



THE VIPERS REDSHIFT SURVEY



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on behalf of the VIPERS Team

GEE2 Meeting, Milano Nov. 2011

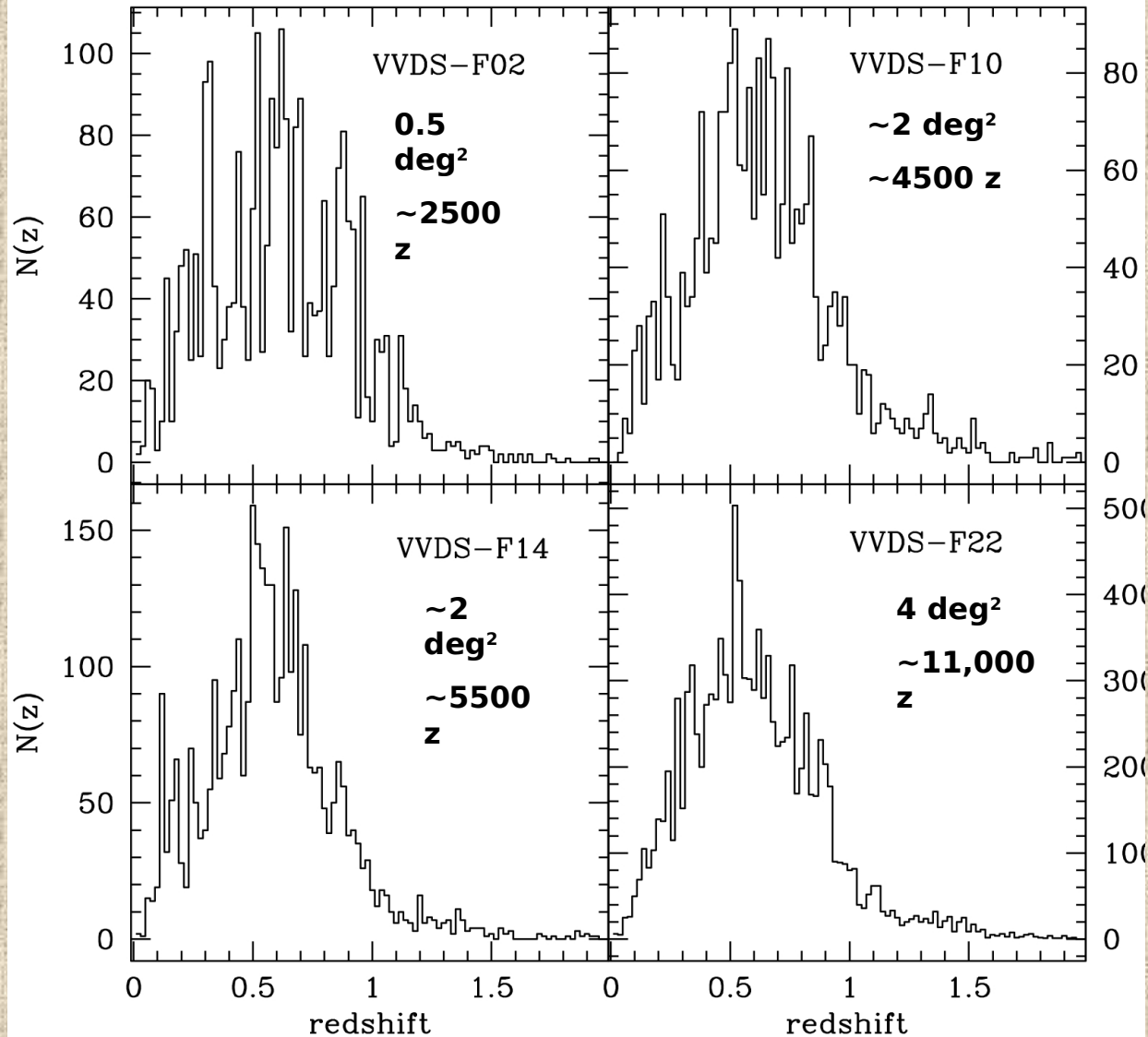


General motivations for a large redshift Survey at $z\sim 1$



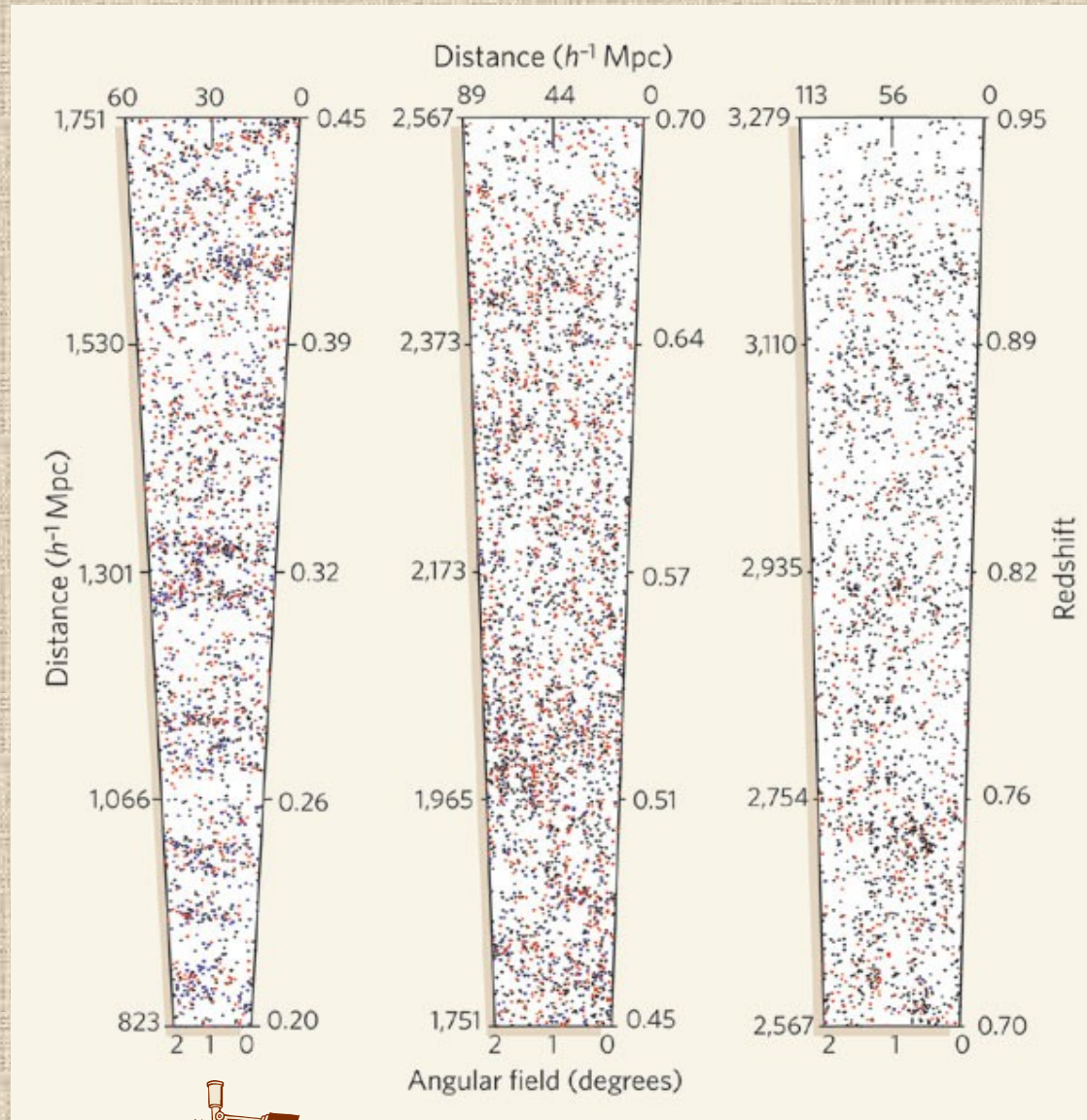
- Clustering measurements from existing $z\sim 1$ samples (VVDS, ZCOSMOS) are cosmic-variance limited: map large-scale structure at $z\sim 1$ up to scales $\sim 100 h^{-1}\text{Mpc}$
- Exploit VIMOS high multiplexing on moderately large field of view: focus on growth of structure and clustering building upon VVDS early results on redshift distortions
- Optimize largest possible volume (reduce cosmic variance) and good sampling (reduce Poissonian noise)
- Benefit from previous VVDS/zCOSMOS experience: new techniques to maximize volume and sampling in redshift range of interest
- The next step of large-scale structure studies: in practice, a 2dFGRS at $z\sim 1$

