CALIFA analysis: simulations and aperture effects

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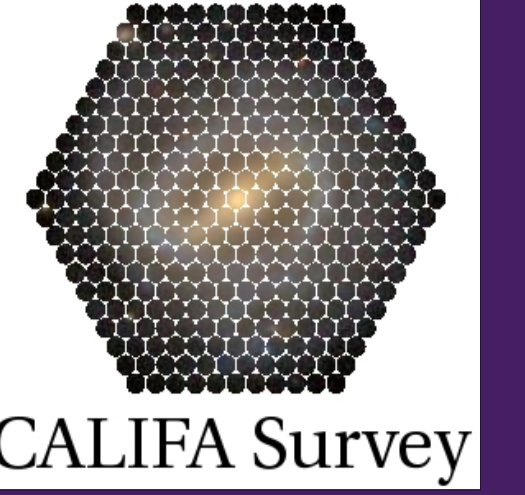
CALIFA Survey

CALIFA survey

The Calar Alto Large Integral Field Area Survey (CALIFA) is a recently started survey with the main aims at observing a statistically well-defined sample of ~600 galaxies in the local universe with the PMAS/PPAK integral field spectrophotometer on the 3.5 m telescope at the CAHA. The main goal of this survey is to characterize the spatially resolved spectroscopic properties (both the stellar and ionized gas components) of all the population of galaxies at the current cosmological time, in order to understand in detail the how is the final product of the evolution of galaxies.

CALIFA pilot studies

To guarantee the final science product of CALIFA survey, exploratory pilot studies aimed to test the observing program, the data reduction and the quality of the final data were carried out. The observations were performed using PMAS at the Calar Alto (CAHA, Spain) observatory 3.5m telescope in the PPAK mode (efective FWHM ~1.6" when the 3 dithered pointing are combined).

Two different setups were used in these pilot studies to test the optimal final configuration for the CALIFA survey: V300 grism (3700–7100Å, R~500) and V600 grism (3850–7000Å , R~800).
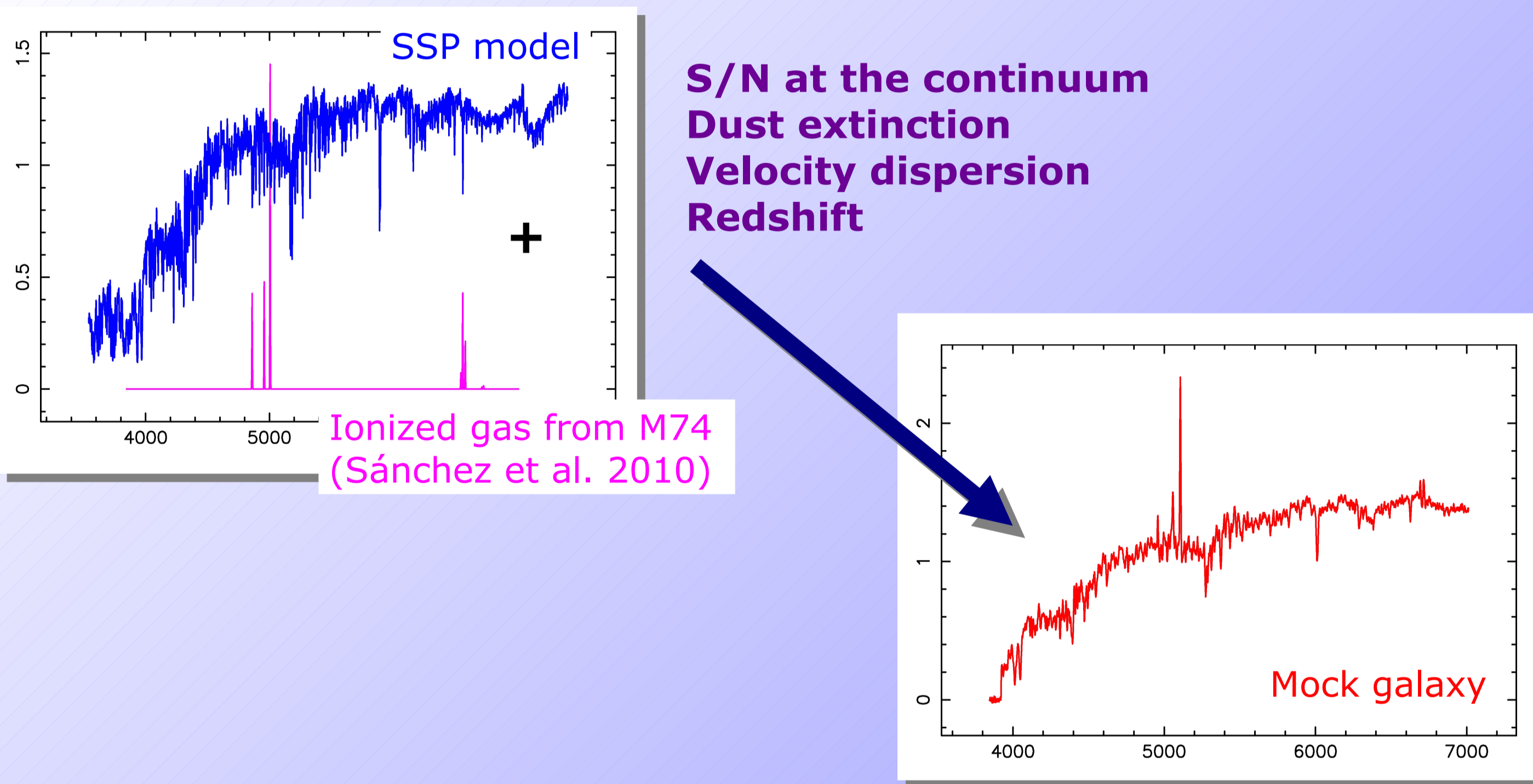
The pilot sample

