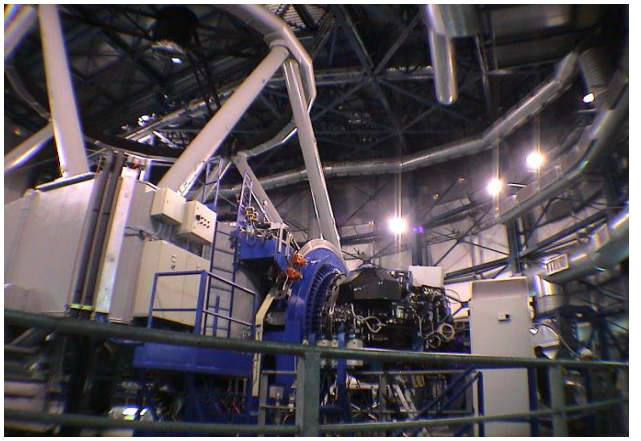
AGN Sample in the VIMOS-VLT Deep Survey



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+VVDS-team

- **Gavignaud I, Bongiorno A., Paltani S., Mathez G, Zamorani G. et al ., A&A accepted**
- **Bongiorno A., Zamorani G., Gavignaud I., Marano B., Paltani S. et al., to be submitted**

The VIMOS VLT Deep Survey: 1st epoch data

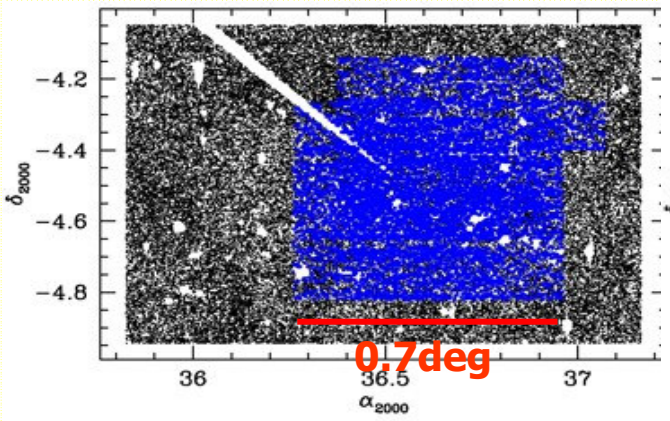
DEEP Sample:
$17.5<I_{AB}<24.0$
2 fields

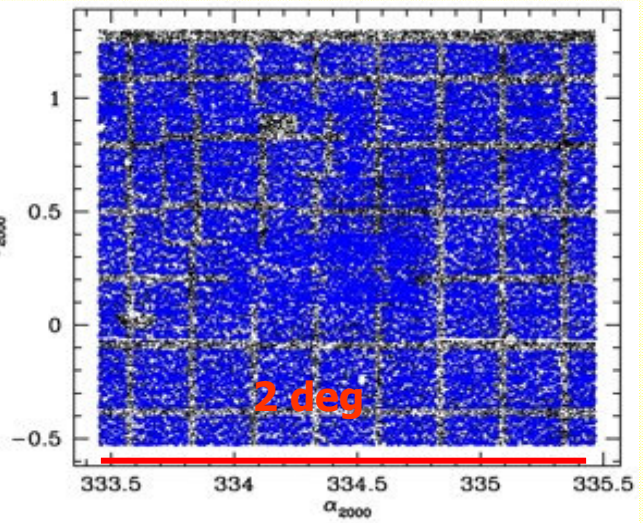
- 0226-04: ~0.7 deg², 9600 spectra
- CDFS: ~0.15 deg², 1700 spectra

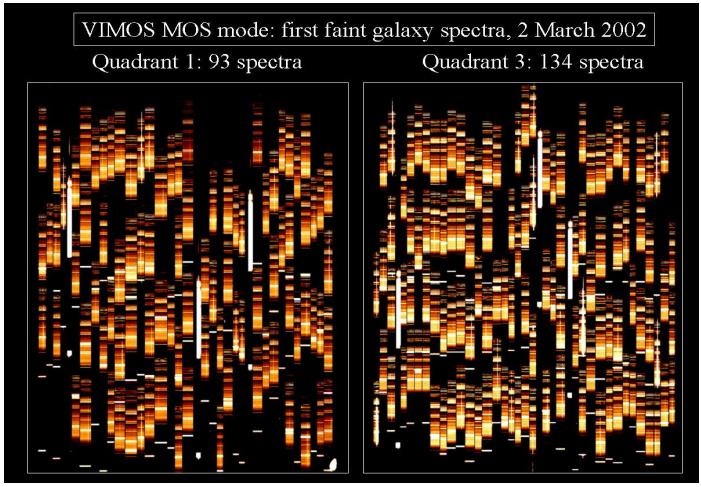
WIDE Sample:
$17.5<I_{AB}<22.5$
4 fields
each 2x2 deg²

- 1003+01: ~0.33 deg², 2100 spectra
- 2217-00: ~0.8 deg², 5700 spectra

Today, coverage of 02h & 22h fields







The VVDS type -1 AGN Sample: Selection

- Pure magnitude limited sample I_{AB} band
- Free of morphological or colour selection biases

