VIPERS

VIMOS PUBLIC EXTRAGALACTIC REDSHIFT SURVEY

Unveiling the combined evolution of galaxies and large scale structure at 0.5 < z <1.2

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INAF-OABrera

on behalf of the VIPERS Team

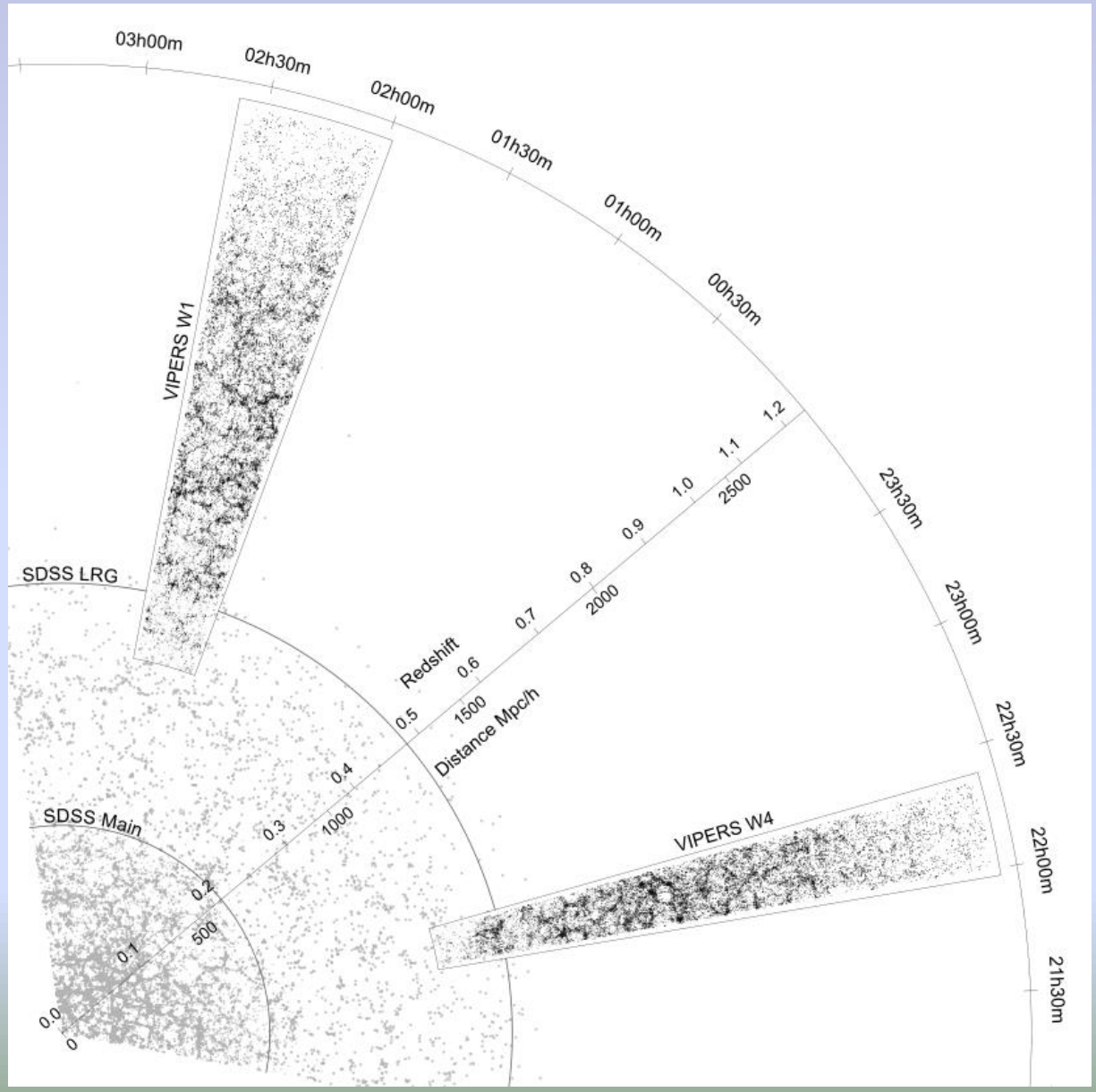
Multi-Object Spectroscopy in the Next Decade

