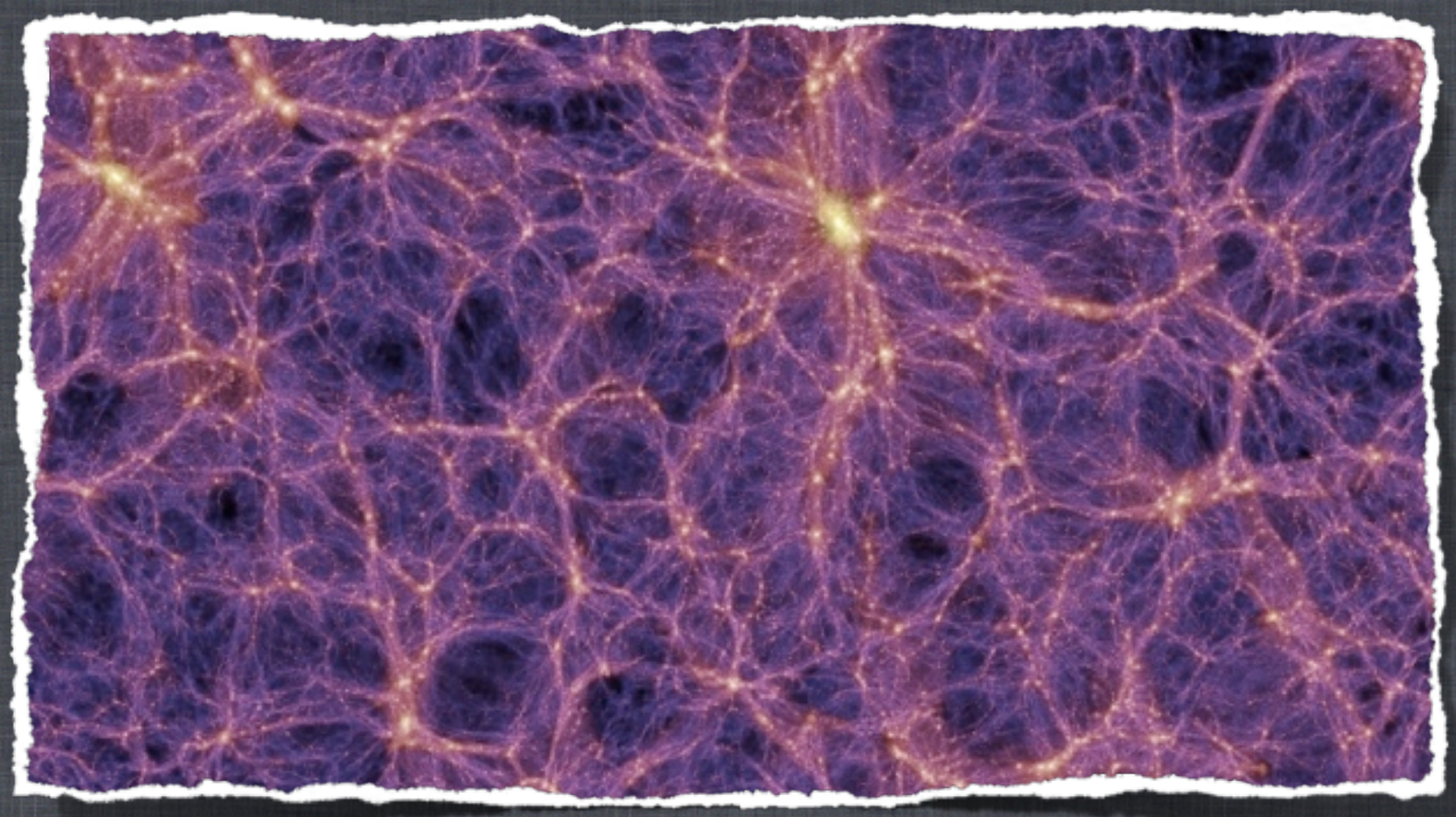
The role of environment as traced by semi-analytic models and KMOS observations



Matteo Fossati (USM/MPE)
& D. Wilman, T. Mendel, A. Beifiori, G. De Lucia,
M. Hirschmann, P. Monaco, F. Fontanot & KMOS^{3D} team

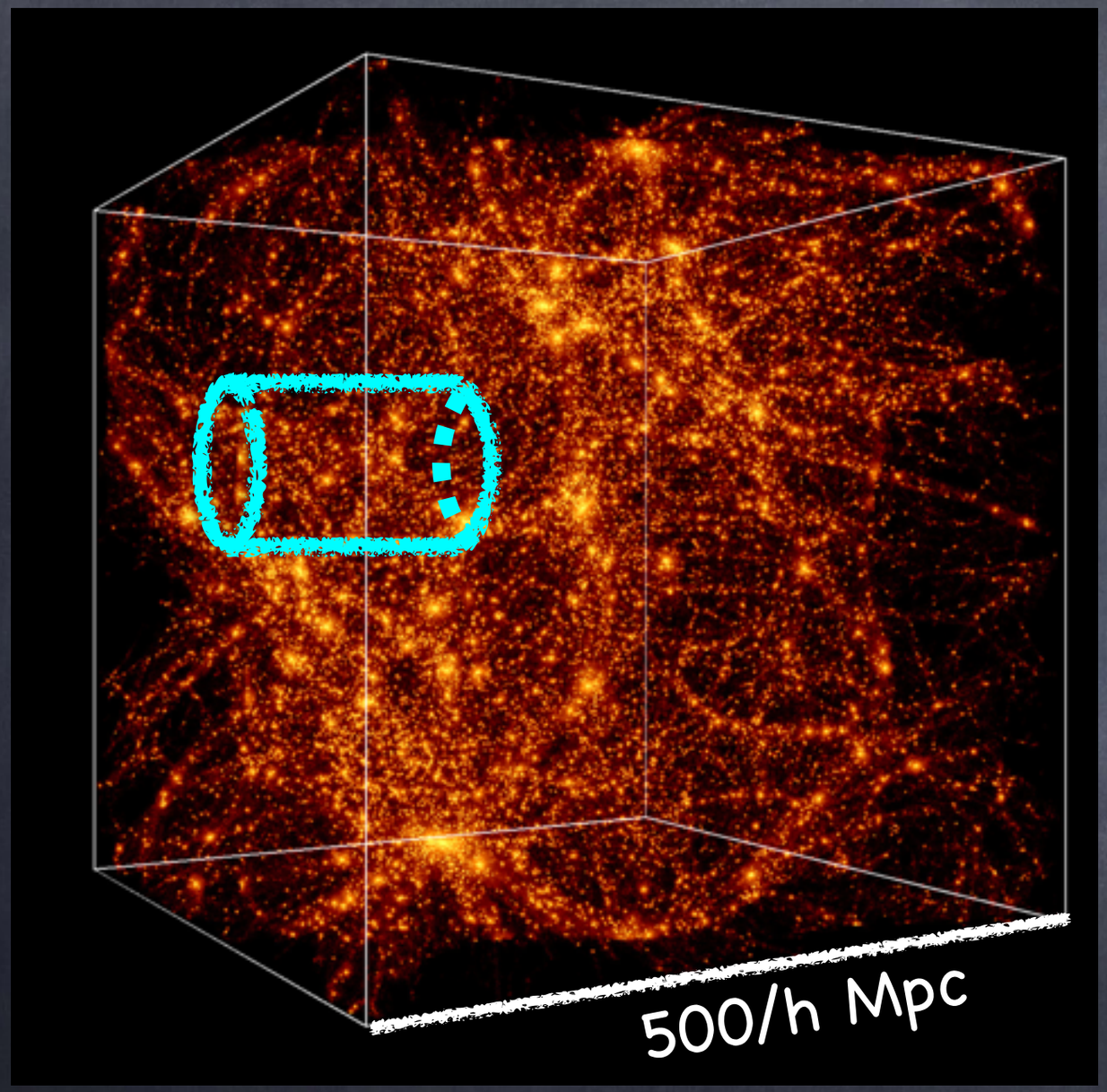
EGEE - Bologna - 15th September 2014

Motivation

- Quantify the evolving environment of galaxies
  - Tools and methods to define and characterise environment at high-z (but not only)
  - General methods that can be applied to a variety of datasets.
- Results validation by means of scientifically interesting test on physical quantities in the models