130 BLAGN

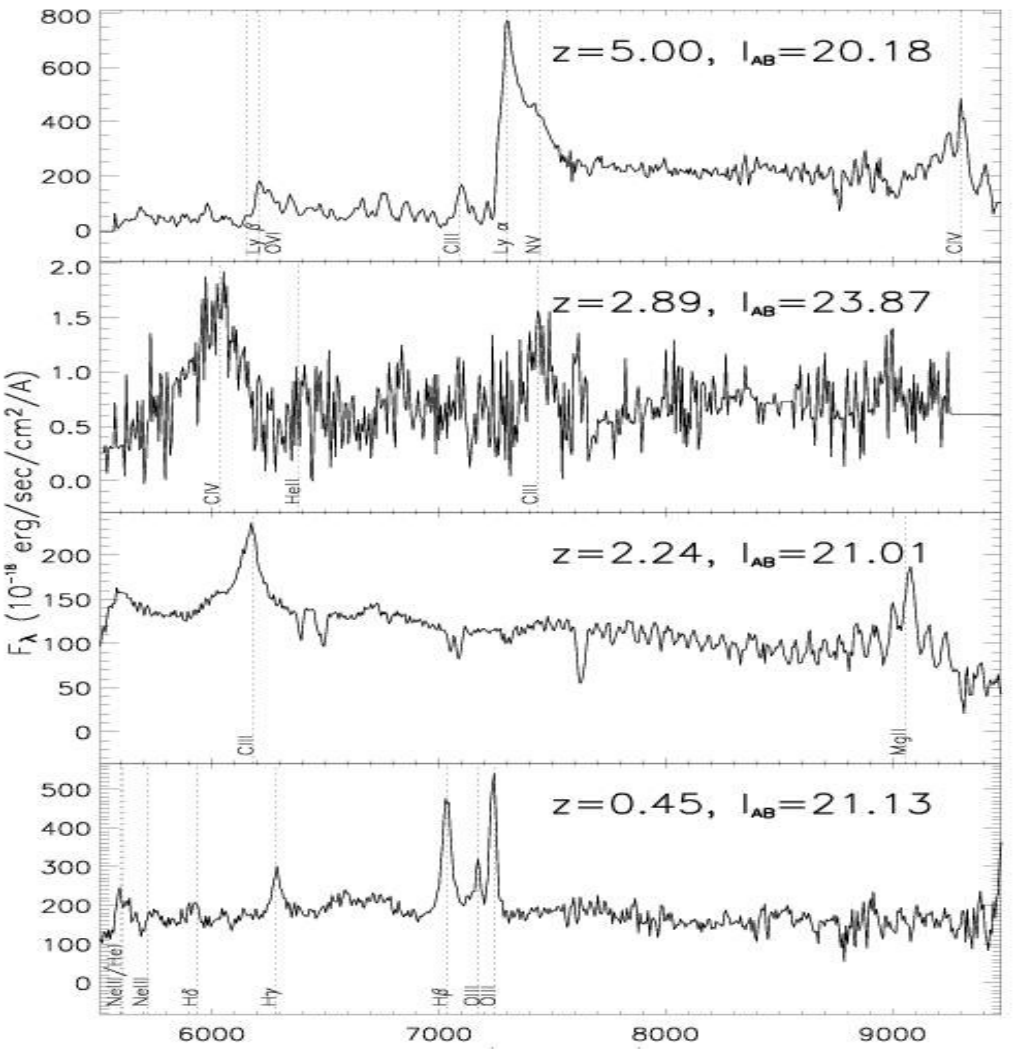
Optically selected ONLY on the basis of their SPECTRA: At least ONE broad line

Wide sub-sample ($I_{AB} \leq 22.5$) → **56 AGN**

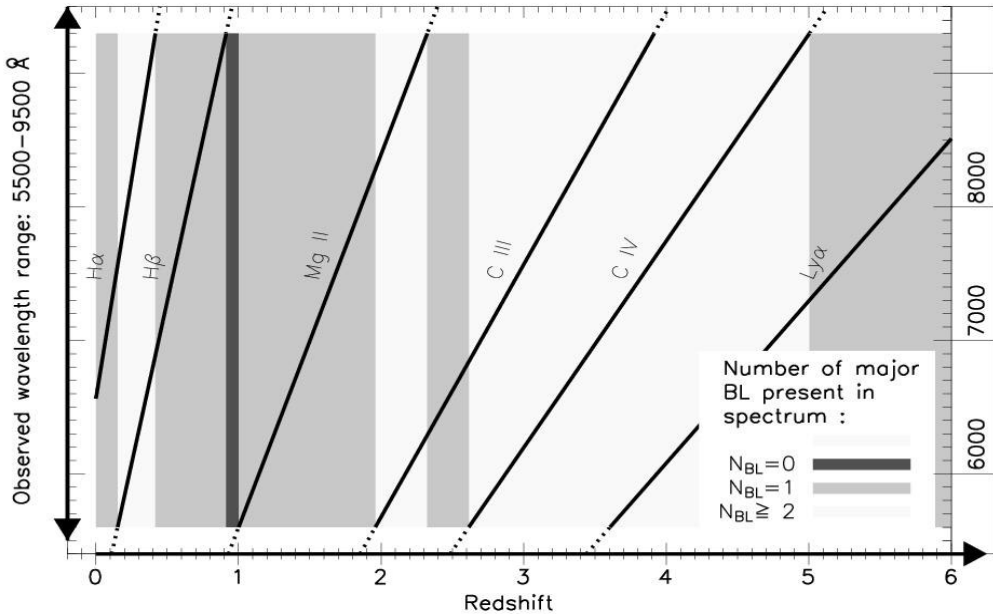
Deep sub-sample ($I_{AB} \leq 24.0$) → **74 AGN**

