ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Proto-Groups at 1.8<z<3 in zCOSMOS-deep

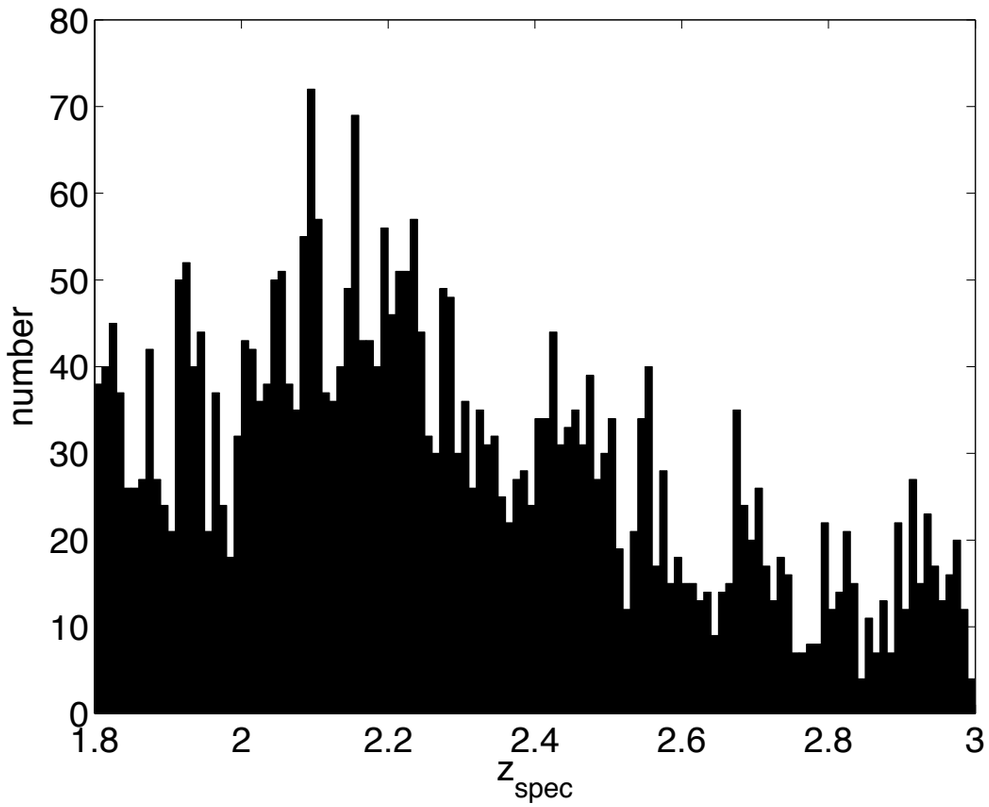
C. Diener, S. J. Lilly + the zCOSMOS team

based on Diener et al. 2012 (in prep.)

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

zCOSMOS-deep

- BzK and ugr selected + cut in B and K band (star-forming galaxies at z>1)
  (Lilly et al. 2012, in prep.)
- 70% sampled area covering 0.6x0.62deg
  Full area: 0.92x0.91deg
- 3502 objects with reliable redshifts in the range 1.8<z<3, ~70% success rate and dv = 300km/s

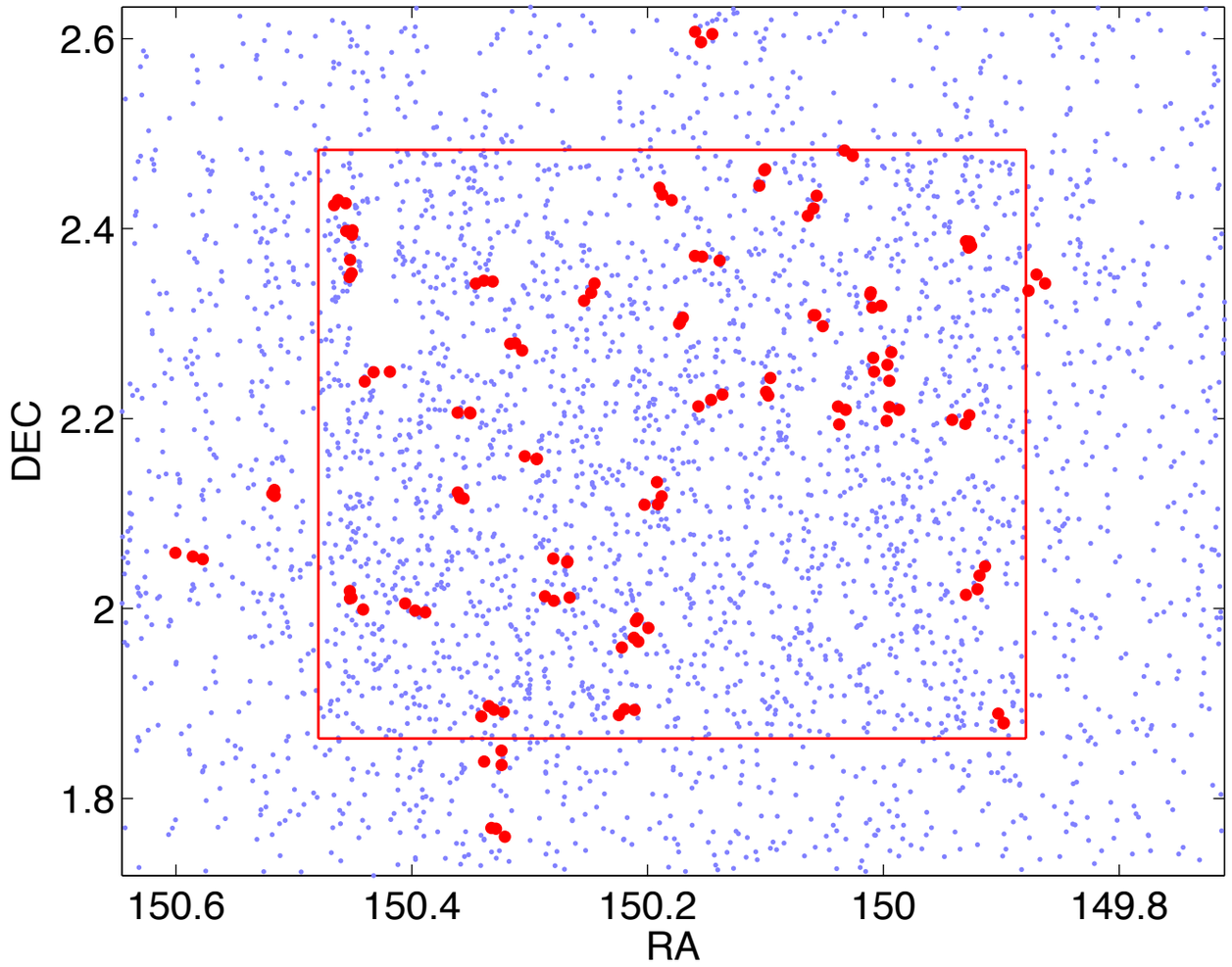


cf. zCOSMOS-bright, 120km/s, 18'000 objects to z~1, about 500 groups with N>2 (Lilly et al. 2009, Knobel et al. 2012)