Big Questions, Large Surveys and Wide Fields

La Palma

March 2015

VIPERS: VIMOS Public Extragalactic Redshift Survey



VIPERS
VIMOS PUBLIC EXTRAGALACTIC REDSHIFT SURVEY

PI. L. Guzzo

Total volume covered
5×10^{7} Mpc^3

~100,000 redshifts,

~40% sampling

Density and volume comparable to 2dFGRS, but at z~0.8

~ half volume of SDSS main at z ~ 0

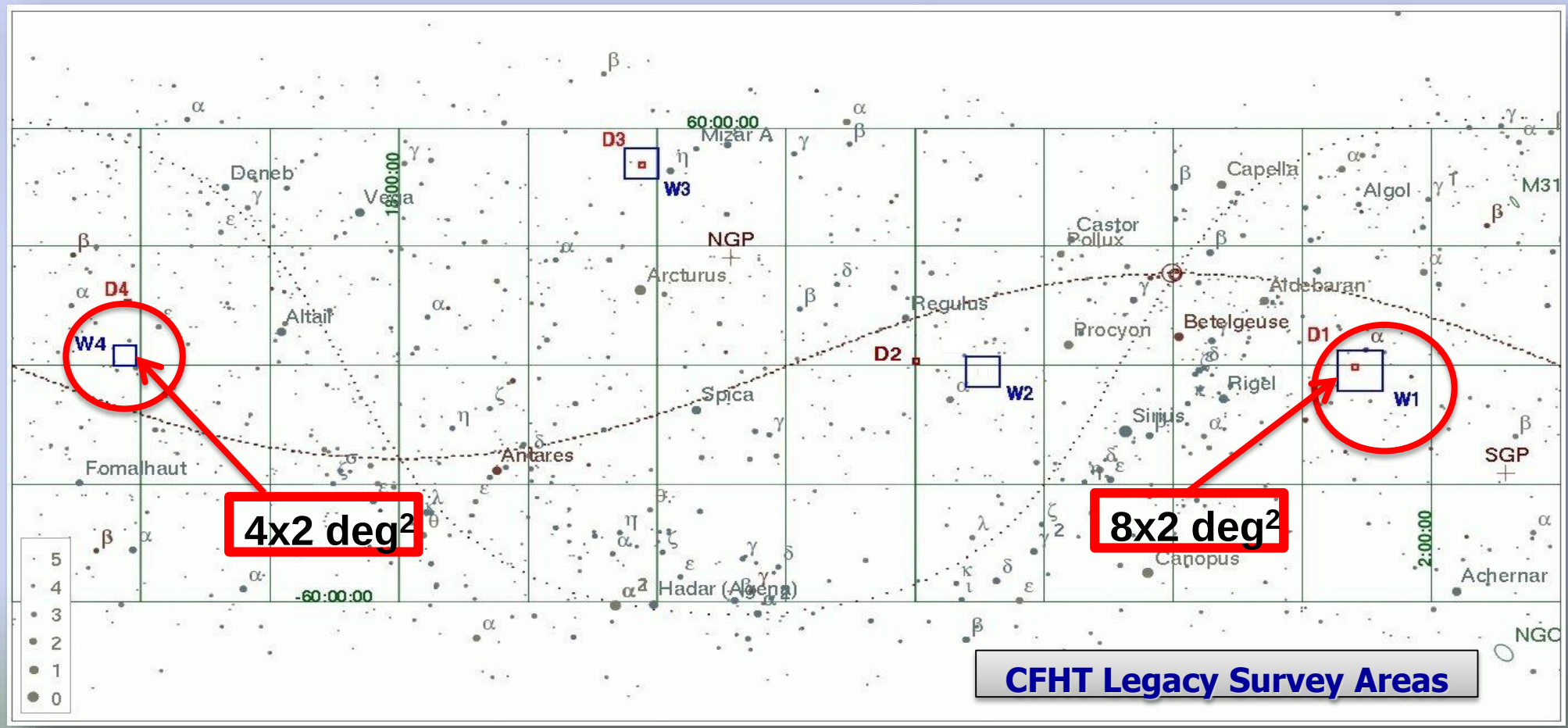
VIPERS in a nutshell

- **440.5 VLT hours @ VIMOS + LR Red grism**

Exploiting VIMOS Multi-Object Spectroscopy at VLT

VIPERS in a nutshell

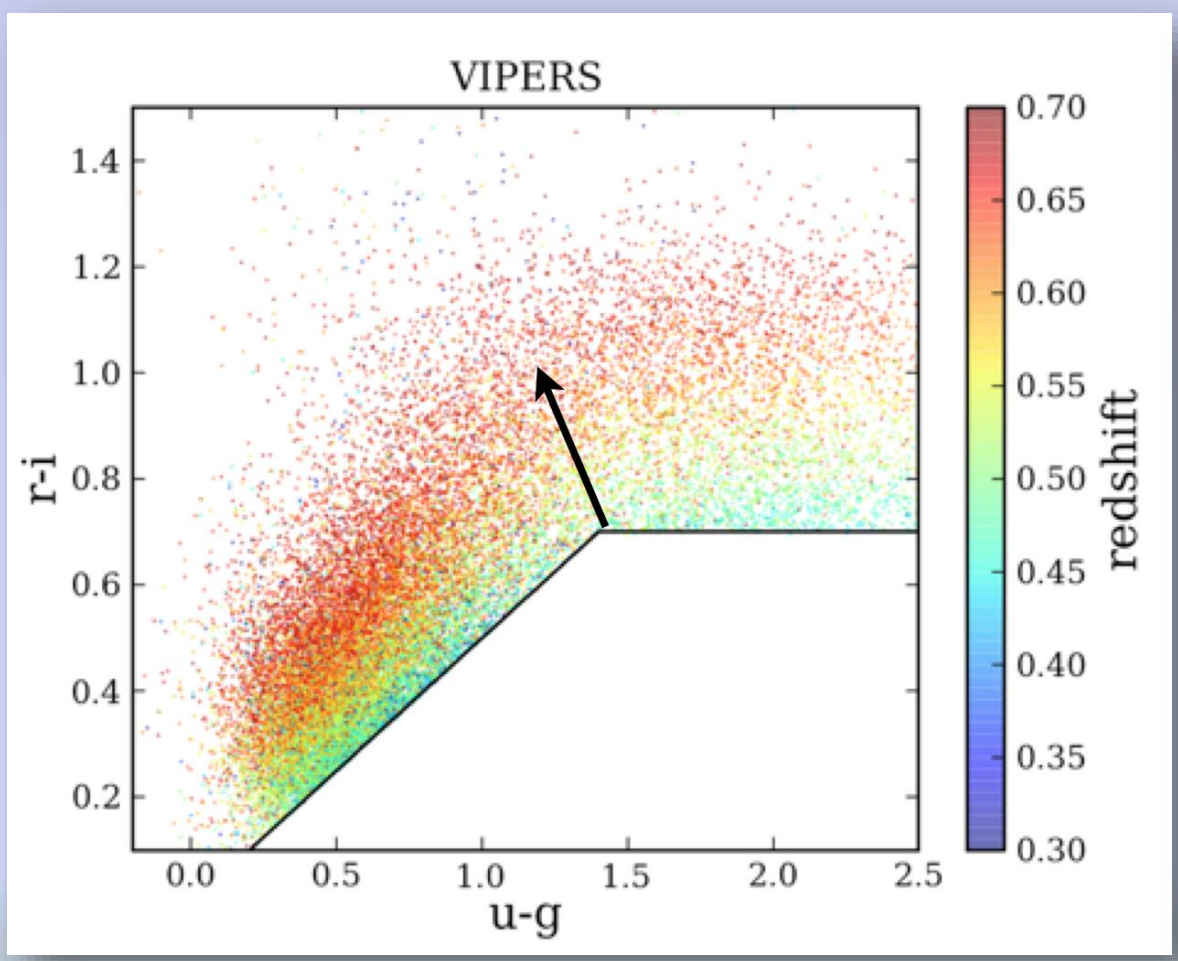
- **440.5 VLT hours @ VIMOS + LR Red grism**
- **~24 deg² over W1 and W4 CFHTLS wide fields (~16 + 8)**

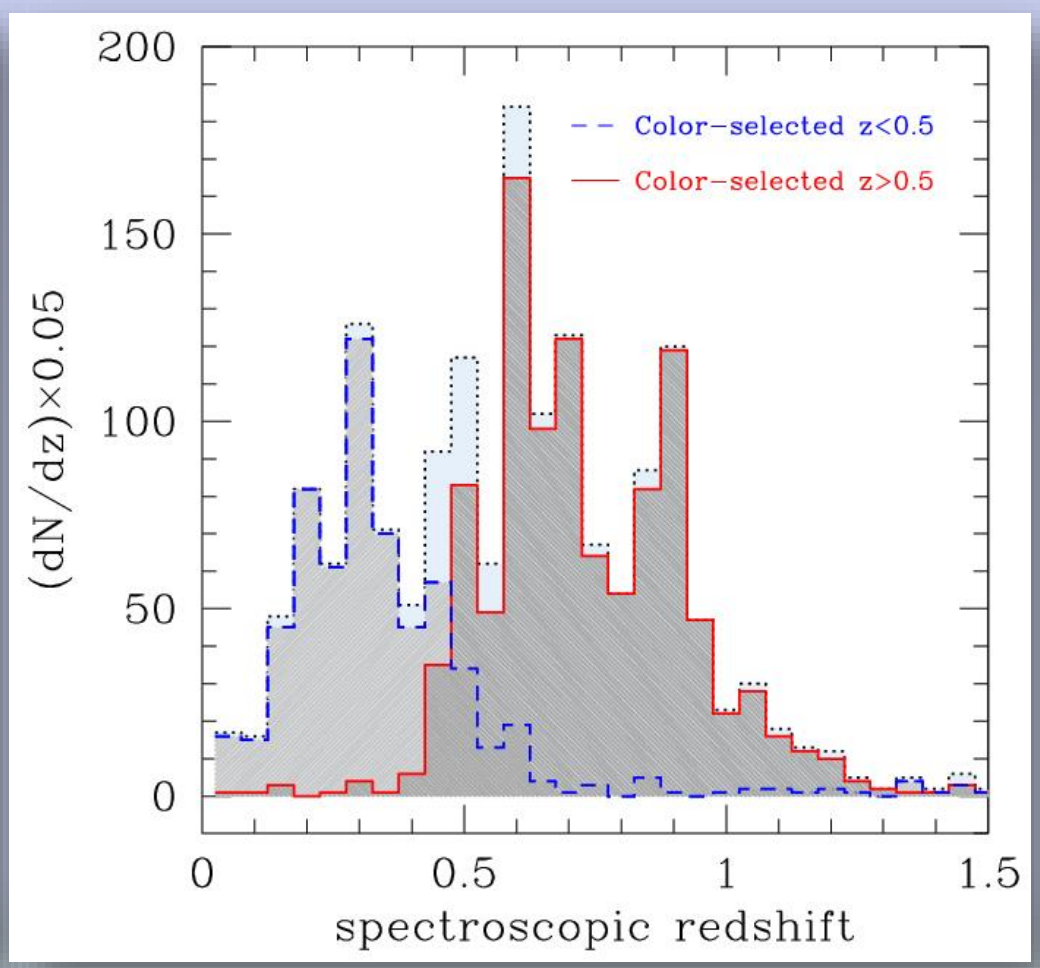


VIPERS in a nutshell

- 440.5 VLT hours @ VIMOS + LR Red grism
- ~24 deg^2 over W1 and W4 CFHTLS wide fields (~16 + 8)
- $I_{AB} < 22.5$ + z>0.5 color-color pre-selection
- PSF + SED–based star-galaxy separation (AGN color recovery)

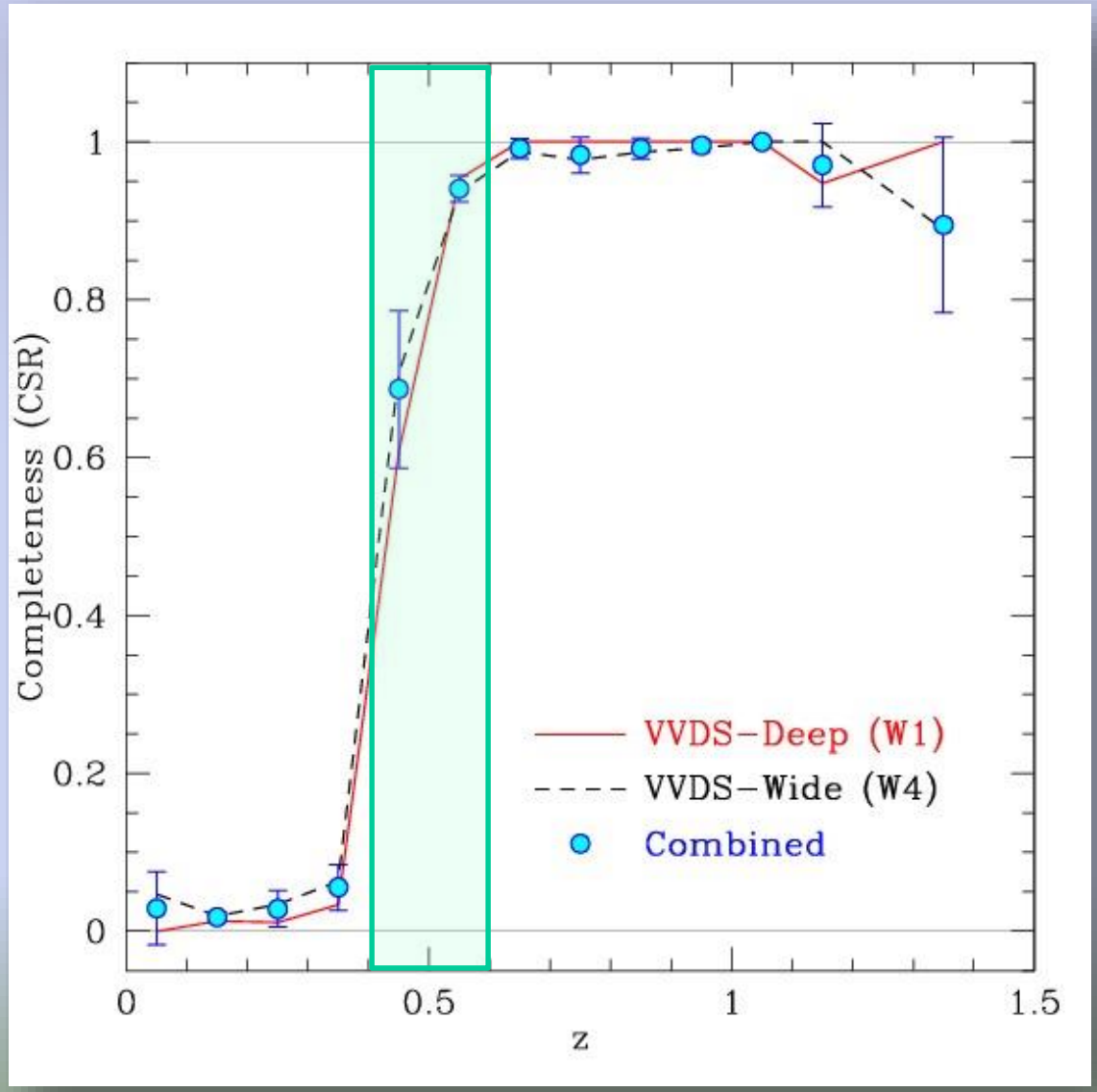
VIPERS COLOR-COLOR SELECTION: ISOLATING z>0.5 GALAXIES (calibrated using VVDS)