VVDS-Wide $I_{AB} < 22.5$ fields: redshift distributions



Garilli et al. 2008

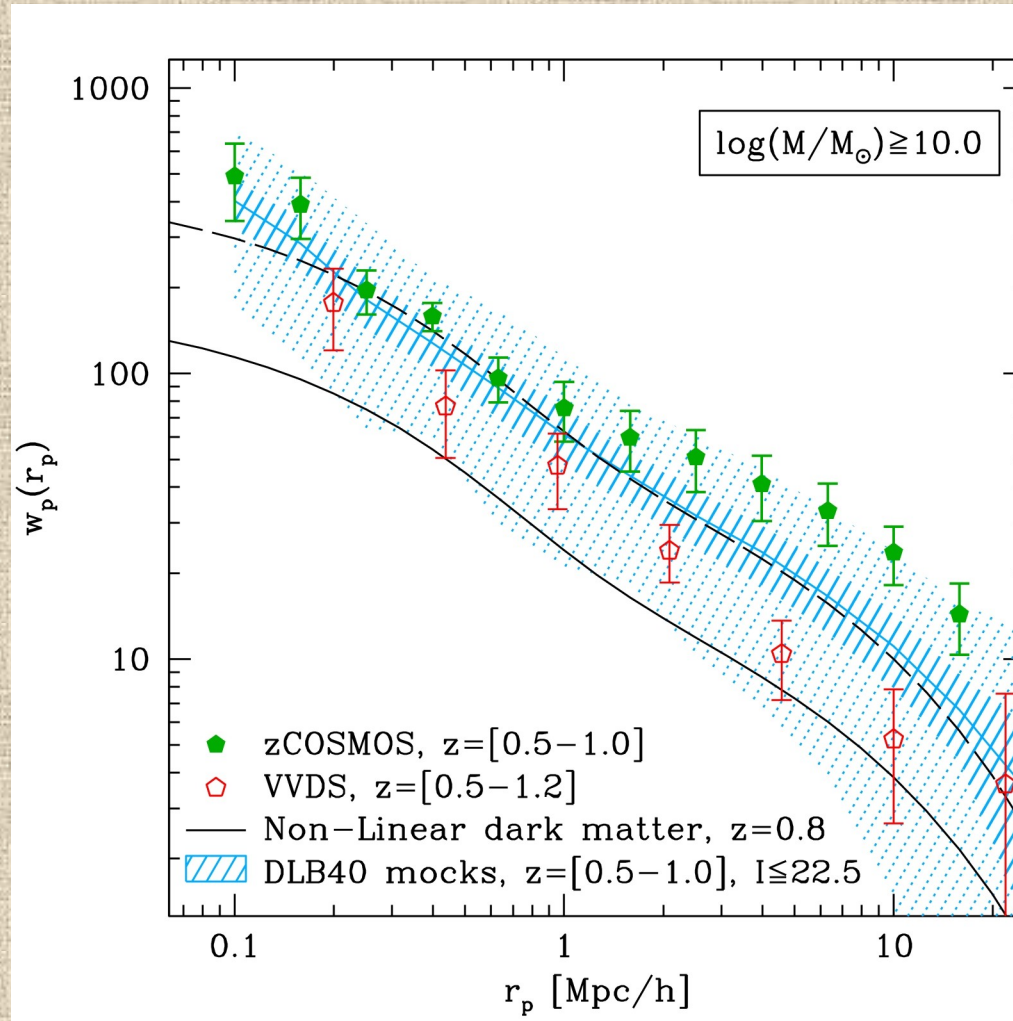
VVDS-Wide F22 field: 10,000 redshifts to $z \sim 1.2$



(Garilli et al. 2008, A&A 486, 683)



VVDS vs zCOSMOS at similar z: the impact of survey-size fluctuations (Cosmic Variance)



B. Meneux, L. Guzzo
& zCOSMOS Collaboration,
2009

VIPERS in a nut-shell



- 440.5 VLT hours
- $\sim 24 \text{ deg}^2$ over W1 and W4 CFHTLS wide fields ($\sim 16 + 8$)
- $I_{AB} < 22.5$, LR Red grism, 45 min exp.
- 288 VIMOS pointings
- $z > 0.5$ color-color pre-selection
- PSF + SED -based star-galaxy separation (AGN color recovery)
- **$\sim 100,000$ redshifts, $> 40\%$ sampling**
- **Density and volume comparable to 2dFGRS, but at $z \sim 0.8$**

VIPERS broader scientific goals



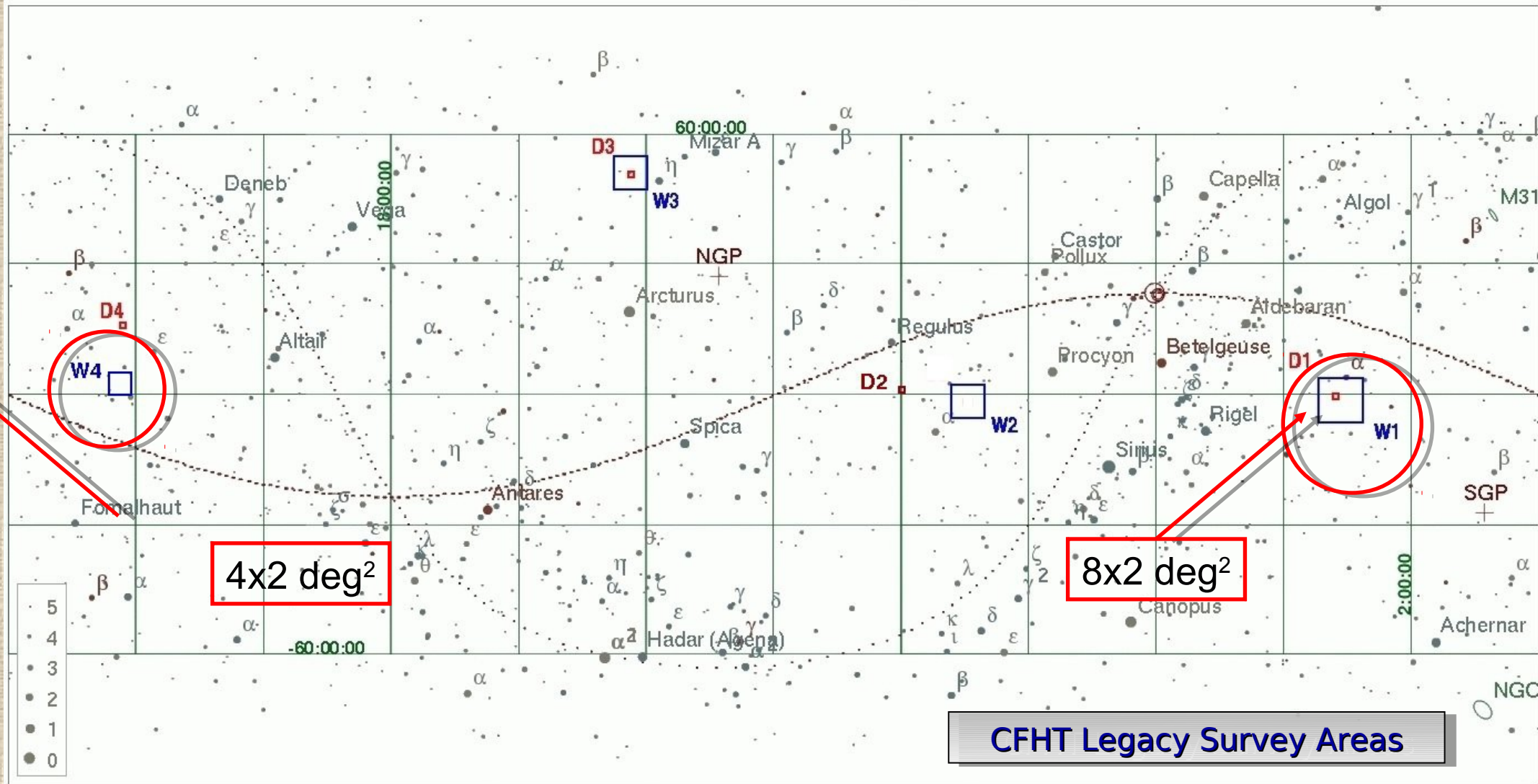
- Growth rate from redshift-space distortions
- Galaxy clustering at $z \sim 1$:
 - Evolution of $x(r)$ and $P(k)$ (W_m, W_b at $z \sim 1$)
 - Dependence on galaxy properties
 - HOD modeling
- Galaxy biasing
- Massive clusters and super-clusters of galaxies
- Evolution of galaxies and dependence on local density
- Bright/massive/rare galaxies and the galaxy luminosity and stellar mass functions
- Evolution of AGN's
- Weak-lensing (photo-z calibration)
- Multi-wavelength investigations (SWIRE, XMM, UDS)

VIPERS Team (11 institutes, 49 people)