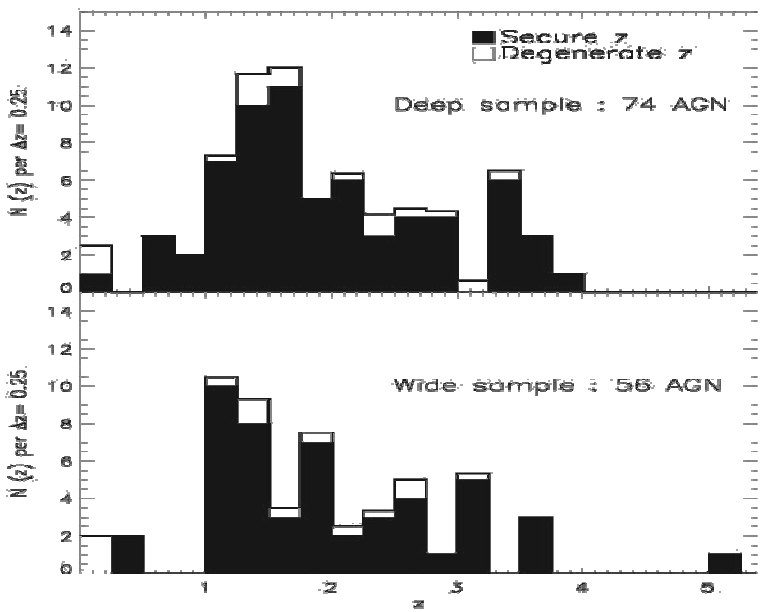
~ 700 AGN

Expected at the end of the survey

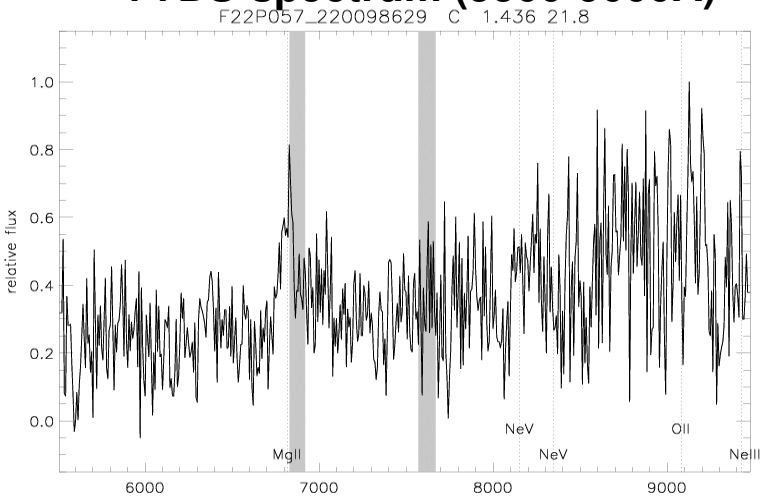


Redshift degeneracy

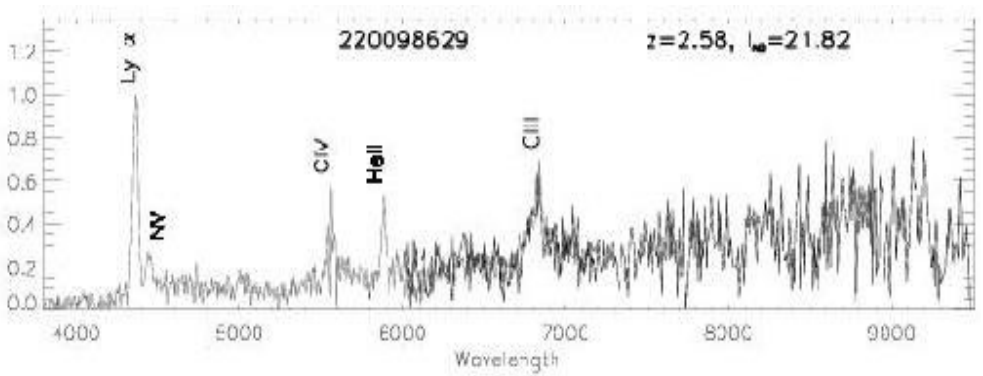




VVDS-spectrum (5500-9000Å)