VIPERS COLOR-COLOR SELECTION: ISOLATING z>0.5 GALAXIES (calibrated using VVDS)

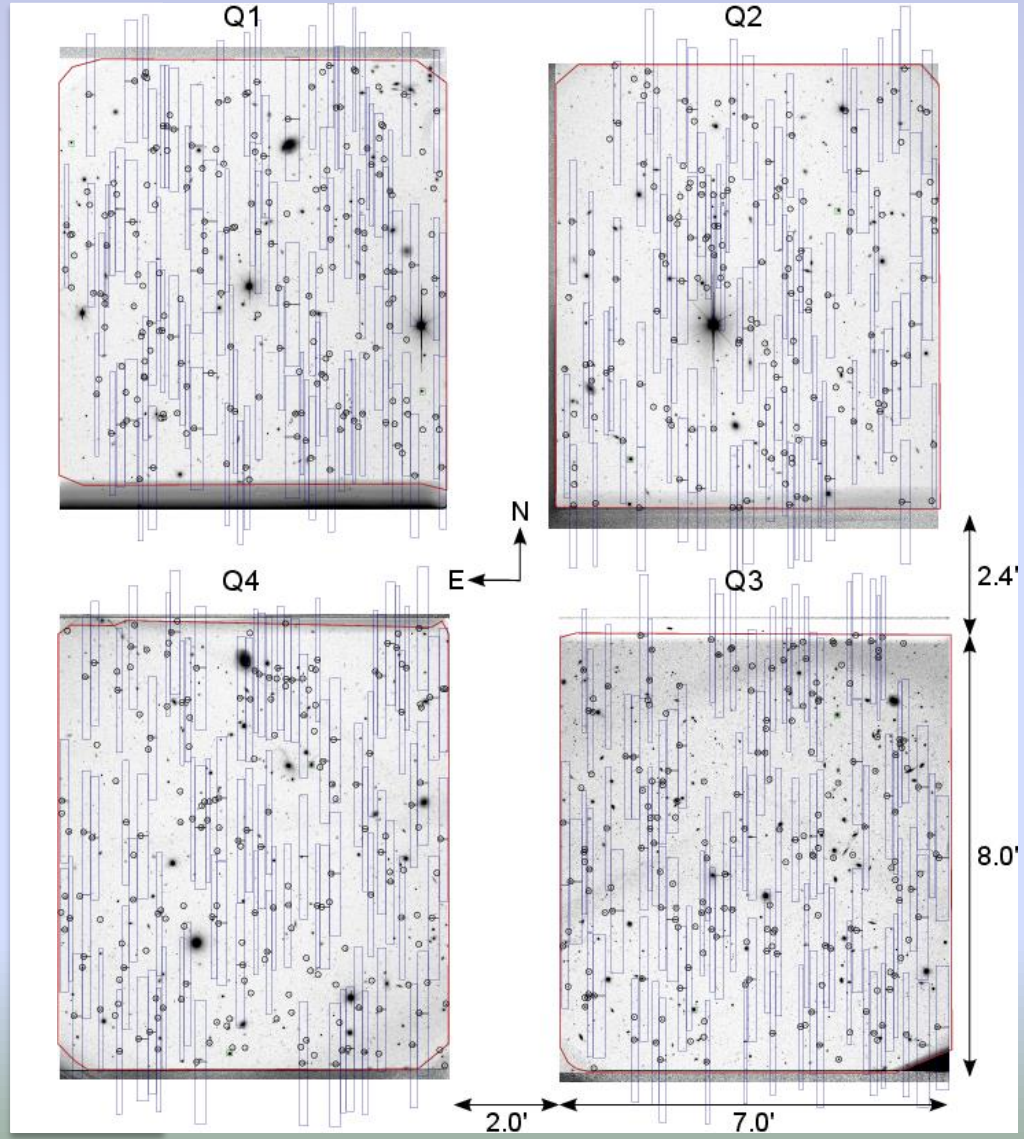
- **Colour Sampling Rate = 1 for z>0.6**
- **Transition range 0.4<z<0.6 (due to mag errors and intrinsic scatter in color-redshift relation)**
- **Selection function in the transition reconstructed using complete VVDS data**
- **Data in this range can be used for some analyses but not for others**



Guzzo & VIPERS team 2014

Advantages of VIPERS selection strategy

- **Sampling ~40% of all I_{AB}<22.5 galaxies between z=0.5 and 1.2 in only one VIMOS pass:**
  - ❖ Get high density of tracers at desired z range
  - ❖ Avoid multiple passes, thus maximize area for given telescope allocation
  - ❖ Targets are not dense: preserve most of angular clustering signal (minimize "proximity bias")



Fully automated web-based archive

SURVEY STATUS AS OF 24/02/2015

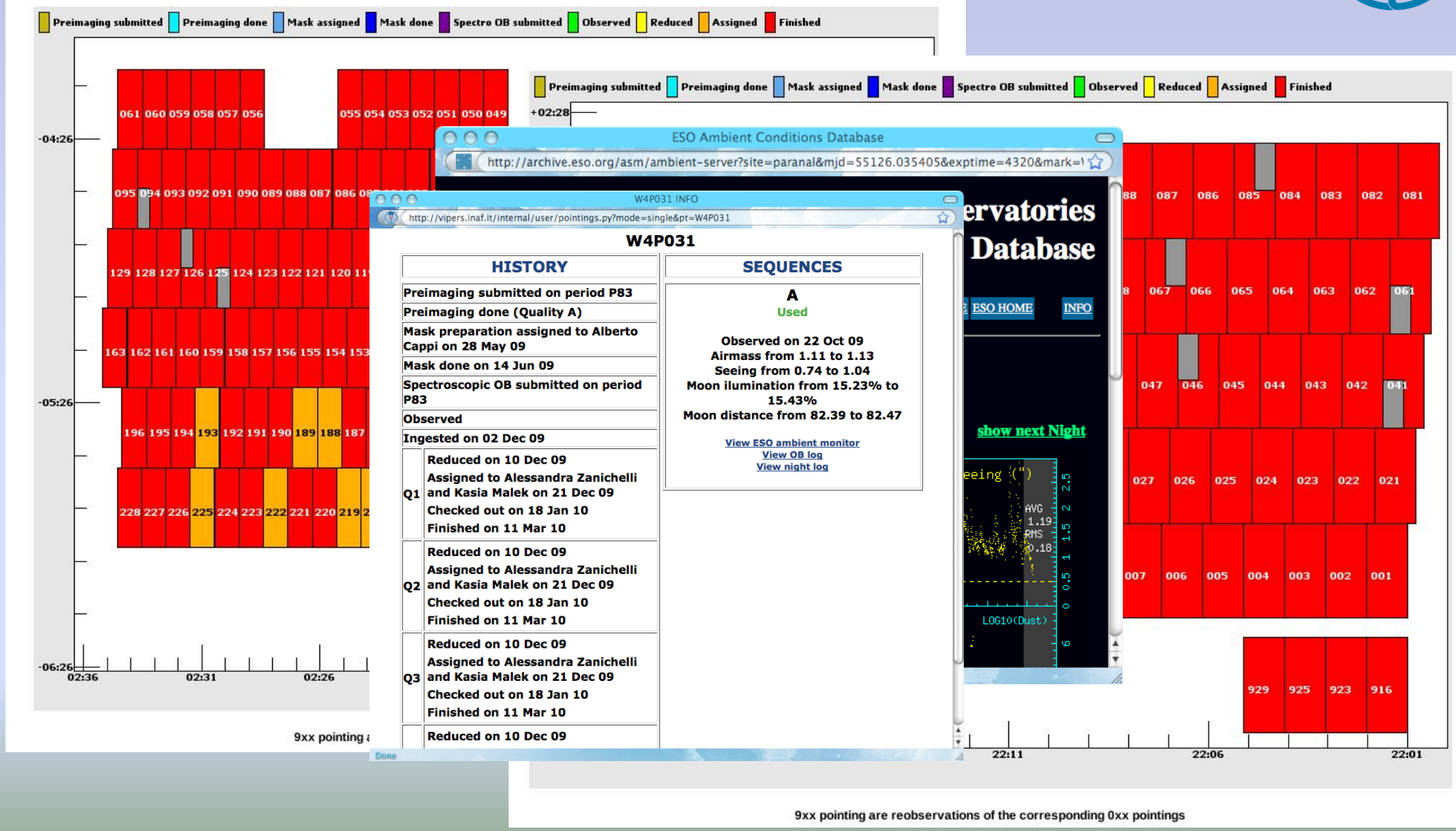
EFFECTIVE TARGETS	MEASURED REDSHIFTS	STELLAR CONTAMINATION	COVERED AREA
89052	84674	2207 (2.6 %)	

EFFECTIVE TARGETS (ET) are all the primary targeted objects with the exclusion of the ones flagged as -10 (undetected). MEASURED REDSHIFTS (MR) are the fraction of ET for which a redshift has been measured. STELLAR CONTAMINATION are the MR objects which have been identified as stars.