The sample selection for the CALIFA pilot studies was presented in the first proposal of the project, to the CAHA Executive Committee in June 2009. This initial sample comprised four main subsamples: (1) Galaxies extracted from the SDSS DR4 imaging sample brighter than r<15.75 mag, at a redshift slice between 0.015 < z < 0.025, without any other further selection; (2) the face-on disk galaxies included in the Disk-Mass Survey (Bershady et al 2010); (3) Galaxies from the Coma cluster, at the RA slice of 12 h, with a slighly larger redshift slice (0.015<z0.035). In total, a sample of about 1000 galaxies were selected with these criteria, and 48 galaxies were finally observed within the pilot studies.
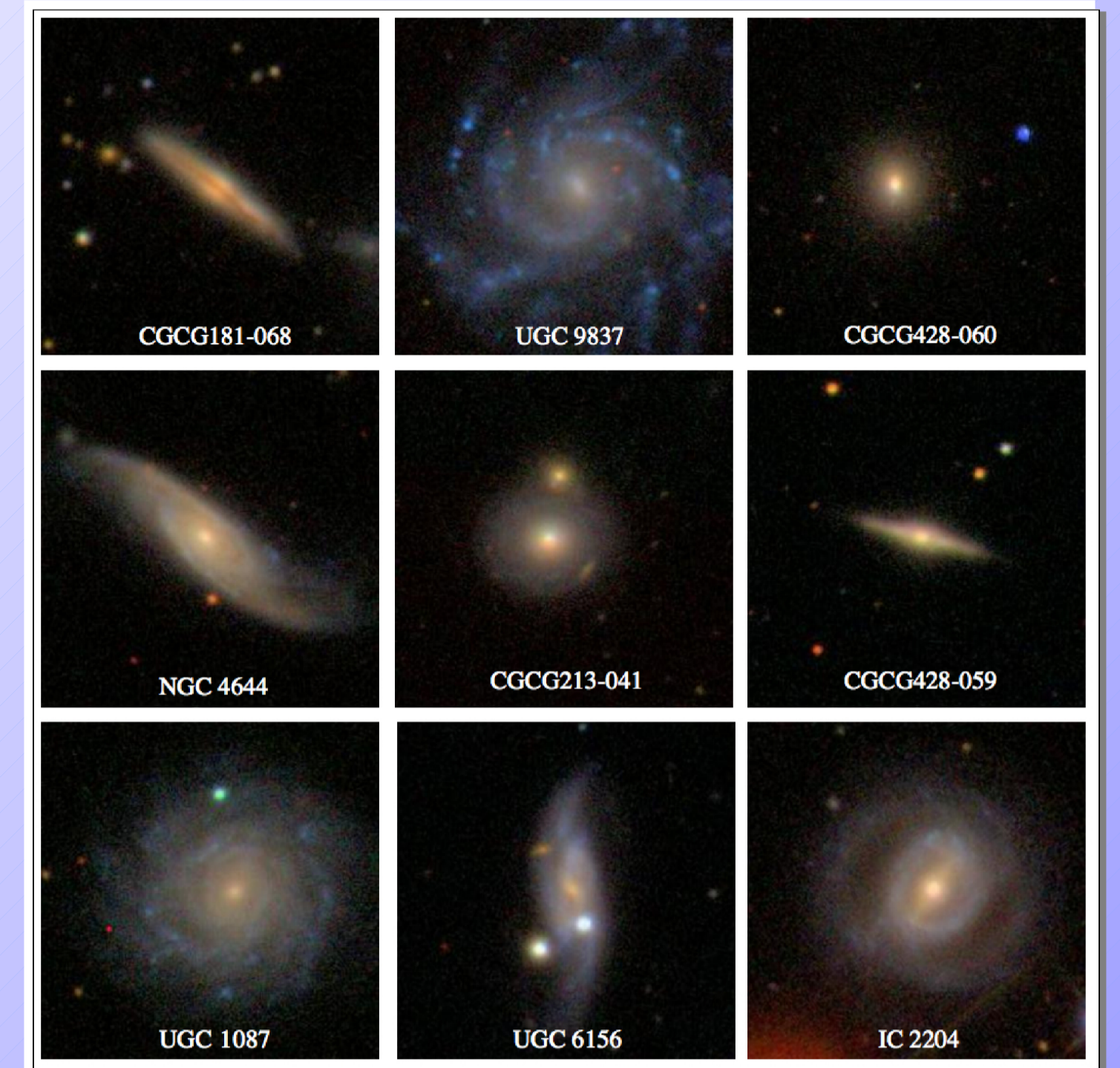