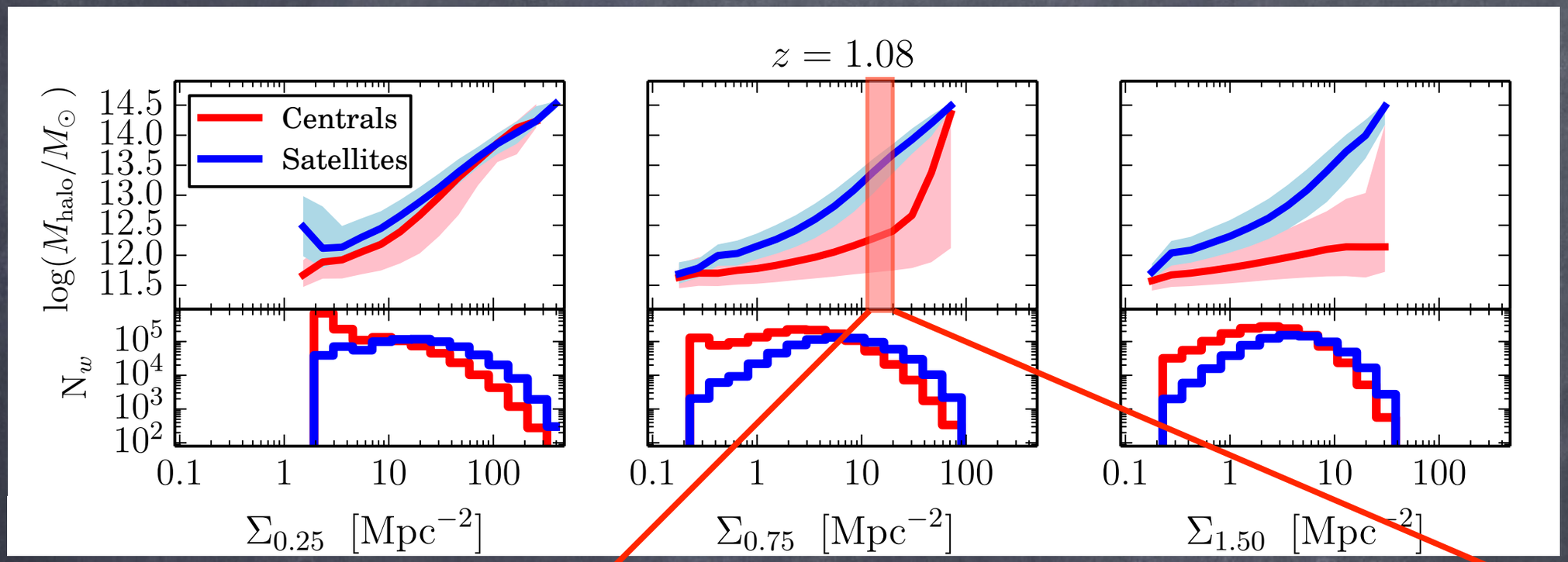
M. Fossati et al. submitted

The sample and density measurements

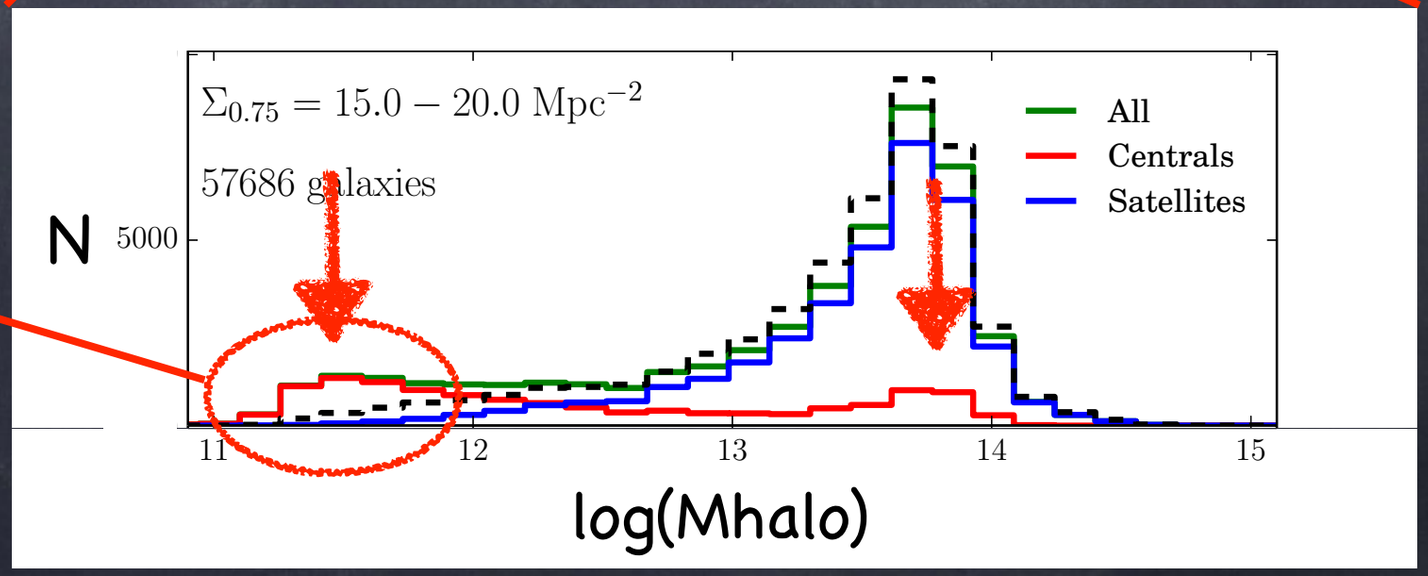


- SAM from Guo et al. 2013 (MR7 simulation, WMAP7 initial parameters)
- Snapshots at z= 1.08, 2.07
- Simple stellar mass selection
  $M^* > 10^{9.5}\ M_{sun}$
- Three samples to test the effects of redshift accuracy.
- Density in cylinders covering intra-halo and super-halo scales 0.25 and 1.50 Mpc
- Velocity cut +/- 1500 Km/s (7000 km/s for Photo-z)
- Stellar mass rank in the same set of cylinders