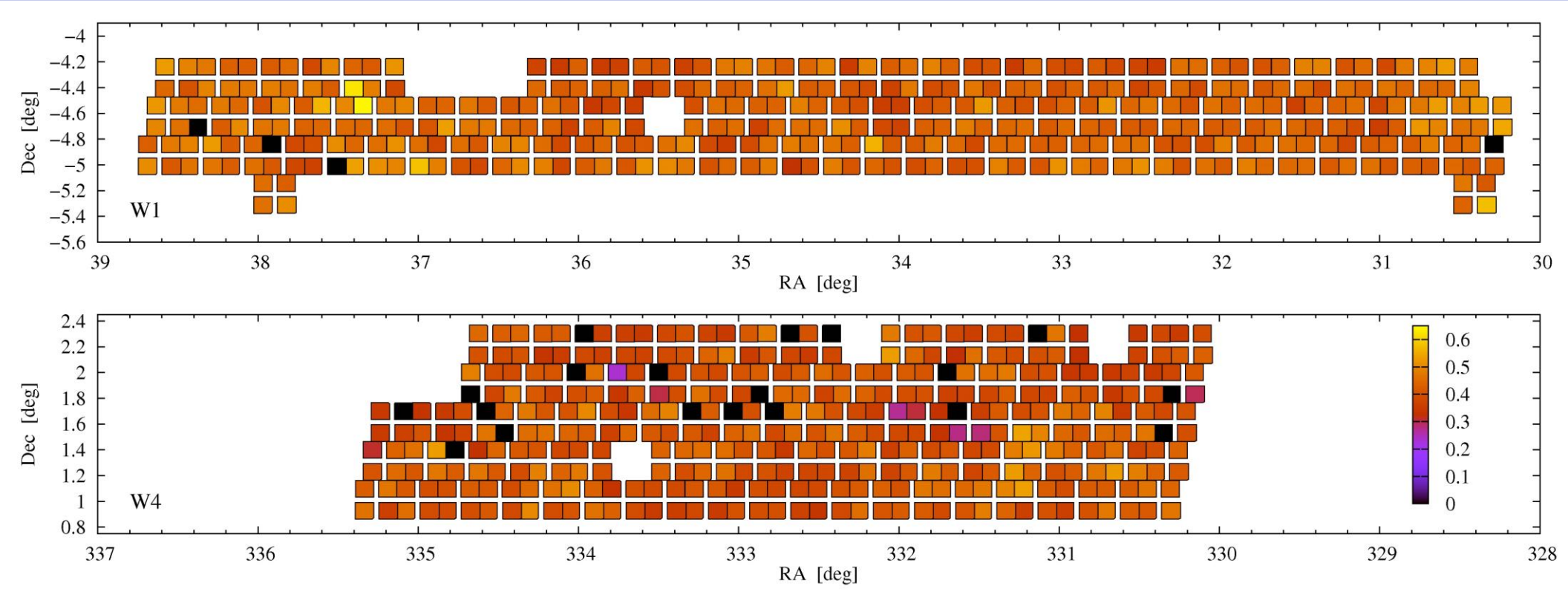
(web management tool developed by P. Franzetti)

All data are already in our hands
Redshift measurements are finishing these days

Fully automated web-based archive



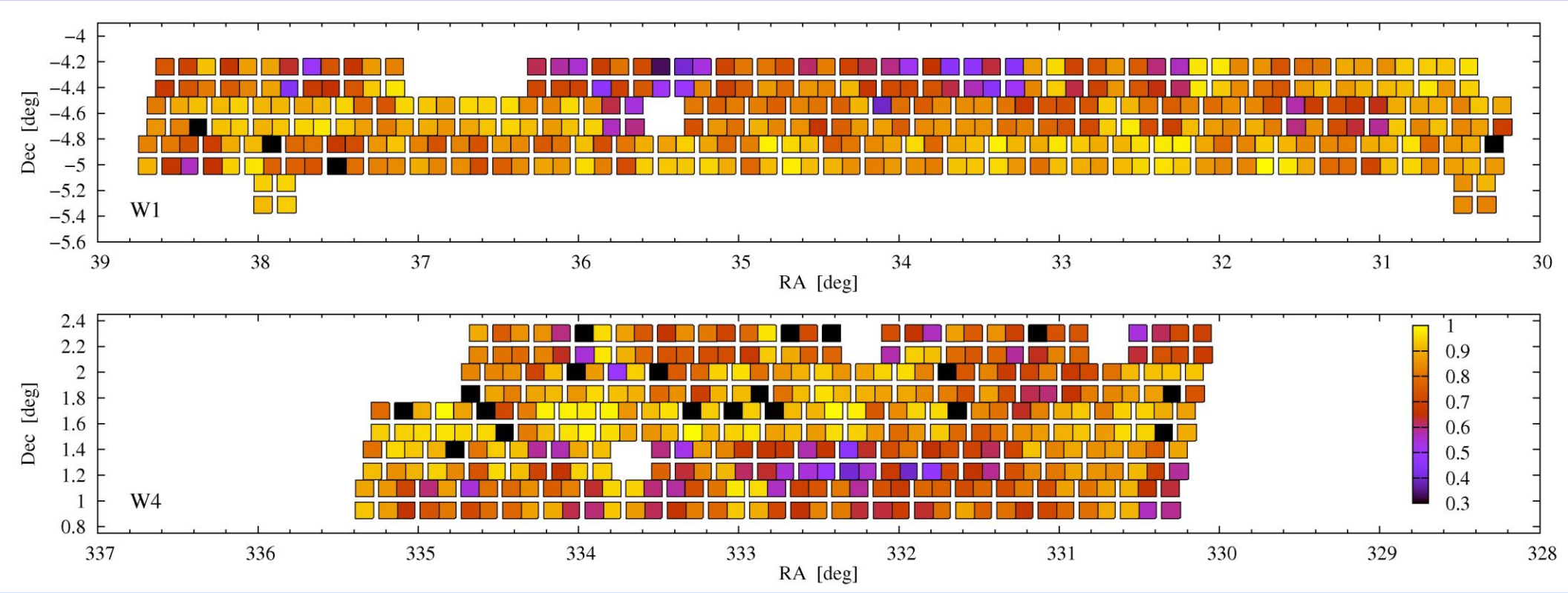
VIPERS Target Sampling Rate



Guzzo & VIPERS team 2014

~40% on the whole VIPERS area

VIPERS Spectroscopic Success Rate



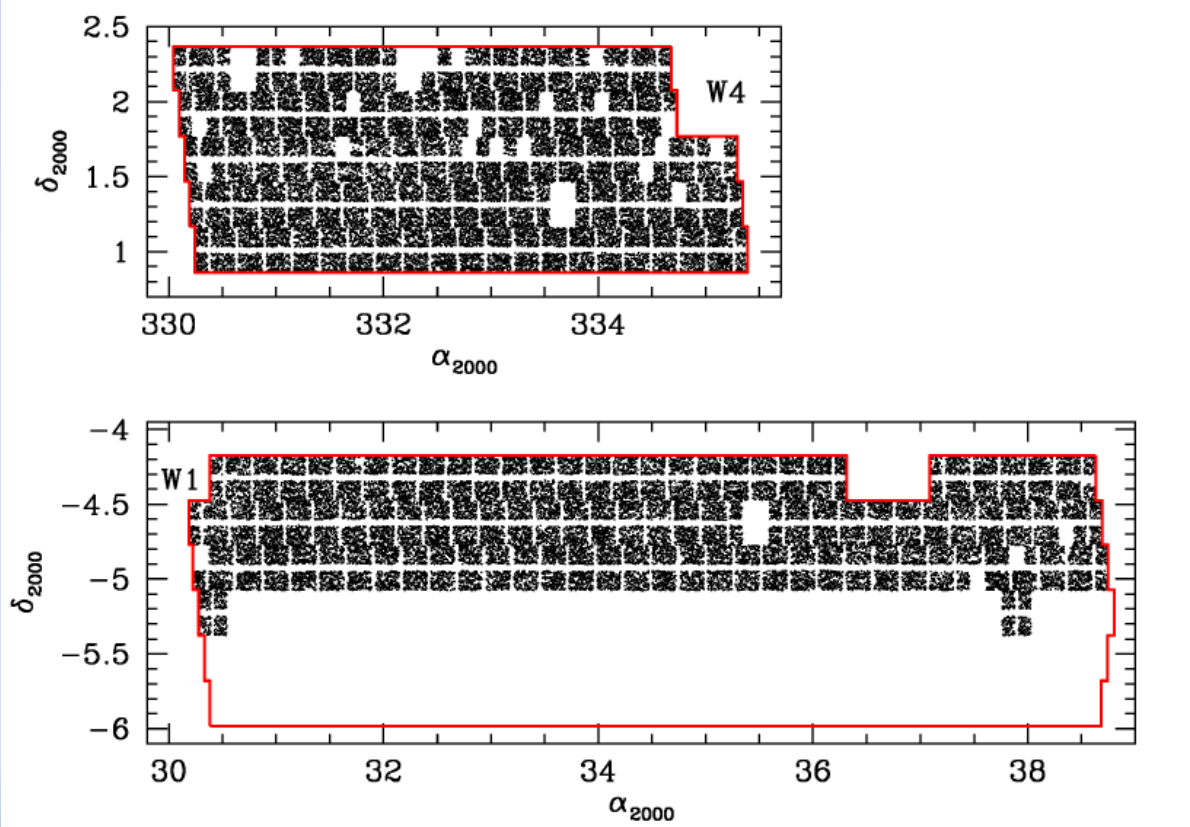
Guzzo & VIPERS team 2014

~80% on the whole VIPERS area

Public Data Release 1 (PDR1)

(Oct. 2013, see Garilli & VIPERS Team A&A 2014)