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Group finder

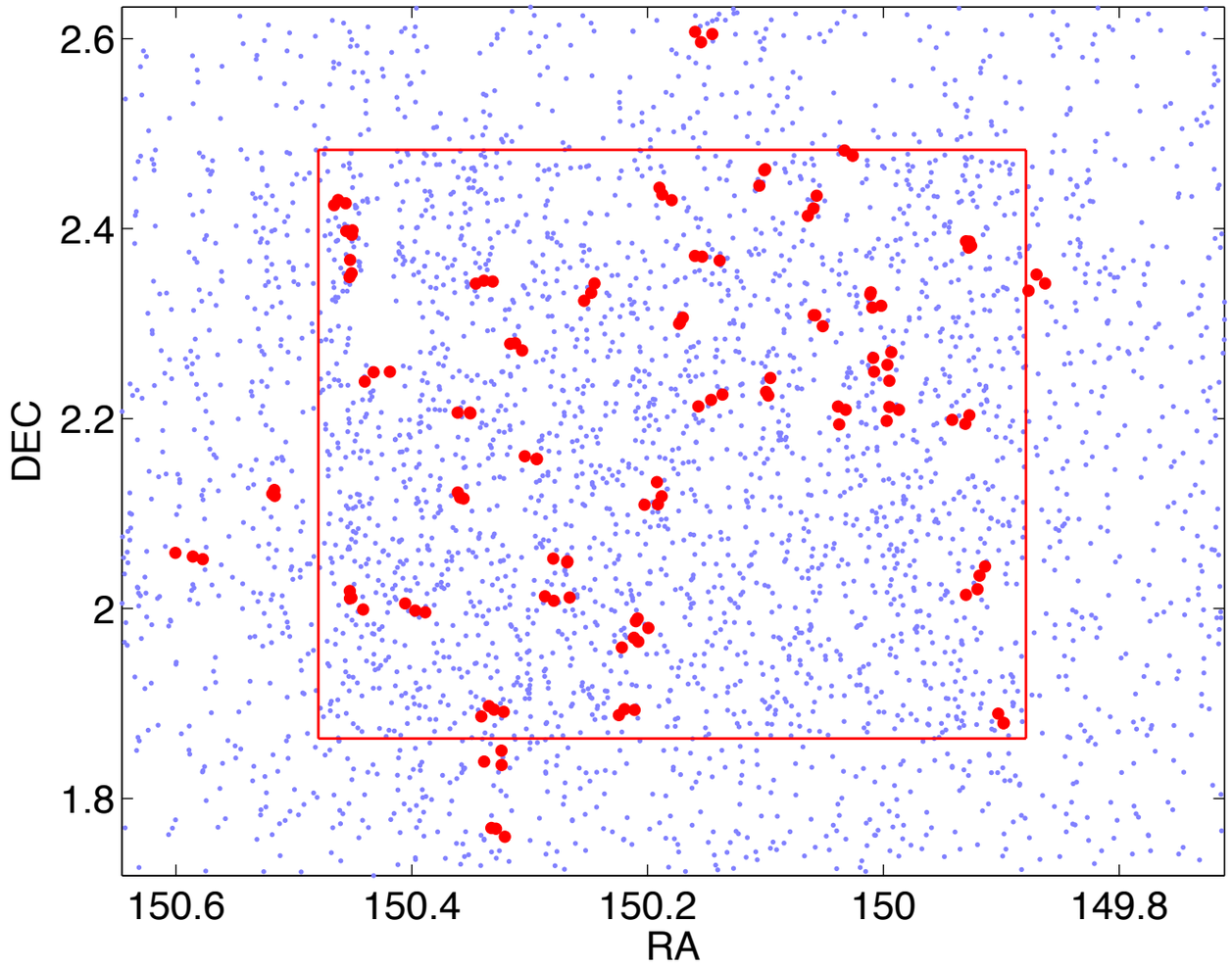
- FOF-method
- Calibrated with mocks
- dr = 500kpc and
  dv = 700km/s
- Requiring N>2



ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Group finder

- FOF-method
- Calibrated with mocks
- dr = 500kpc and
  dv = 700km/s
- Requiring N>2



