3D mapping of stellar populations as a function of environment

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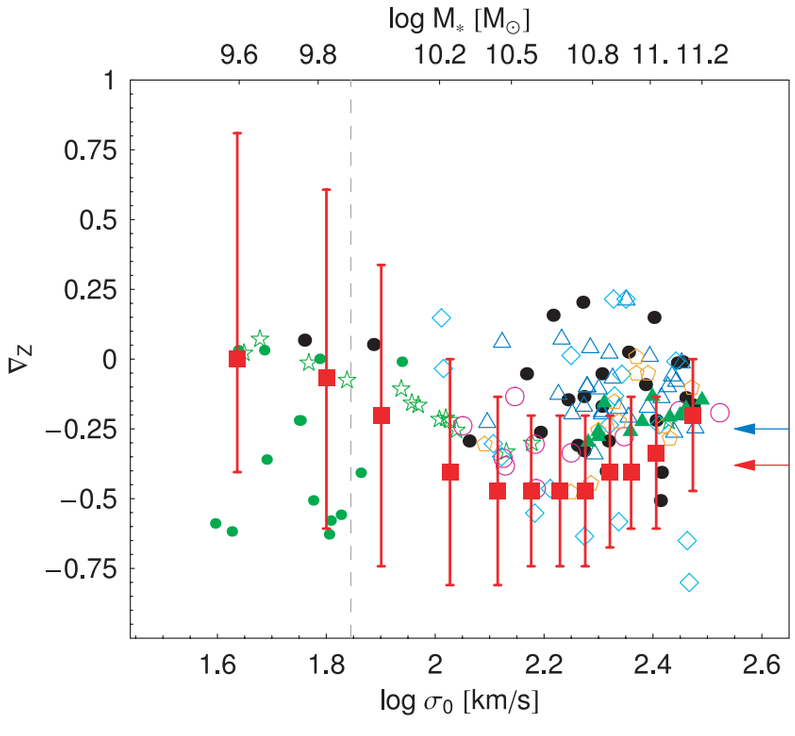
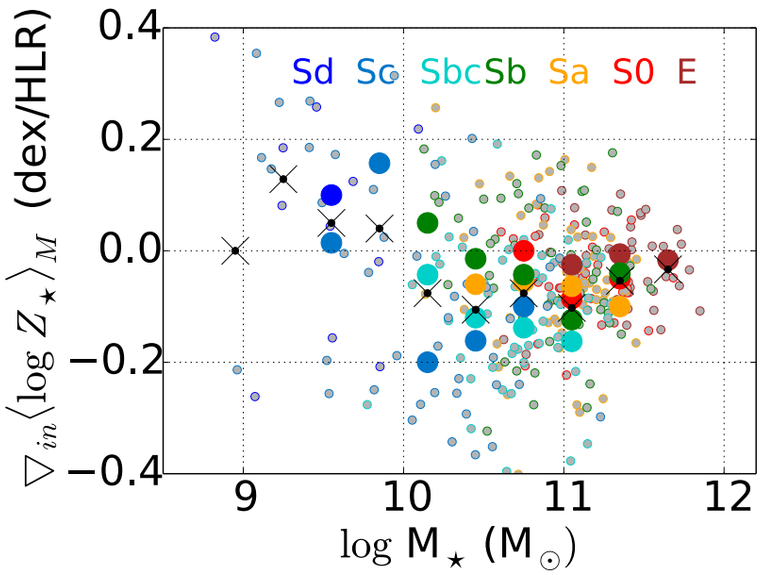
Stellar population gradients