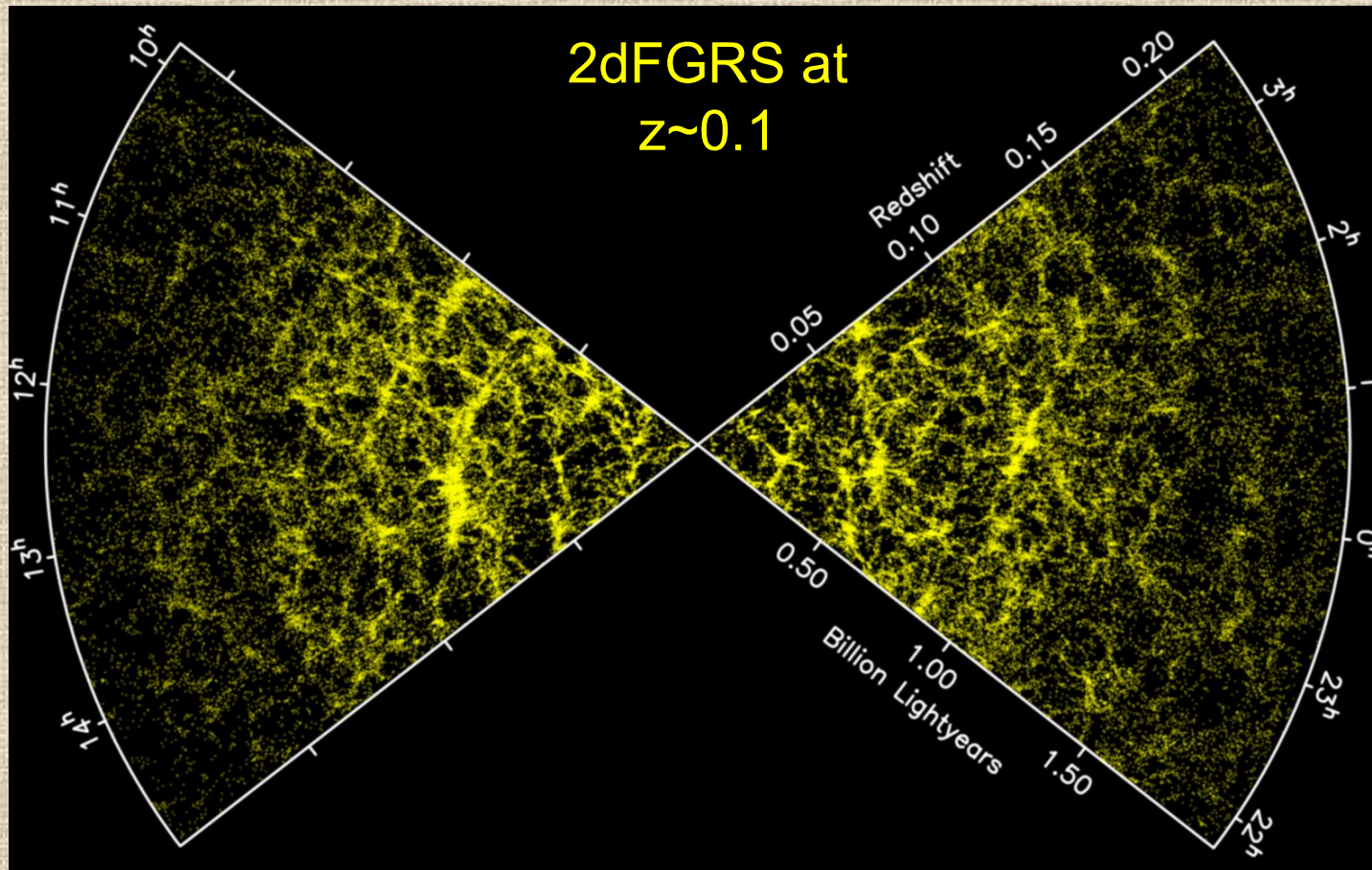


- **MILANO OAB (Project Office)**: L. Guzzo, B. Granett, A. Iovino, A. Marchetti, U. Abbas (Turin), G. De Lucia (Trieste), O. Cucciati (Trieste)
- **MILANO IASF (Data Reduction Centre)**: M. Scodeggio, B. Garilli, A. Fritz, D. Bottini,, P. Franzetti, D. Maccagni, L. Paoro, M. Polletta
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- **GARCHING MPE**: S. Phleps, H. Schlegelhauser
- **MARSEILLE**: O. Ilbert, O. Le Fevre, V. Le Brun, C. Adami, L. Tasca, C. Marinoni, J. Bel, C. Schimd, J. Blaizot (Lyon), S. Arnoux (CFHT)
- **PARIS (TERAPIX CFHTLS centre)**: H. McCracken, Y. Mellier, M. Wolk, J. Coupon (Tokyo)
- **PORTSMOUTH**: W. Percival, R. Tojeiro, R. Nichol
- **WARSAW**: A. Pollo, J. Krywult, K. Malek