- **Completion 64%**

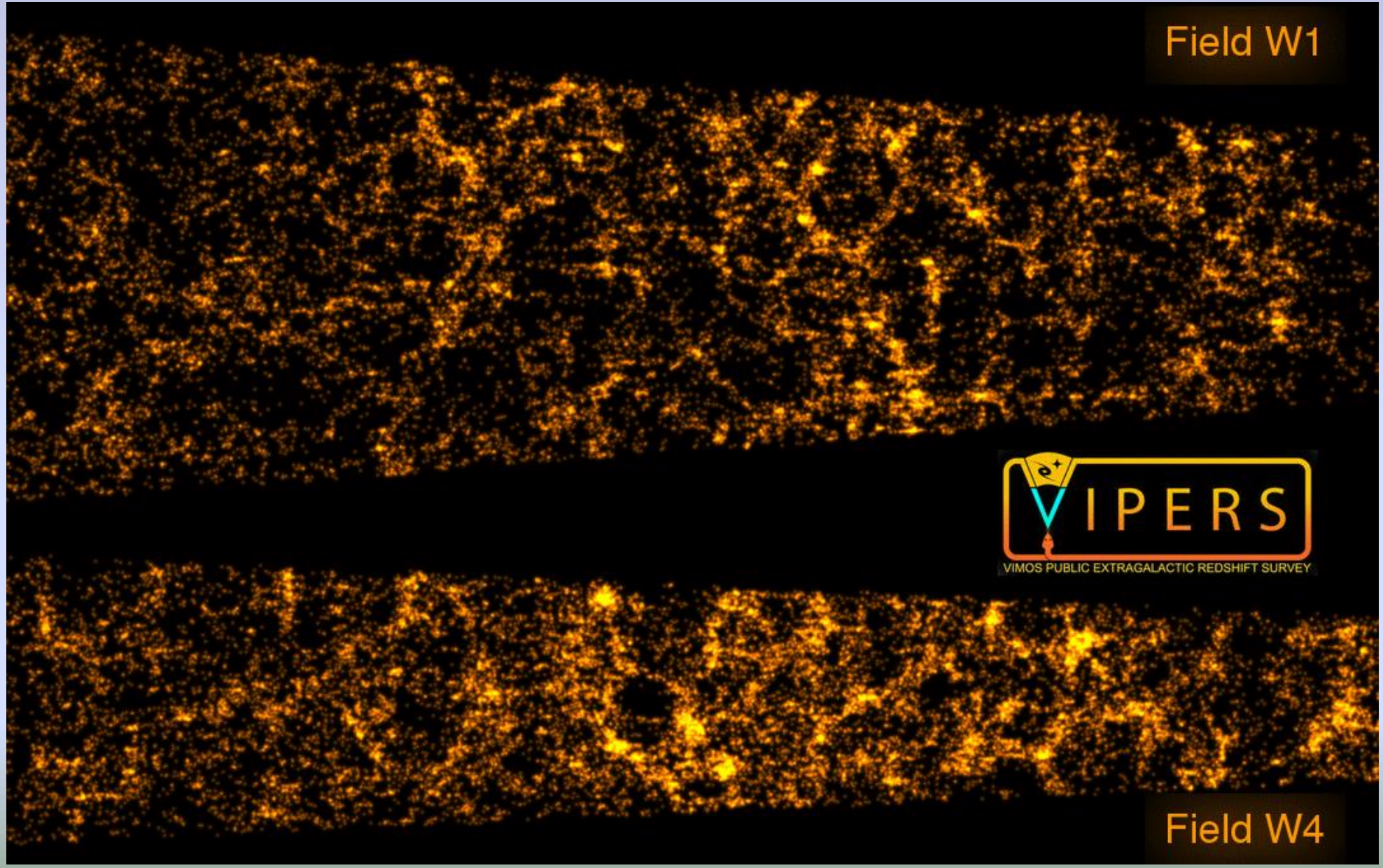


	W1	W4
Final surveyed area	15.7	7.8
PDR-1 surveyed area	7.9	7.8
PDR-1 effective area	5.5	5.1

VIPERS Team Members

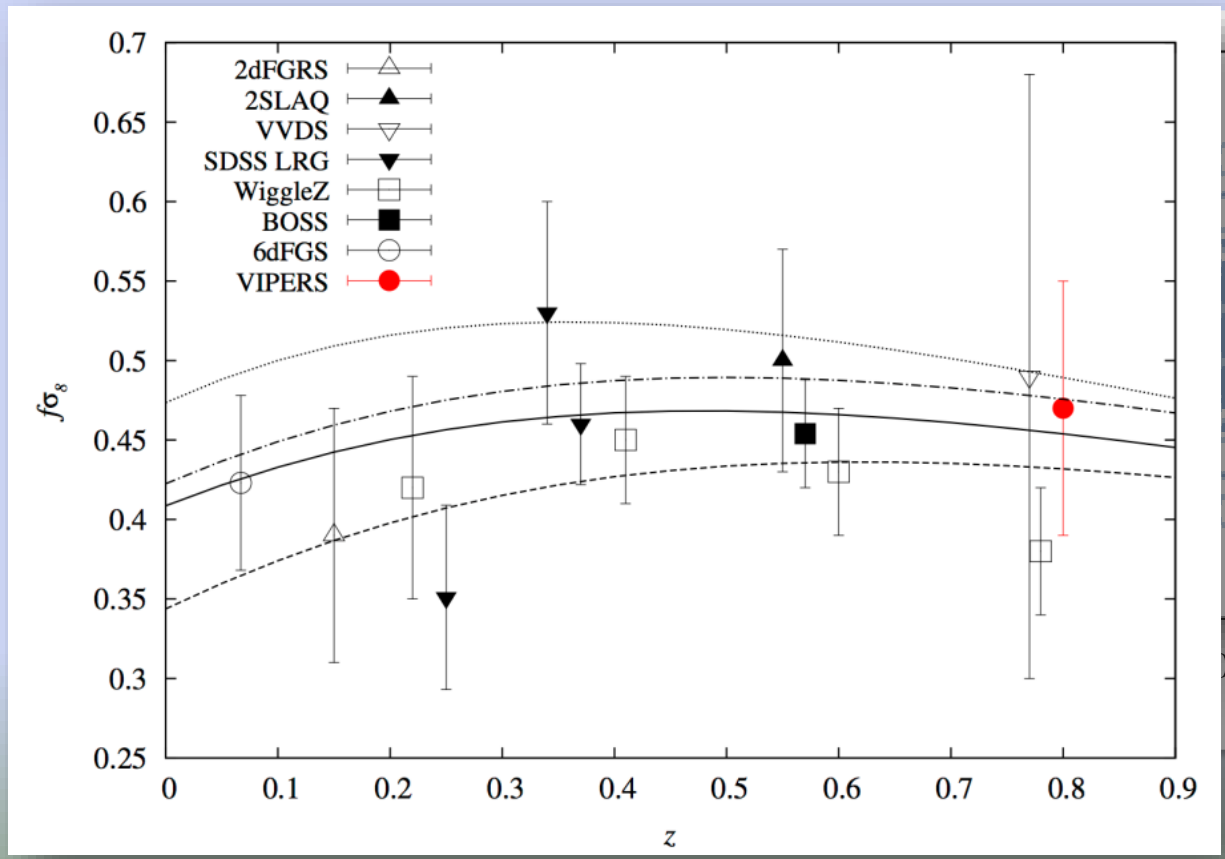
57 people, 10 institutions, 5 nations

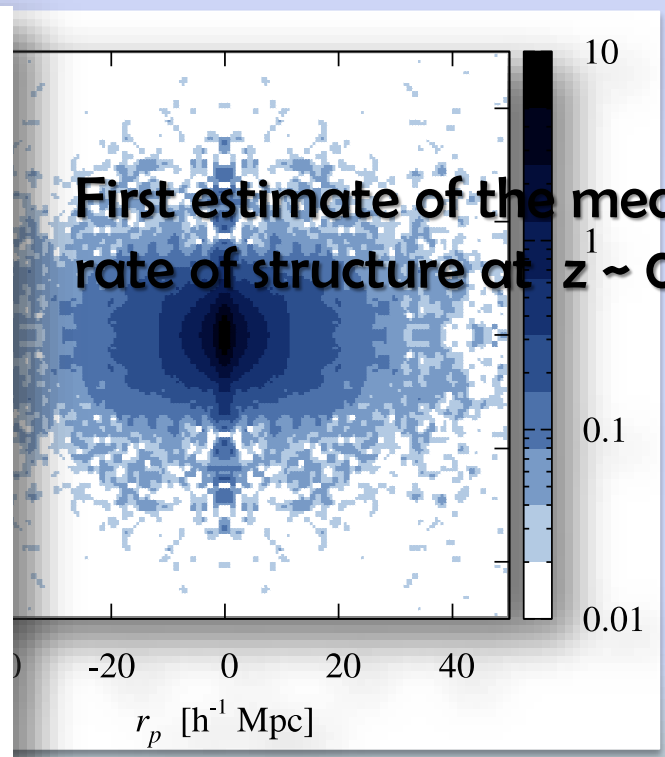
PDR1 cone diagrams



VIPERS broad scientific goals

- **Cosmological constraints from galaxy clustering measured up to 100 Mpc scales at z~1**
- **Measure structure growth through Redshift Space Distortions out to z~1, possibly using different tracers**





First estimate of the mean growth rate of structure at $z \sim 0.8$

De la Torre & VIPERS team 2013

VIPERS broad scientific goals

- **Cosmological constraints from galaxy clustering measured up to 100 Mpc scales at z~1**
- **Measure structure growth through Redshift Space Distortions out to z~1, possibly using different tracers**

See also:

- Marulli et al. A&A 2013: **Luminosity and stellar mass dependence of galaxy clustering at 0.5<z<1.1**
- Bel et al. A&A 2014: **Ω_m from the clustering ratio measured at z~1**
- Di Porto et al. A&A 2015: **Measuring non-linear galaxy bias at z ~0.8**

VIPERS broad scientific goals

- **Precise measurements of statistical properties of galaxy population (color, luminosity, stellar mass …)**

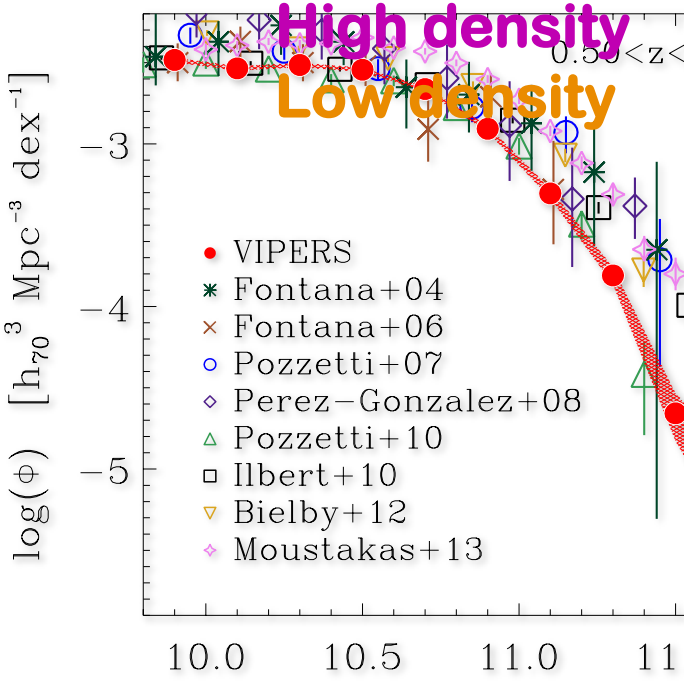
For each galaxy there is a suite of photometric data:
u, g, r, i z from CFHTLS,
near-UV (FUV and NUV) from GALEX,
K-band from WIRCAM follow-up,
UKIDSS public data (Y,J, H, K) where available