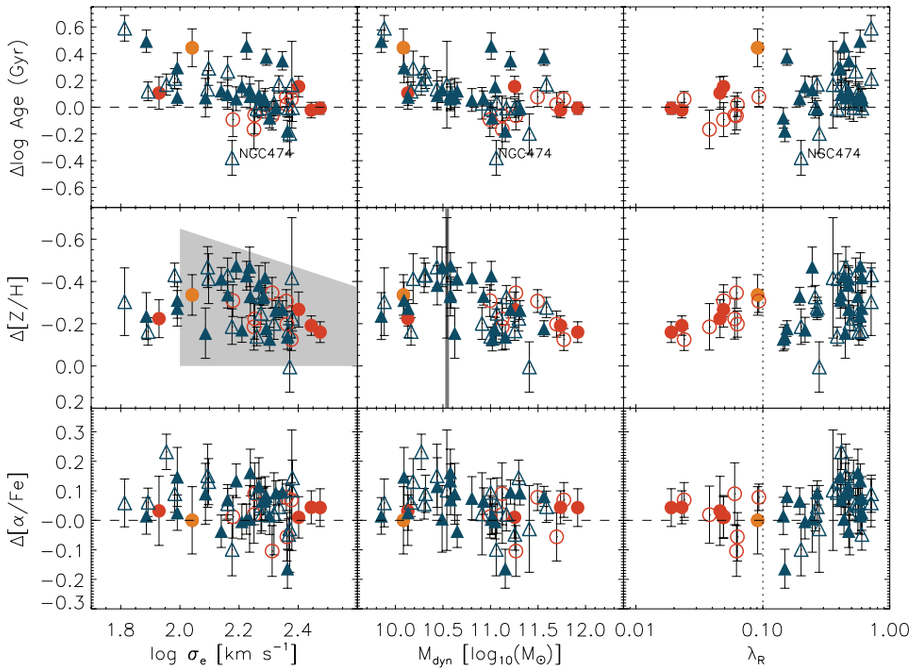
Tortora et al 2010

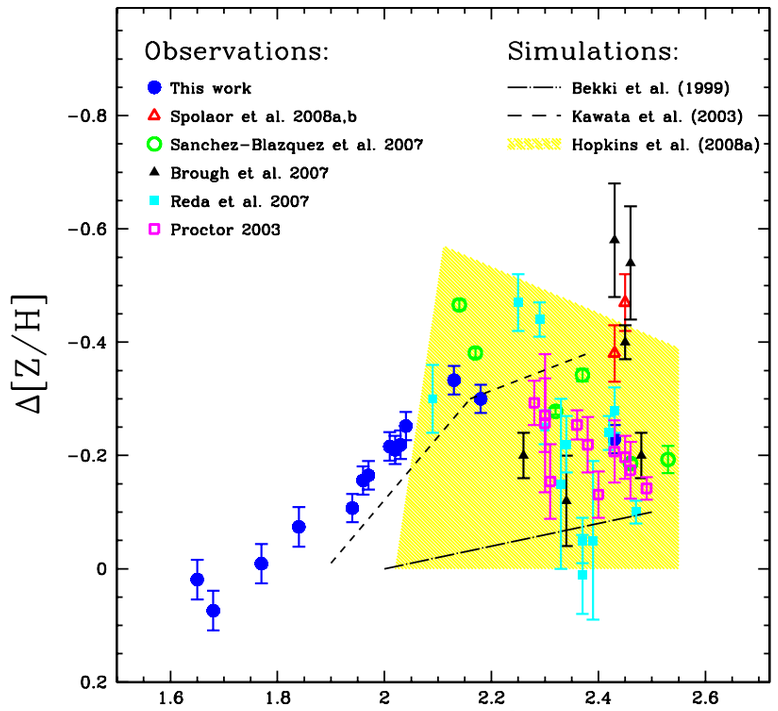


González Delgado et al 2015

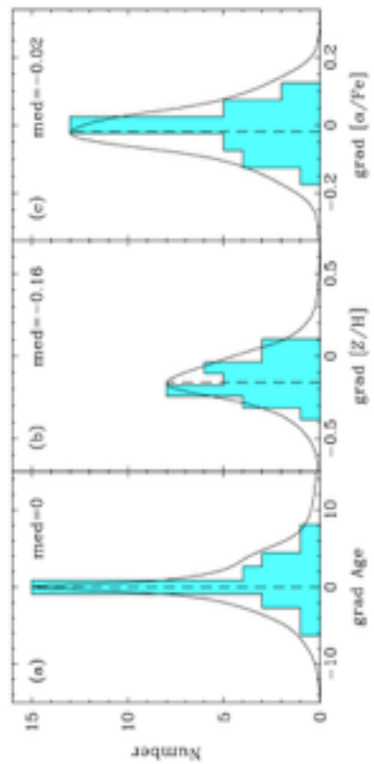


Kuntschner et al 2010

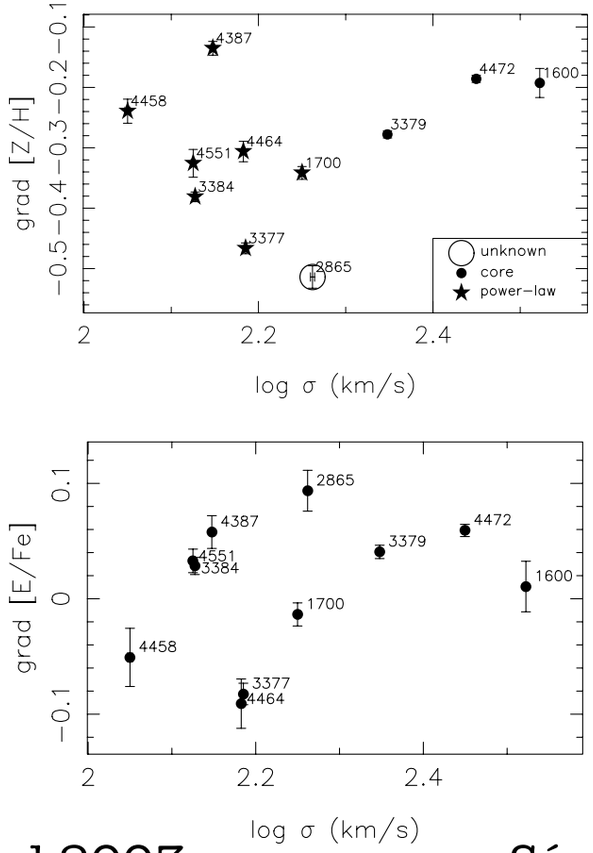




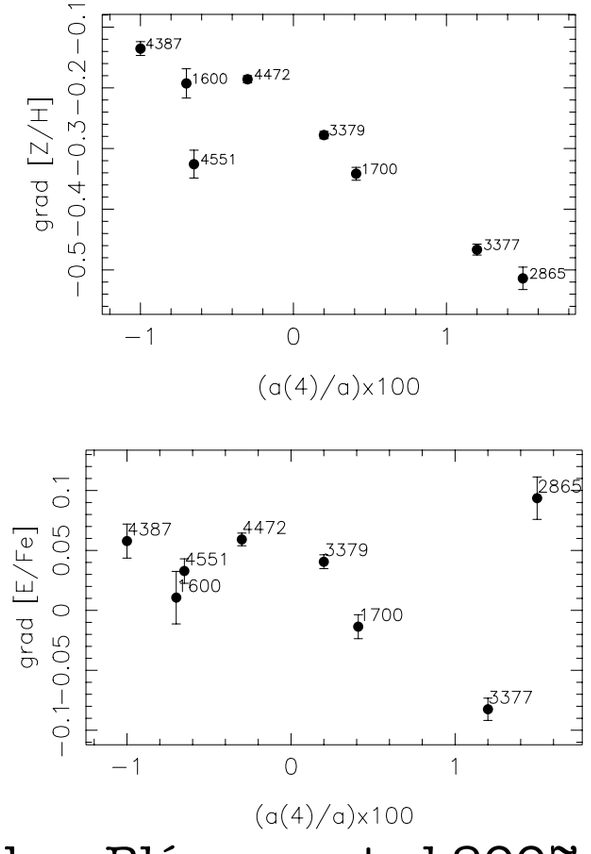
Spolaor et al 2009



Mehlert et al 2003



Sánchez-Blázquez et al 2007



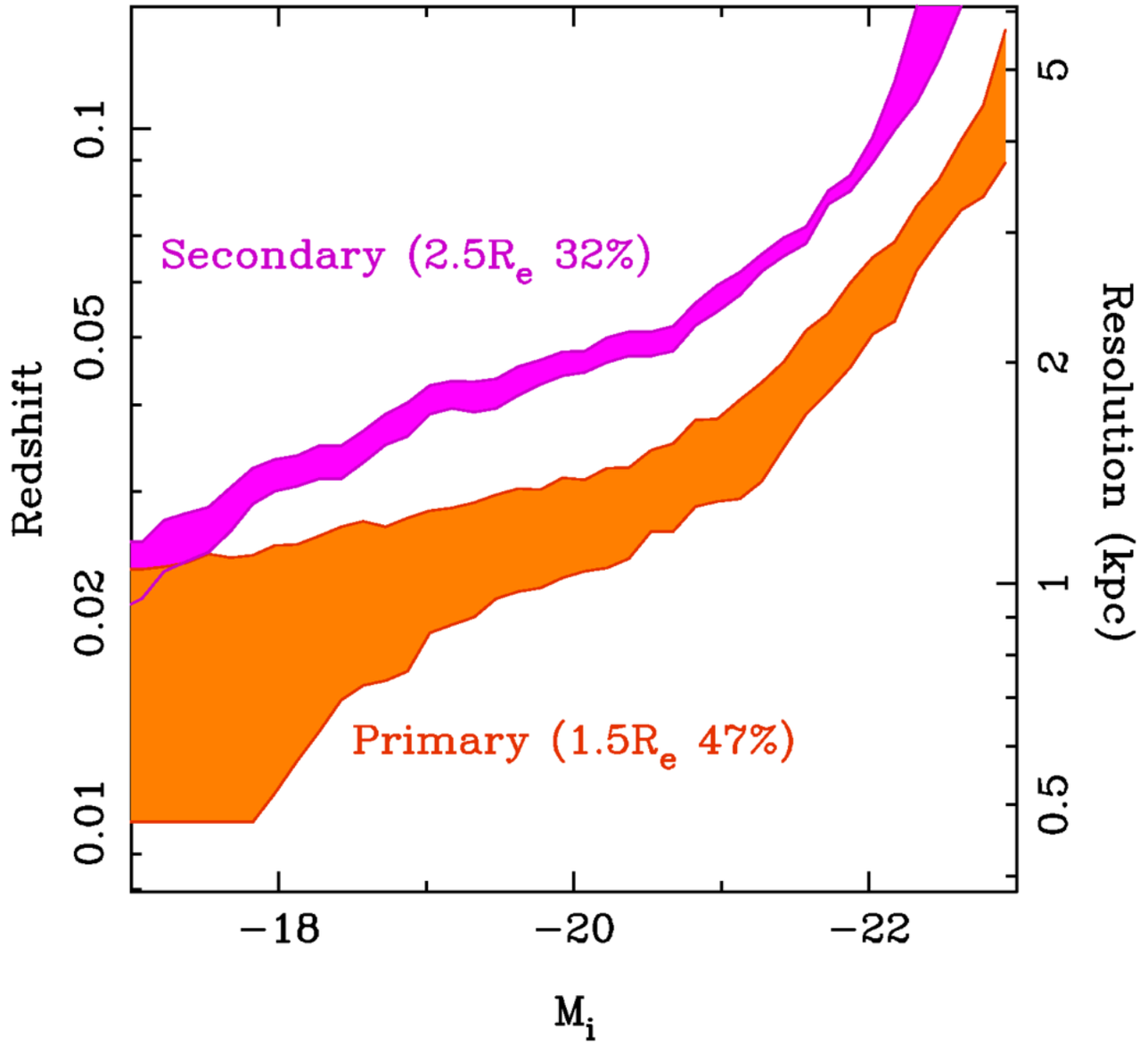
MaNGA target selection

Primary - 80% covered to 1.5 R_e
- Den = 0.53 mag^{-1} deg^{-2}
- 47% of the sample

Secondary - 80% covered to 2.5 R_e
- Den = 0.35 mag^{-1} deg^{-2}
- 32% of the sample

Color-Enhanced - Fill in sparse regions of NUV-i vs i plane
- Aim to cover 1.5 R_e
- 16% of the sample
- S4.3

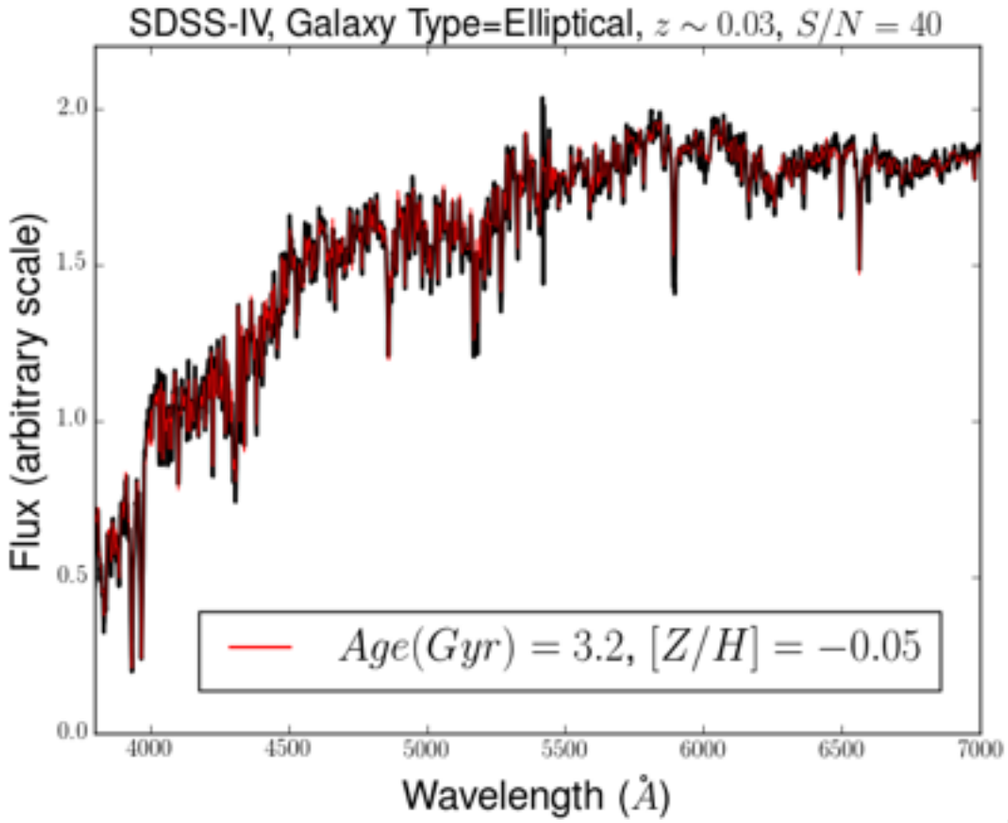
Ancillary - 5-10% of the sample
- S4.3



Full Spectral Fitting Code FIREFLY

Wilkinson et al 2015, 2016

Gives an array of fits, each as a combination of single-burst modes (SSPs), to get SFH, metallicity, age distribution, etc.

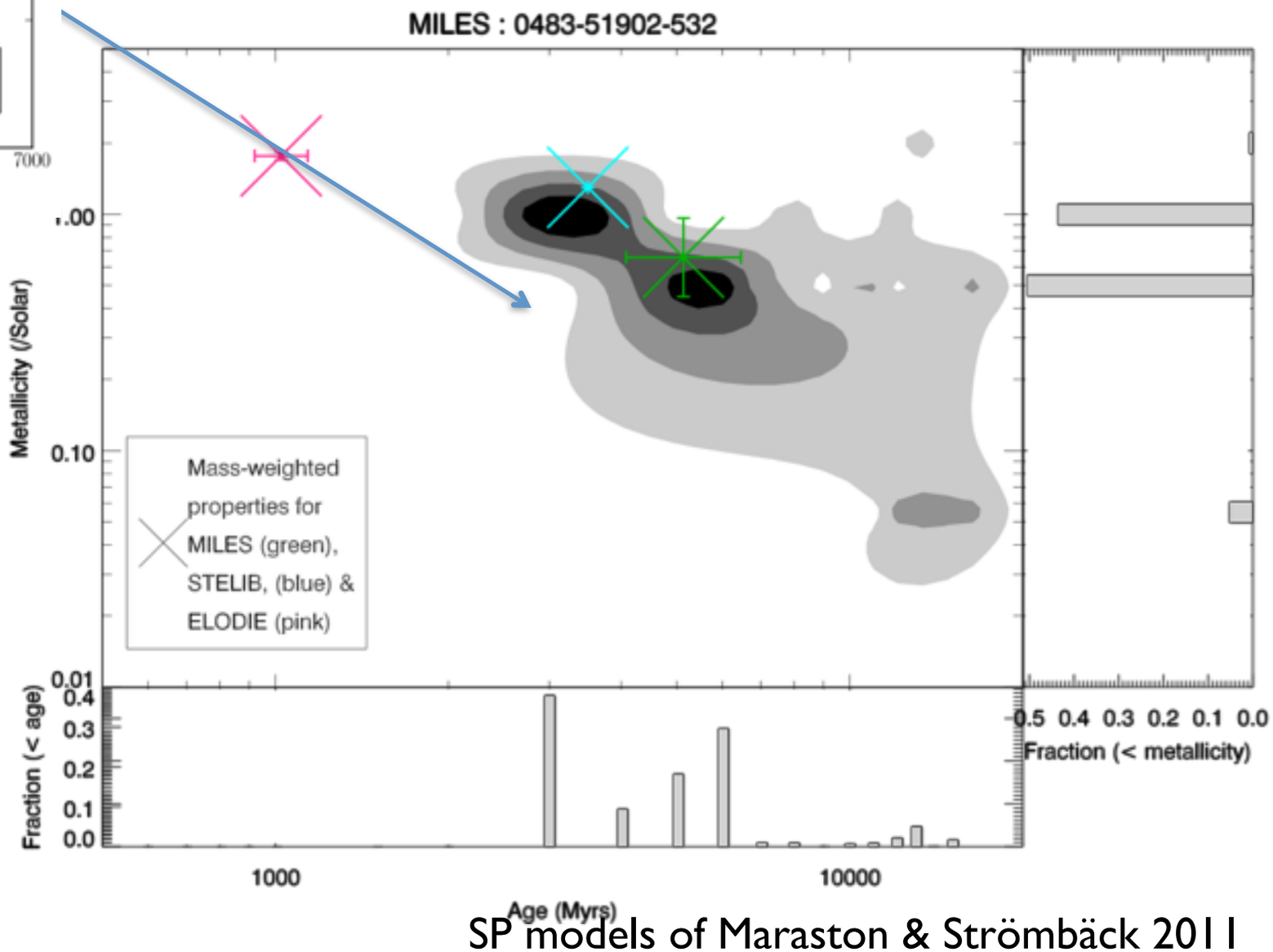


Fast computation of **likelihood surfaces** of properties

Ability to change and **compare input stellar population** model ingredients

Reconstructs SFHs from combinations of bursts

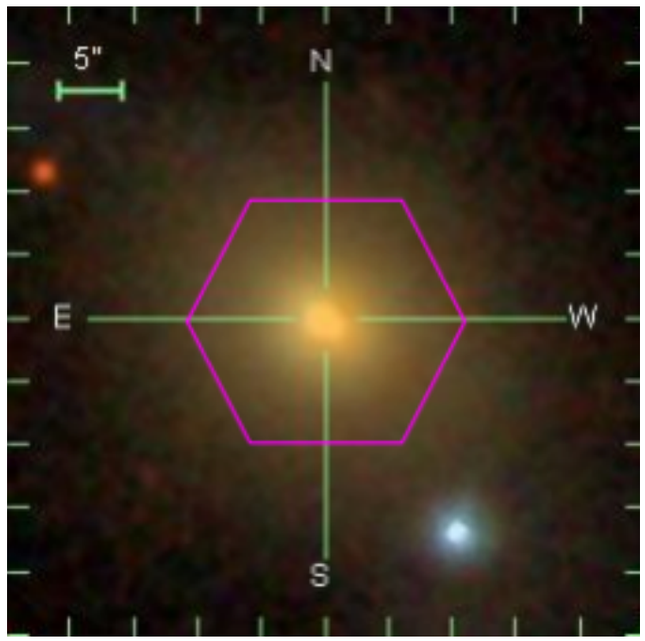
pPXF (Cappellari & Emsellem 2004)
STARLIGHT (Cid-Fernandes et al)
FSPS (Conroy et al 2014)
...