42 candidate groups, most with 3 members

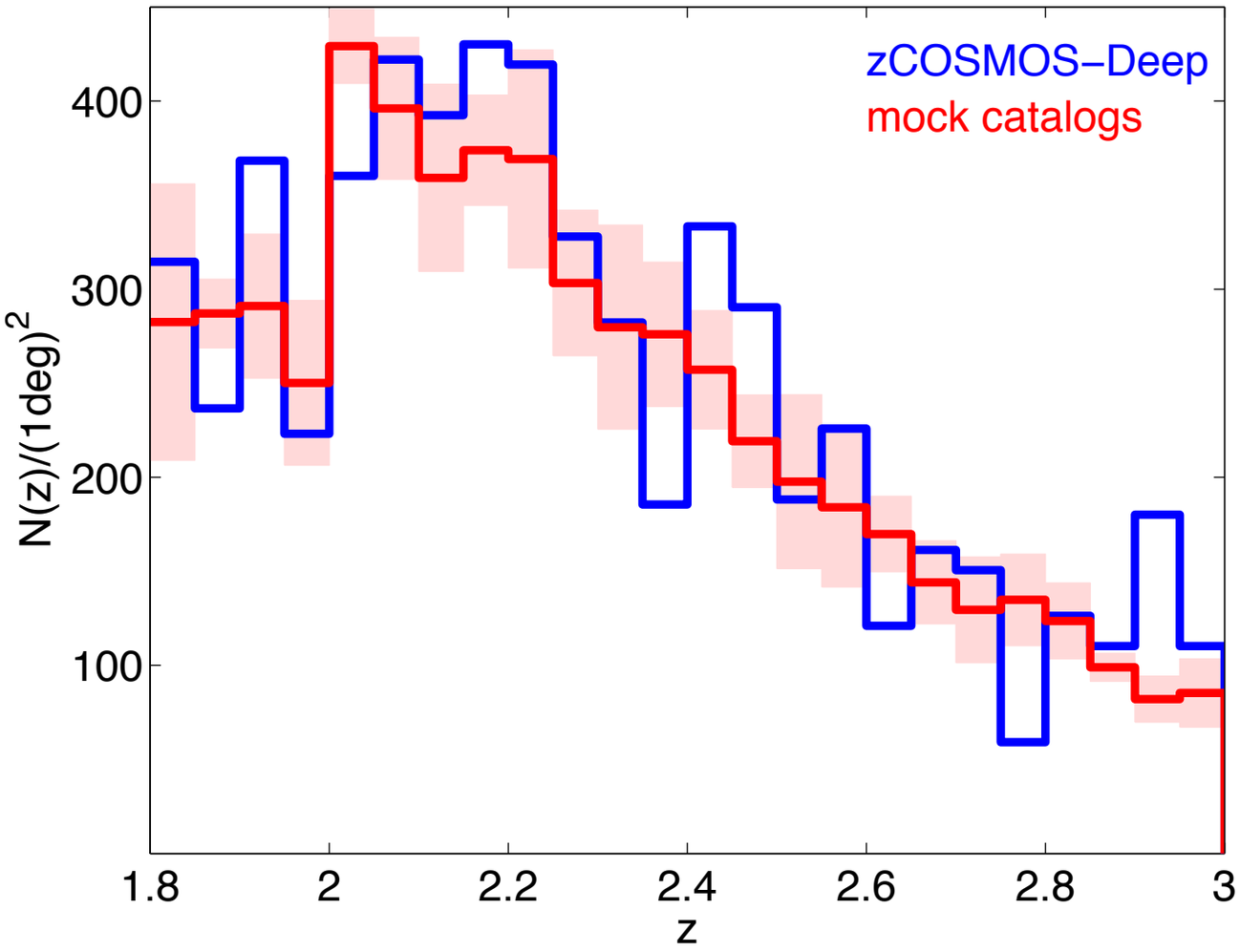
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Mocks

12 mock catalogs resembling zCOSMOS-deep
(Kitzbichler & White 2007)

➡ same velocity error

➡ Cut in B and K to mimic N(z)-distribution



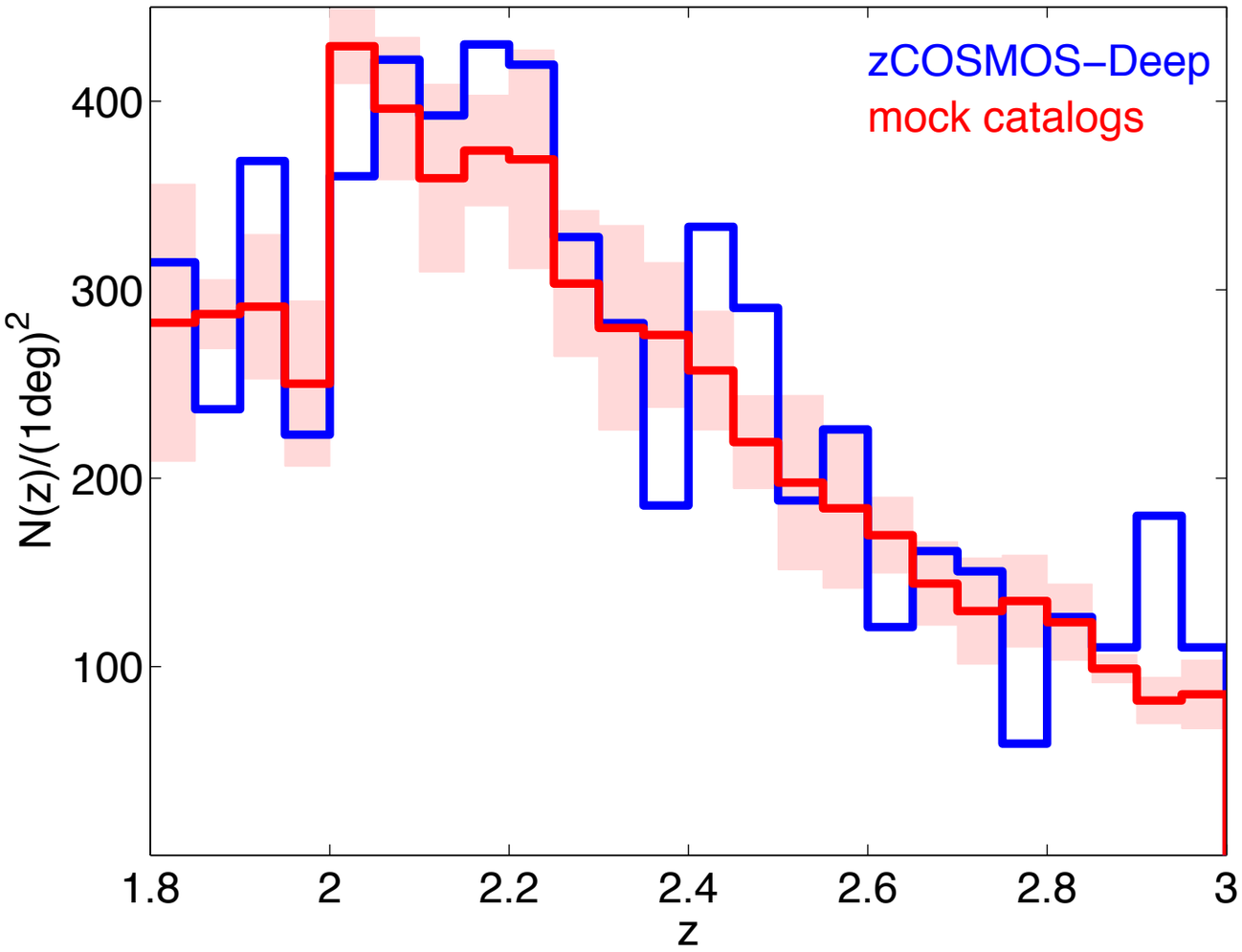
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Mocks

12 mock catalogs resembling zCOSMOS-deep
(Kitzbichler & White 2007)

➡ same velocity error

➡ Cut in B and K to mimic N(z)-distribution



applied group-finder & got consistent numbers (up to 20%)

What are these structures in the mocks?