Spectroscopic follow-up (3500-6500Å)
Observation Nov 2005 FORS1 VLT

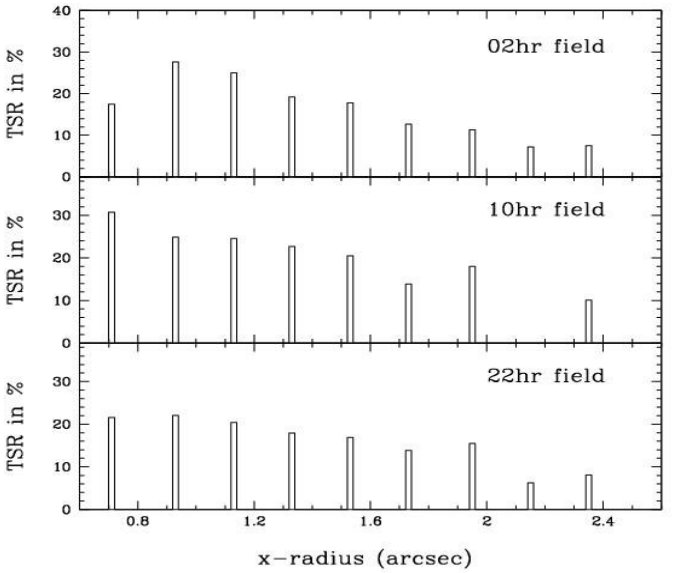


Incompleteness function

1. Treatment of non-targeted BLAGN:

$$w^{TSR} = \frac{1}{TSR}$$

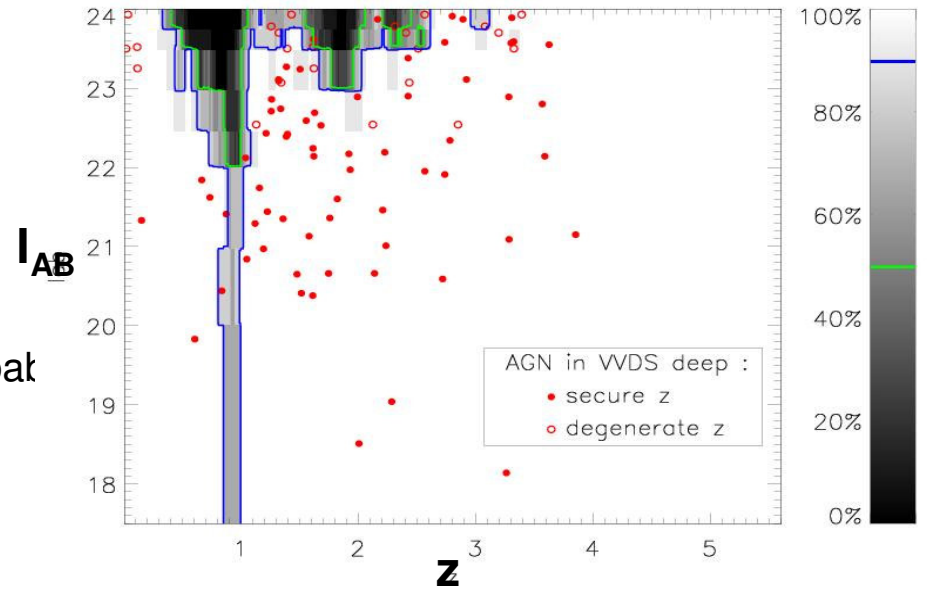
TSR *(target sampling rate)*: fraction of objects in the photometric catalog inside our targeted area which have been spectroscopically observed



2. Treatment of misclassified BLAGN:

$$w^{SSR} = \frac{1}{SSR}$$

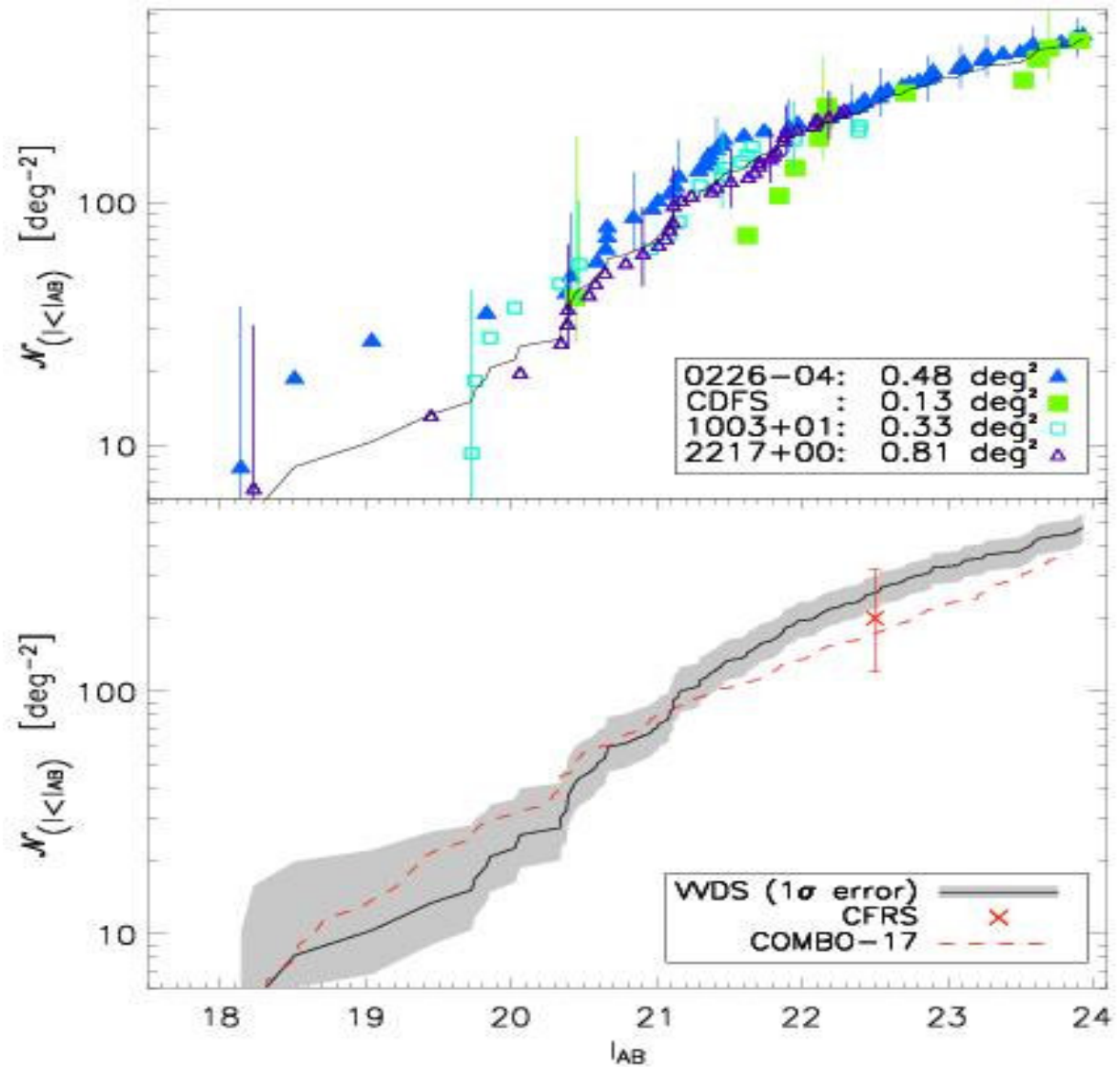
SSR *(spectroscopic success rate)*: probab a spectroscopically targeted AGN to be securely Identified. **F(z,m,SED)**



Counts

$$N(\leq I_{AB}) = \frac{1}{A} \sum_{i, I_{AB,i} \leq I_{AB}} w_i^{TSR} w_i^{SSR}$$