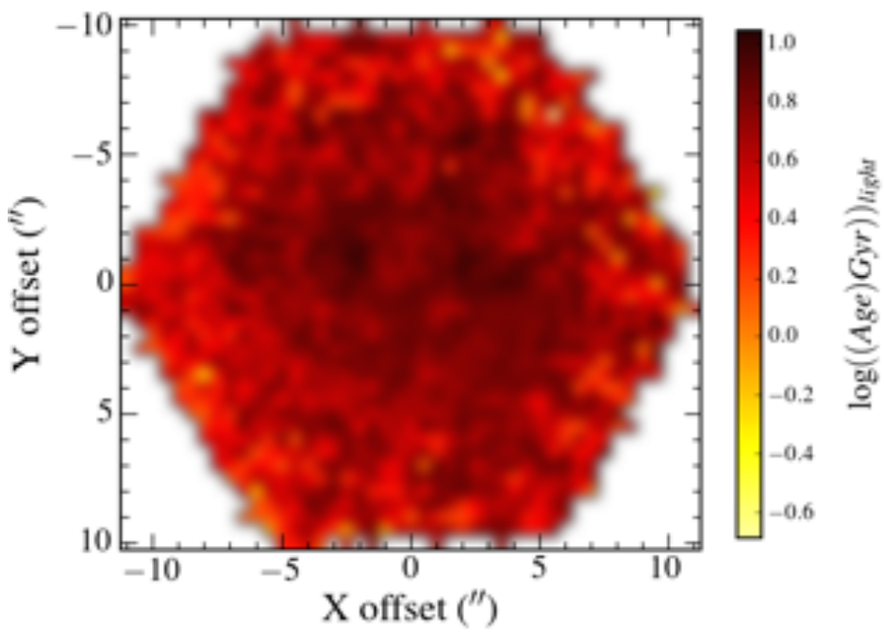
SP models of Maraston & Strömbäck 2011

Stellar Population Properties

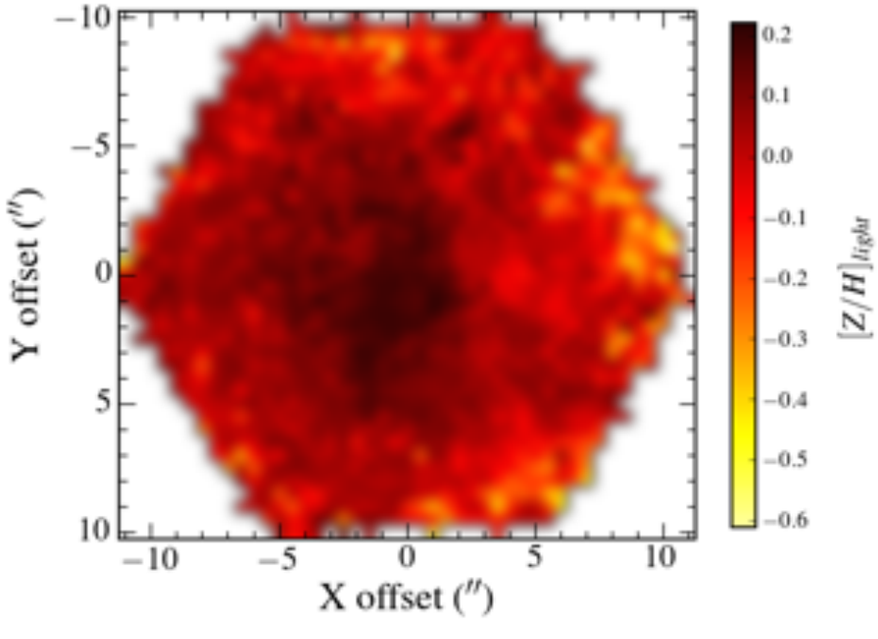
MaNGA Id: 1-217022



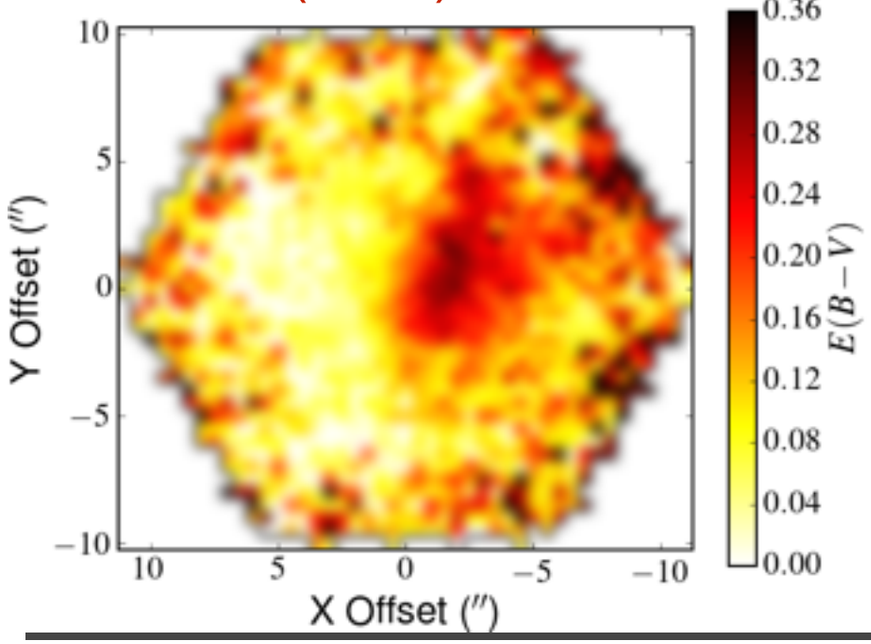
log(Age(Gyr))



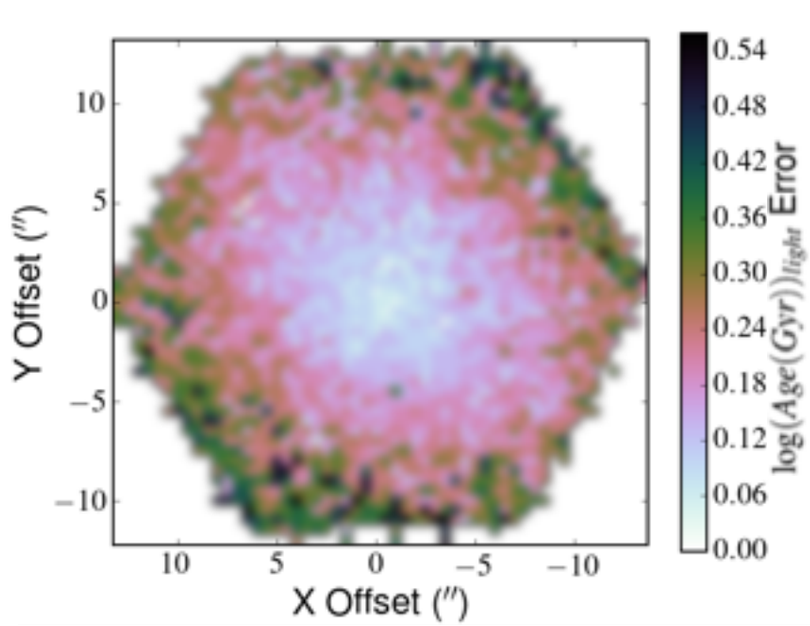
[Z/H]

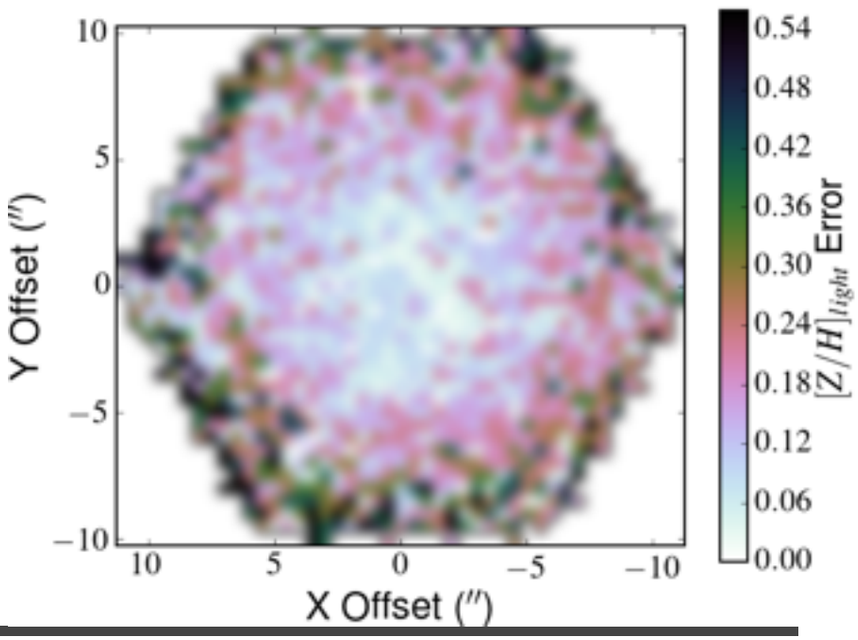


E(B-V)



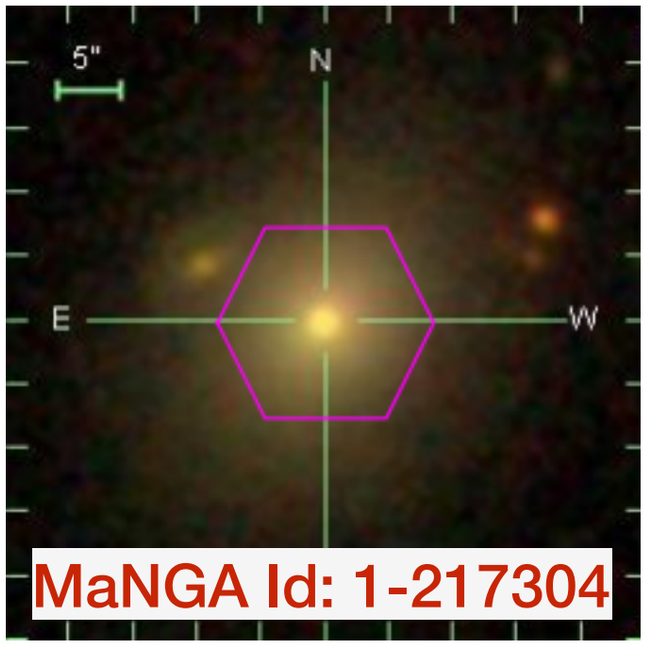
Errors on age and metallicity.