Subset of 9 of the 48 observed galaxies. All images are of 1.5 x 1.5 arcmin (north is up, east is left), from SDSS survey.

Mock catalog of galaxy spectra

SSP model

Ionized gas from M74 (Sánchez et al. 2010)

S/N at the continuum
Dust extinction
Velocity dispersion
Redshift

Mock galaxy

Decoupling the stellar population and the gas content

Galaxy
Modeled gas
Best fitted stellar population
Residuals

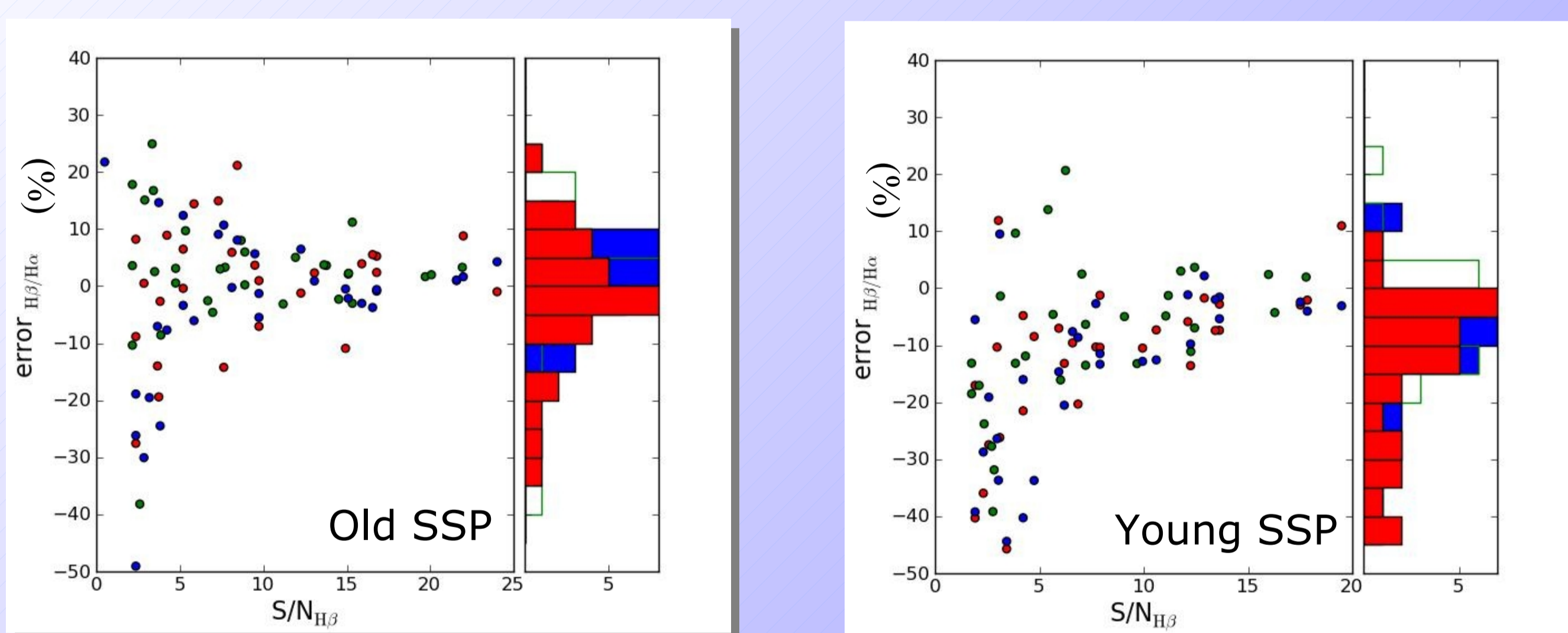**Using the fitting tool *auto_ssp_elines.pl* (Sánchez et al 2010)**
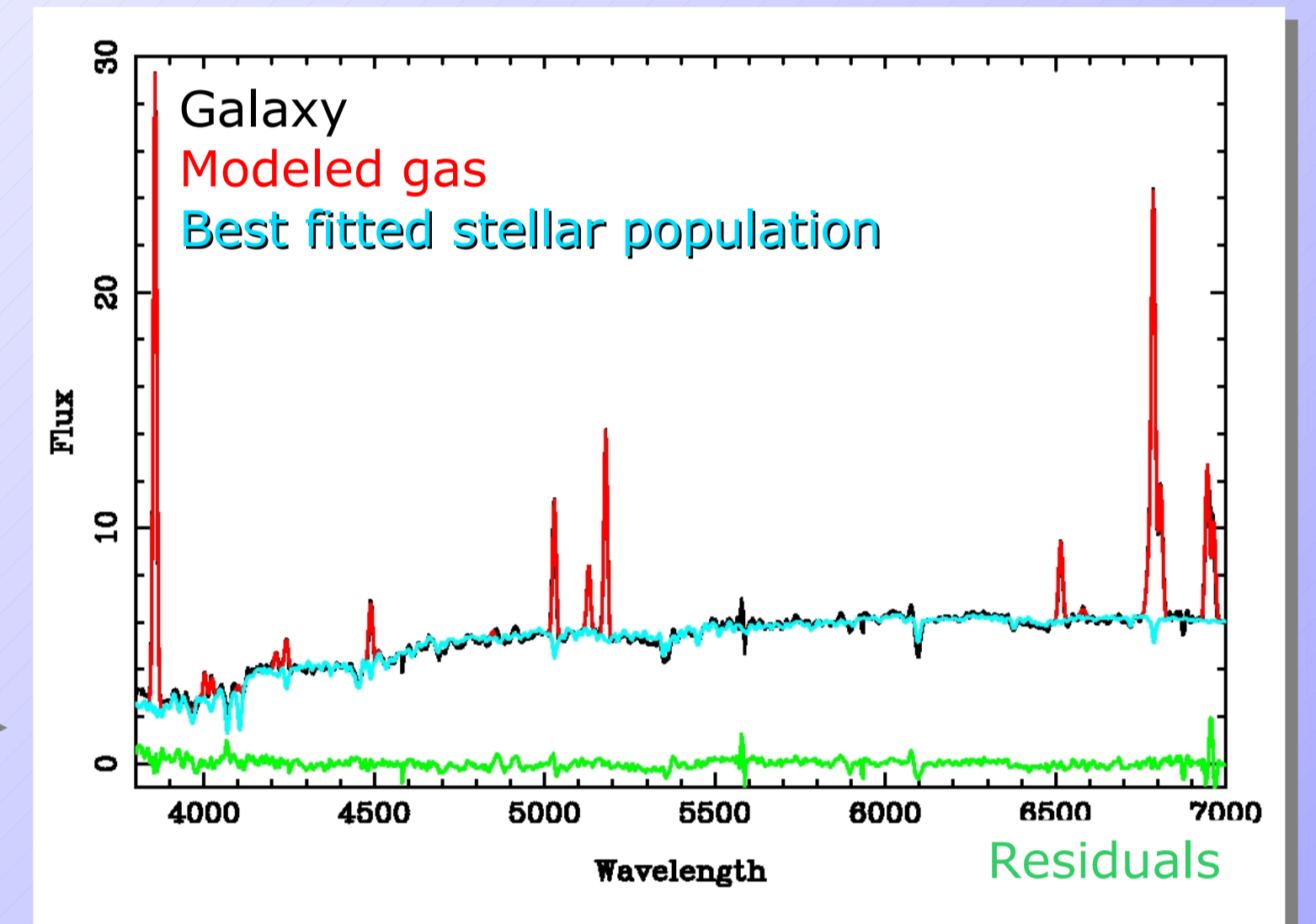
Emission lines
Stellar populations (age, metallicity)
Kinematics (redshift, velocity dispersion)
Dust extinction