Location of VIPERS fields



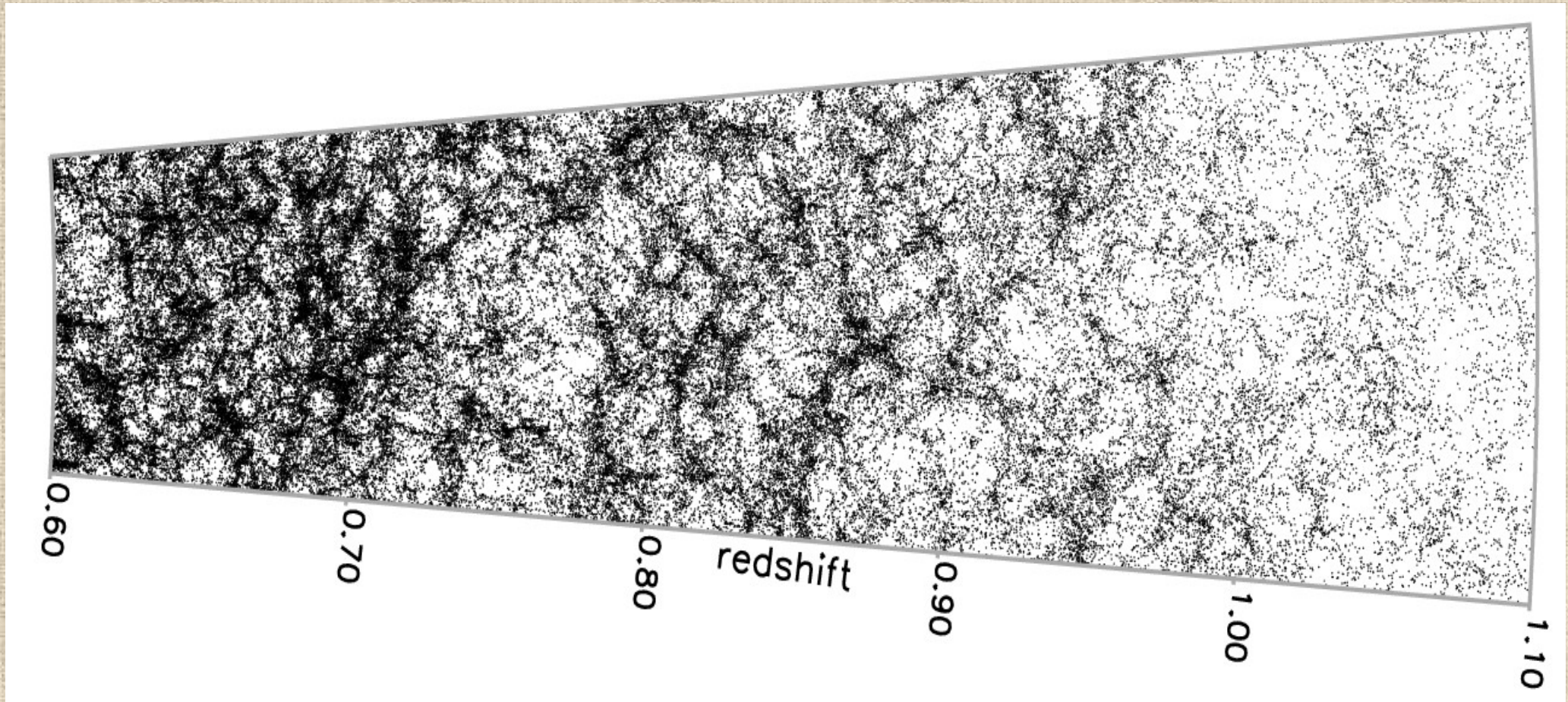
VIPERS: a 2dFGRS at $0.5 < z < 1.2$



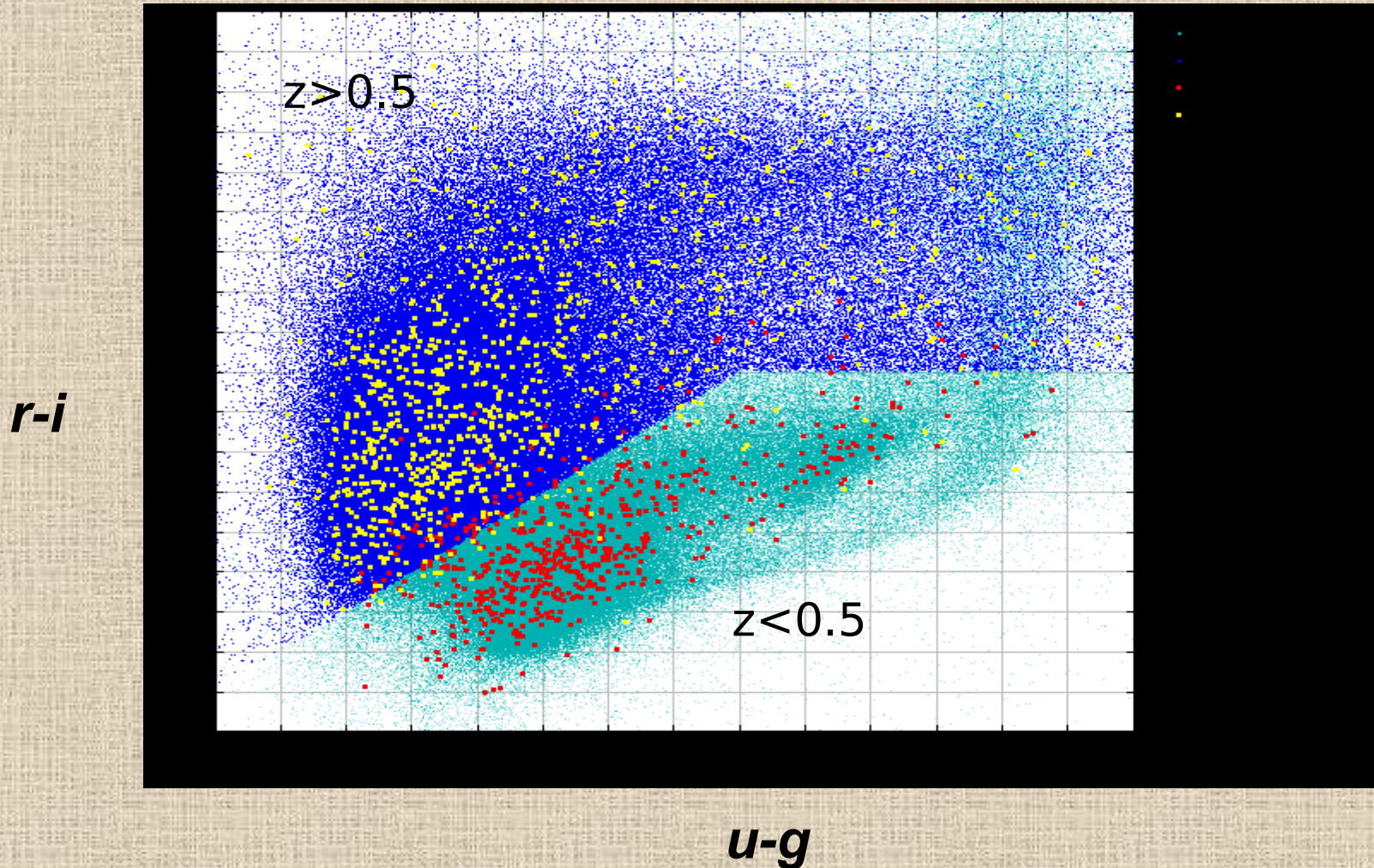
VIPERS: a 2dFGRS at $0.5 < z < 1.2$



VIPERS 2x8 deg² slice in CFHTLS W1 field
(mock sample from MPA Millennium Database,
by G. De Lucia & G. Blaizot)



VIPERS color-color selection: isolating $z > 0.5$ galaxies



VIPERS target catalogue with VVDS check sample

VIPERS redshift measurements (as of Nov. 06, 2011)

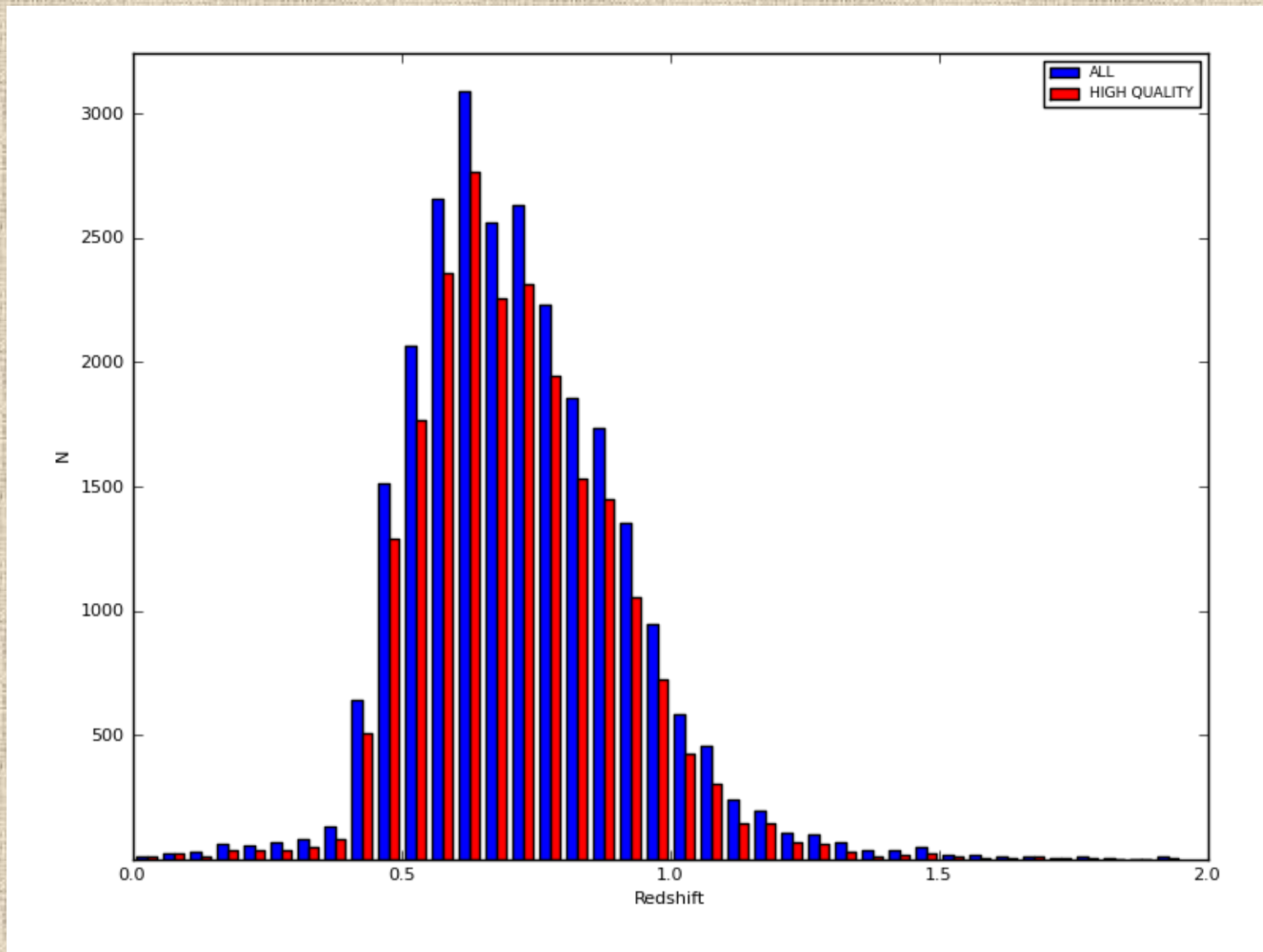


SURVEY STATUS AS OF 06/11/2011

EFFECTIVE GALAXY TARGETS	MEASURED REDSHIFTS	STELLAR CONTAMINATION	COVERED AREA
28834	26605	833 (3.1 %)	31.4 %

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

VIPERS redshift distribution (as of Nov. 06, 2011)

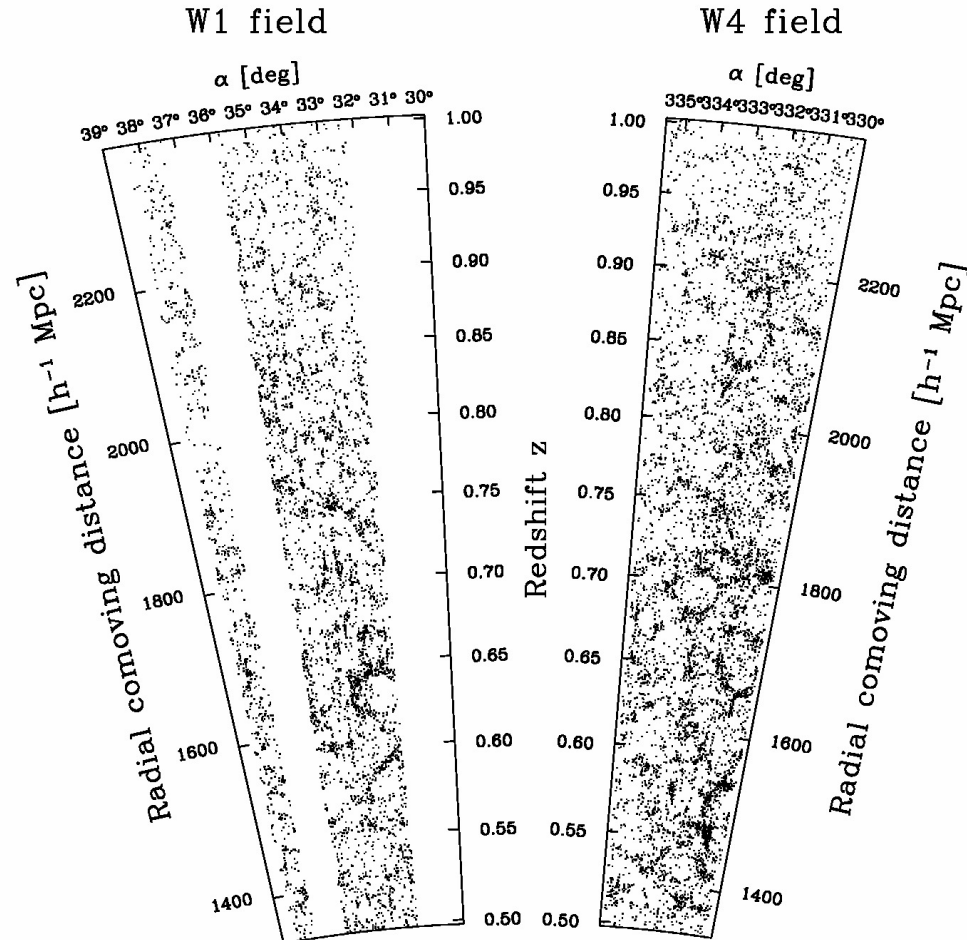


26,605 redshifts
(~30% of total survey)