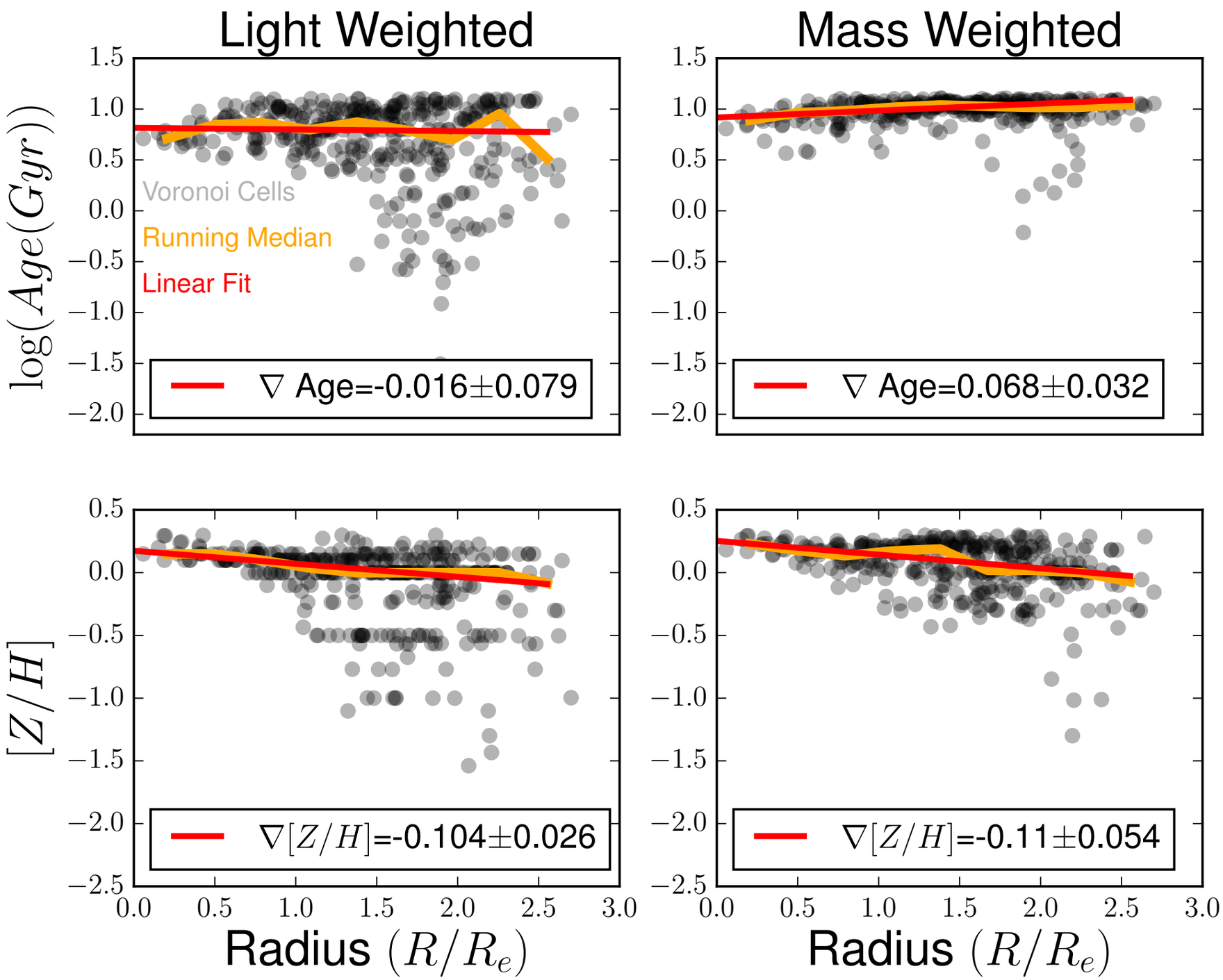


Radial Gradients of Properties

Early Type Galaxy

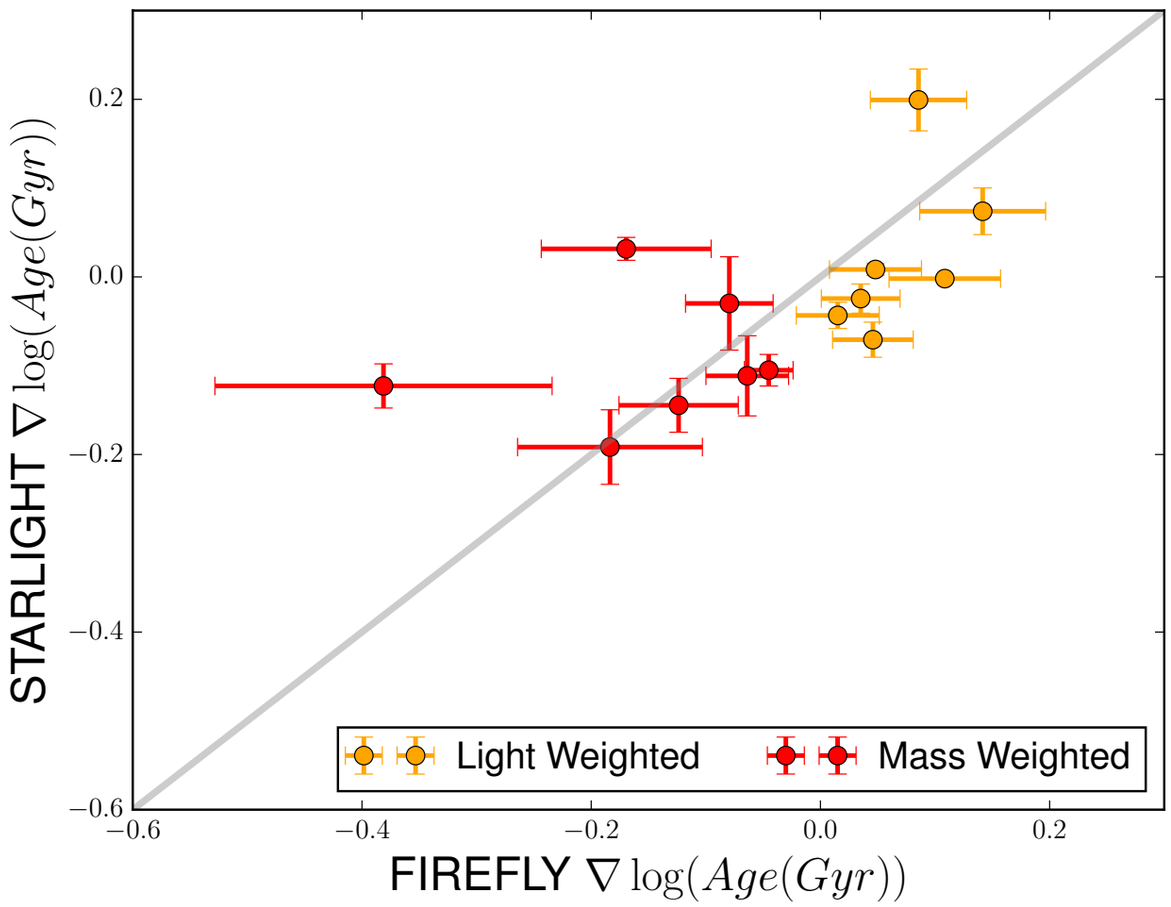


- Recover literature values of gradients ~-0.16/0.3 (Mehlert et al 2003, Spolaor et al 2009)

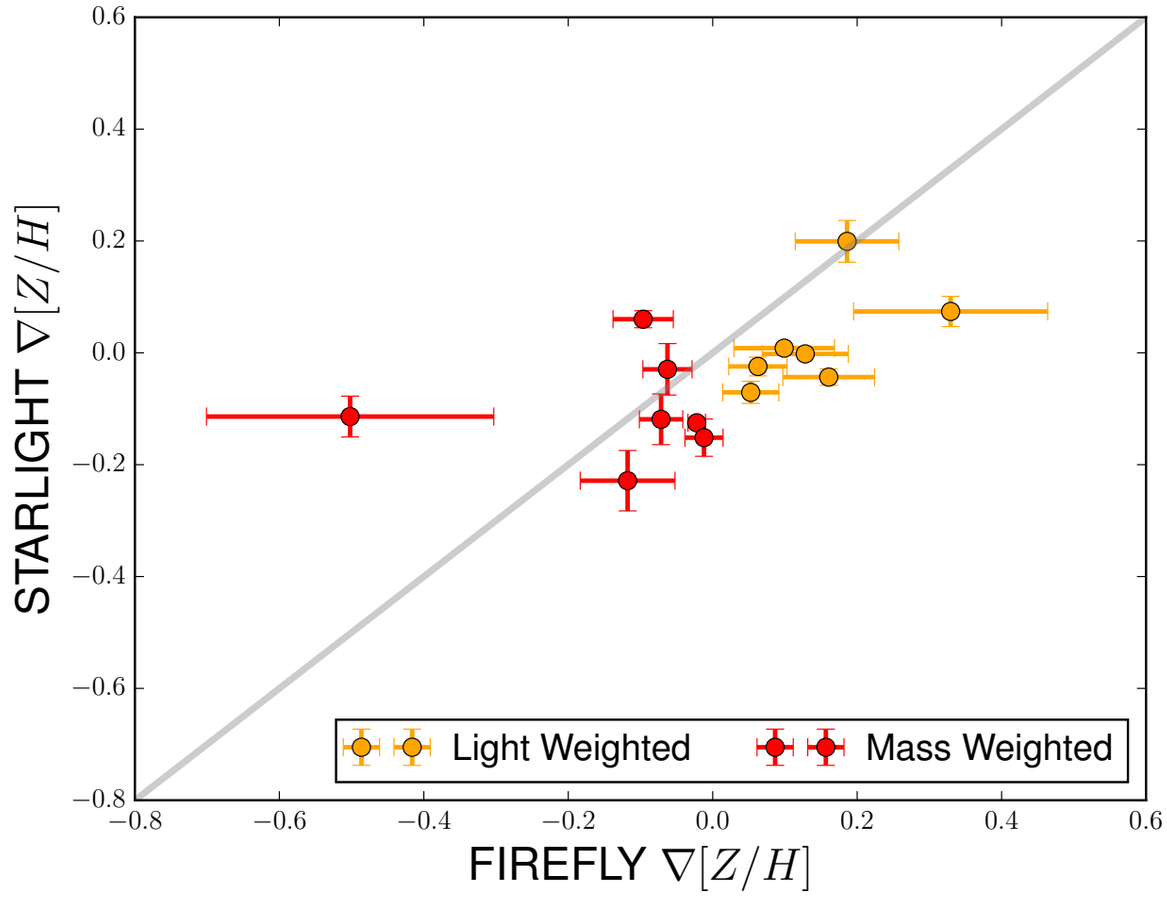


Comparison with STARLIGHT

Age gradient



Metallicity gradient

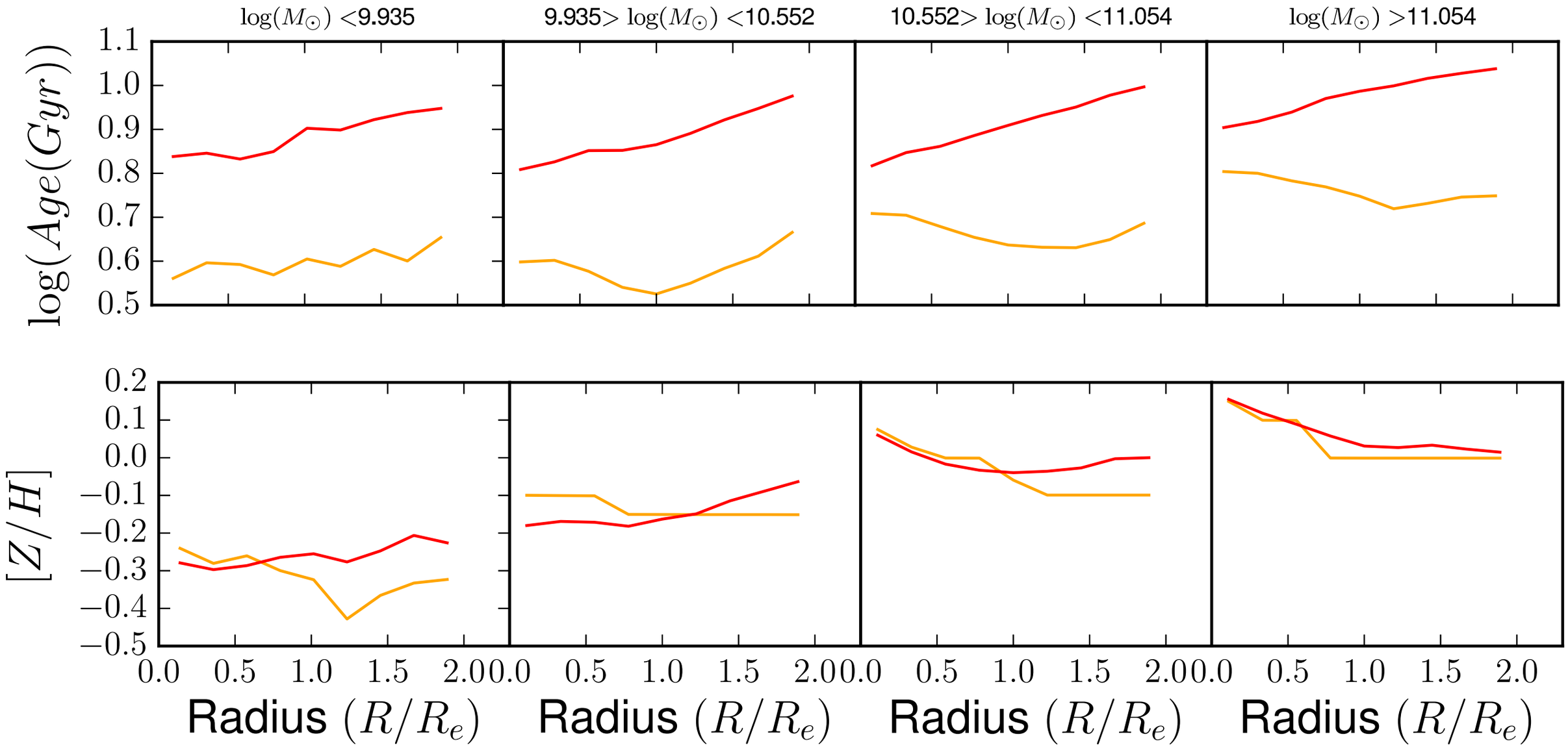


Reasonable agreement for light-averaged quantities, some discrepancy for mass-weighted.

See also Wilkinson et al 2015

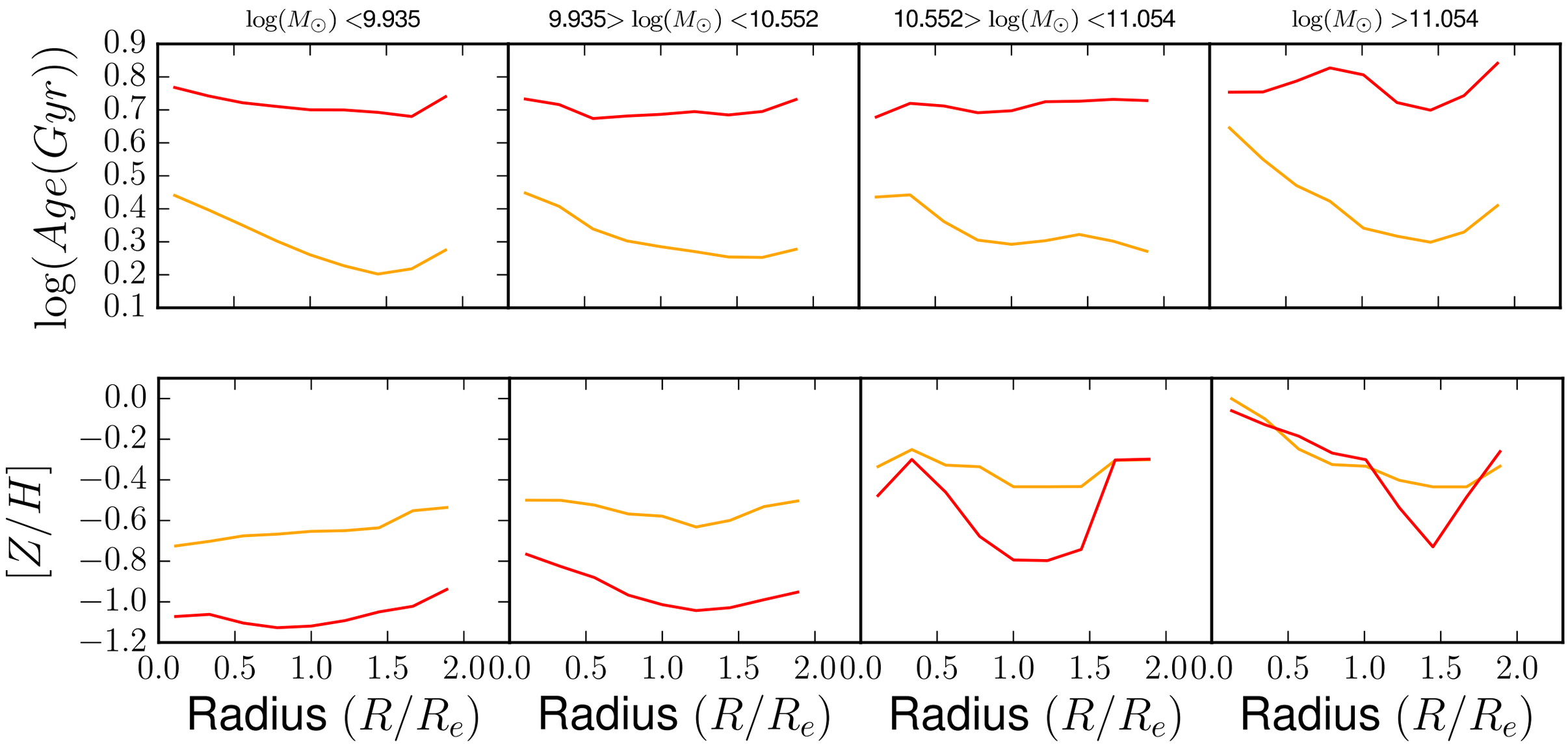
Stellar populations in early-types - light vs mass weight