Recovering the ionized gas

Dependence on their intensity

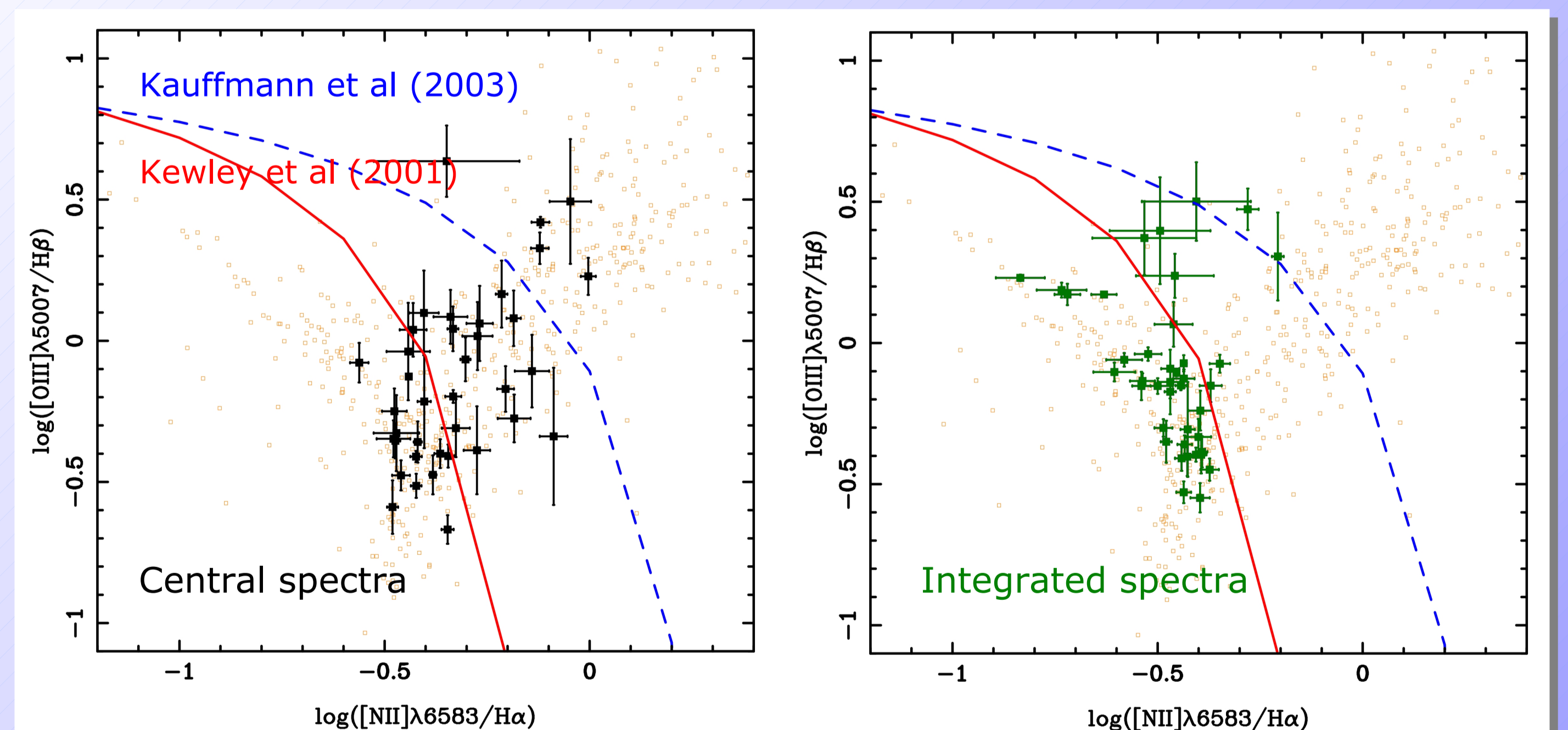Mock galaxies with ionized gas of different intensity