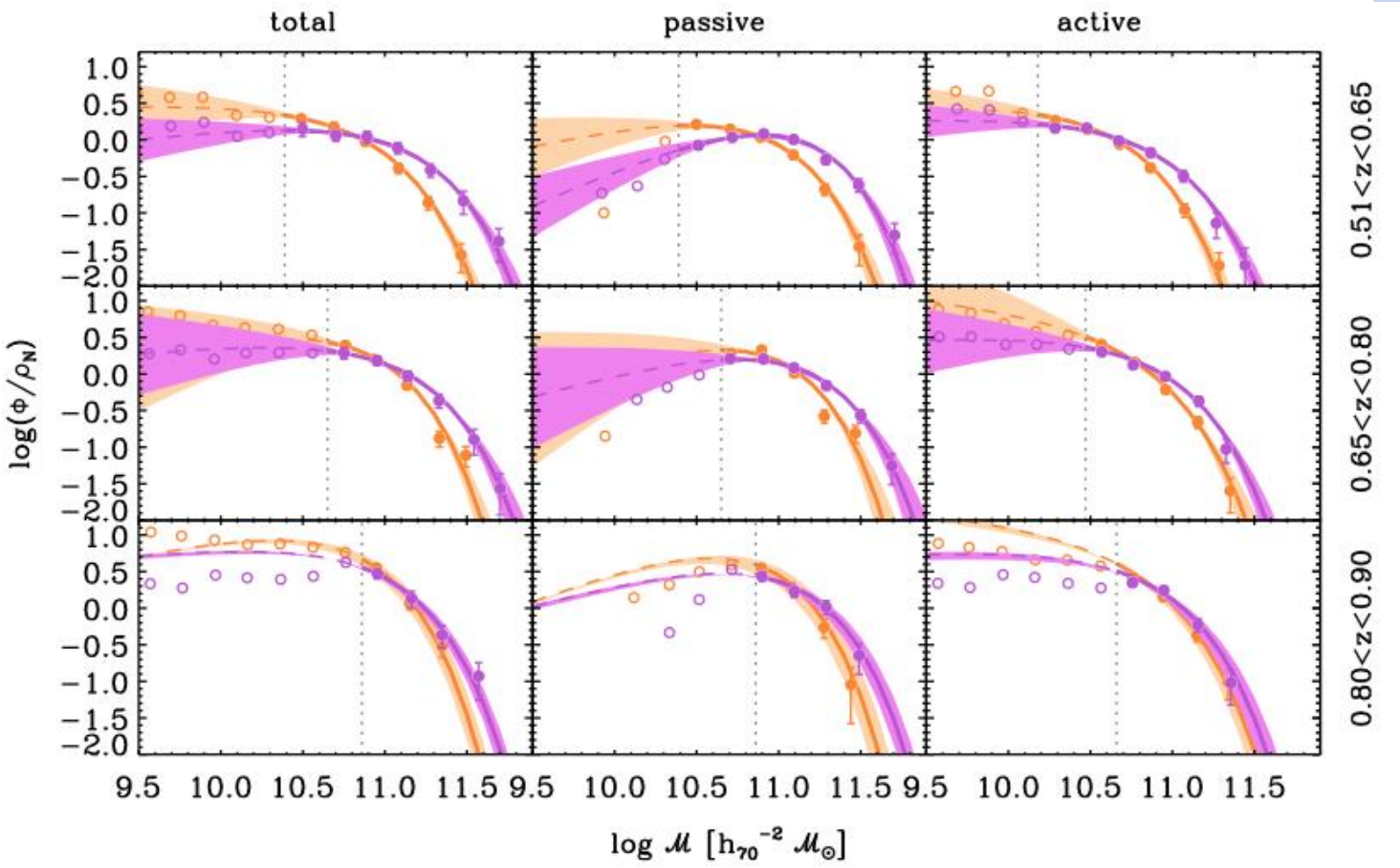
SED fitting program Hyperzmass

Galaxy rest-frame magnitudes, stellar masses together with measured spectral features

VIPERS broad scientific goals

- **Precise measurements of statistical properties of galaxy population (color, luminosity, stellar mass ...)**





Most precise measurement of the number density of massive galaxies at z~1

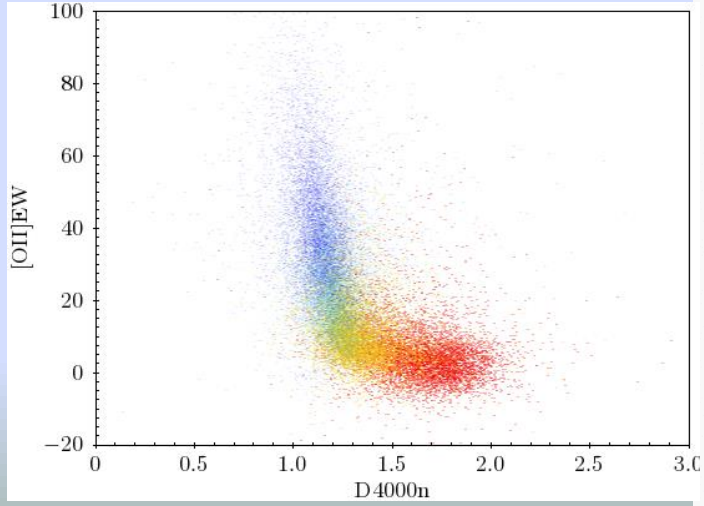
Davidzon & VIPERS team 2015

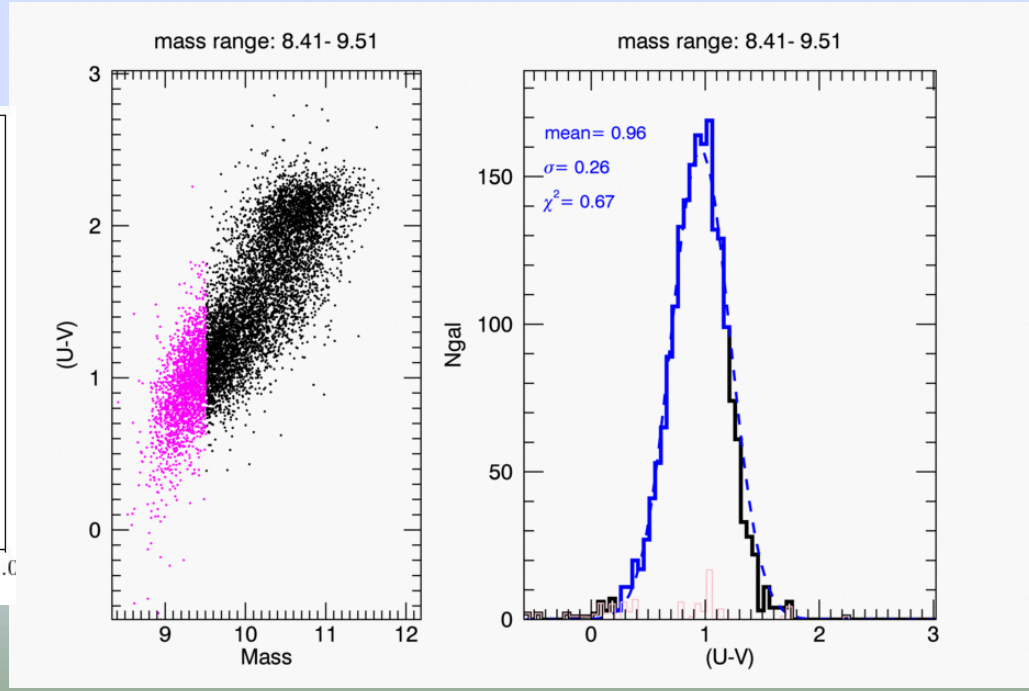
VIPERS broad scientific goals

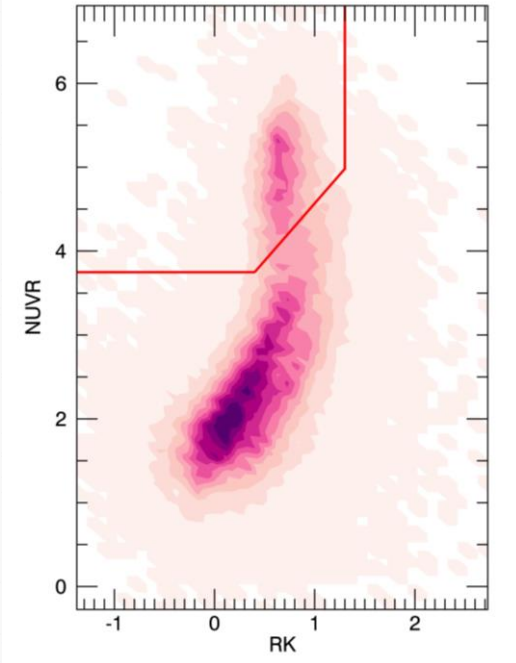
- **Precise measurements of statistical properties of galaxy population (color, luminosity, stellar mass …)**

See also:

- Fritz et al. A&A 2013: **A quiescent formation of massive red sequence galaxies over the past 9 Gyr**
- Marchetti et al. A&A 2013: **Spectral classification through Principal Component Analysis**
- Malek et al. A&A 2013: **A Support Vector Machine classification of galaxies, stars and AGNs**

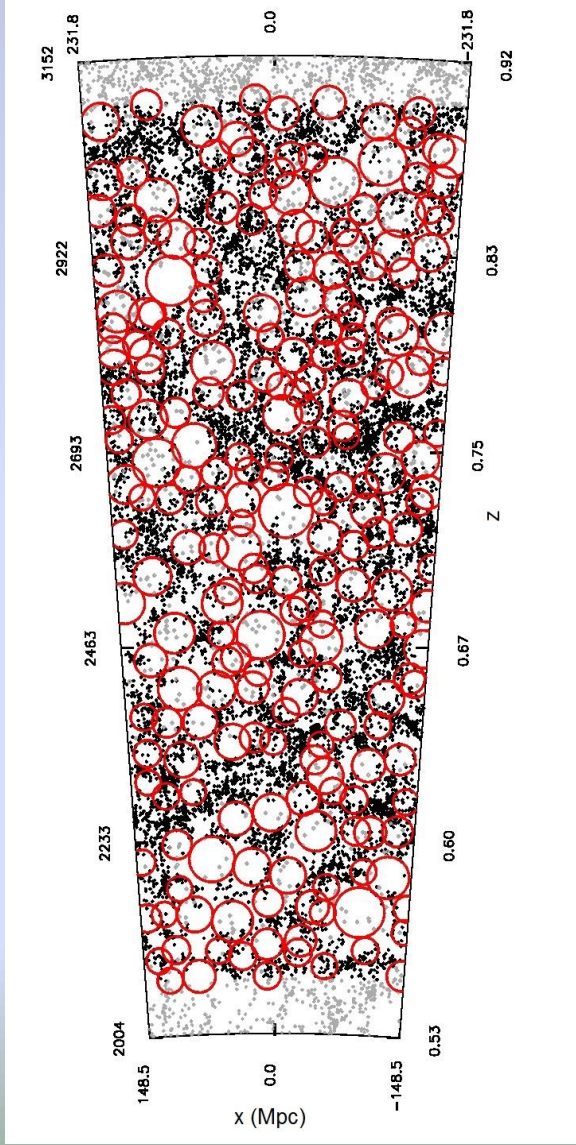


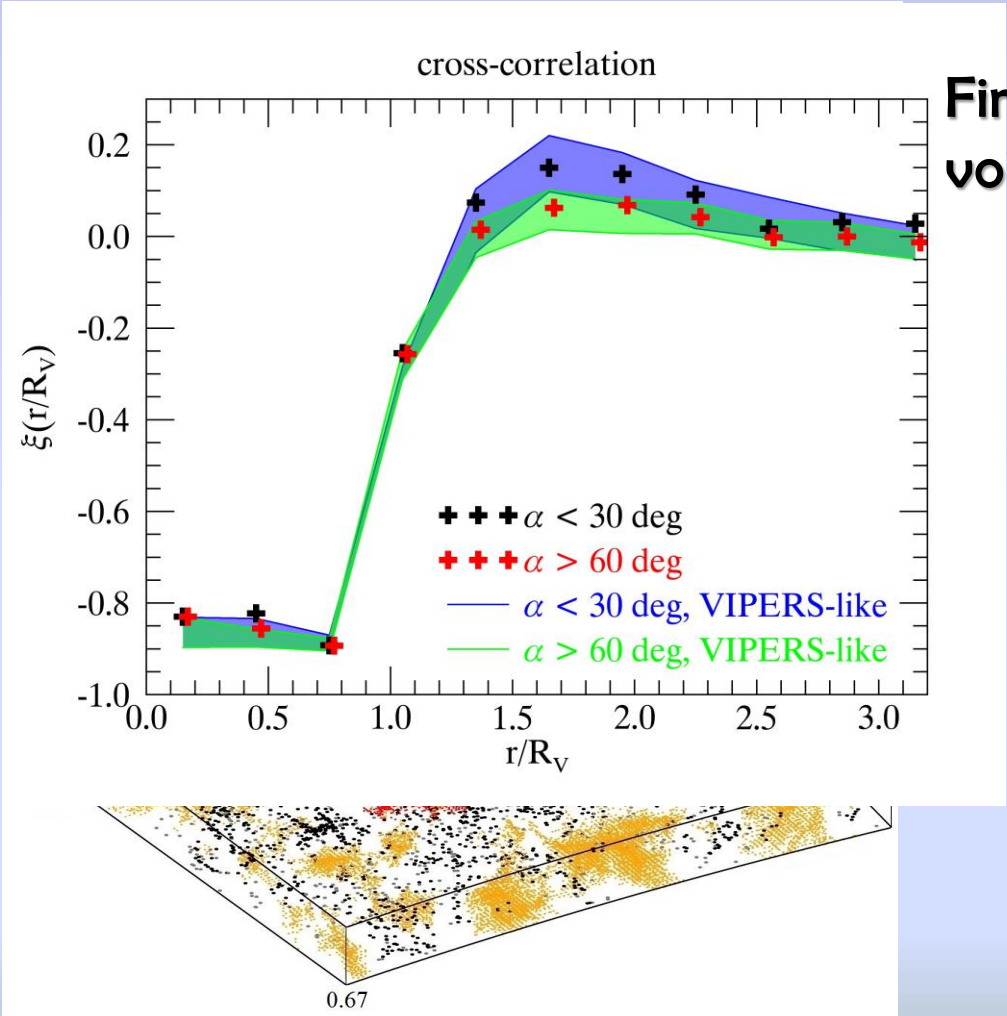




VIPERS broad scientific goals

- **Identify structures as groups, filaments, voids**





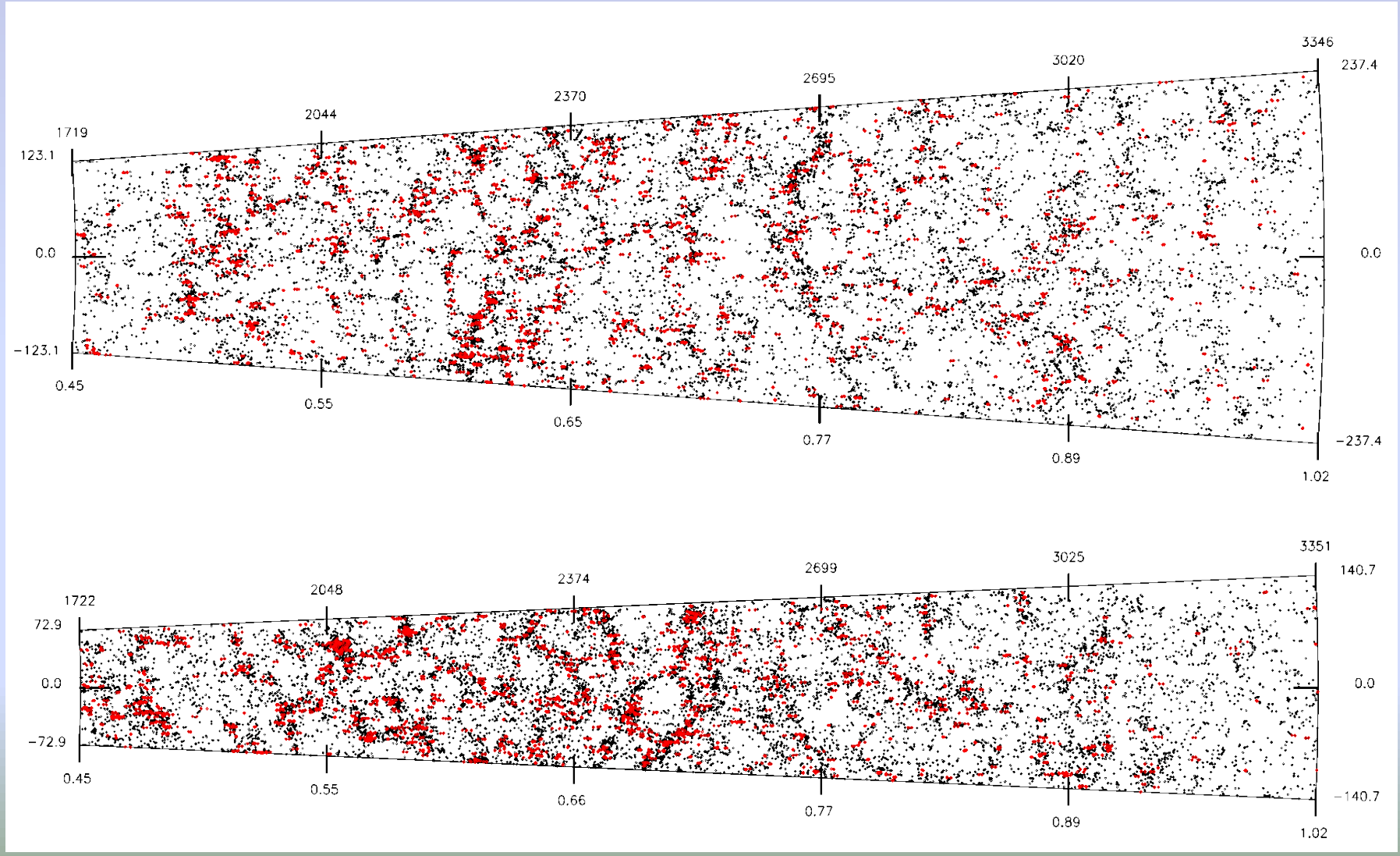
First catalog of voids at these redshifts

Anisotropy of voids-galaxy cross-correlation function indicates that galaxies are outflowing from voids