- General downsizing and age/Z-mass relation recovered
- Outside-in formation, but light-weighted age gradient flat: rejuvenation in outskirts
- Metallicity gradient changes slope to negative in light weight: rejuvenation involves pristine gas in outskirts and internal, re-processed gas in centre

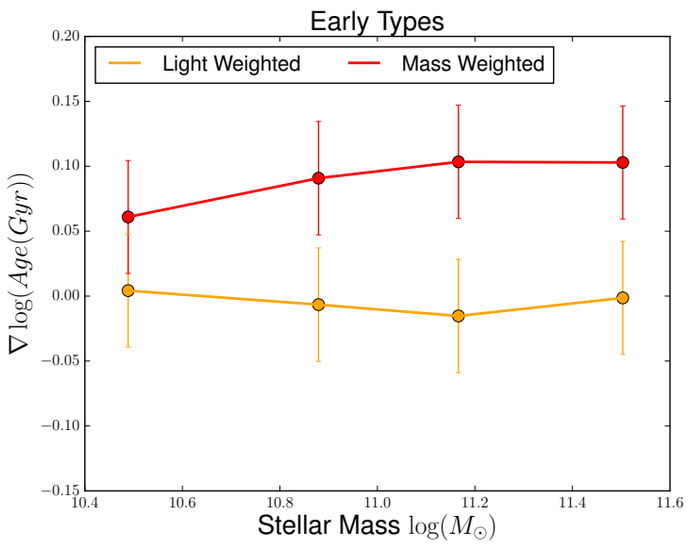


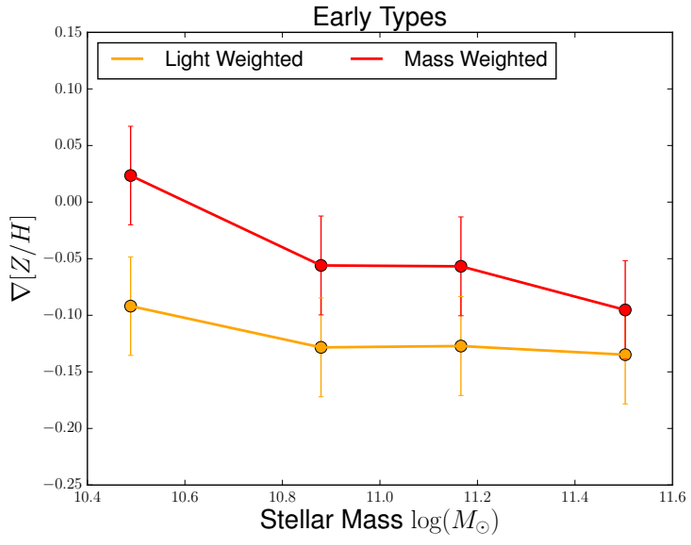
Stellar populations in late-types - light vs mass weight

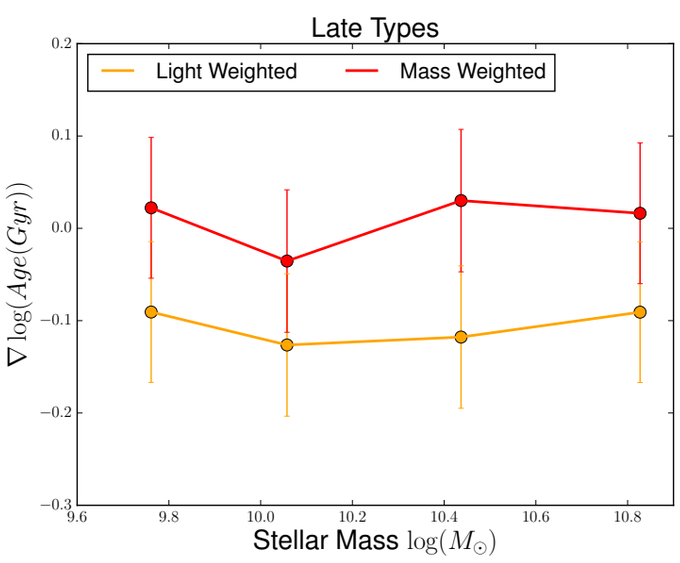
- Ages radially independent, but Inside-out formation in light-weight
- Higher metallicities in light-weight: residual star formation involves internal, re-processed gas at all radii (mostly lower mass galaxies)
- Residual star formation in the outskirts not dominated by accretion of pristine gas

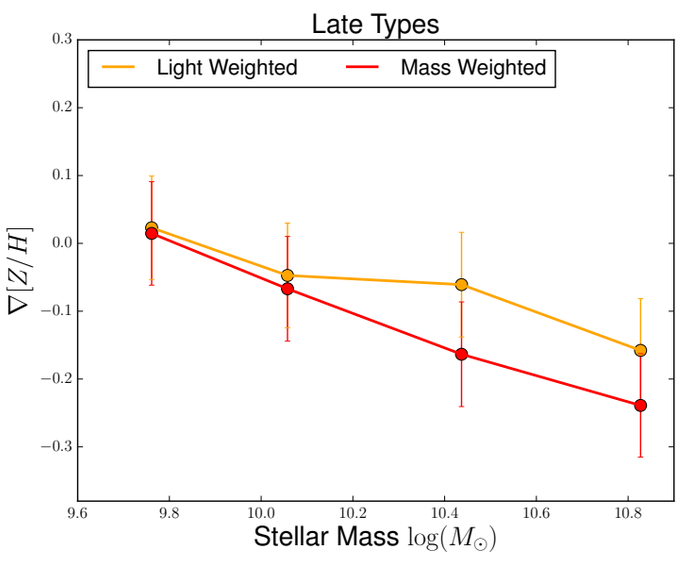


Gradient with mass and type - light vs mass





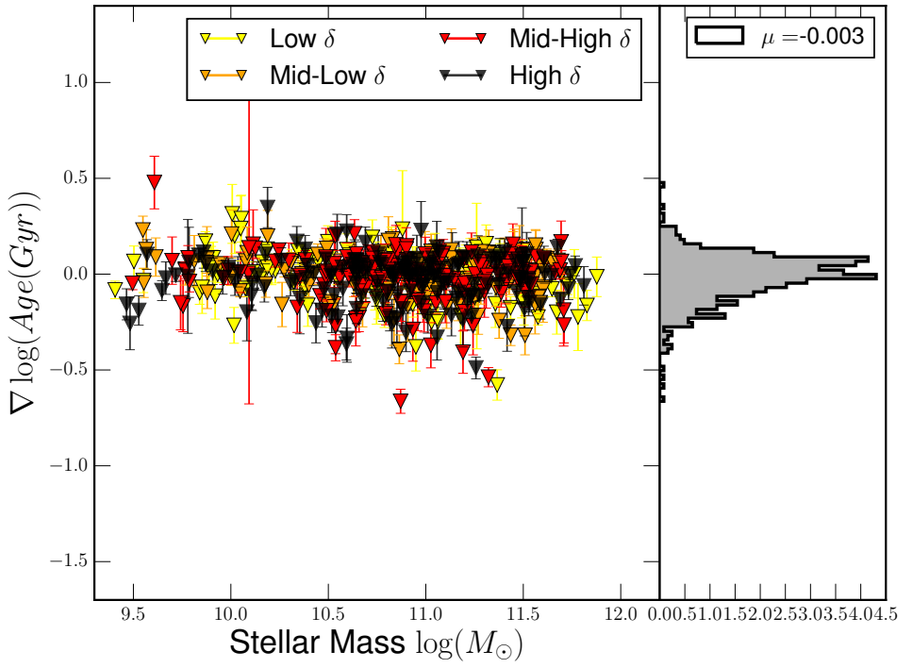


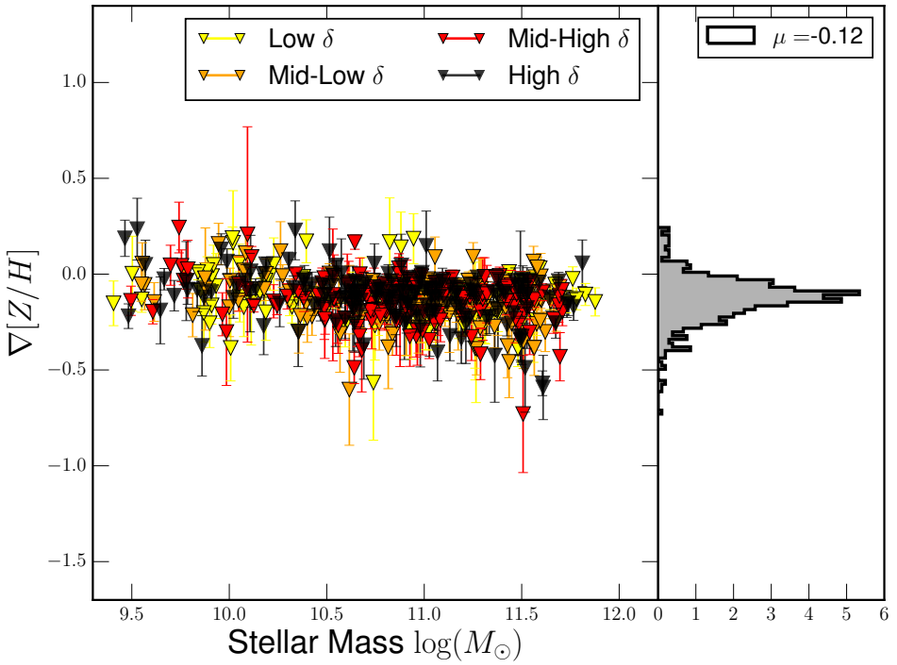


- Age gradient steeper in light-weight for both types (outside-in for early-types)
- No dependence on mass
- Light-weighted Z gradient steeper for early-types (pristine gas in outskirts)
- Light-weighed Z gradient same for late-types (radially independent processing of internal gas)
- Z gradient mass dependent for both types (more so for late-types: bulge-disc transition?)