First VIPERS 3D galaxy distribution



FIRST 3D VIEW
OF STRUCTURE
IN THE $z \sim 0.8$
UNIVERSE
OVER SUCH
LARGE SCALES

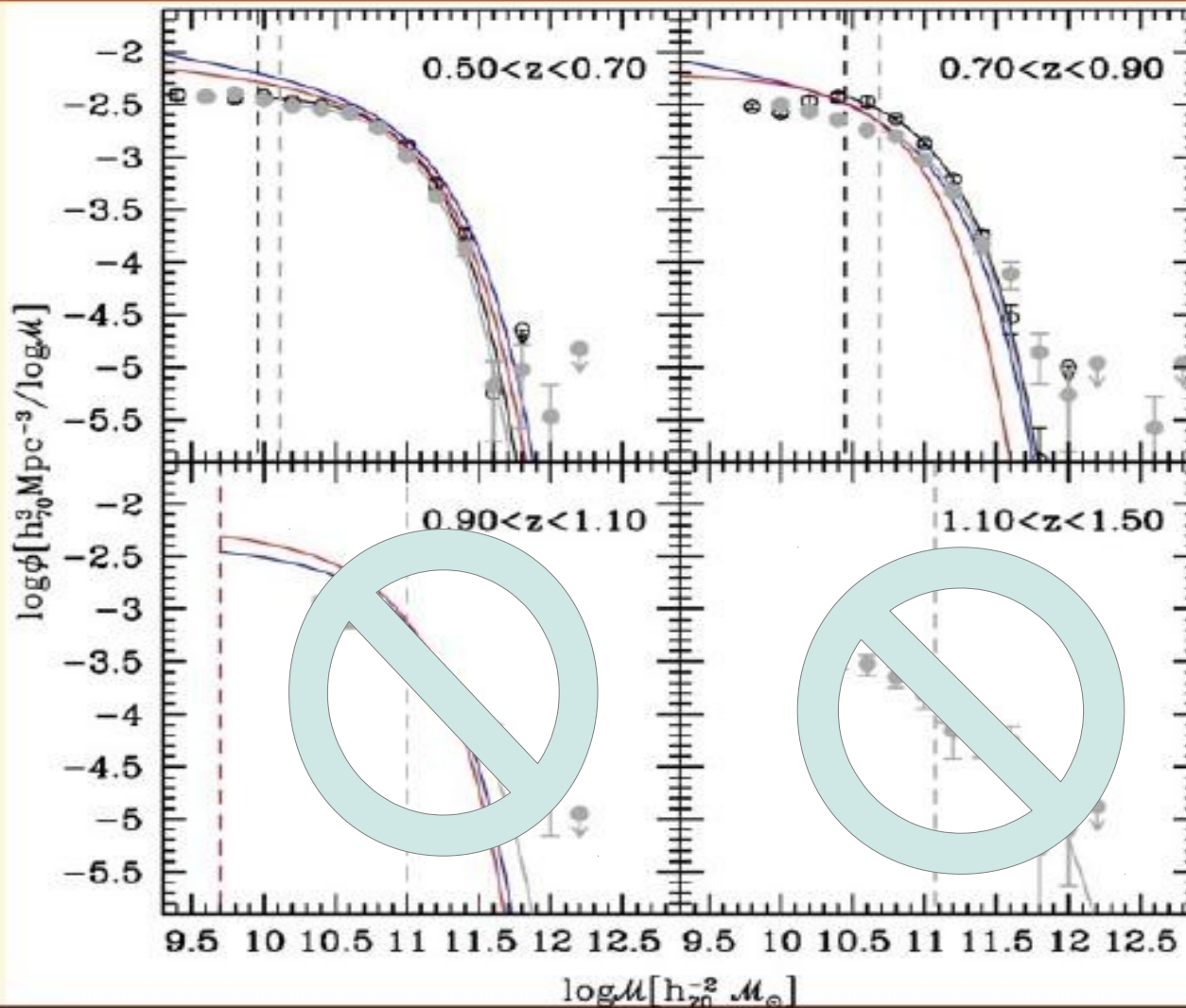


18,586 redshifts

Galaxy Stellar Mass Functions

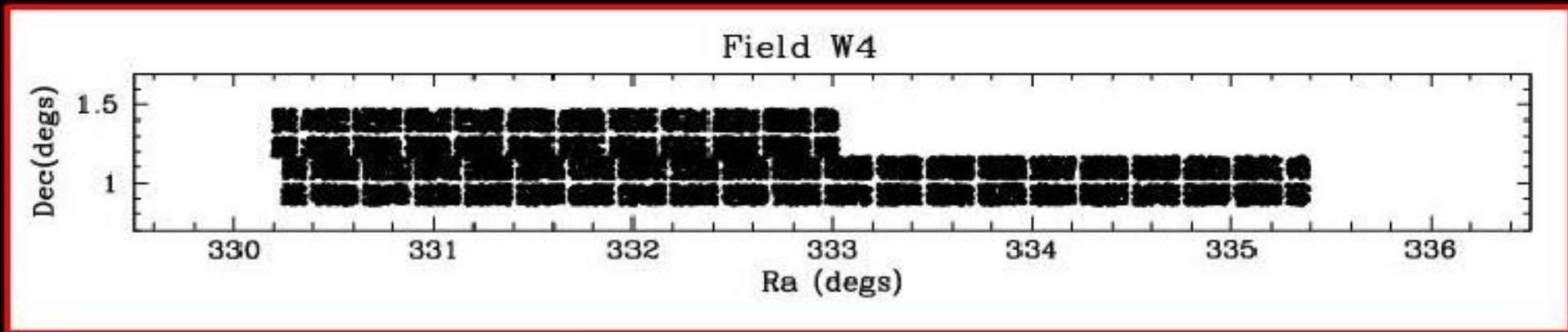
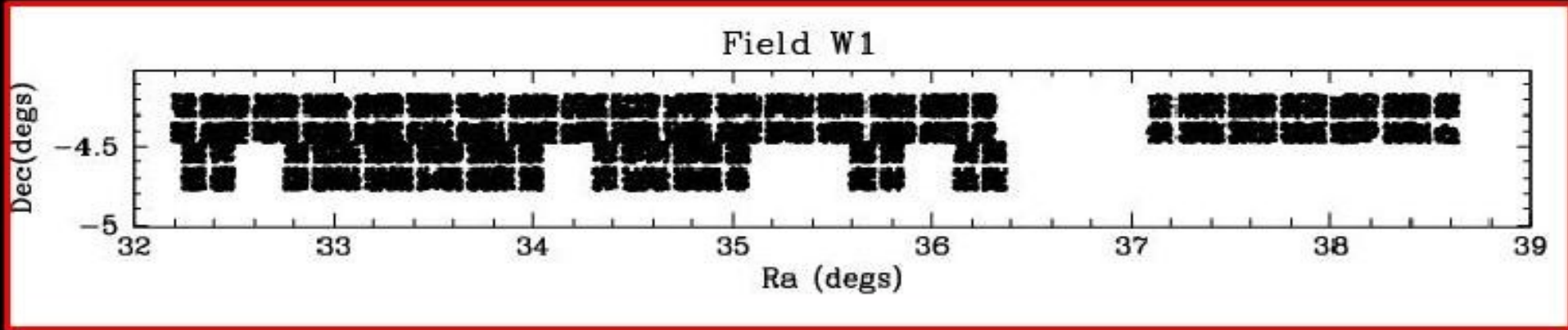