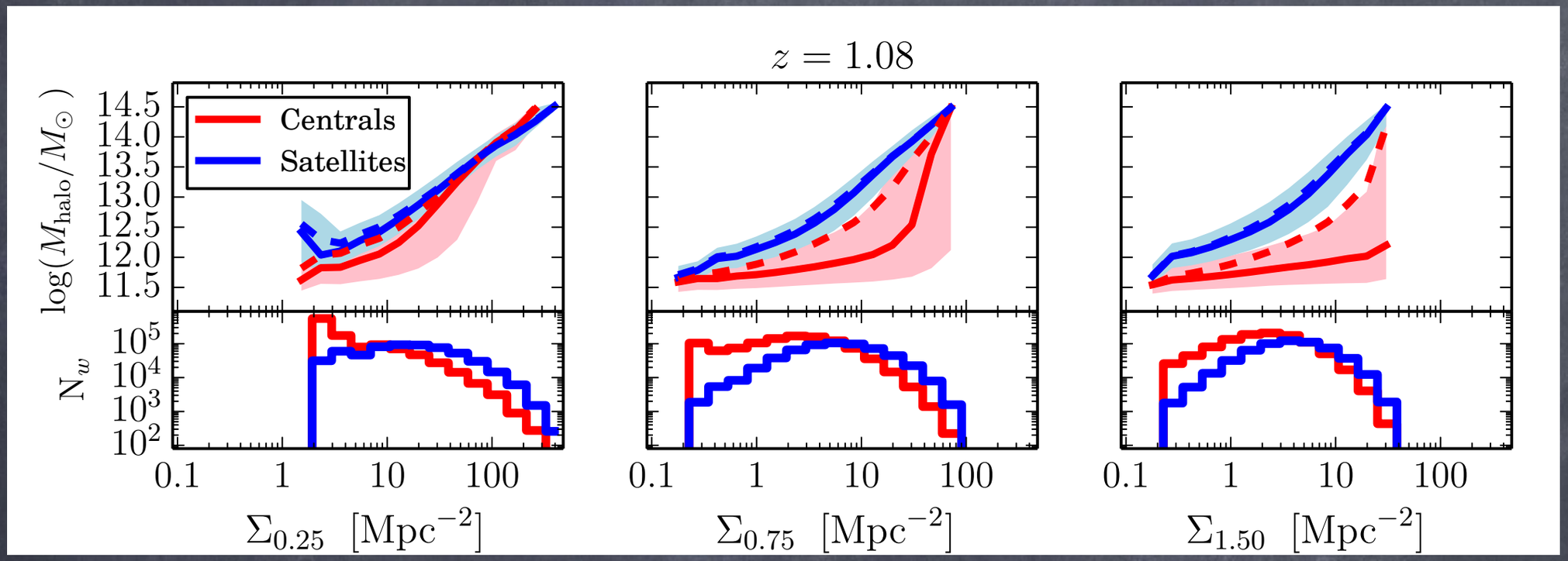
Density - Halo mass correlation



Infalling or "backsplash" population (see M.Gray - M.Hirschmann talks and Bahe+13, Wetzel+13)