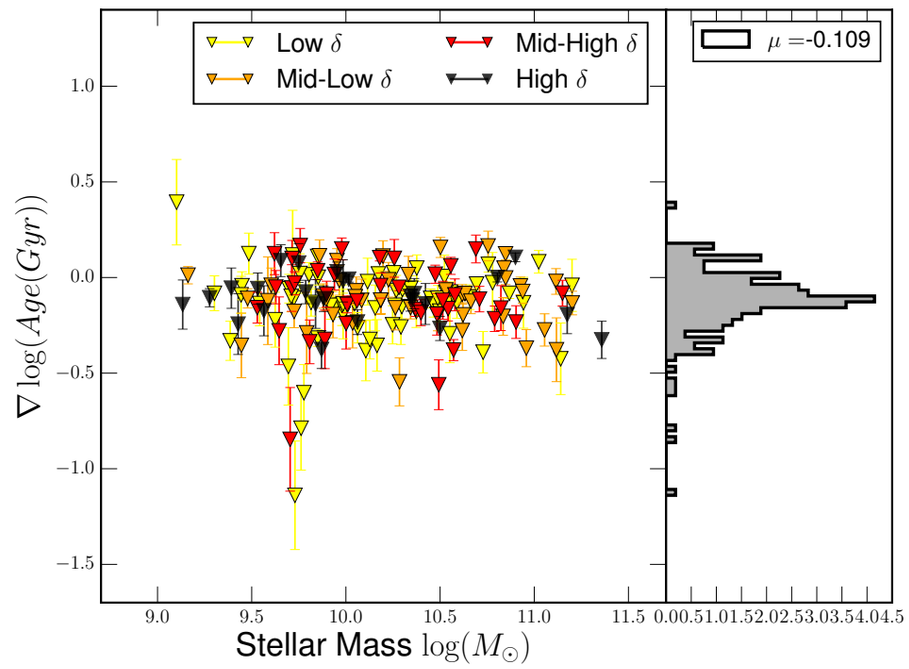
Dependence on environment

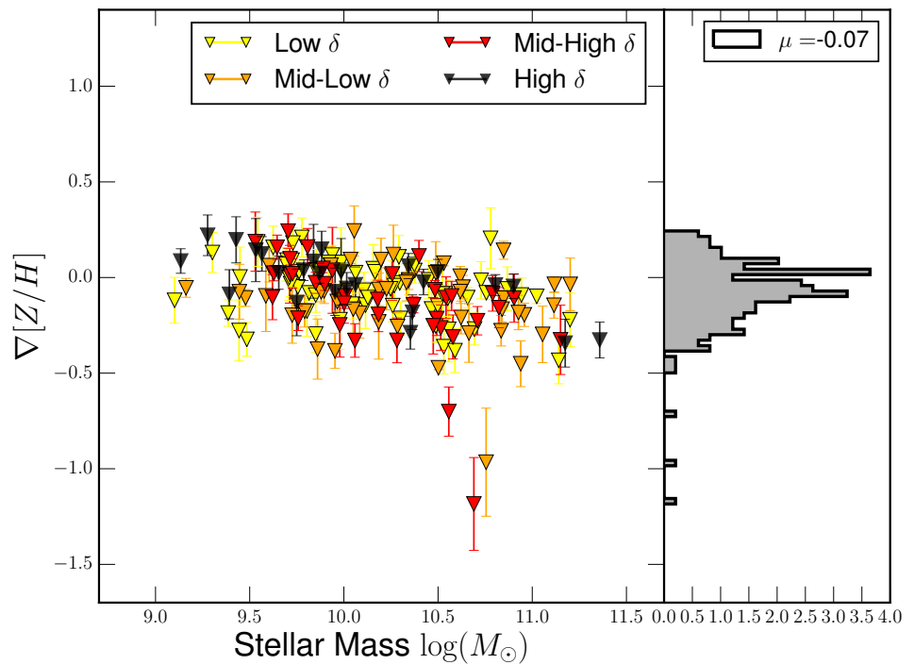
Early Types



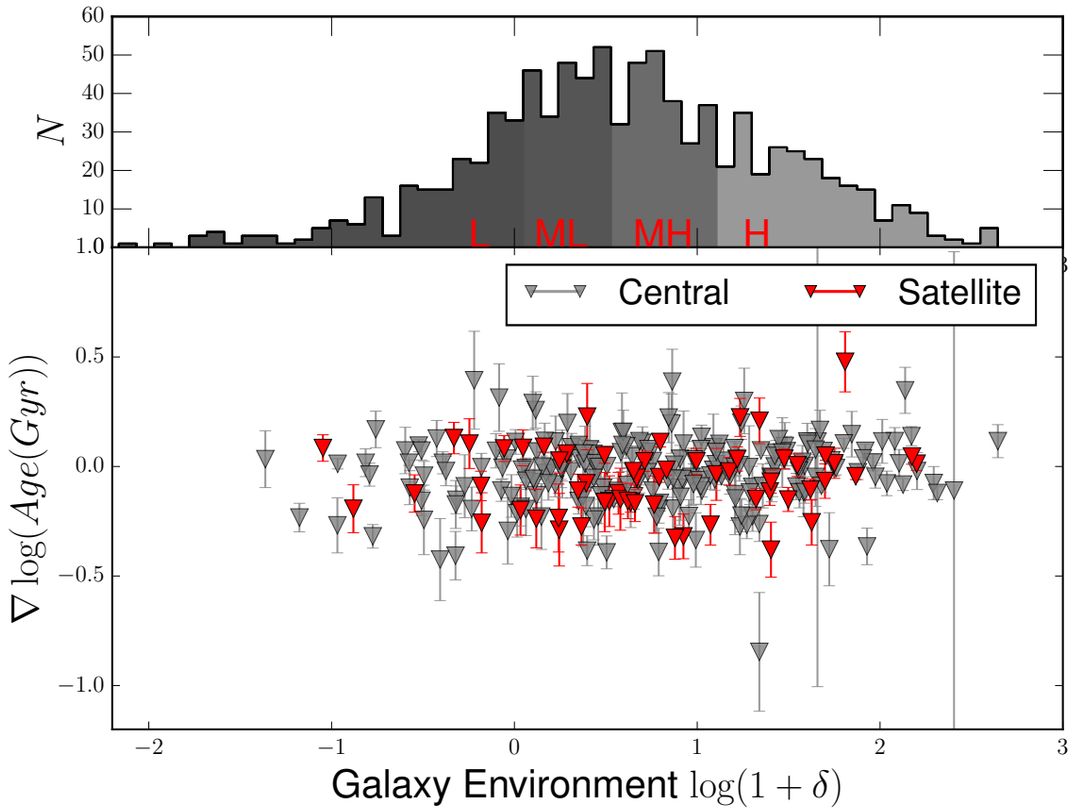


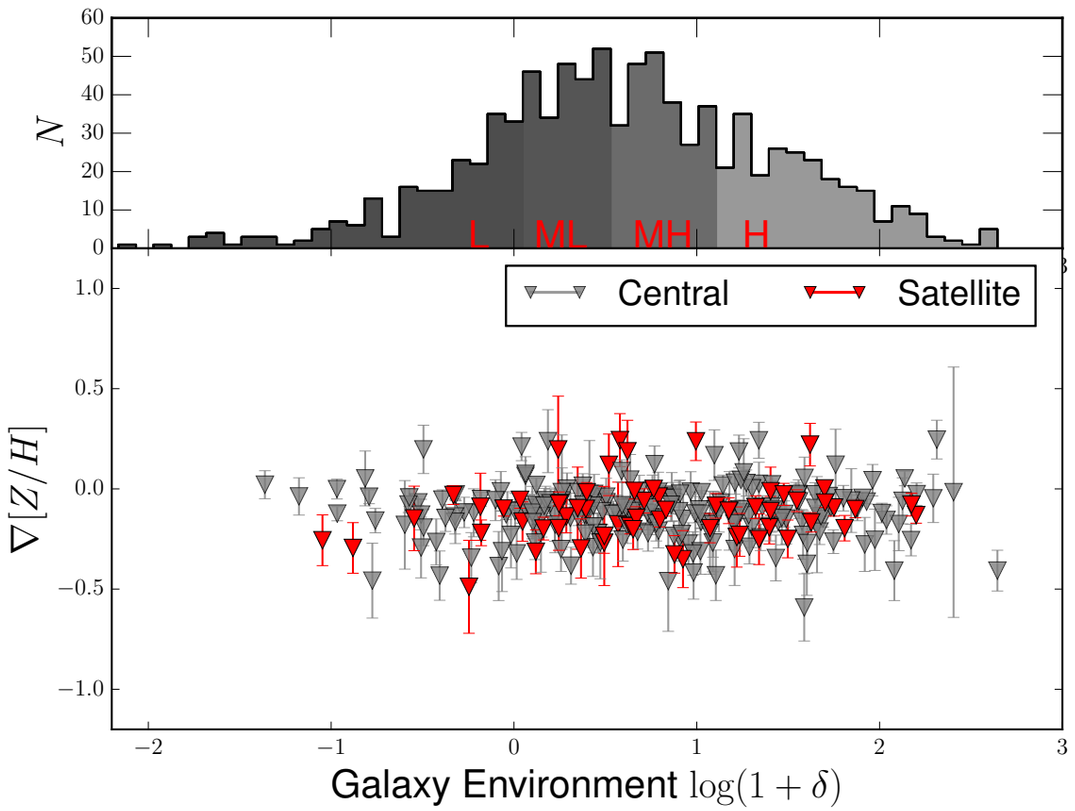
Late Types





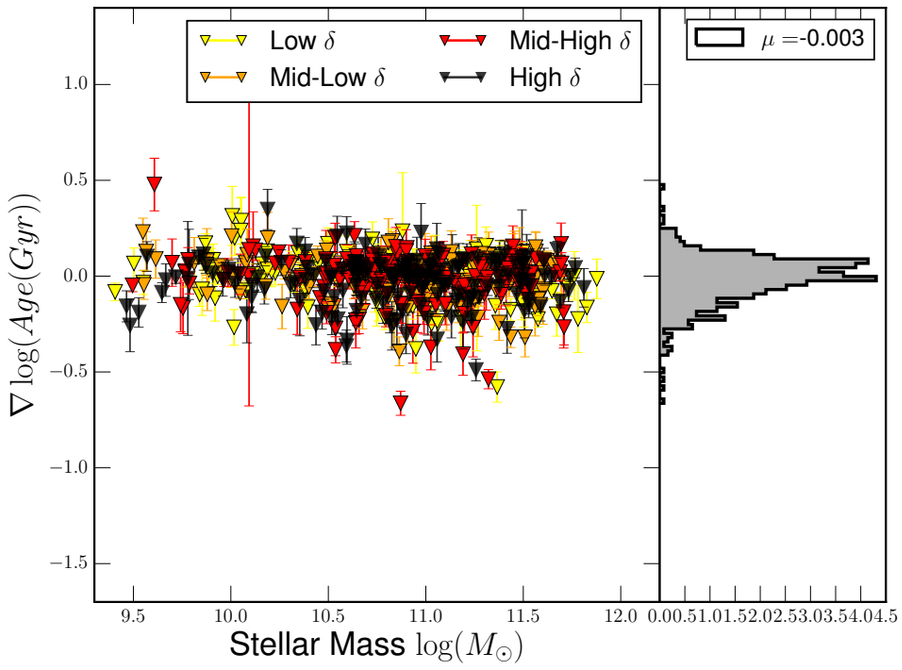
Central vs satellite

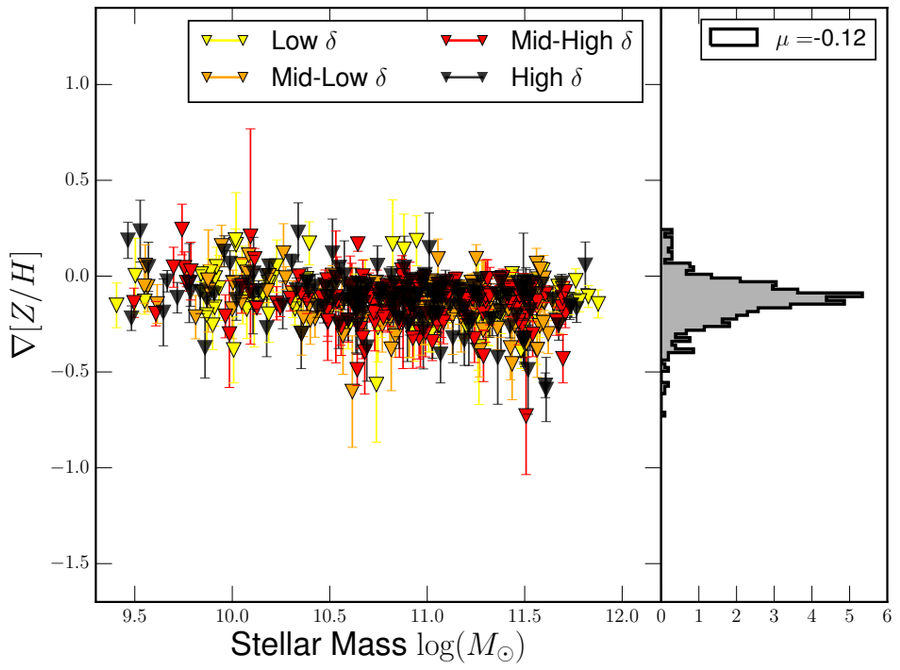




Comparison with simulations

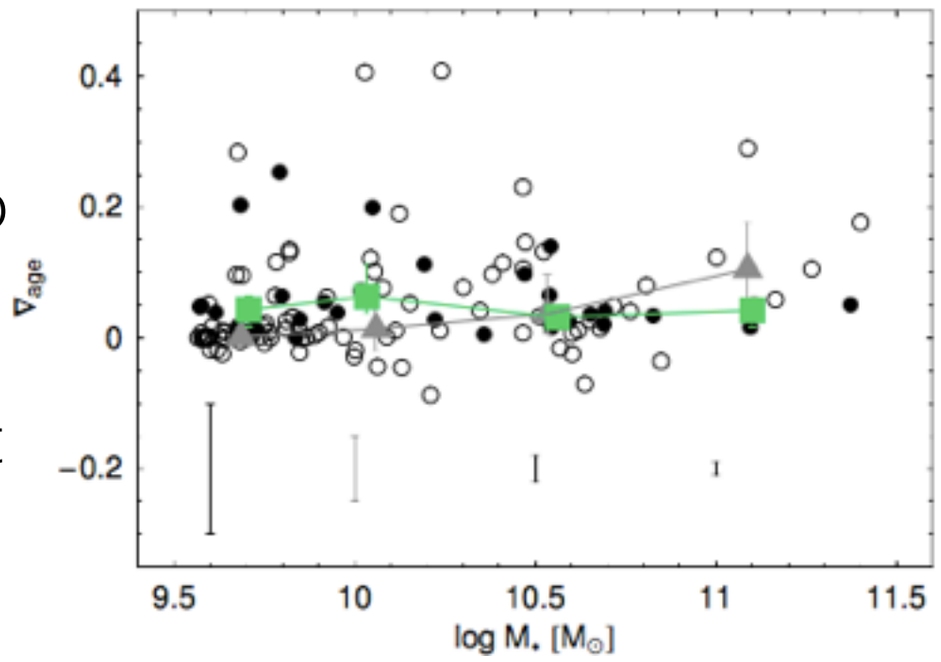
MaNGA

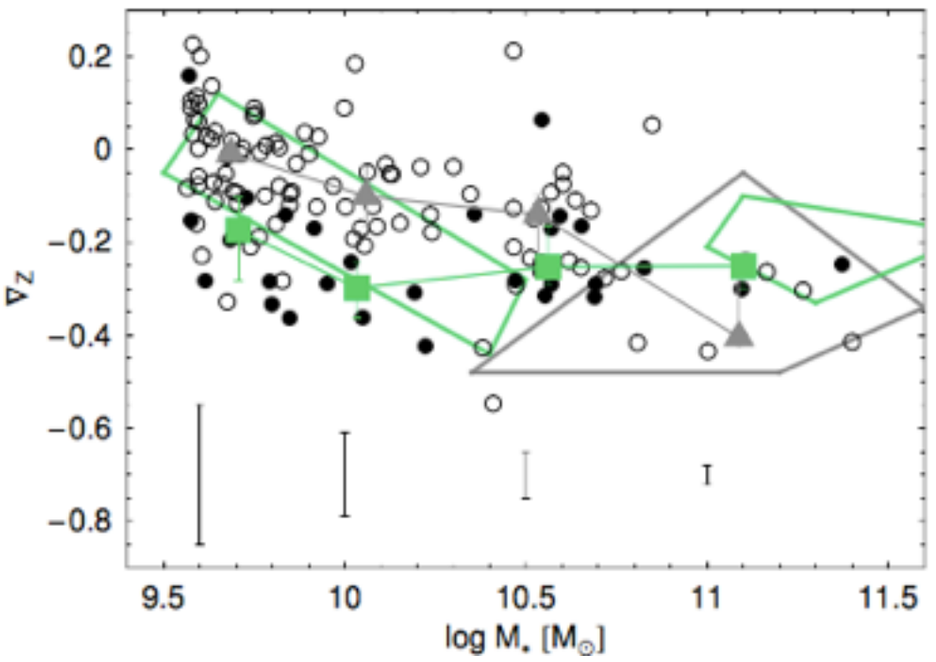




Simulations