- Only 0.2% fully assembled at epoch of observation
- ~10% at least partially assembled

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

What are these structures in the mocks?

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

What are these structures in the mocks?

BUT:

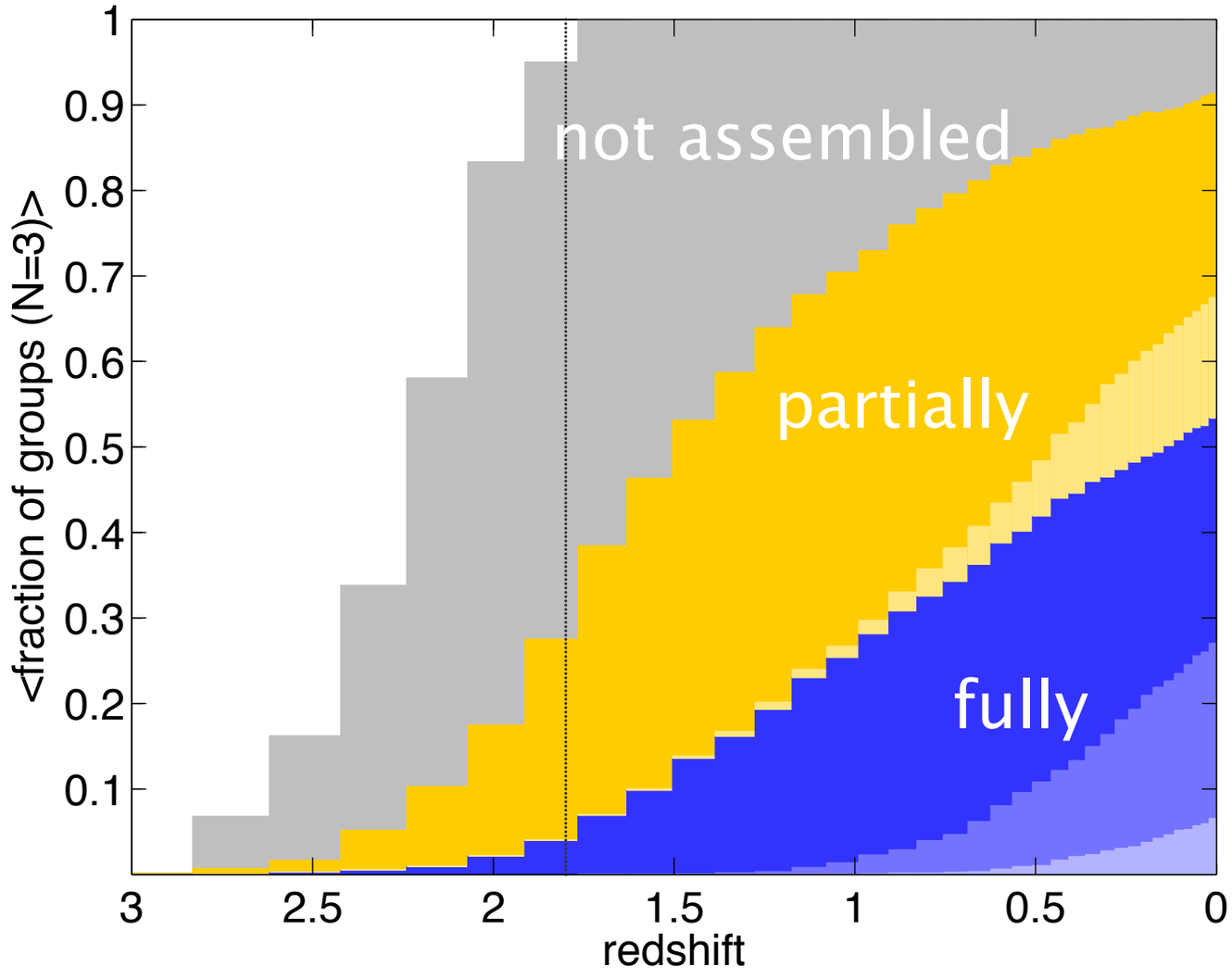
93% will fully or partially assemble by present epoch

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

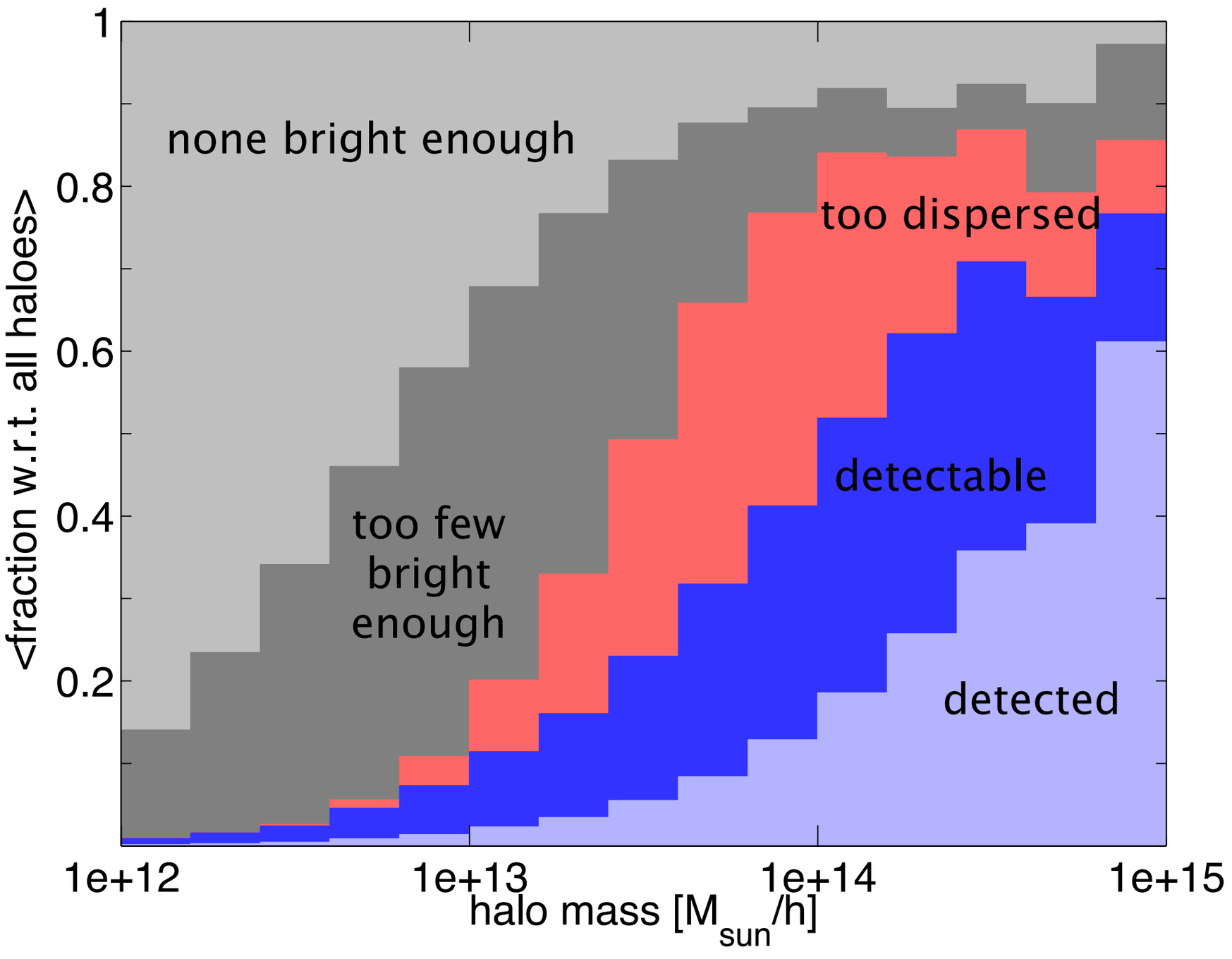
What are these structures in the mocks?