Black: zCOSMOS
Blue: VVDS I-sel
Red: VVDS K-sel
Gray: W1+W4





Some news on the Mocks side



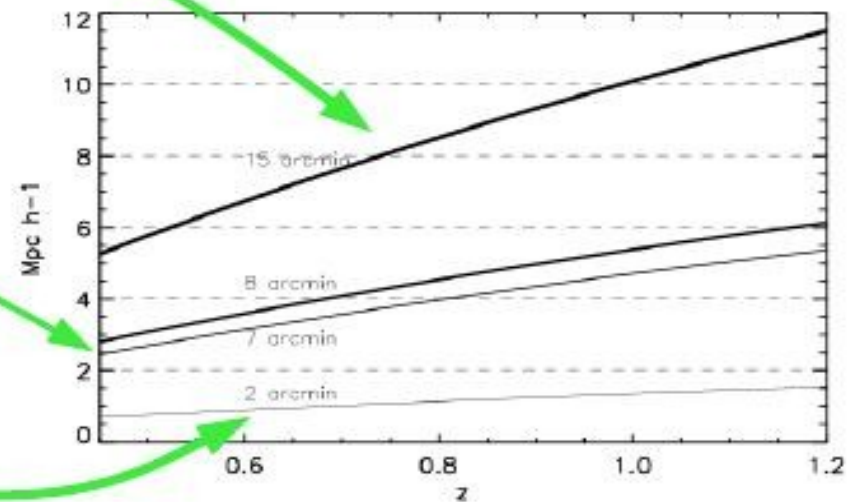
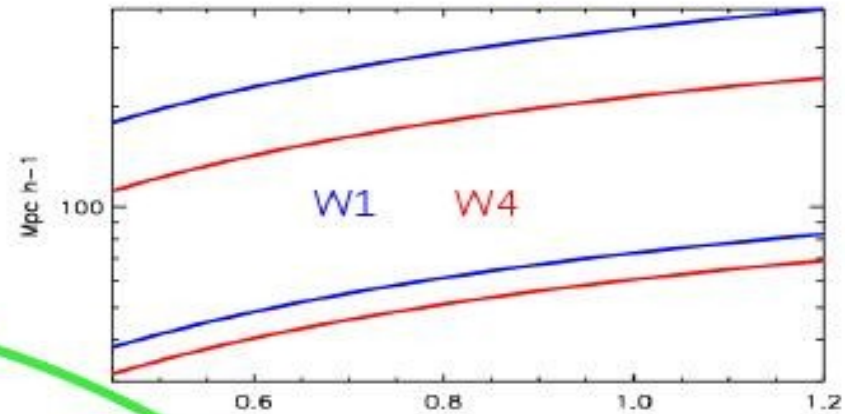
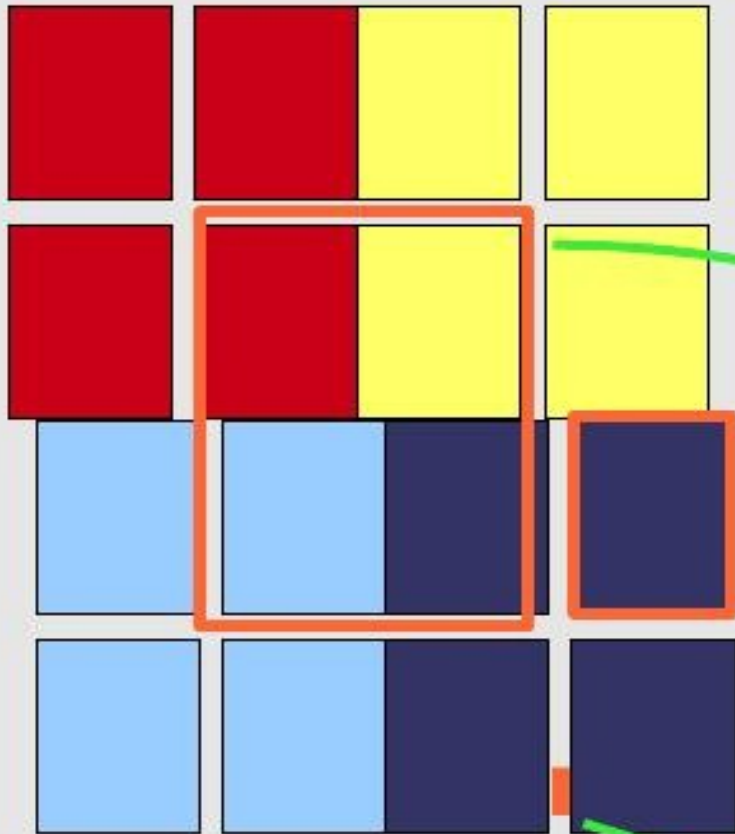
Mocks as of 2009+2010 observations