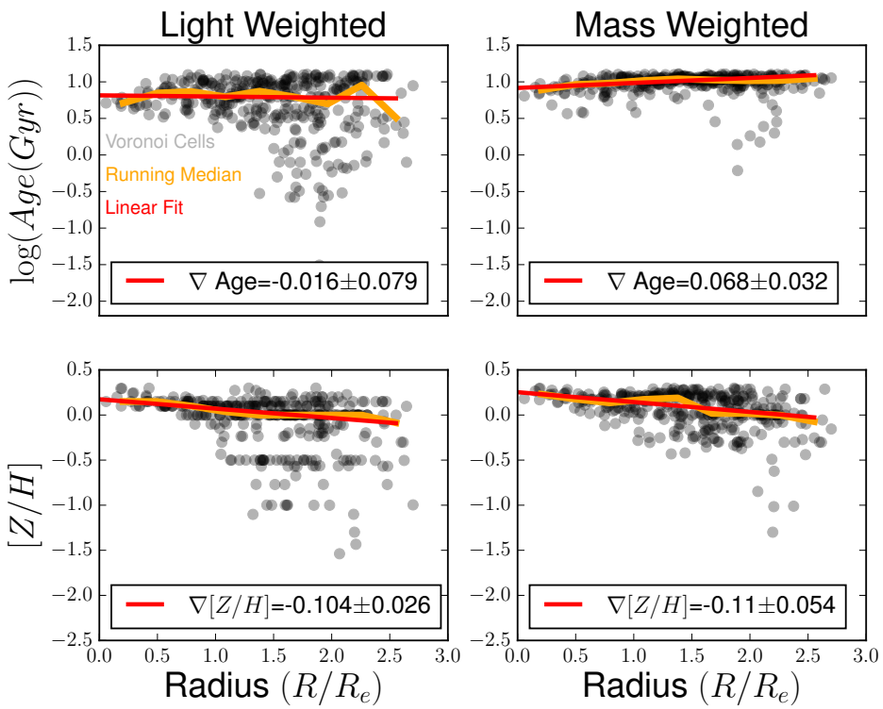
N body + hydro simulation (Romero et al 2006; Tortora et al 2011)





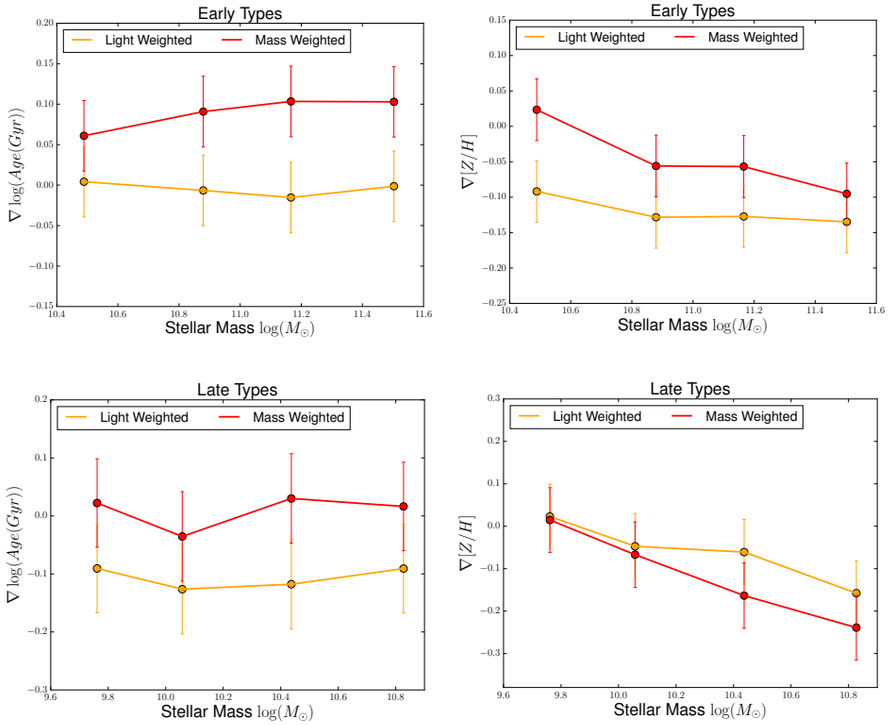
Summary

Stellar population gradients

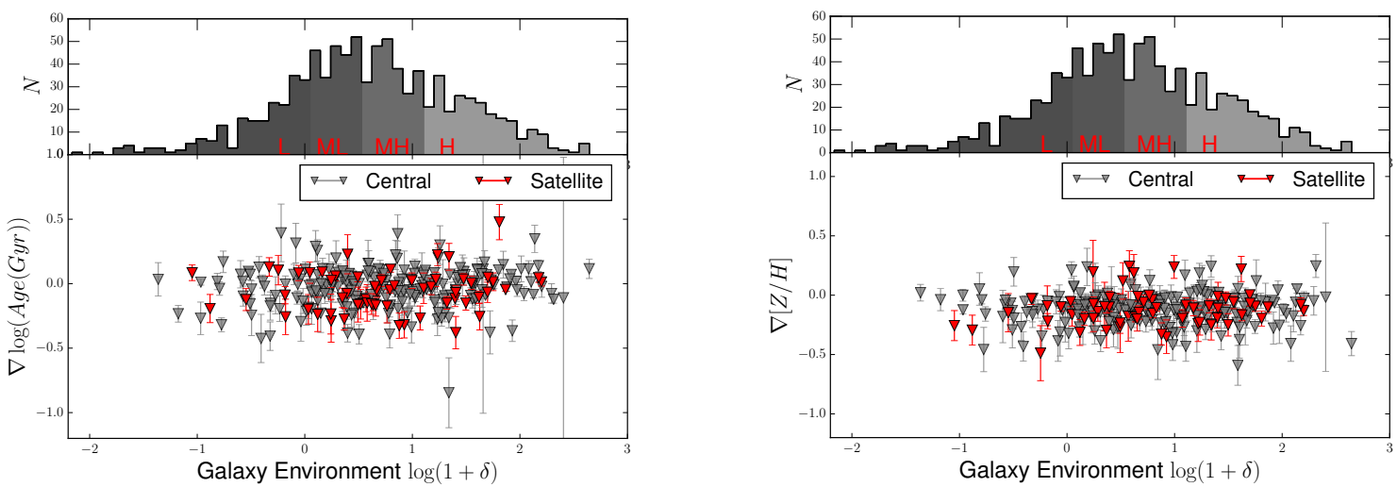


Mass vs light-weight

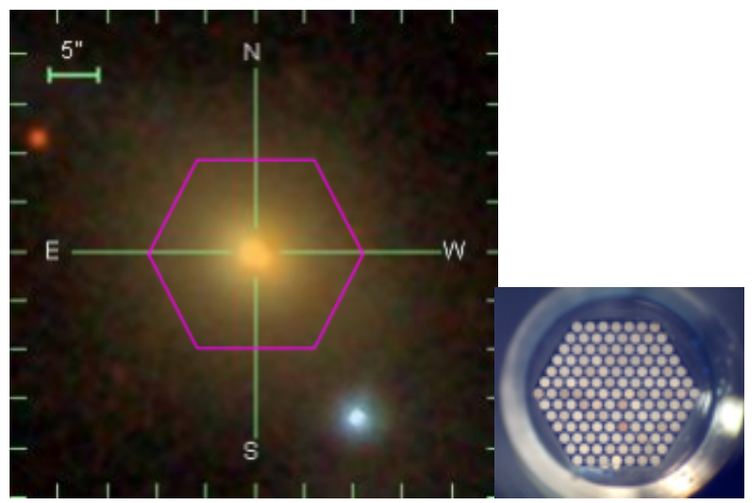
- Outside-in formation in early-types
- Rejuvenation from pristine gas in the outskirts
- Metallicity gradient mass dependent
- Residual star formation in late-types from internal gas