BUT:

93% will fully or partially assemble by present epoch



Which of todays haloes would be detected?

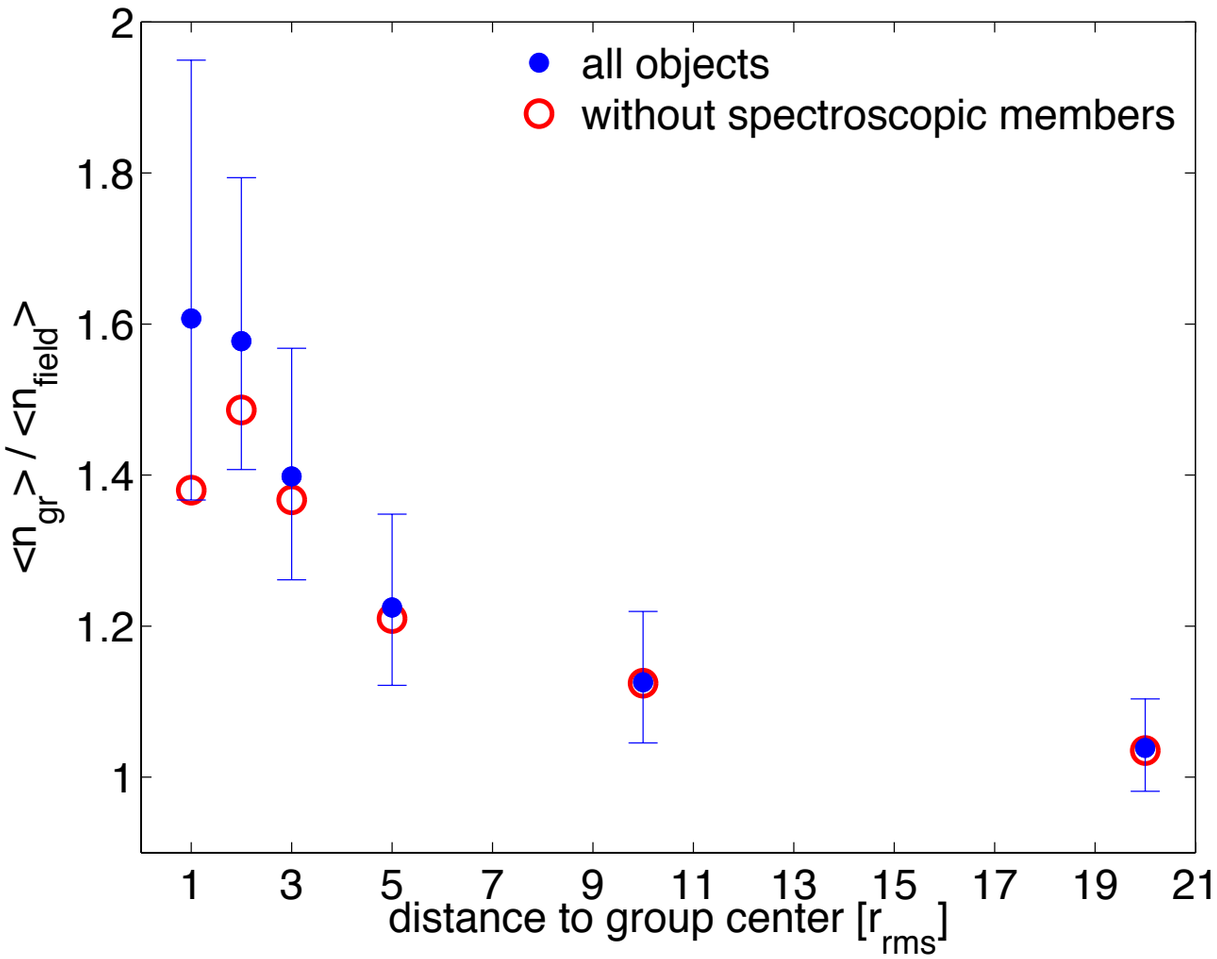


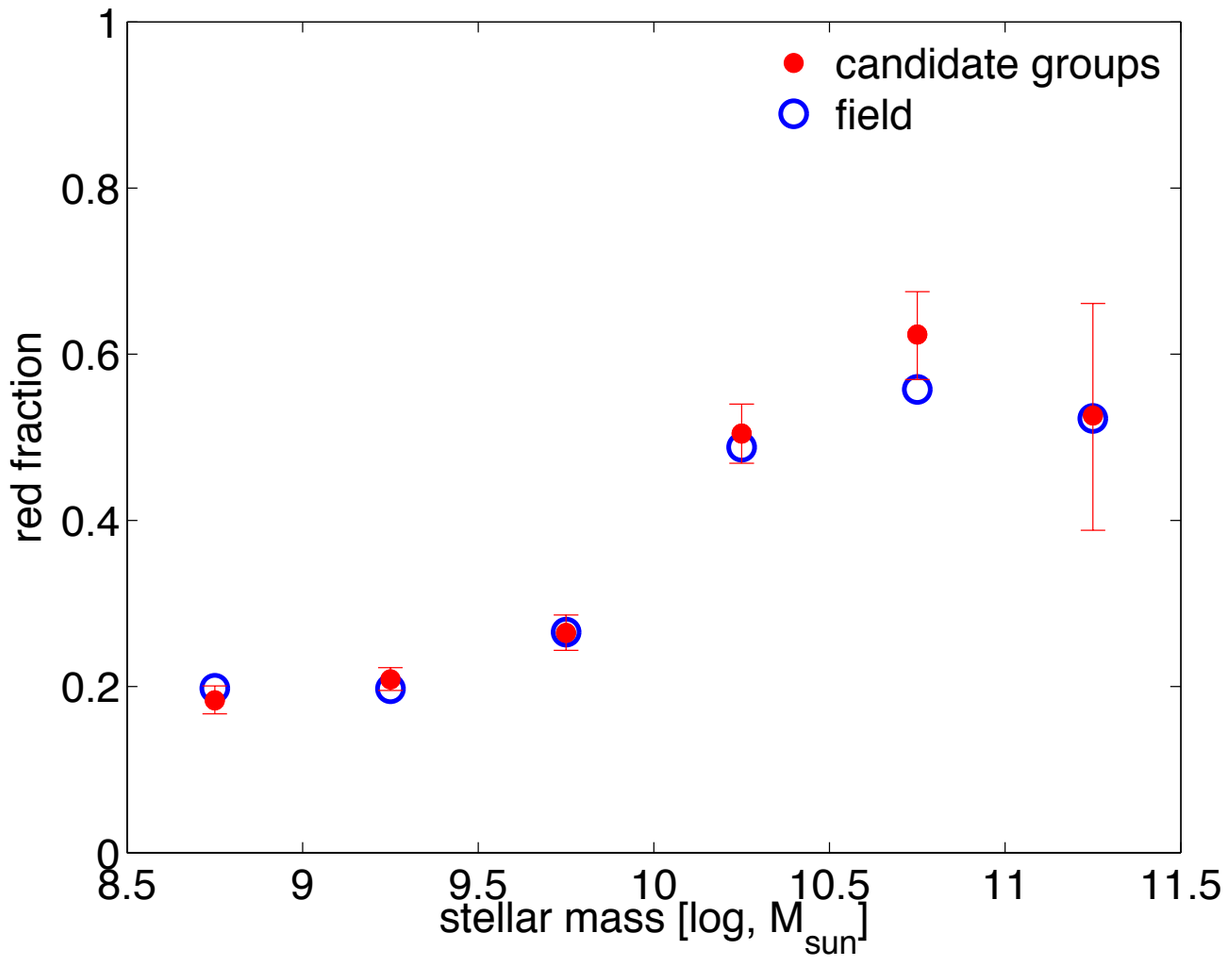
- Up to 70% of todays high mass haloes