Old SSP

Young SSP

Similar relative errors for the bulk of the cases for both SSPs
Asymetric distribution for young SSPs: higher errors for lower S/N

Recovering the stellar populations

Dependence on the S/N at the continuum

Mock galaxies with different S/N in the continuum

Old SSP

Young SSP
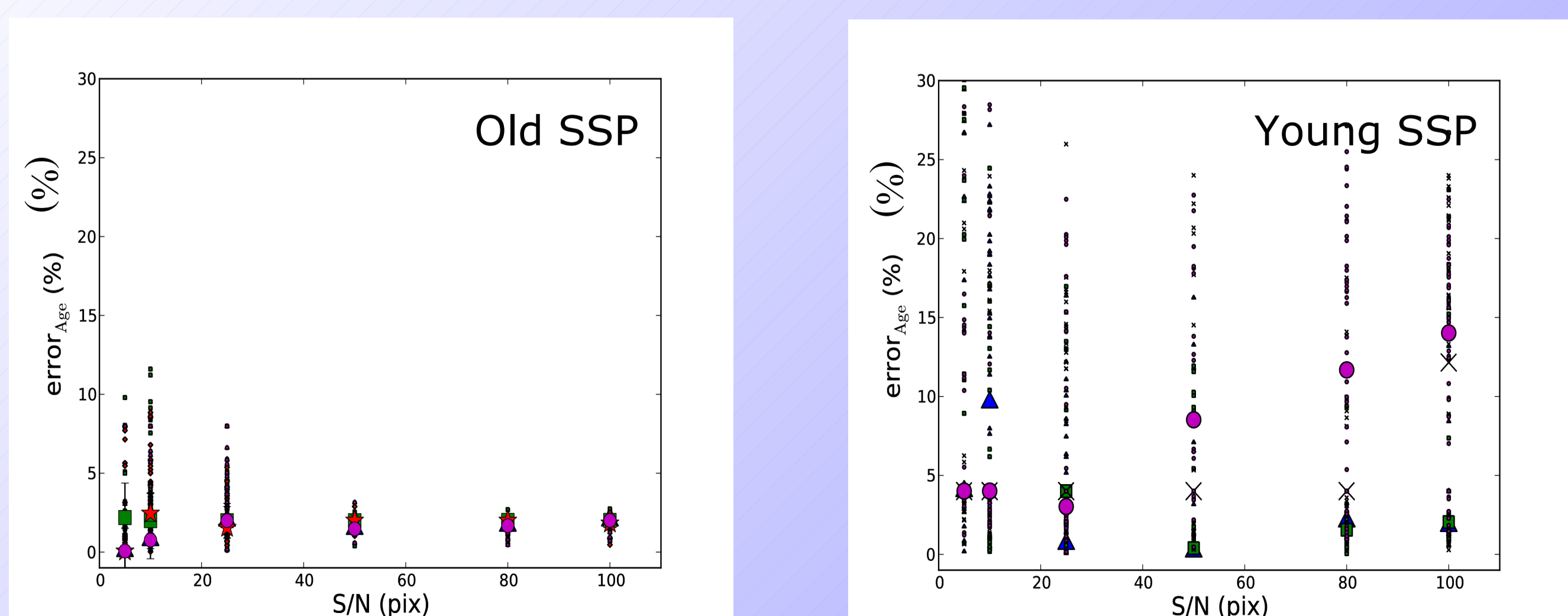
We represent the median values of the 50 simulations (small dots) over the mock galaxies with different amounts of emission gas (representing with different symbols and colours).

As expected, higher relative errors for recovering the age for young stellar populations

Comparison: central vs. Integrated spectra

The 3D spectroscopy allows to analyse aperture effects

Diagnostic diagrams for the central and the integrated spectra of the observed galaxies in the pilot studies.


Kauffmann et al (2003)
Kewley et al (2001)

Central spectra

Integrated spectra

There is a clear difference when the central or integrated spectra are analysed.

References

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