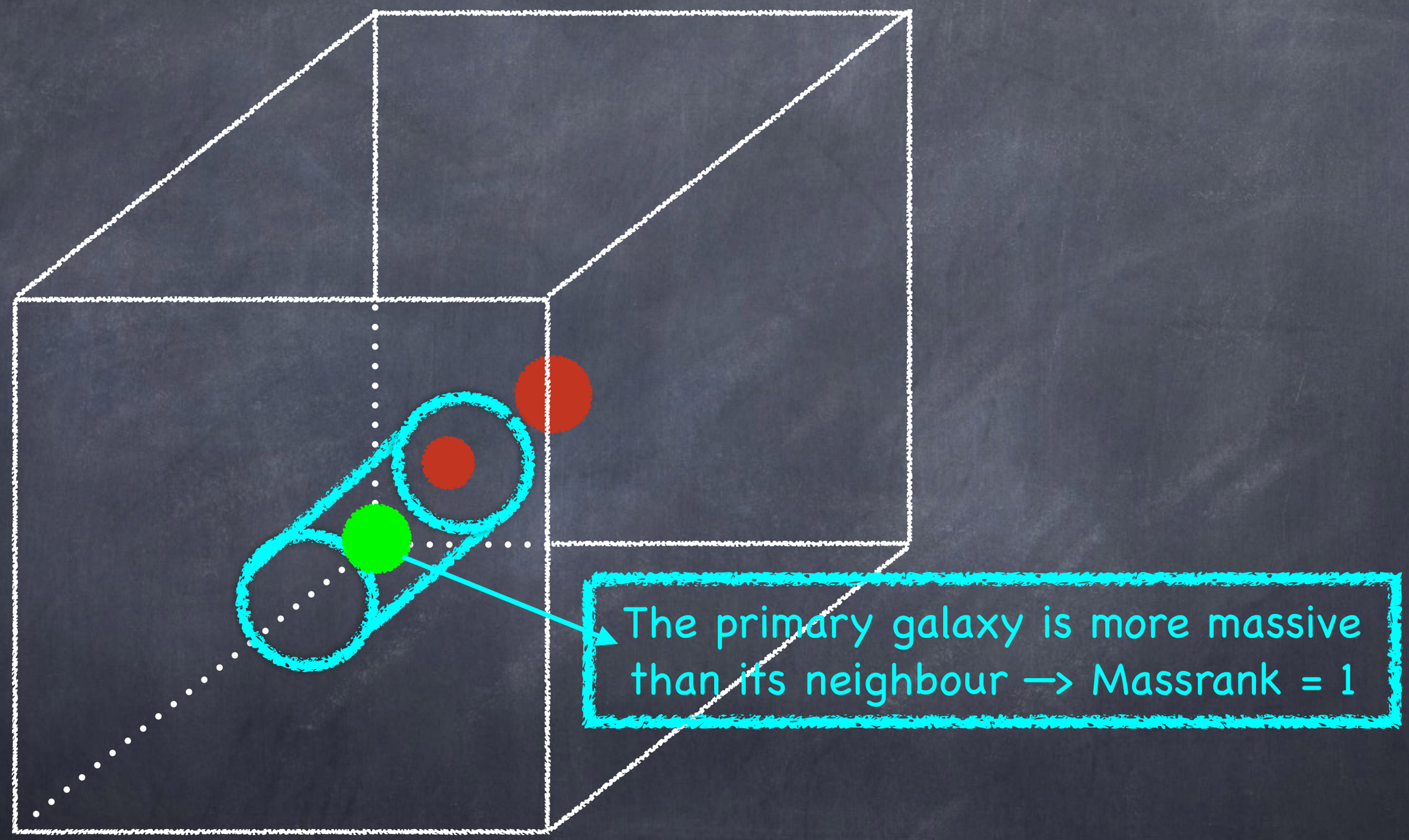


Density - Halo mass correlation

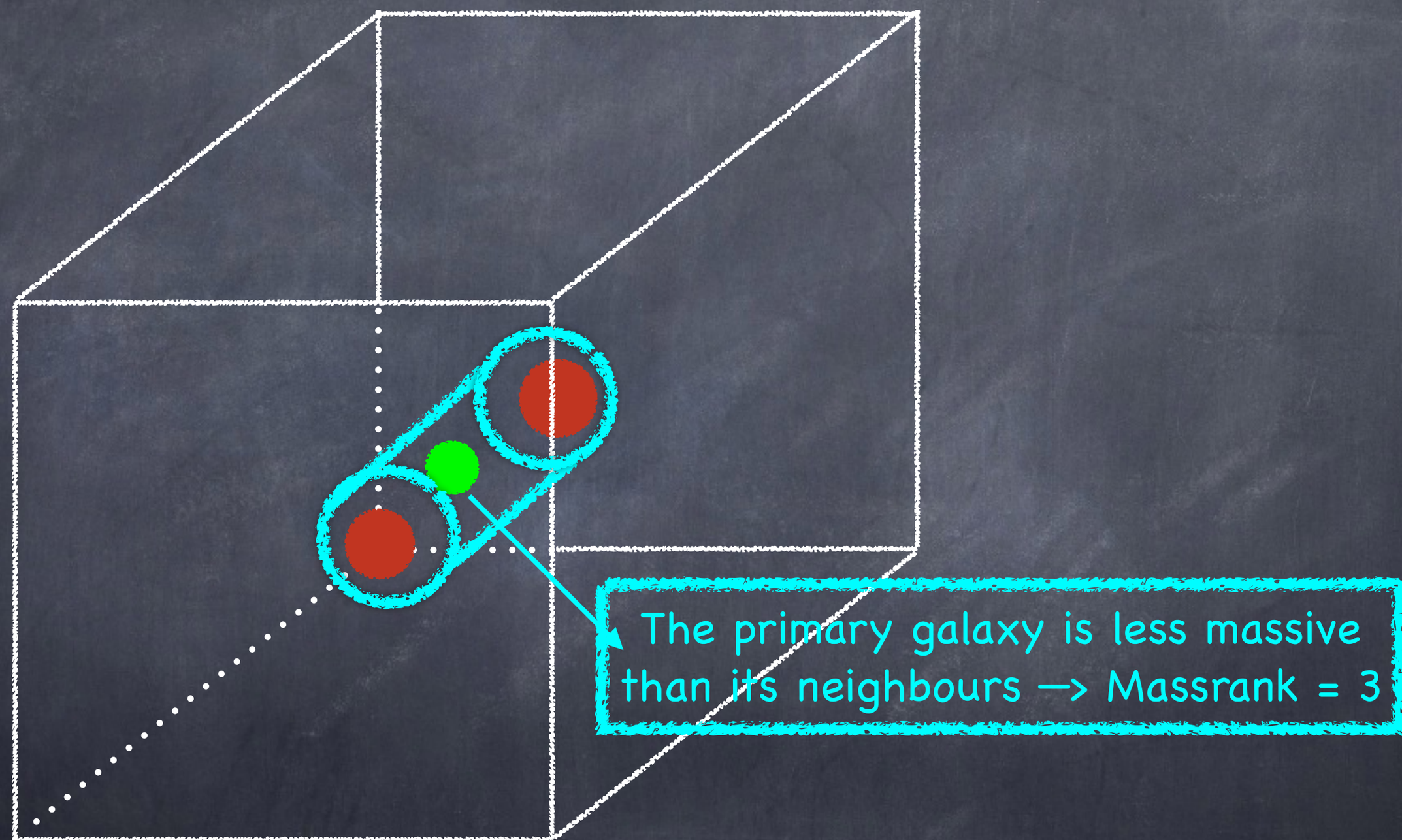


- The density simply traces the mass of the most massive halo in 1 Mpc

Centrals/Satellites identification

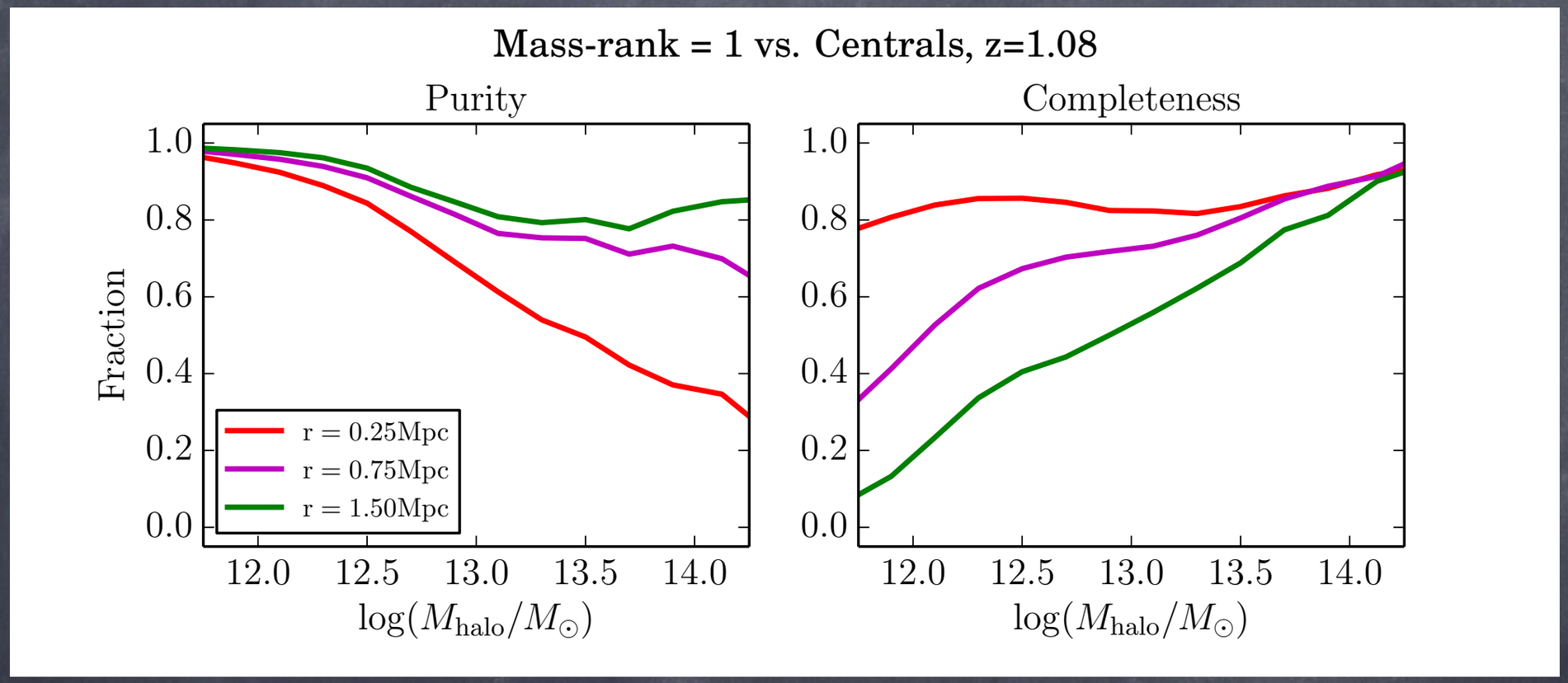


Centrals/Satellites identification



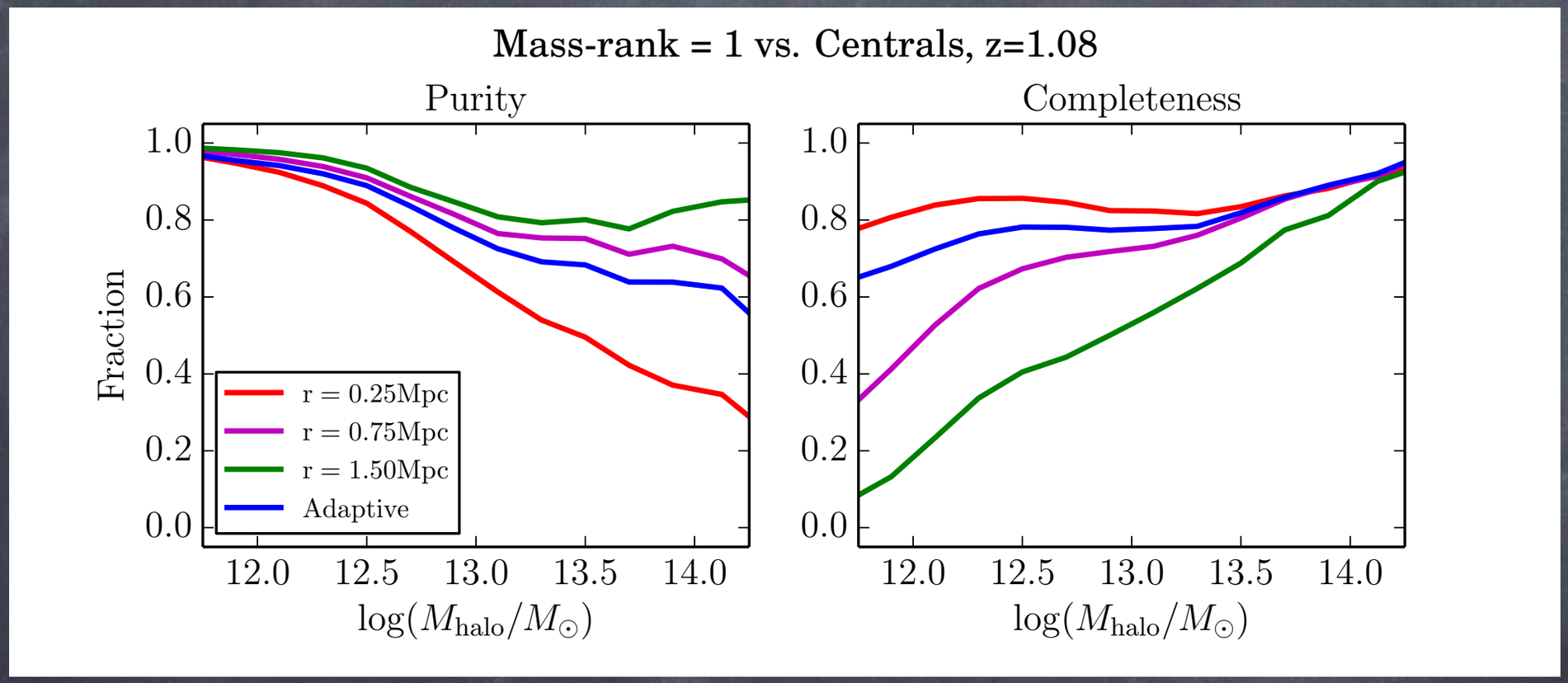
Centrals/Satellites identification

We make use of the stellar mass rank in several apertures to identify central and satellite galaxies.