would be detectable with full sampling

- We actually catalogue half of them

(Photo-z) galaxies associated with these structures

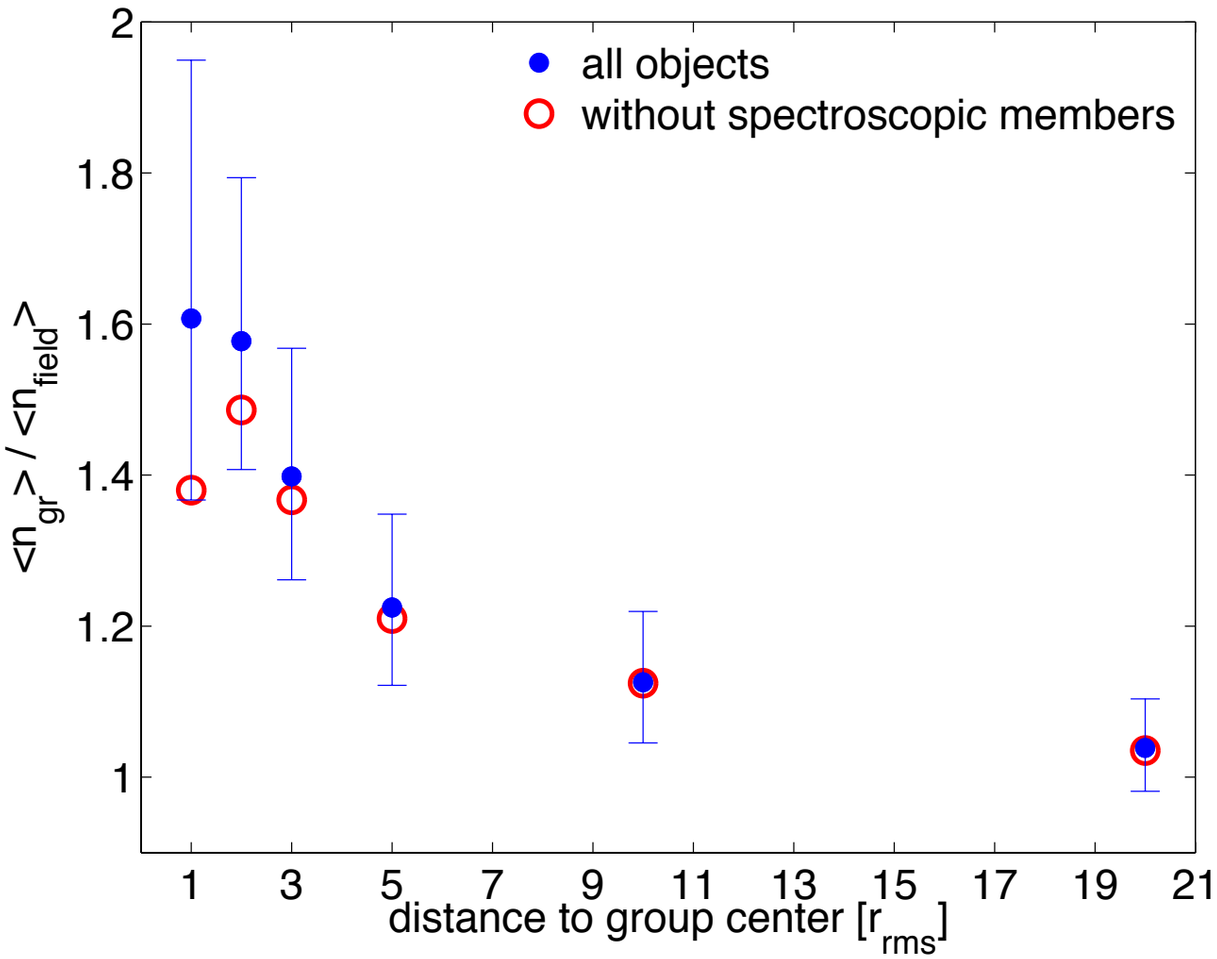
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