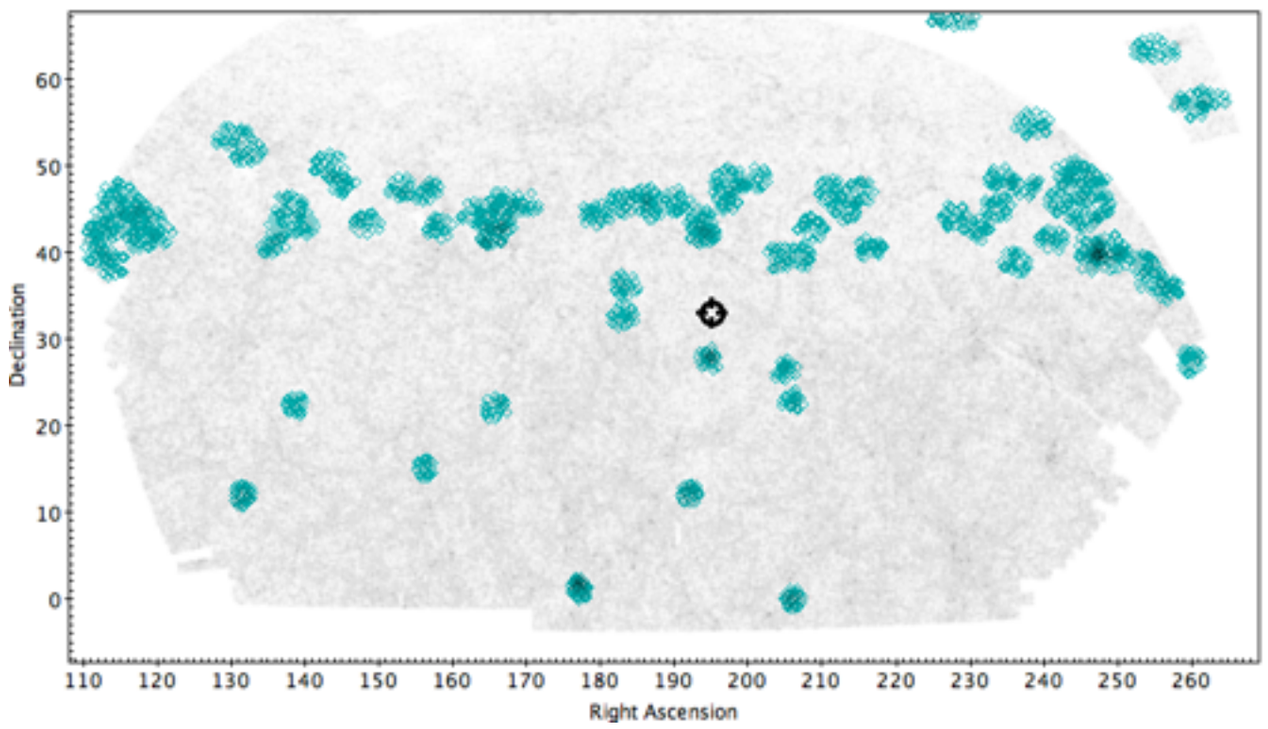
No dependence on environment

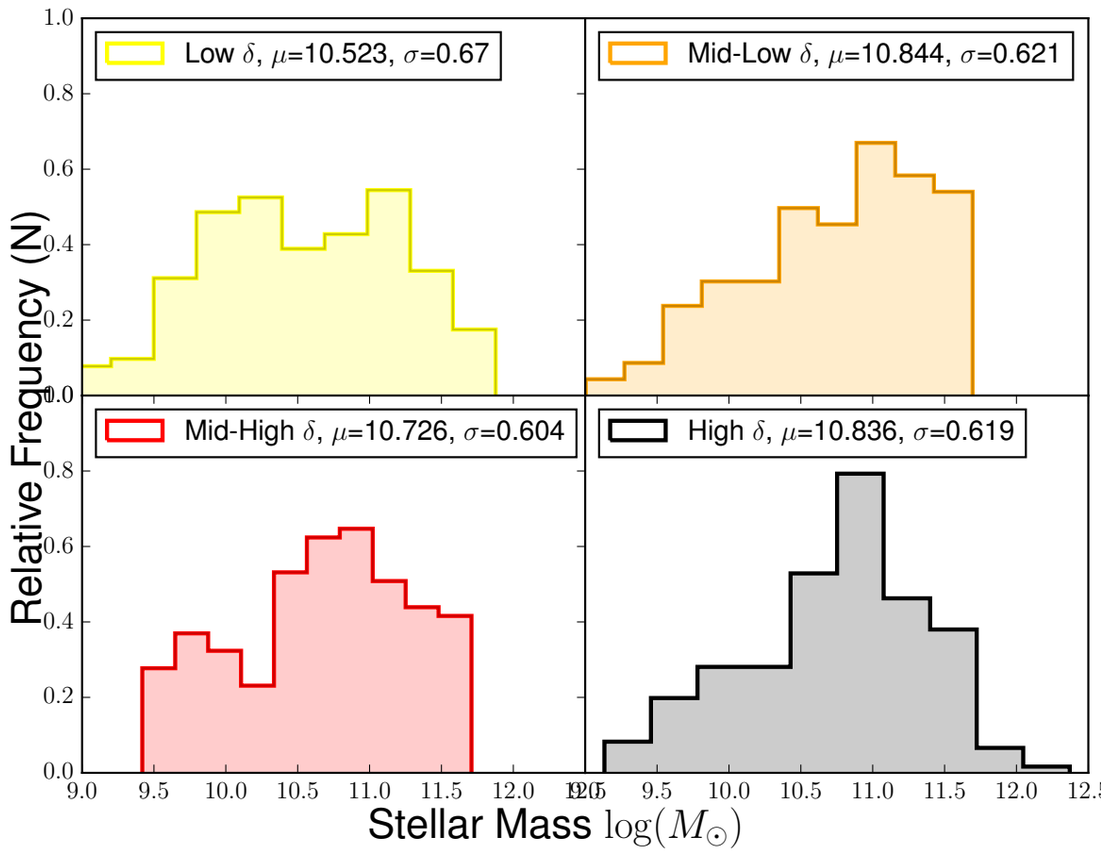


MaNGA IFU survey



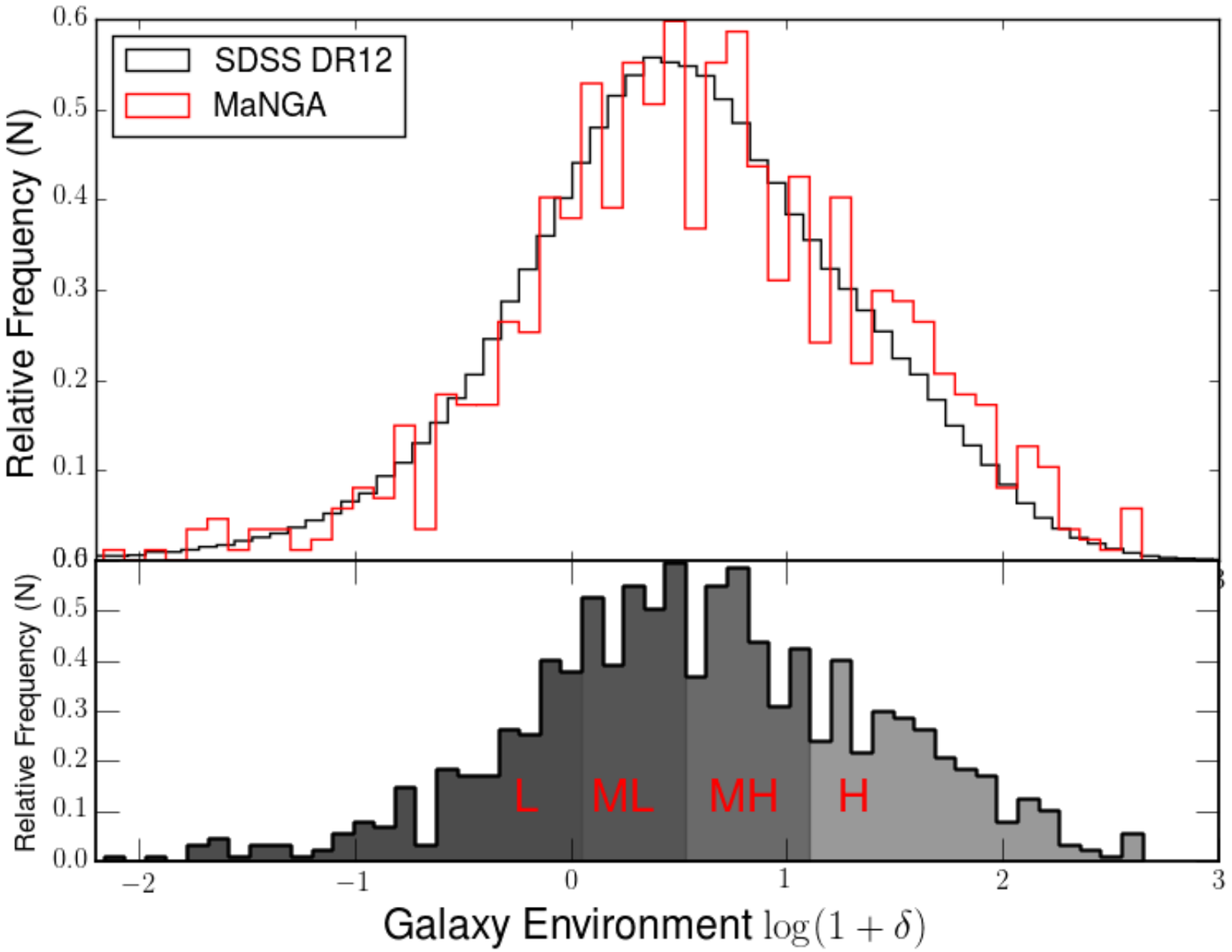
Galaxy Environment





- Some galaxies too close to SDSS footprint edge to calculate environment
- No bias in mass distribution with environment

Galaxy environment

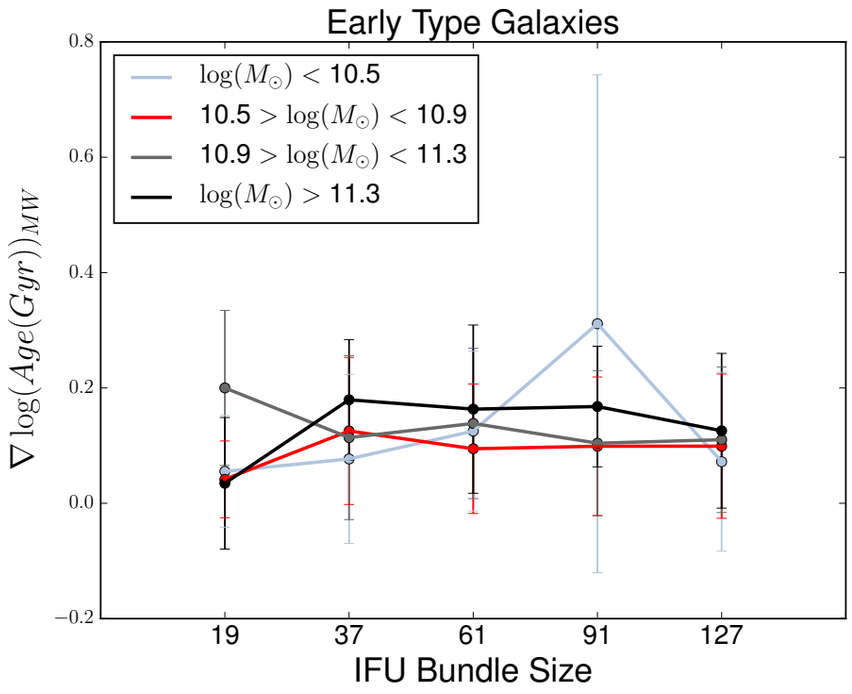


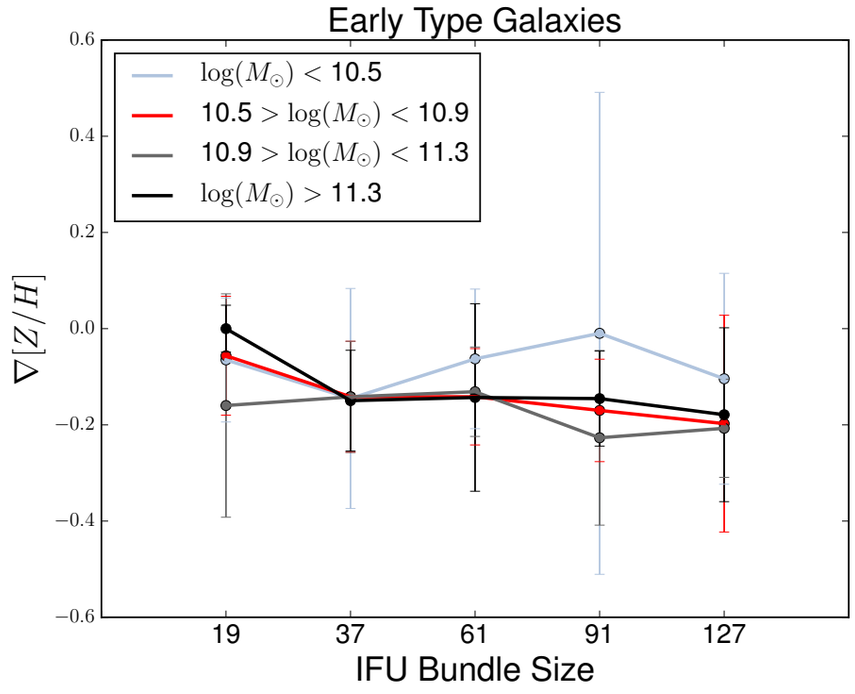
- Quantify ‘environment’ as local over-density (delta) using Nth nearest neighbour method

- Use quartiles of environment calculation to bin galaxies into low, mid-low, mid-high, and high density environments.

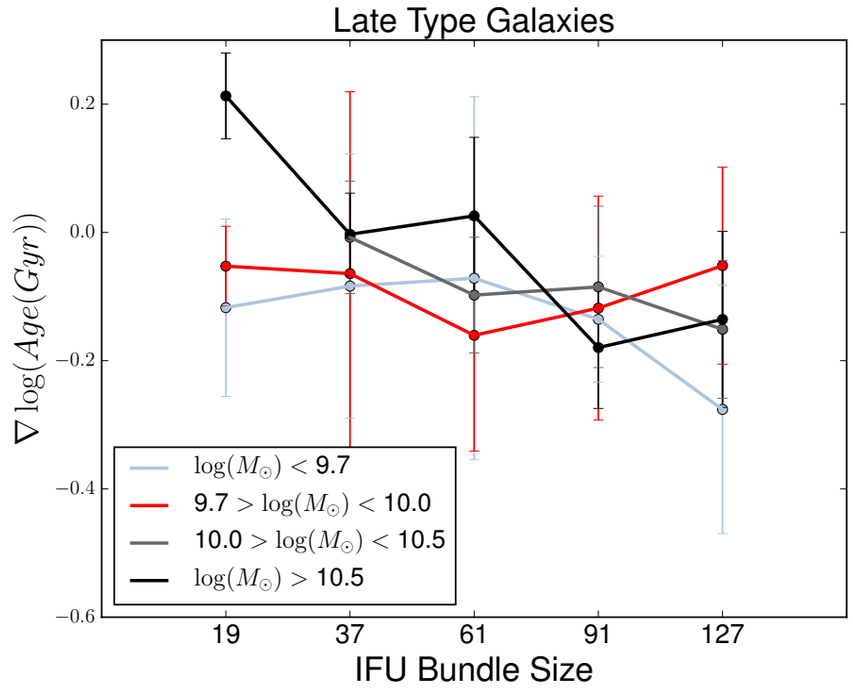
Beam Smearing

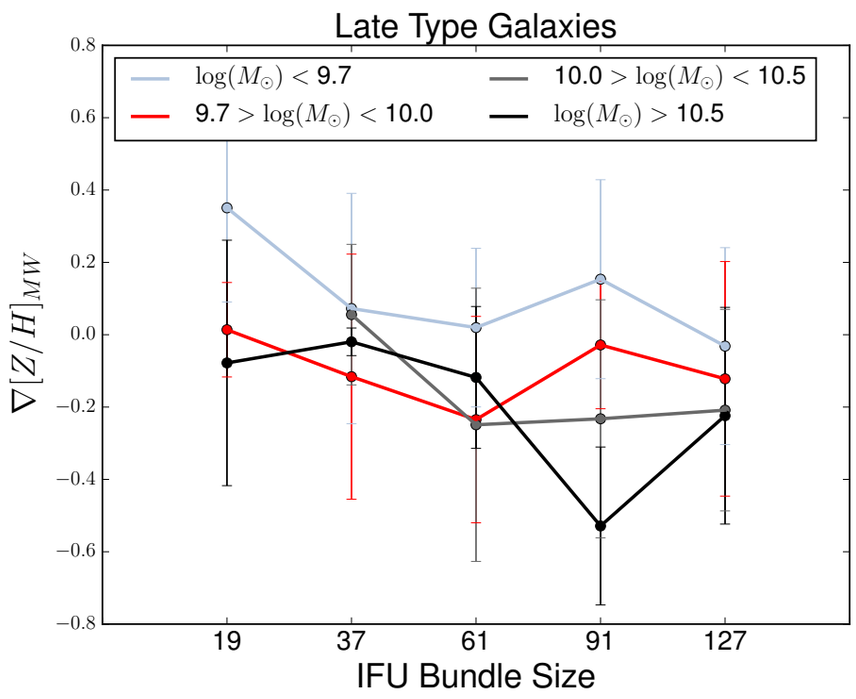
Early Types





Late Types





González Delgado et al 2015