Centrals/Satellites identification

We make use of the stellar mass rank in several apertures to identify central and satellite galaxies.



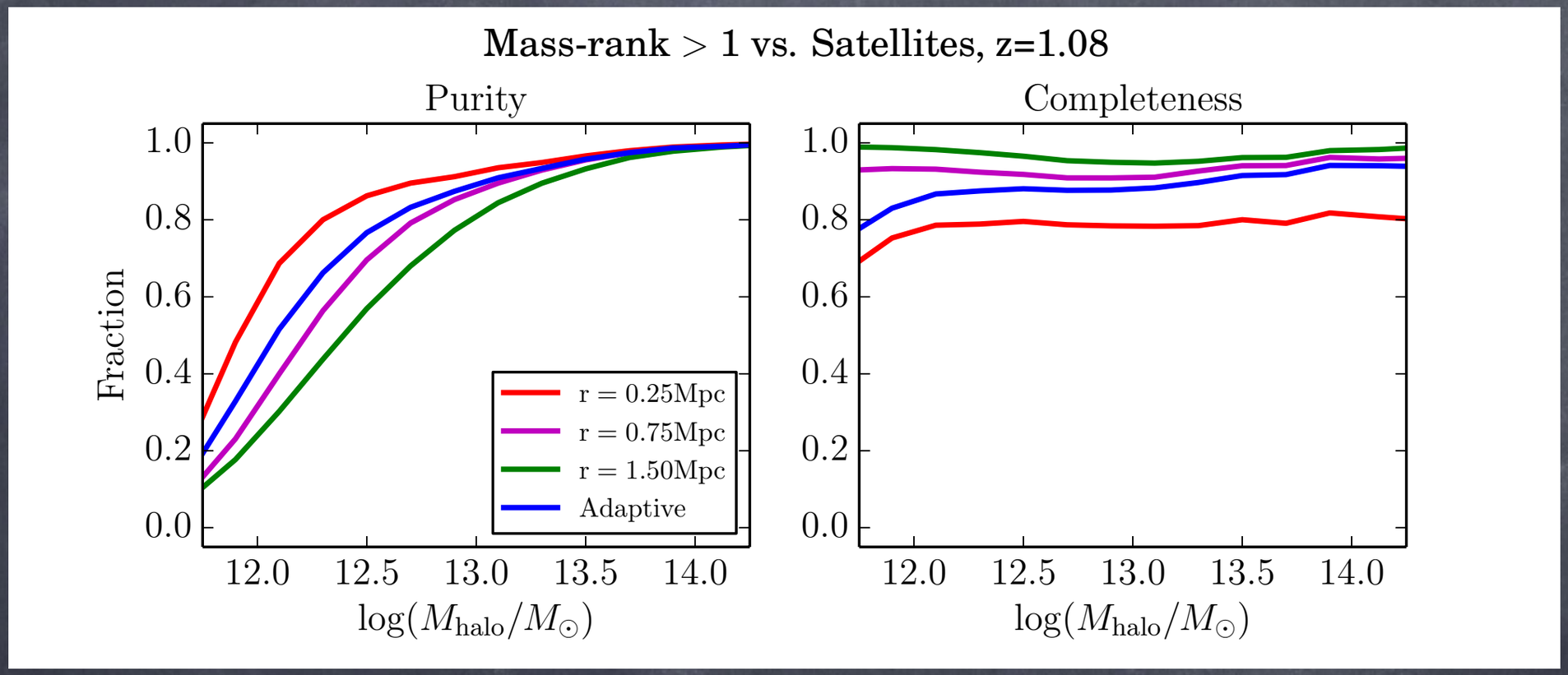
- Adaptive aperture based on the good correlation between M* and M_{halo} for centrals.

$$r = \min(0.75, \mathrm{n} \times 10^{(\alpha \log \mathrm{M}_* + \beta)})\ [\mathrm{Mpc}]$$

α and β are the parameters describing the M_{halo} - r_{vir} correlation in the models. n = 3 is required to avoid very small apertures