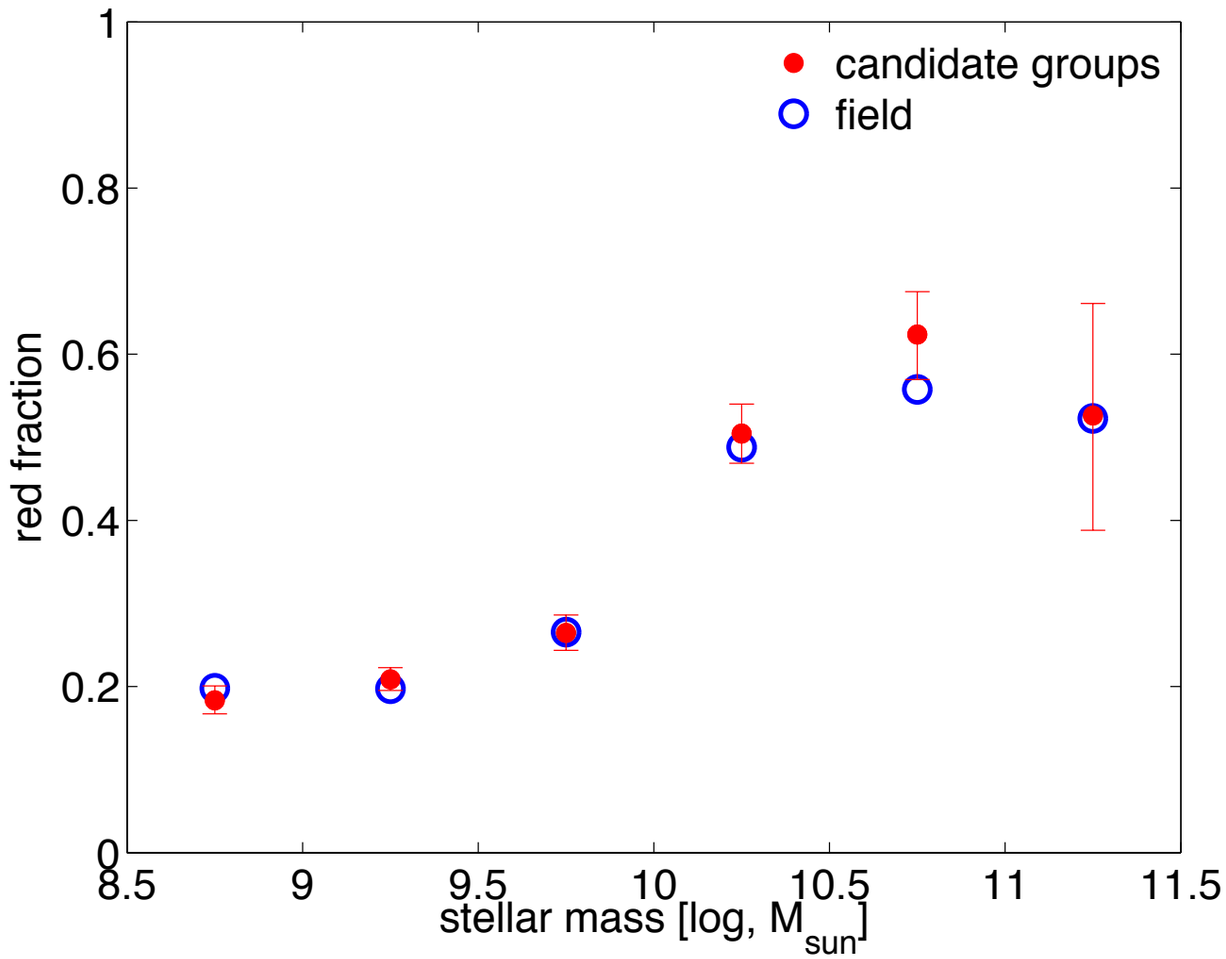




(Photo-z) galaxies associated with these structures

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

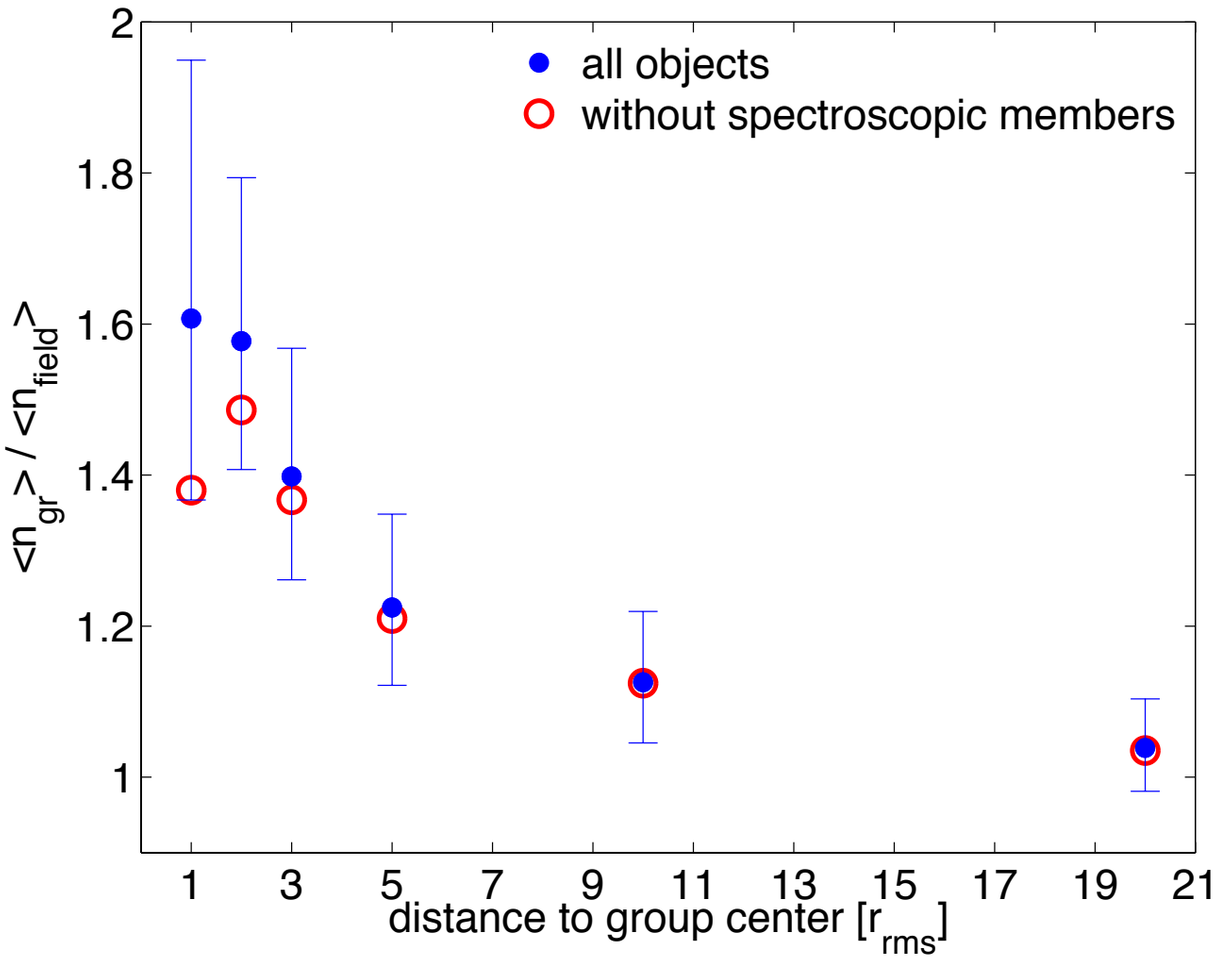


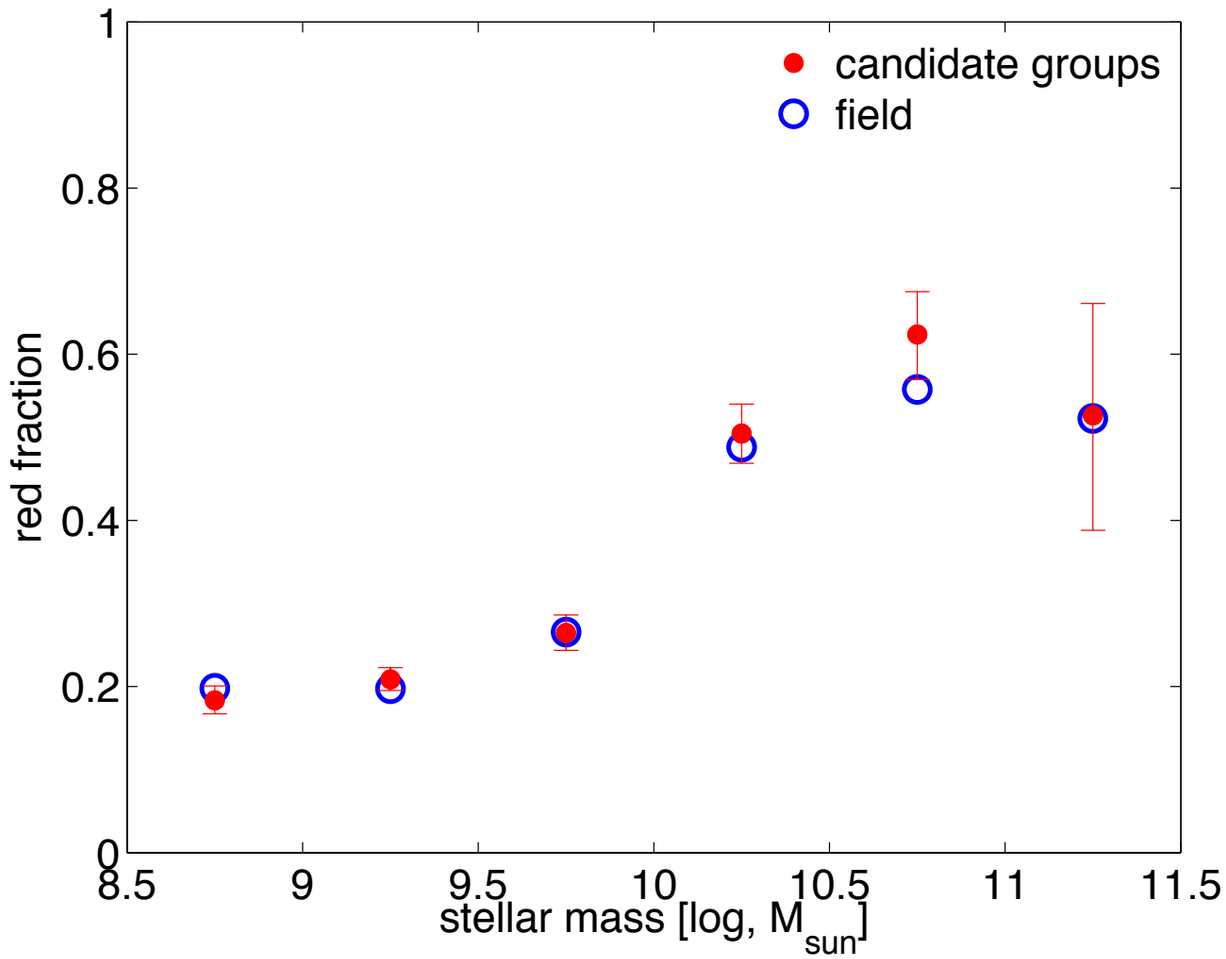


There is an excess of photo-z objects around the candidate groups...

(Photo-z) galaxies associated with these structures

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich





There is an excess of photo-z objects around the candidate groups...

...but there is no evidence of colour differentiation

(Photo-z) galaxies associated with these structures

- In SDSS and zCOSMOS-bright (to z~1) all of the environmental differentiation is in the satellite population (Peng et al. 2010 and 2011, Knobel et al. 2012, Kovac et al. 2012 in prep.)
- If still true at z~2 and if the detected structures are not yet assembled, then we would not expect any colour-differentiation

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Summary

- 42 (spectroscopic) proto-groups at z~2. Also confirmed by photo-z sample
- Most of them are probably not assembled yet, will however do so by z=0.
- With the full sample ~70% of todays high mass haloes are detectable, we catalogue ~35%