KRAKOW – 21-22-23 Sept 2011

A. Iovino

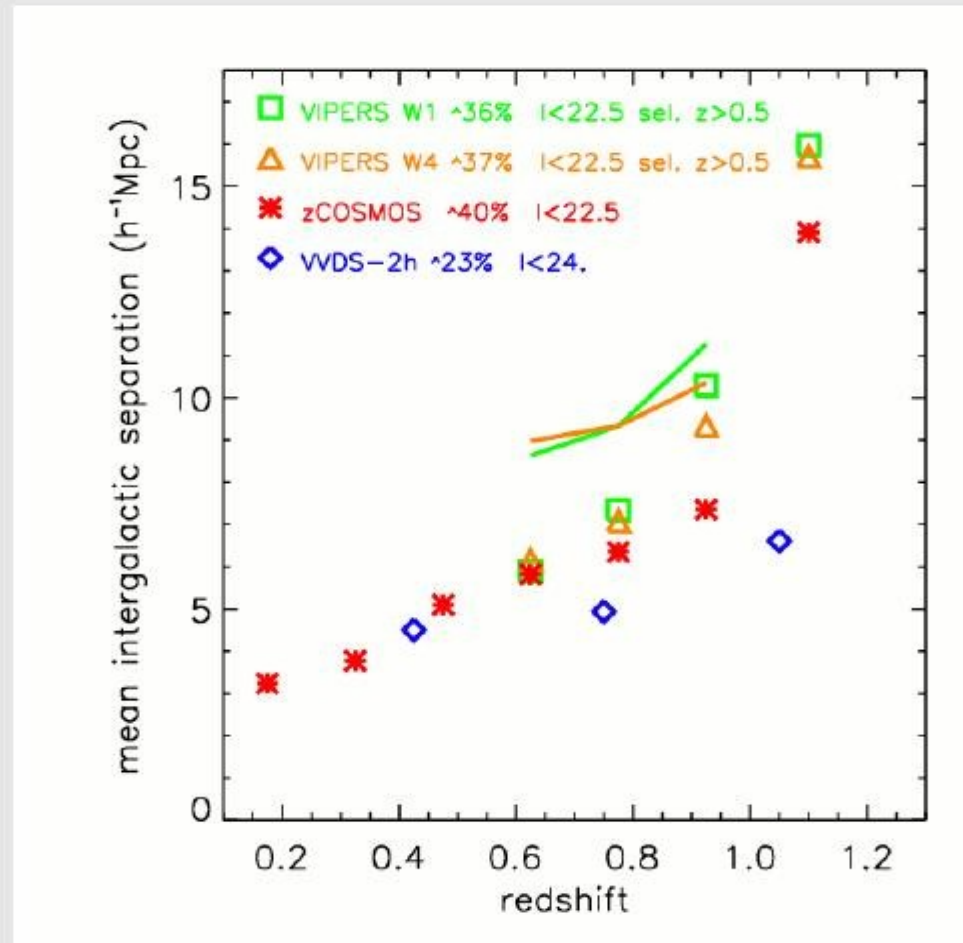


VIPERS observational strategy: typical dimensions



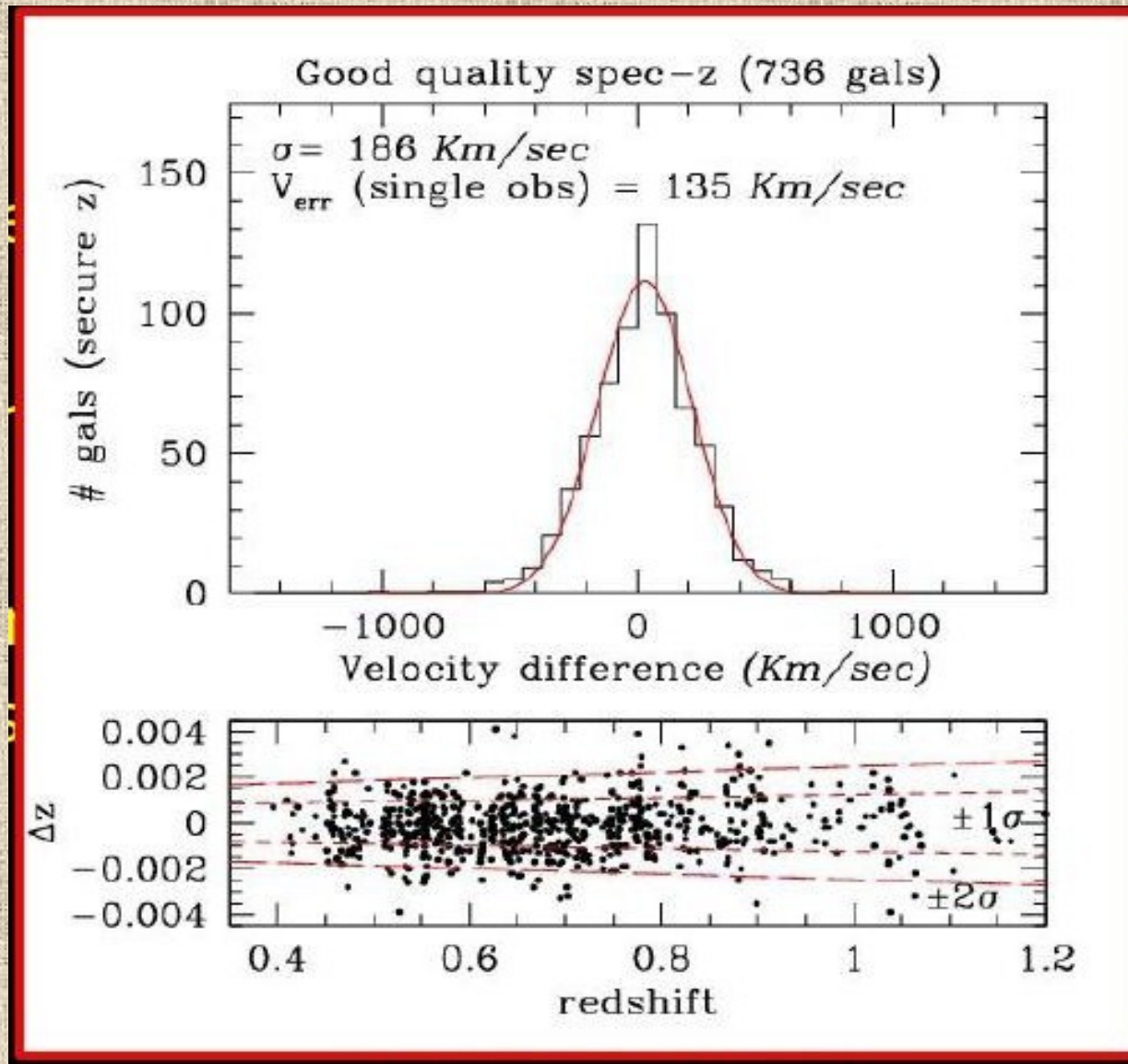
O. Cucciati

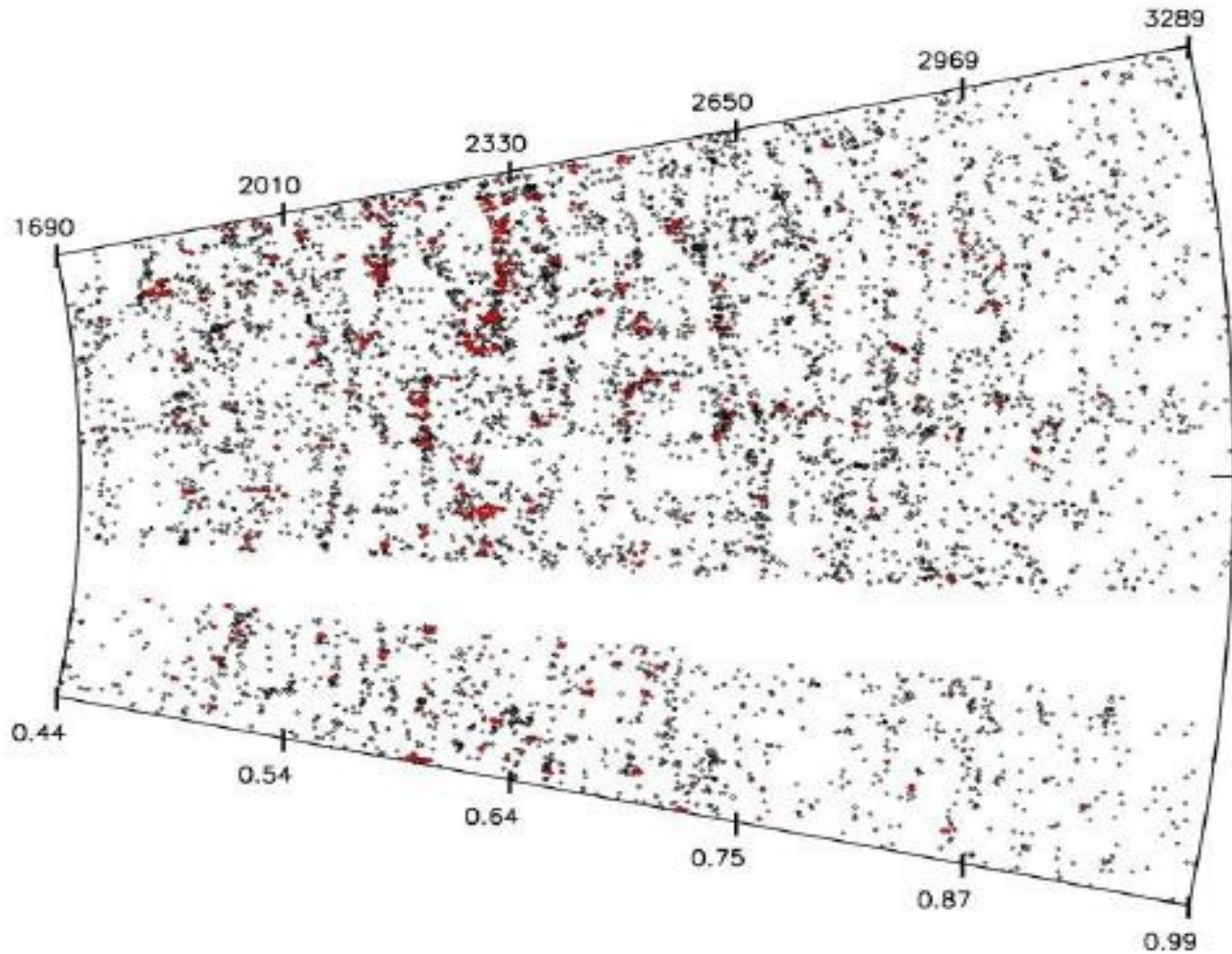
VIPERS observational strategy: mean inter-galaxy separation