I_{AB}	N	N(<I_{AB}) /deg²
19	3	10
20	9	22
21	29	71
22	76	196
23	108	327
24	130	472



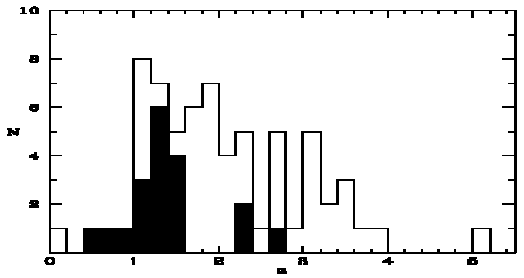
Standard pre-selection methods

Morphological analysis:

$I_{AB} < 22.5$

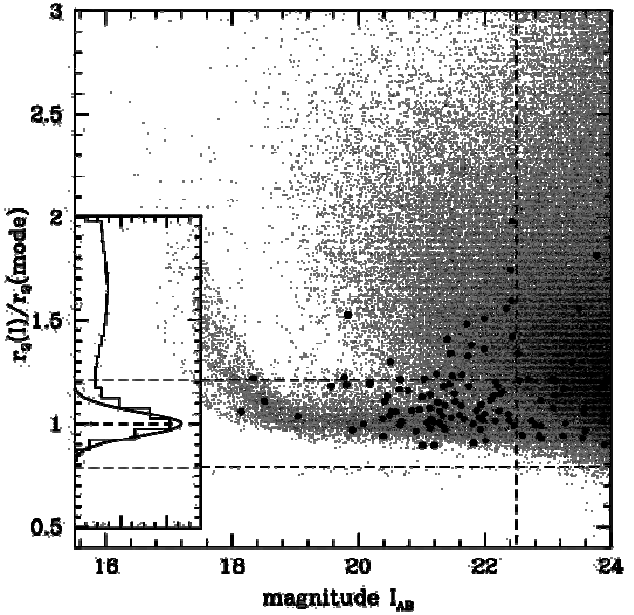
3.5σ { 77% point-like
23% extended

Stars (f>2) $18.5<I_{AB}<22.5$ → 95% point-like



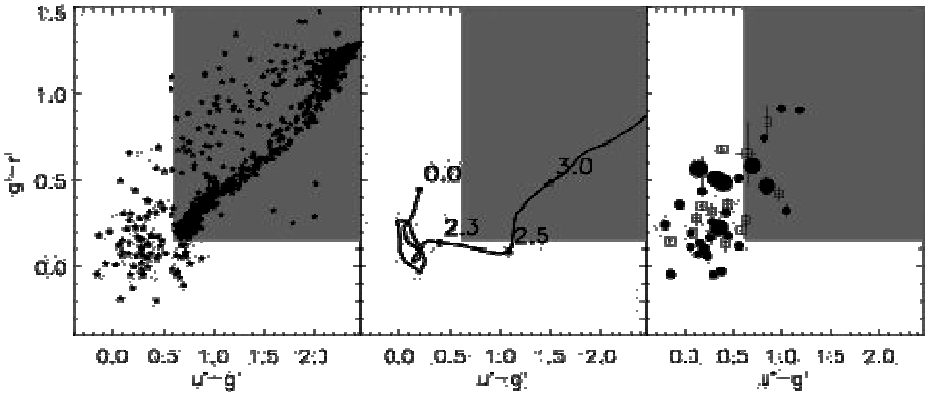
16/19 extended → z<1.6

42% z<1.6 → extended



Color analysis:

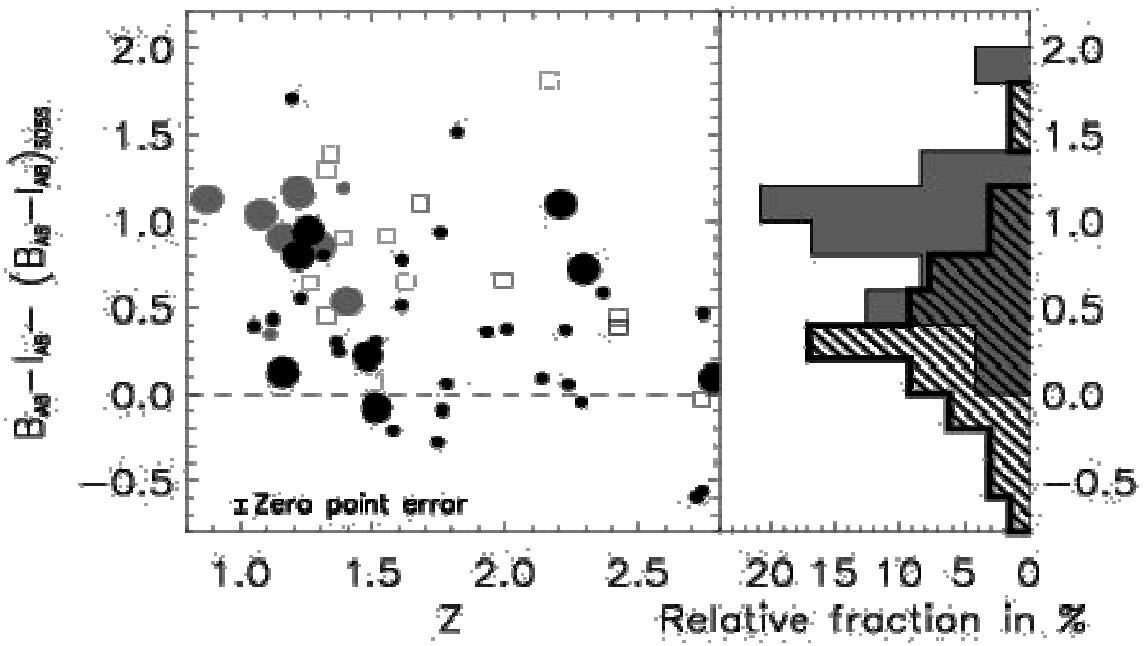
z<2.3
24% excluded
I<22.5 27% excluded



Morphology+color selection → z<2.3 35% excluded

applied to our sample (faint)