Micheletti, AI, Hawken & VIPERS Team 2014

VIPERS broad scientific goals

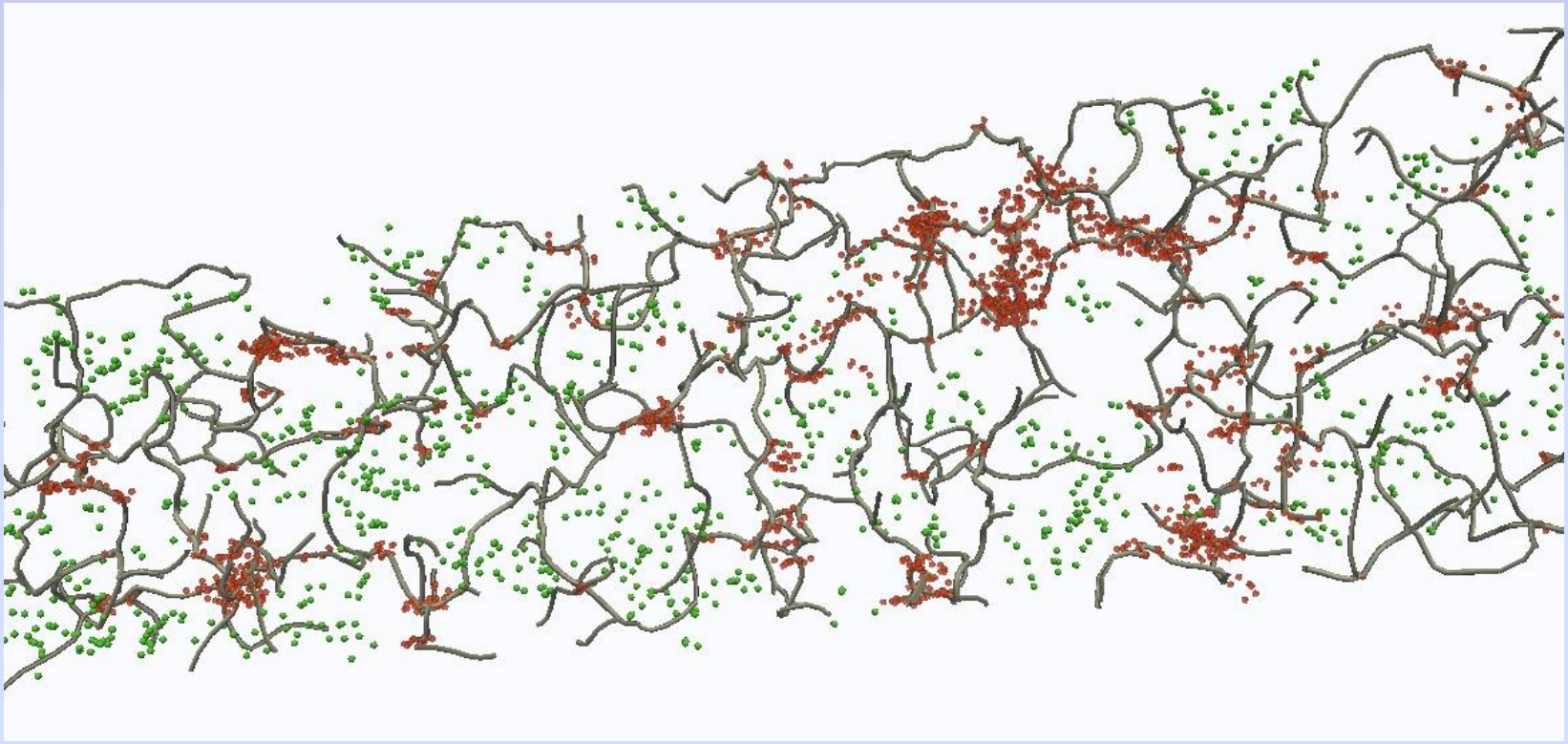
- **Identify structures as groups, filaments, voids**



Groups catalog using FoF and VDM algorithms AI in prep.

VIPERS broad scientific goals

- **Identify structures as groups, filaments, voids**

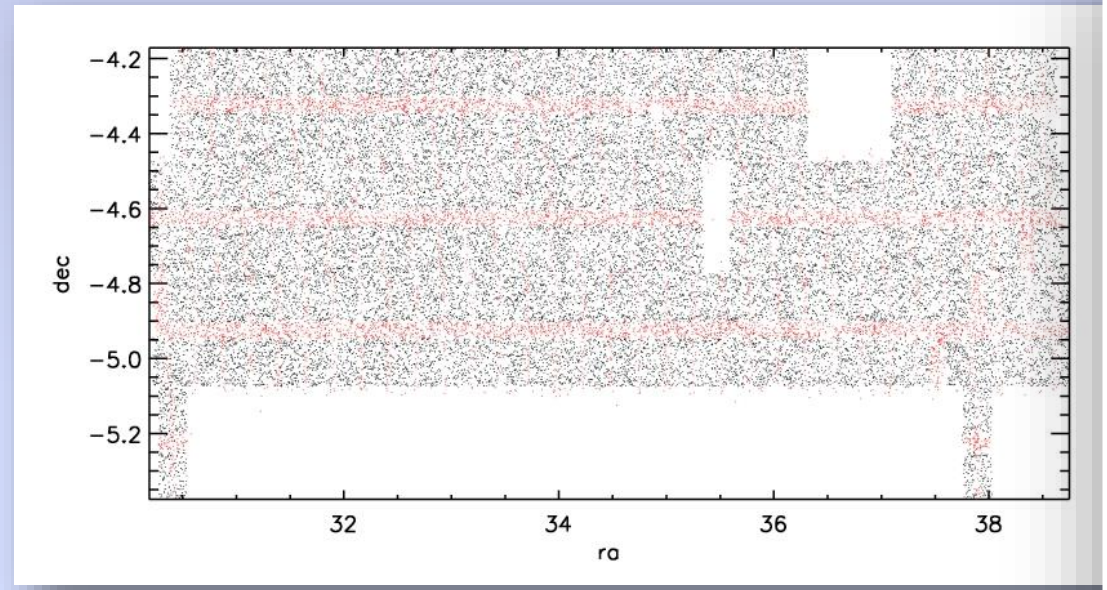


Filaments using Disperse - Davidzon in prep.

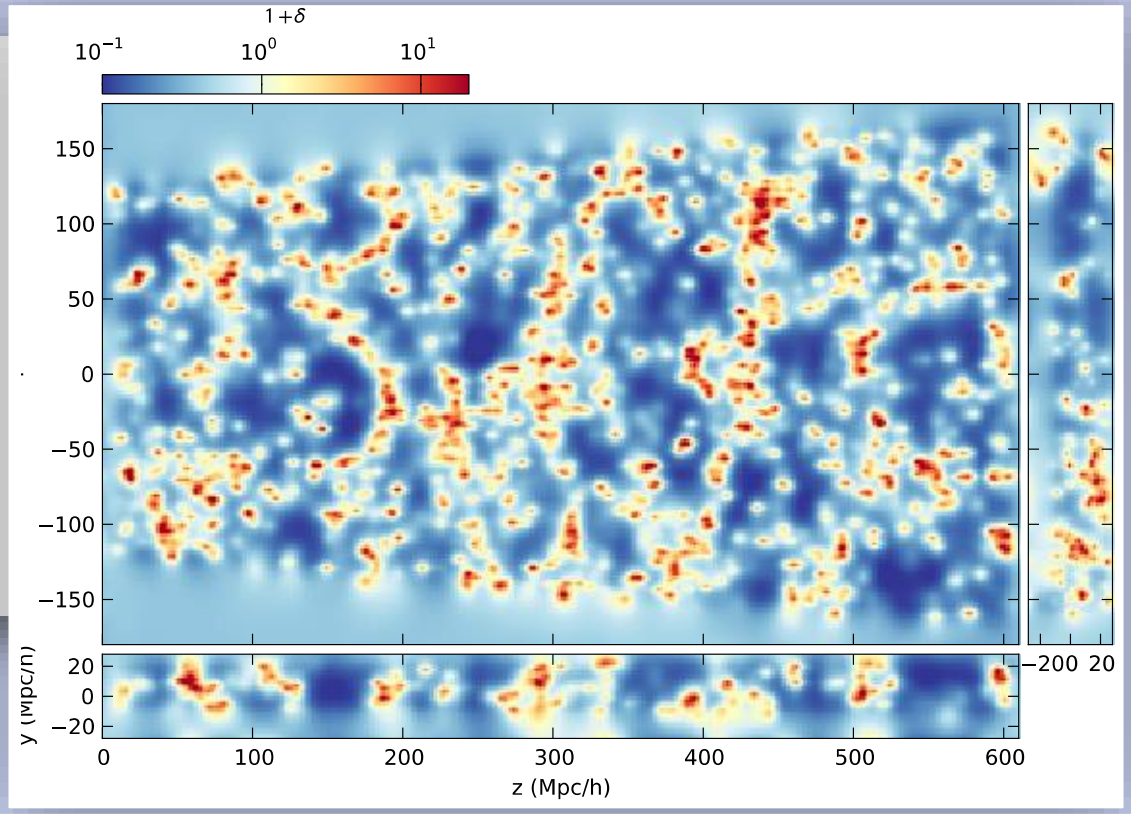
VIPERS skeleton obtained with Disperse (Sousbie 2013)
http://spine-public.projet-horizon.fr

VIPERS broad scientific goals

- **Identify structures as groups, filaments, voids**



Local density reconstruction:
ZADE photo-z attractor



Statistical reconstruction using Wiener filtering

Cucciati & VIPERS Team 2014

Summary

- **VIPERS exploits VIMOS@VLT, filling a specific niche at z~1: large volume ~6 x 10^7 h^{-3} Mpc^3, high ~ 40% sampling. It is complementary to larger-volume, sparser BAO surveys**

- **VIPERS is designed to measure clustering, RSD, structures and environmental properties of galaxies at 0.5<z<1.0**

- **VIPERS is a powerful probe for galaxy evolution studies over 8 billion years (see large and growing set of ancillary data: GALEX, WIRCAM, VISTA, XMM …)**

- **Strong legacy value: DR1 is already available**

- **See www.VIPERS.inaf.it for more info**