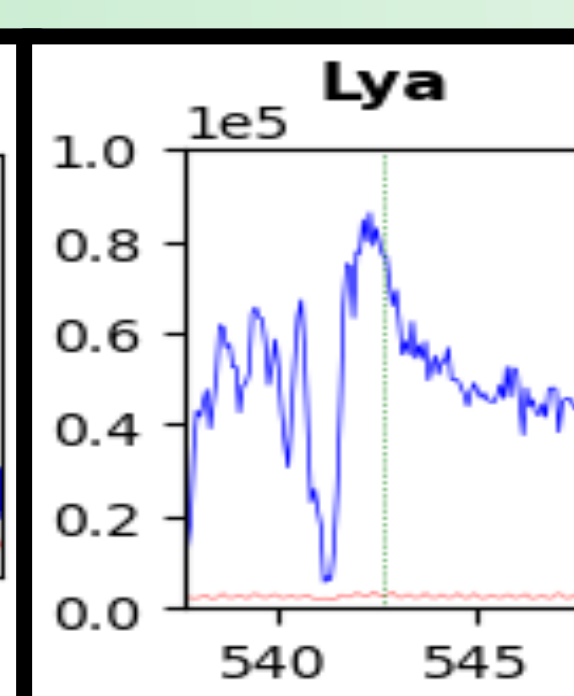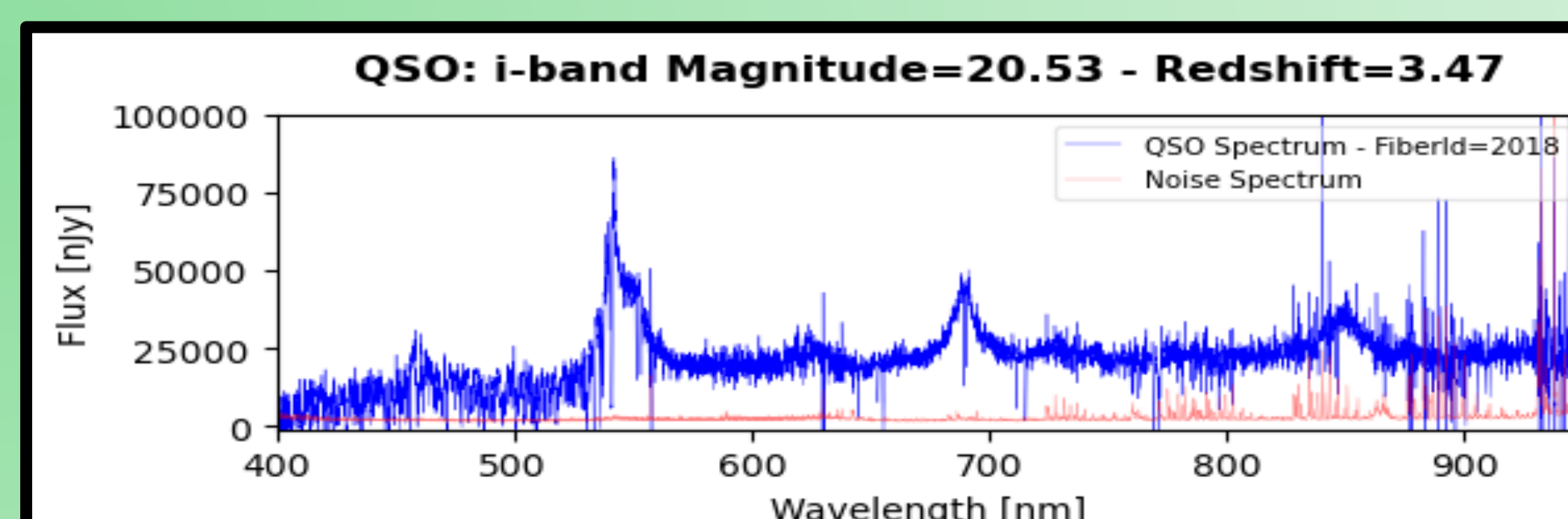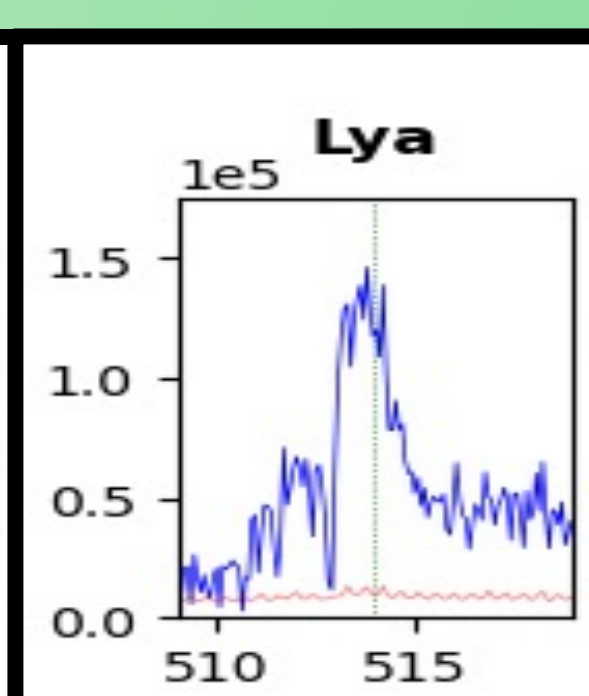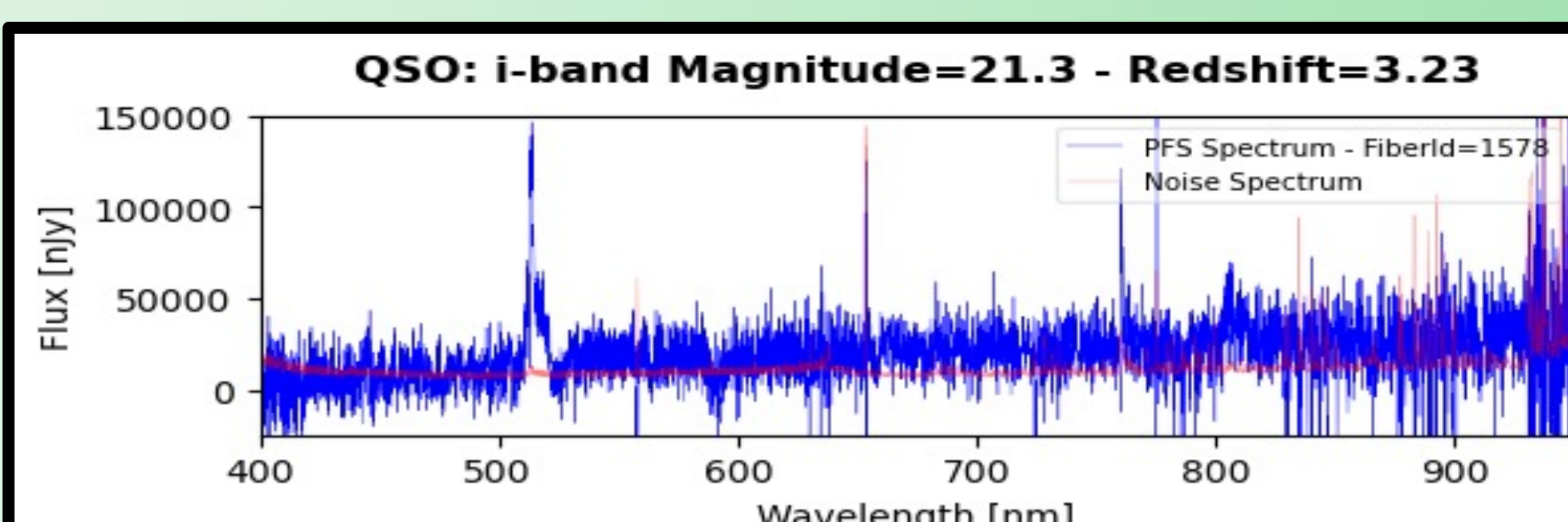
References

[1] Aihara H. et al. 2018, PASJ, 70, Issue SP1
[2] Chambers K.C. et al. 2016, arXiv: 1612.05560
[3] Tachibana Y. & Miller A.A., PASJ 130, 128001

The PS1 observatory filler targets are part of run 17, visit 111167 and catalog ID 10009. The fully reduced 2d spectra will be accessible through the PFS database. Any comments are welcome at sadman.ali@nao.ac.jp