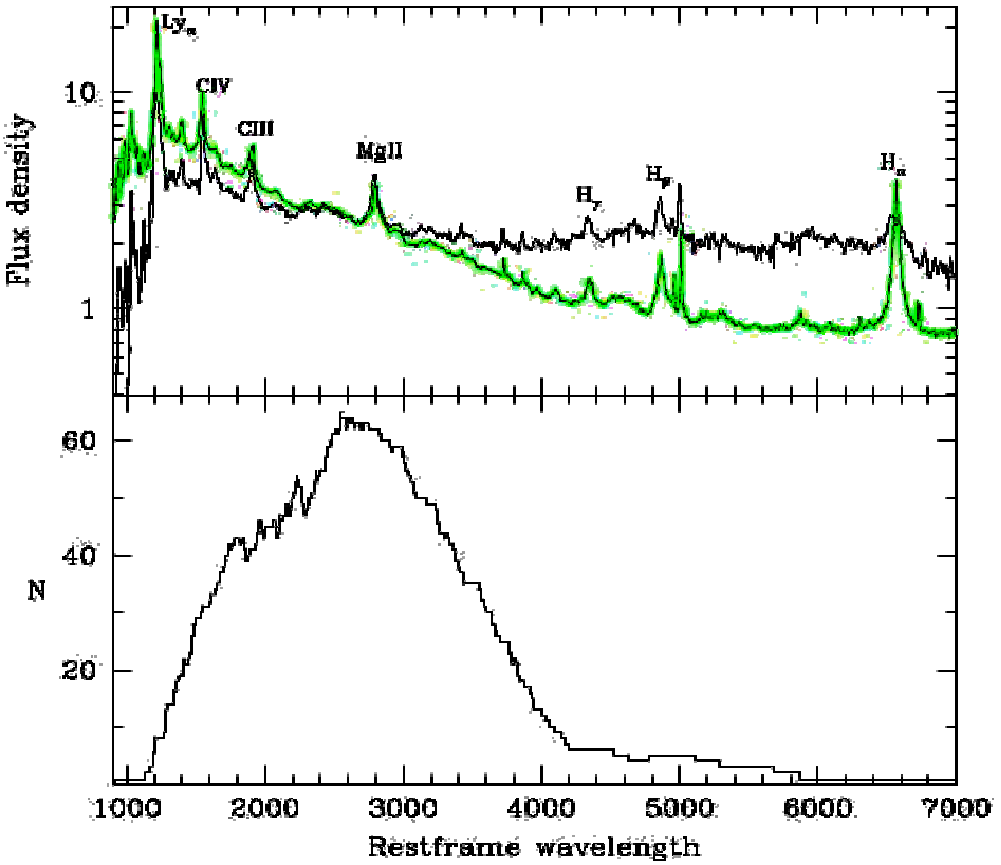
VVDS-AGN sample colors



Luminosity:	Morphology:
$M_B > -23$	Point like
$M_B < -23$	Extended
	Non classified

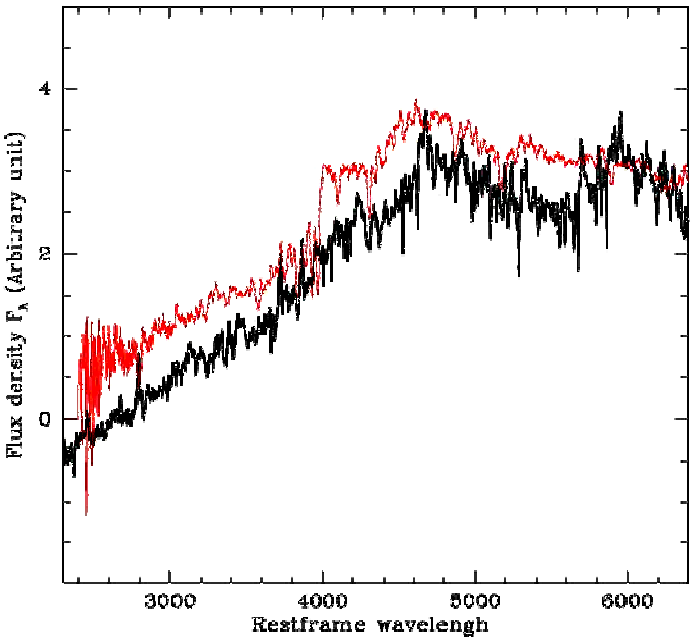
- ✓ *The contamination of the host galaxy is reddening the colors of faint AGN*
- ✓ *BLAGN are intrinsically redder when they are faint*
- ✓ *The reddest colors are due to presence of dust*

Composite spectrum



Red= composite spectrum of early type galaxies

Black=composite VVDS - composite SDSS AGN spectrum



- ✓ *The contamination of the host galaxy is reddening the colors of faint AGN*
- ✓ *BLAGN are intrinsecally redder when they are faint*
- ✓ *The reddest colors are due to presence of dust*

Luminosity function

Coherent sample *(Avni e Bachall 1980)*

$$\begin{cases} \Omega_{tot} = \Omega_{deep} + \Omega_{wide} & \text{for} \quad I_{AB} \le 22.5 \\ \Omega_{tot} = \Omega_{deep} & \text{for} \quad I_{AB} \le 24.0 \end{cases}$$