Centrals/Satellites identification

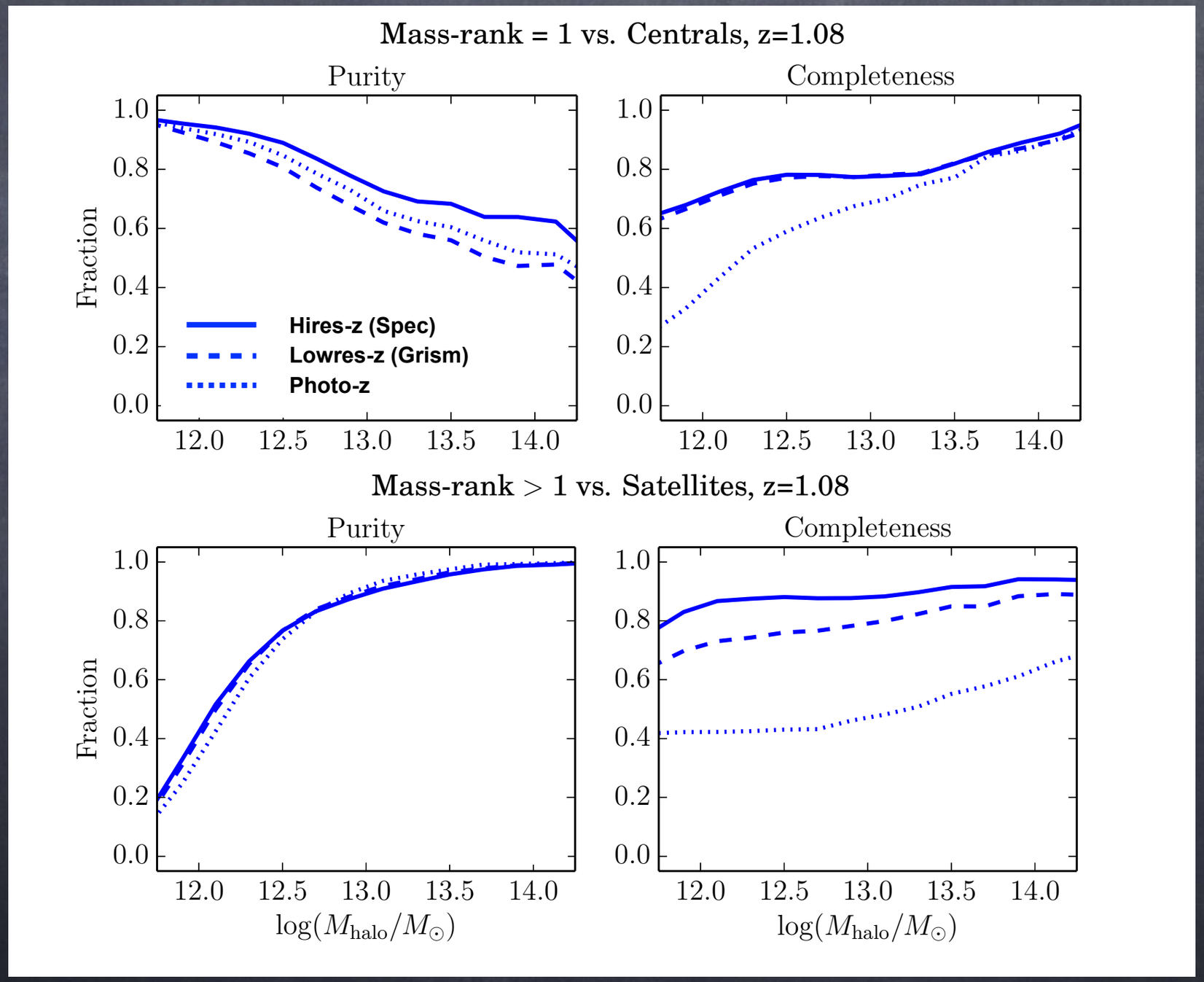
We make use of the stellar mass rank in several apertures to identify central and satellite galaxies.



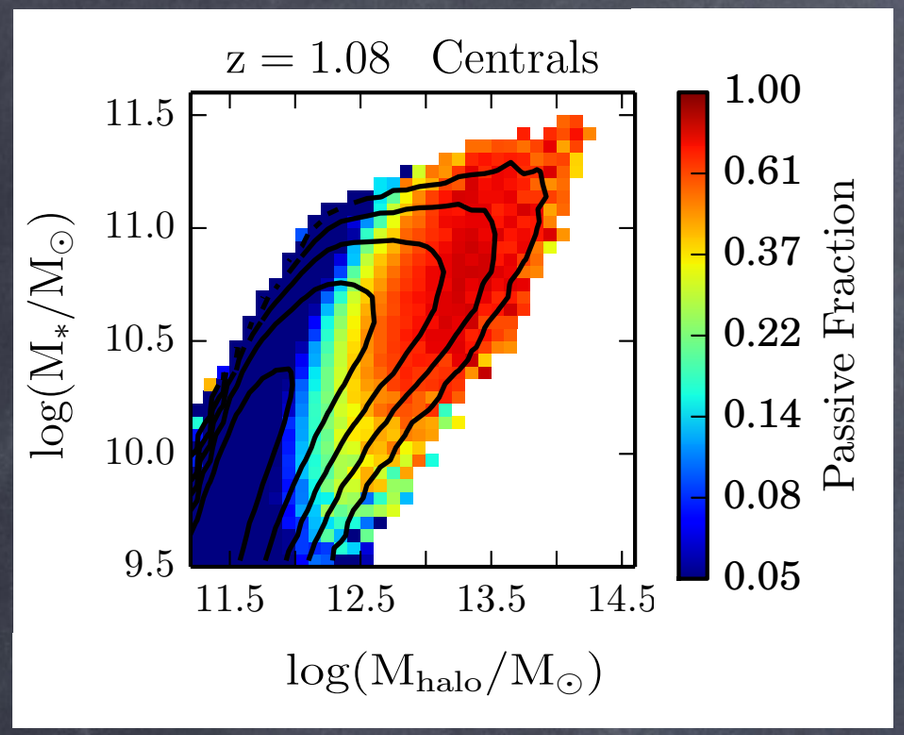
- The adaptive aperture works well also for satellites.