O. Cucciati

VIPERS redshift accuracy





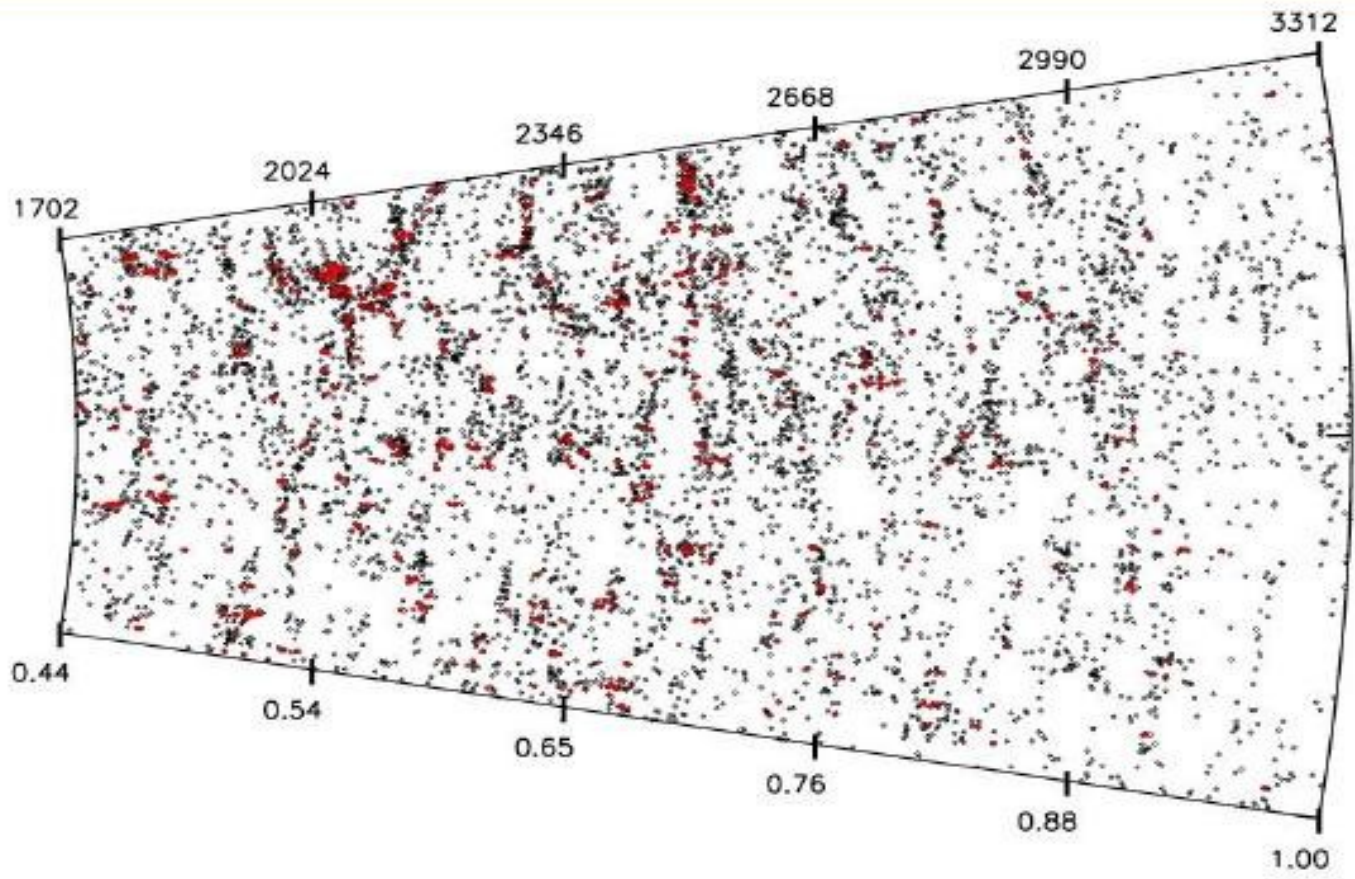
W1
8500 gals

39 groups
with
 $N \geq 5$

A. Iovino

KRAKOW - 21-22-23 Sept 2011

GEE2 Meeting, Milano Nov. 2011



W4
9000 gals
38 groups
with
 $N \geq 5$

A. Iovino

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4000A Break distribution

Outline

Redshift

Mass/mag

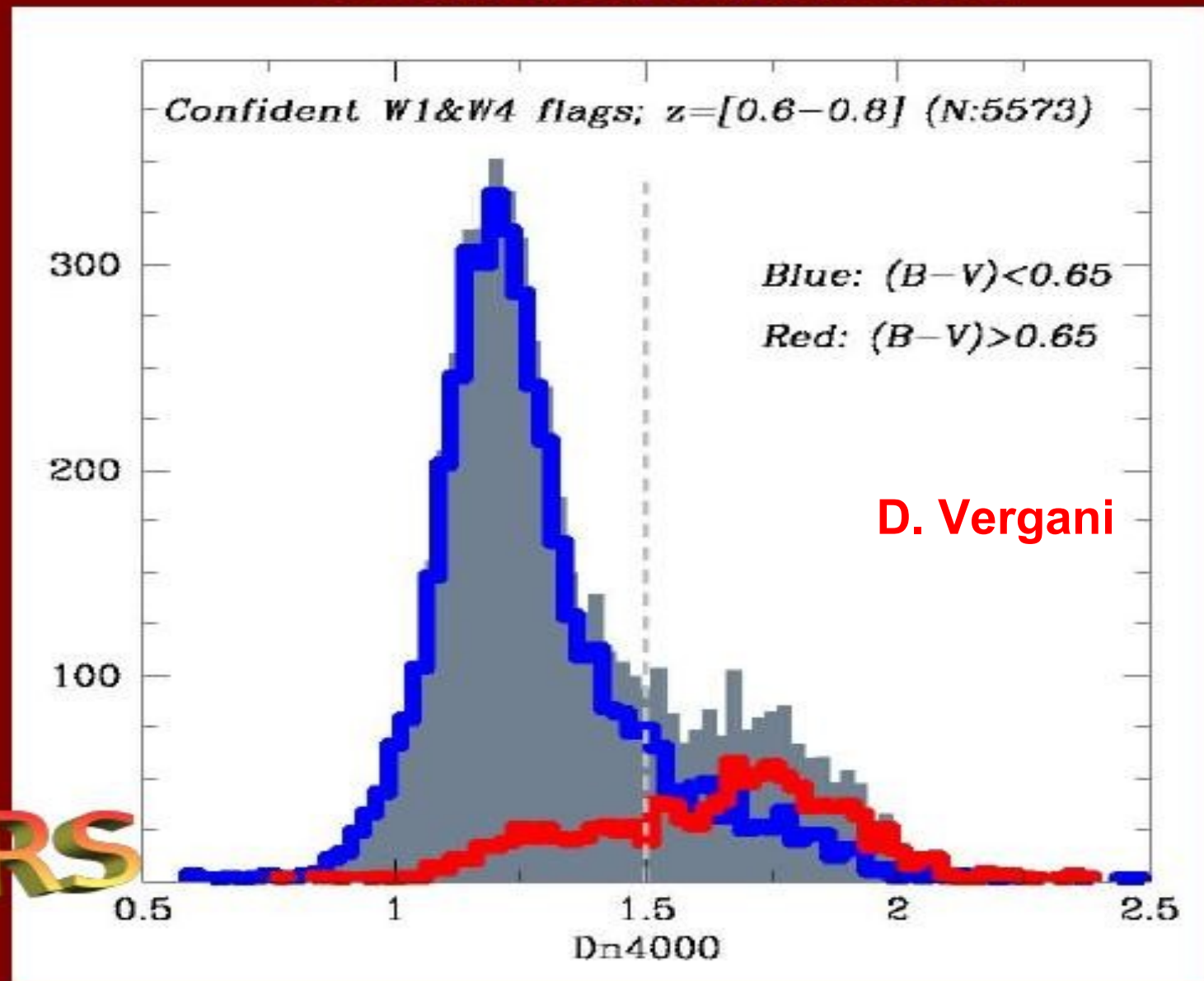
Colours

EW[OII]

Dn4000

Scientific
Interest

VIPERS





Outline

Redshift

Mass/mag

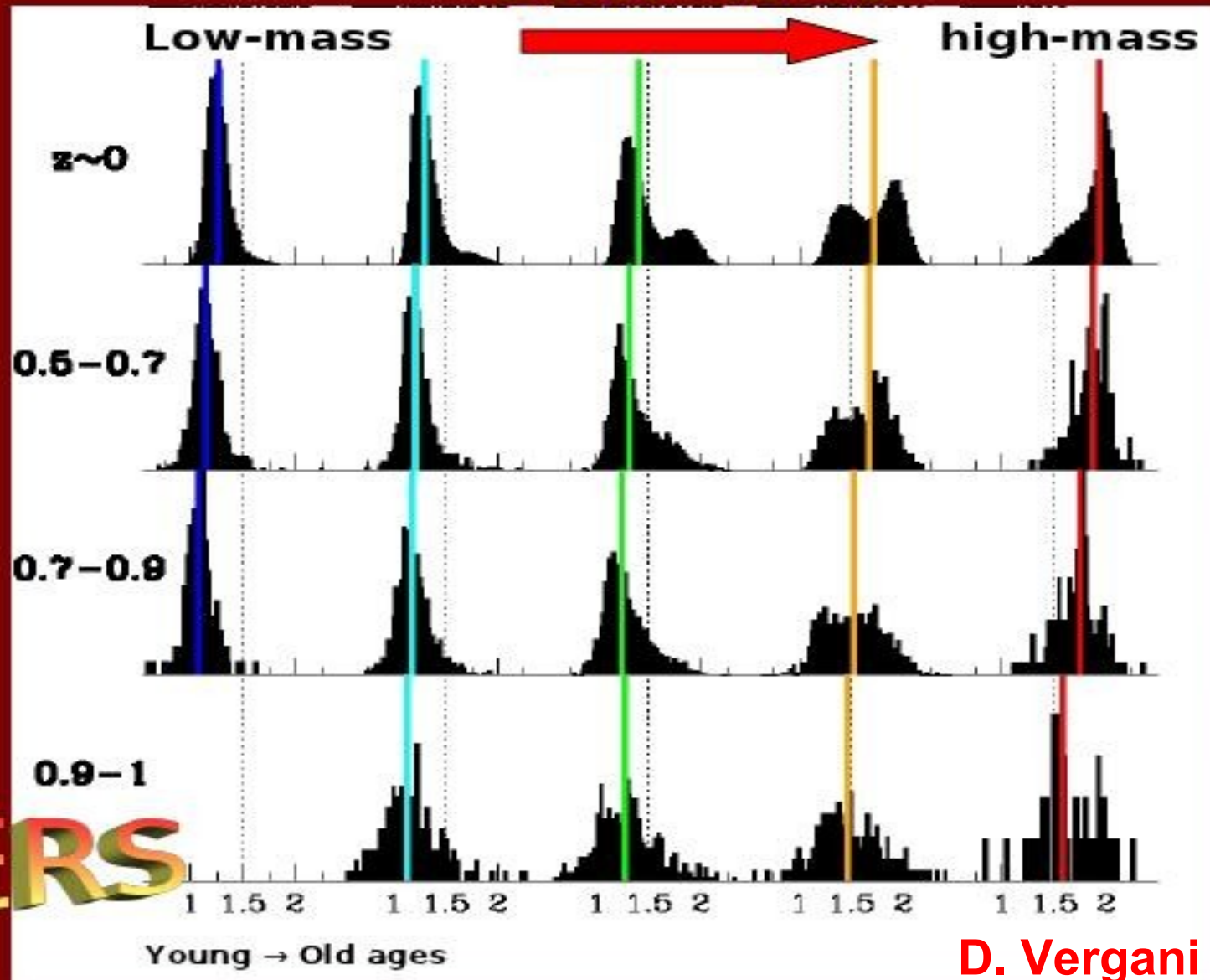
Colours

EW[OII]

Dn4000

Scientific
Interest

$D4000 - M^* - z$



D. Vergani

Most important VIPERS result so far (technology, not science): our capability to carry out the survey

- 1993-1996: MS PhD project, 1 person, 300 spectra in 3 years
(10 **IRAF** tasks for each spectrum)
- 2002-2007: VVDS, 25 people, 30,000 spectra in 6 years
(5 **VIPGI** “buttons” for 1 VIMOS quadrant ~ 120 spectra)
- 2006-2010: zCOSMOS, 30 people, 30,000 spectra in 3.5 years
(same 5 **VIPGI** buttons, plus **EZ** to measure redshift)
- 2010: VIPERS, 20 people, 20,000 spectra in 3 months
(**EasyLife** for complete data reduction, book-keeping, and all data handling tasks)



Indirectly, VIPERS benefits a much broader community

- EasyLife is a pipeline for the reduction of most spectroscopic data (Longslit and MOS, no Echelle), from any spectrograph
- It is now being used for the reduction of Lucifer (IR spectrograph at LBT) spectra, as part of the INAF LBT support center, and be used for the reduction of MODS (optical spectrograph at LBT) as soon as it will be available to INAF astronomers
- Could become the cornerstone of a global spectroscopic data handling center (that we call Spectroscopix, mimicking the world famous Terapix center at IAP)

Summary



- VIPERS finally exploits VIMOS capabilities for LSS study, filling a specific niche $z \sim 1$: volume $6 \times 10^7 h^{-3} \text{ Mpc}^3$, sampling $>40\%$
- Study large-scale structure, clustering and growth at $0.5 < z < 1$, to an accuracy comparable to local state-of-the-art surveys
- Efficient survey pipeline: automatic data calibration, redshift measurement and database archiving: $\sim 22,000$ spectra secured in 2009 season, further $\sim 10,000$ from 2010 under reduction
- Pre-refurbishment data required heavy human review of the automatic redshifts: BIG TEAM EFFORT. Situation improved with new VIMOS CCDs (installed/commissioned in June-September 2010), but full potential still to be reached
- With current observing rate, completion expected by end 2013
- More photometry ongoing/planned (GALEX, WIRCAM, VISTA)
- **Public survey: raw data public immediately, redshifts released in regular tranches**