Absolute magnitude

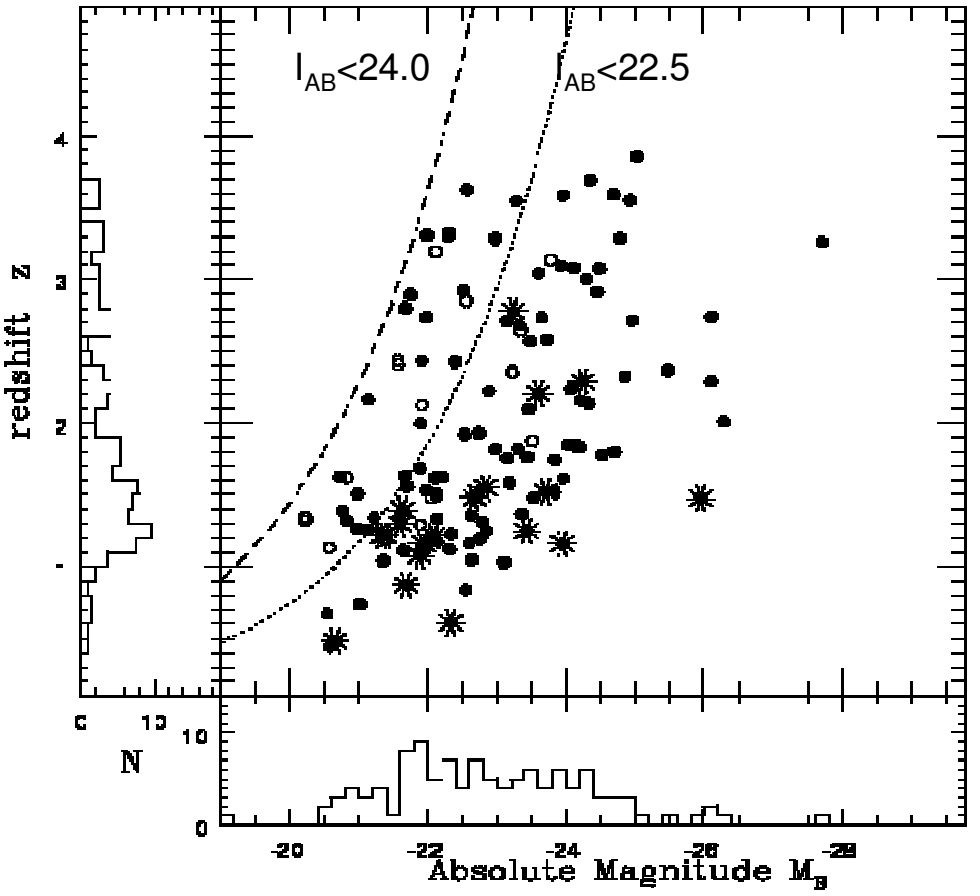
$$M = m_{obs} - 5\log_{10}(dl(z)) - 25 - K$$

m_{obs}, for each object, is chosen in the band which is sampling the rest-wavelength closer to the band in which we compute the LF

Luminosity function:

$\frac{1}{V_{\max}}$ estimator *(Schmidt, 1968)*

$$\phi(M) = \frac{1}{\Delta M} \sum_{M-\Delta M/2}^{M+\Delta M/2} \frac{w_i^{TSR} w_i^{SSR}}{V_{\max,i}}$$