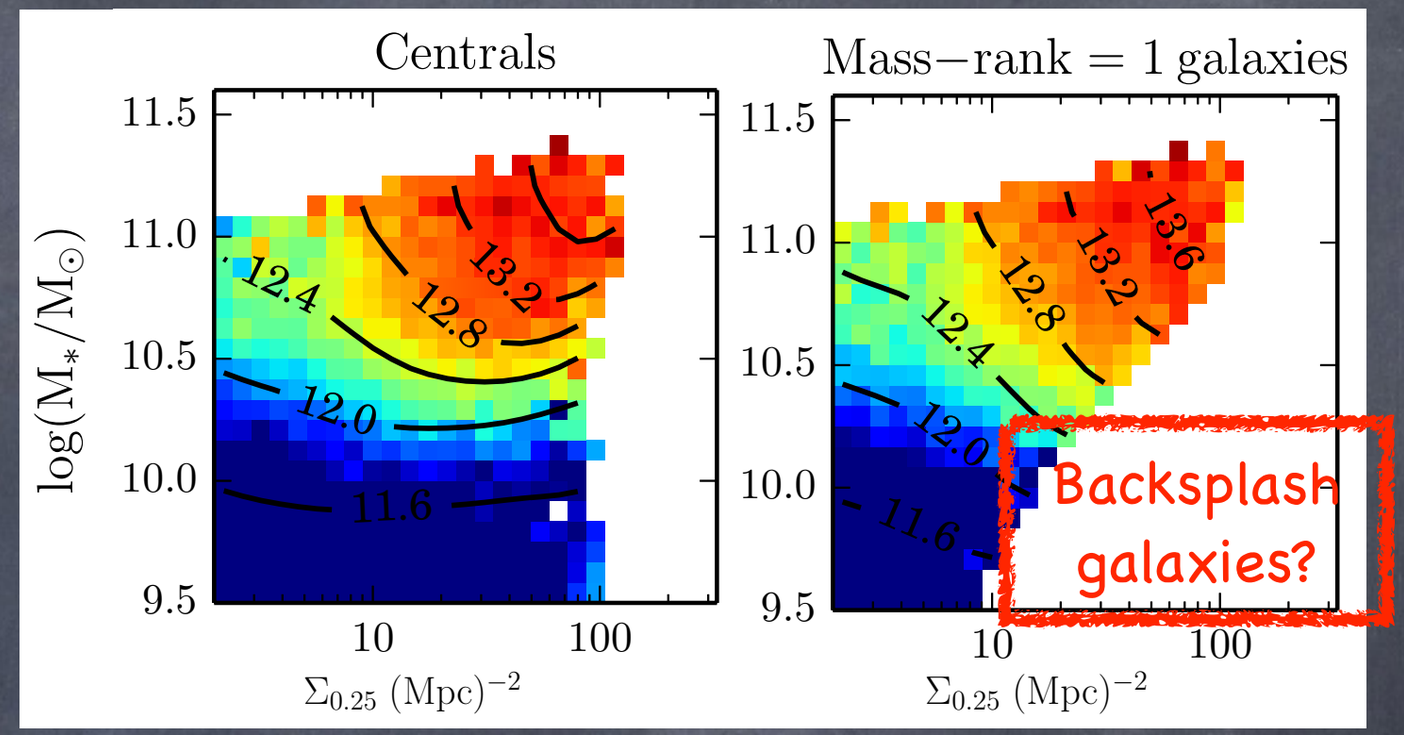
Centrals/Satellites identification

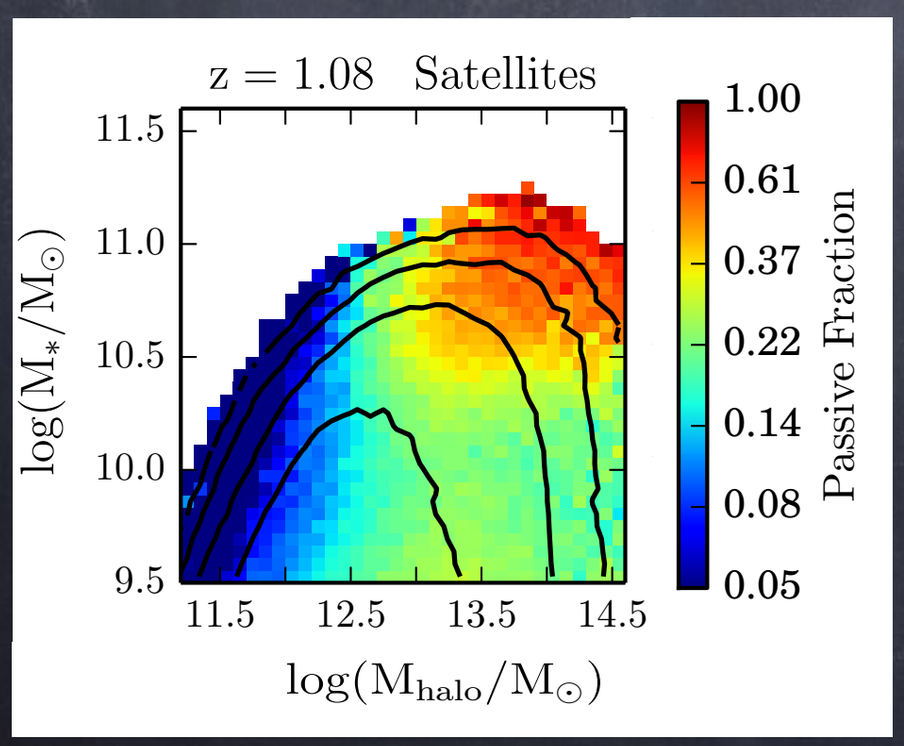
Effects of the redshift accuracy using the adaptive aperture.

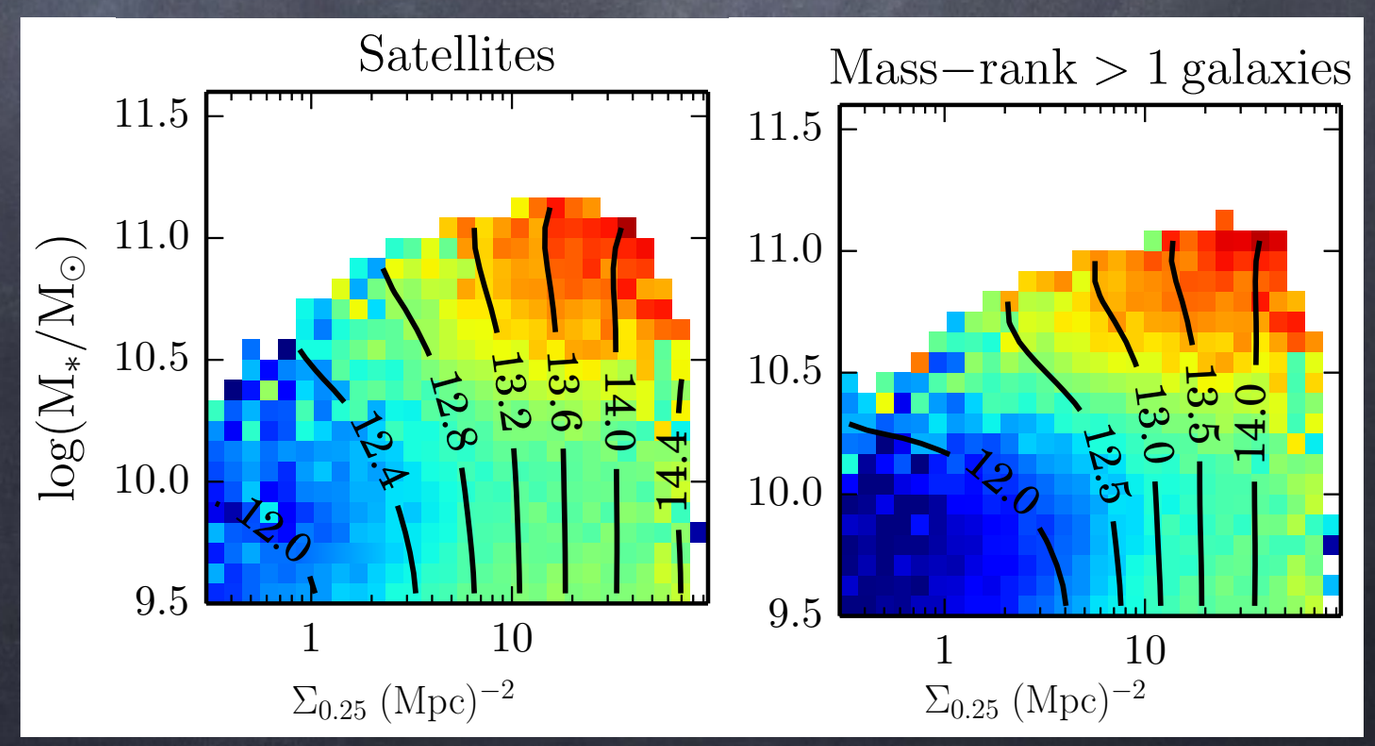


Recovering environmental trends with observational tools



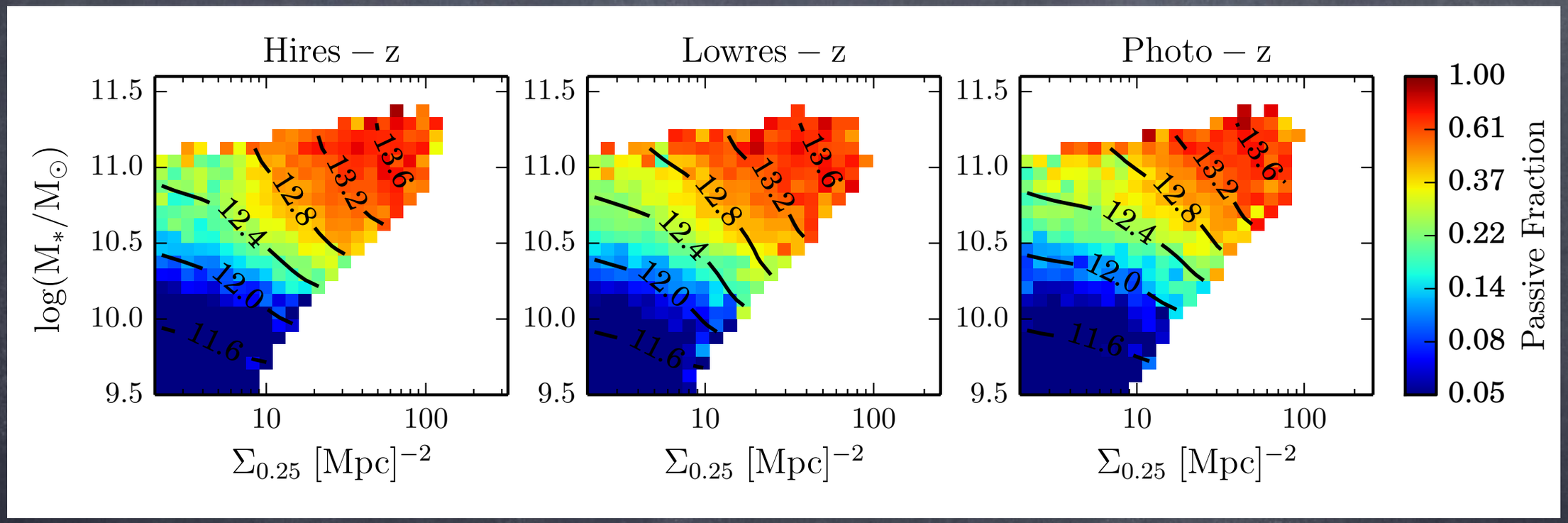






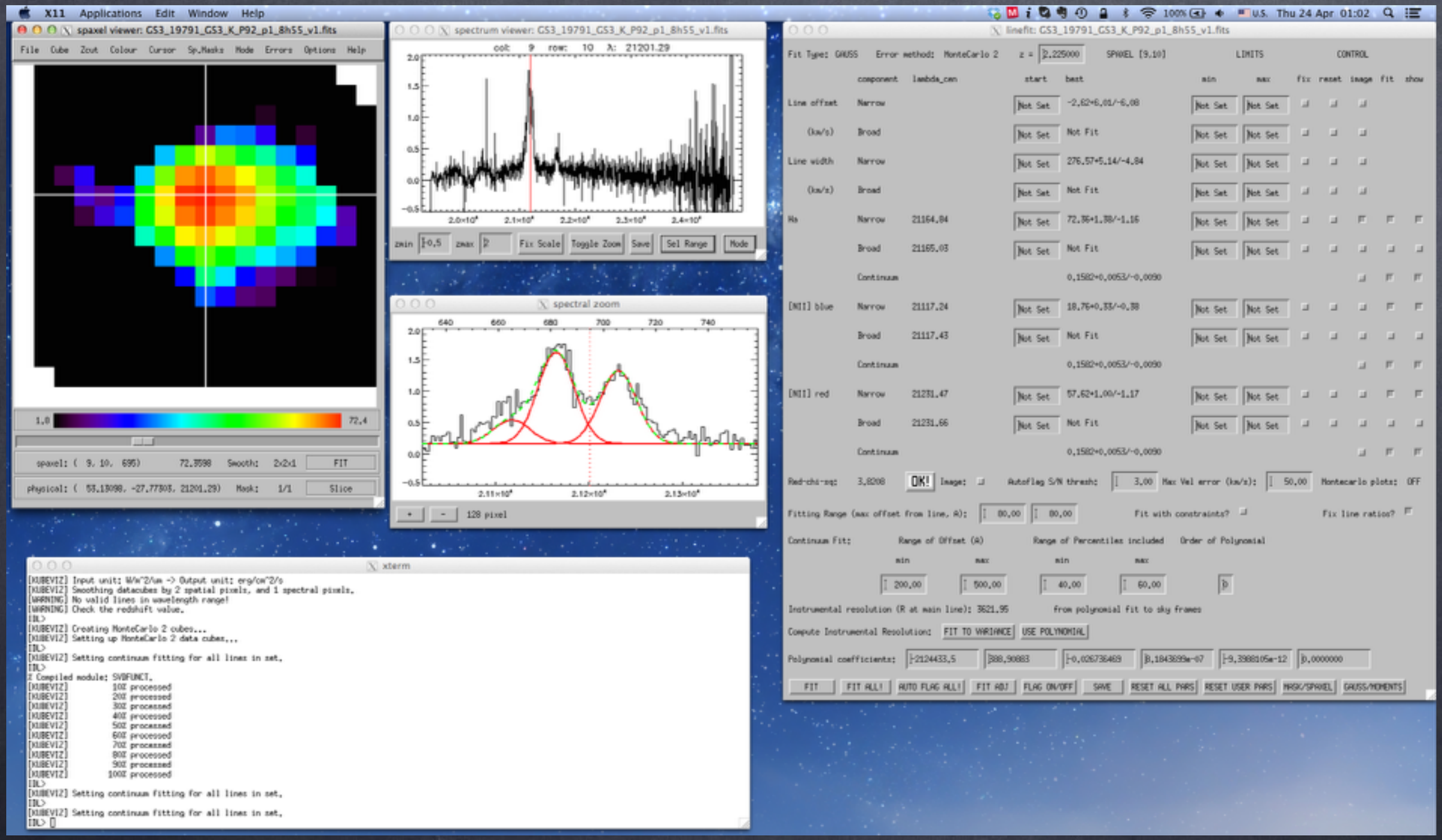
Recovering environmental trends with observational tools

Effects of the redshift accuracy.



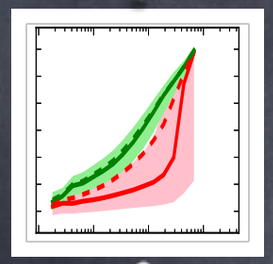
- The results stand even with Photo-z accuracy, but the sample needs to be large and deep.

KUBEVIZ: a code for line fitting

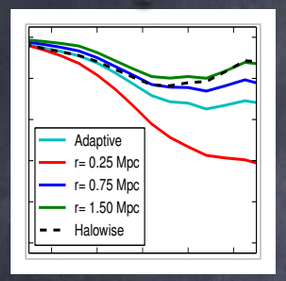


Data-cube visualisation and line fitting (D.Wilman - M.Fossati)

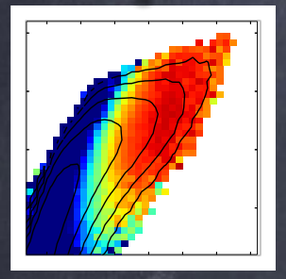
Take-home messages



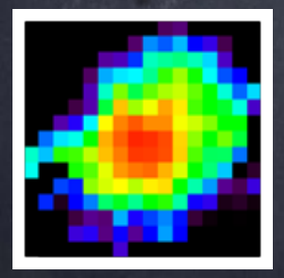
The density poorly correlates with halo mass for central galaxies. A good correlation exists for satellites.



The rank in stellar mass is an effective, and observationally motivated method to identify both centrals and satellites. An adaptive aperture allows to reach high purity and completeness.



The environmental dependence of the fraction of passive galaxies can be recovered by using the density and the mass-rank.



Hα profiles can shed light on the environmental effects acting on galaxies at high-z.