Low redshift luminosity function

2dF,Croom 2004
2dF,Boyle 2001
C17, Wolf 2003

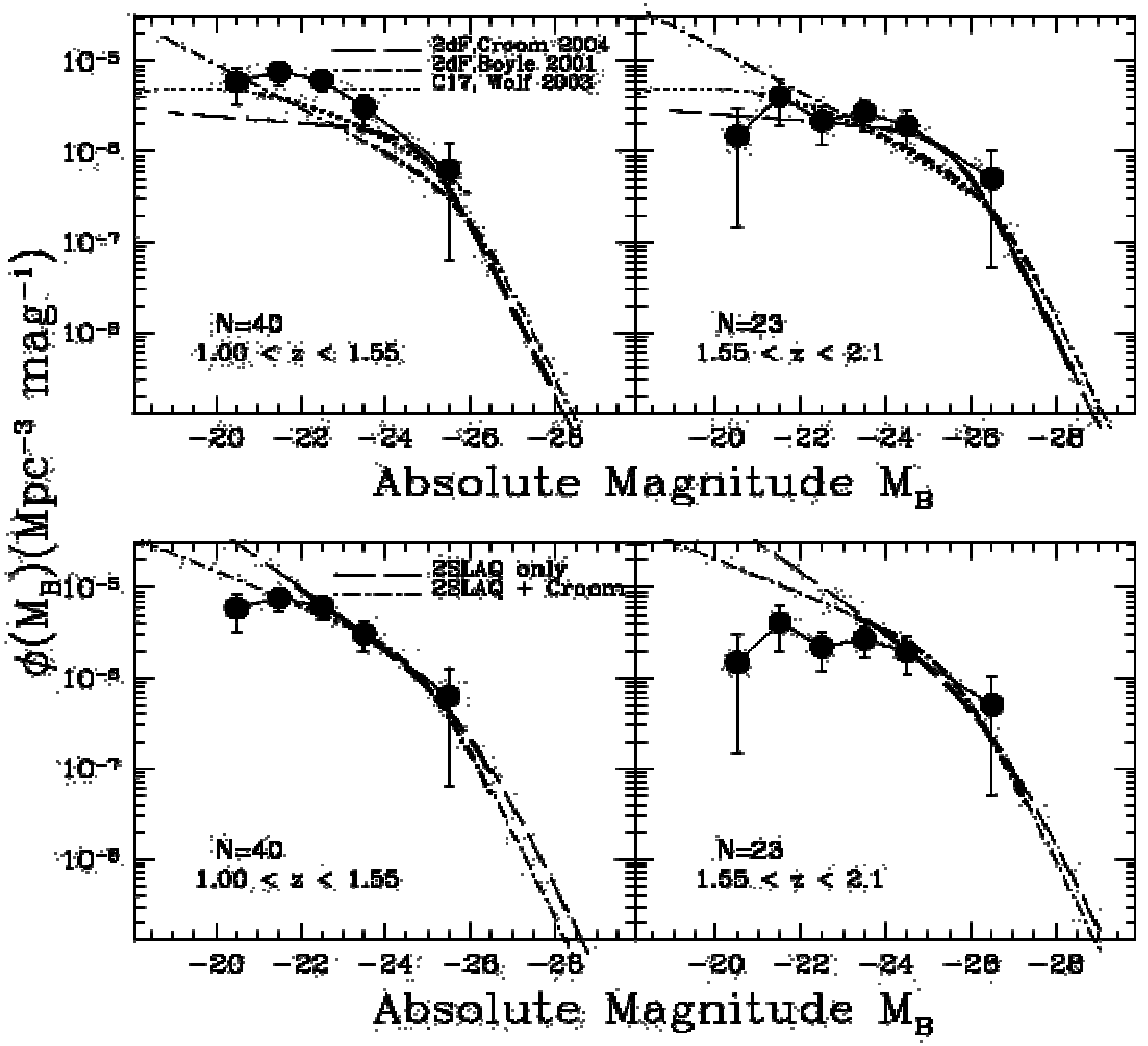
Double Power Law

$$\phi(M,z) = \frac{\phi(M^*)}{10^{0.4(\alpha+1)(M-M^*)} + 10^{0.4(\beta+1)(M-M^*)}}$$

Pure Luminosity evolution

$$M^*(z) = M^*(0) - 2.5(k_1 z + k_2 z^2)$$

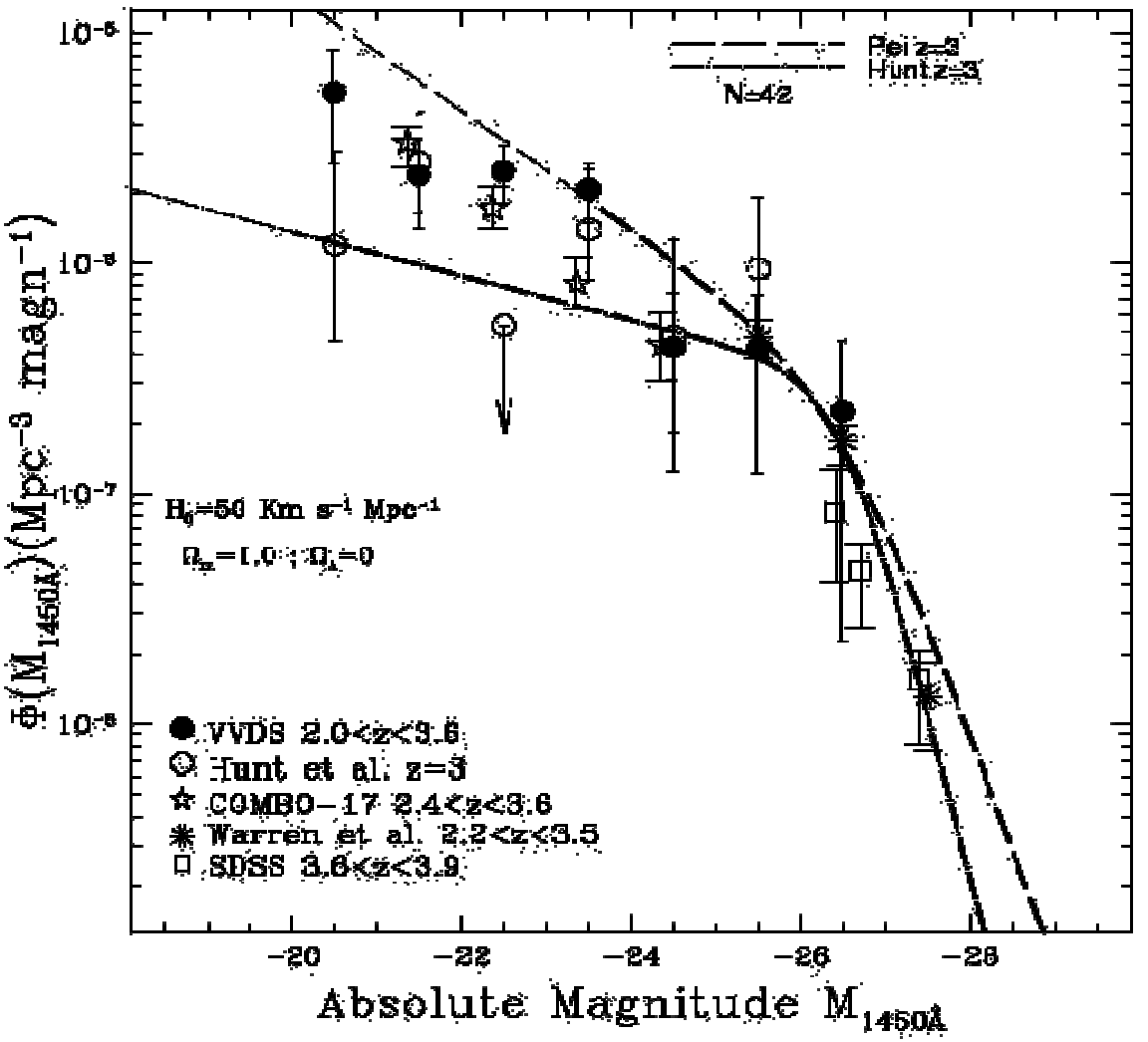
2SLAQ only
2SLAQ + Croom



High redshift luminosity function

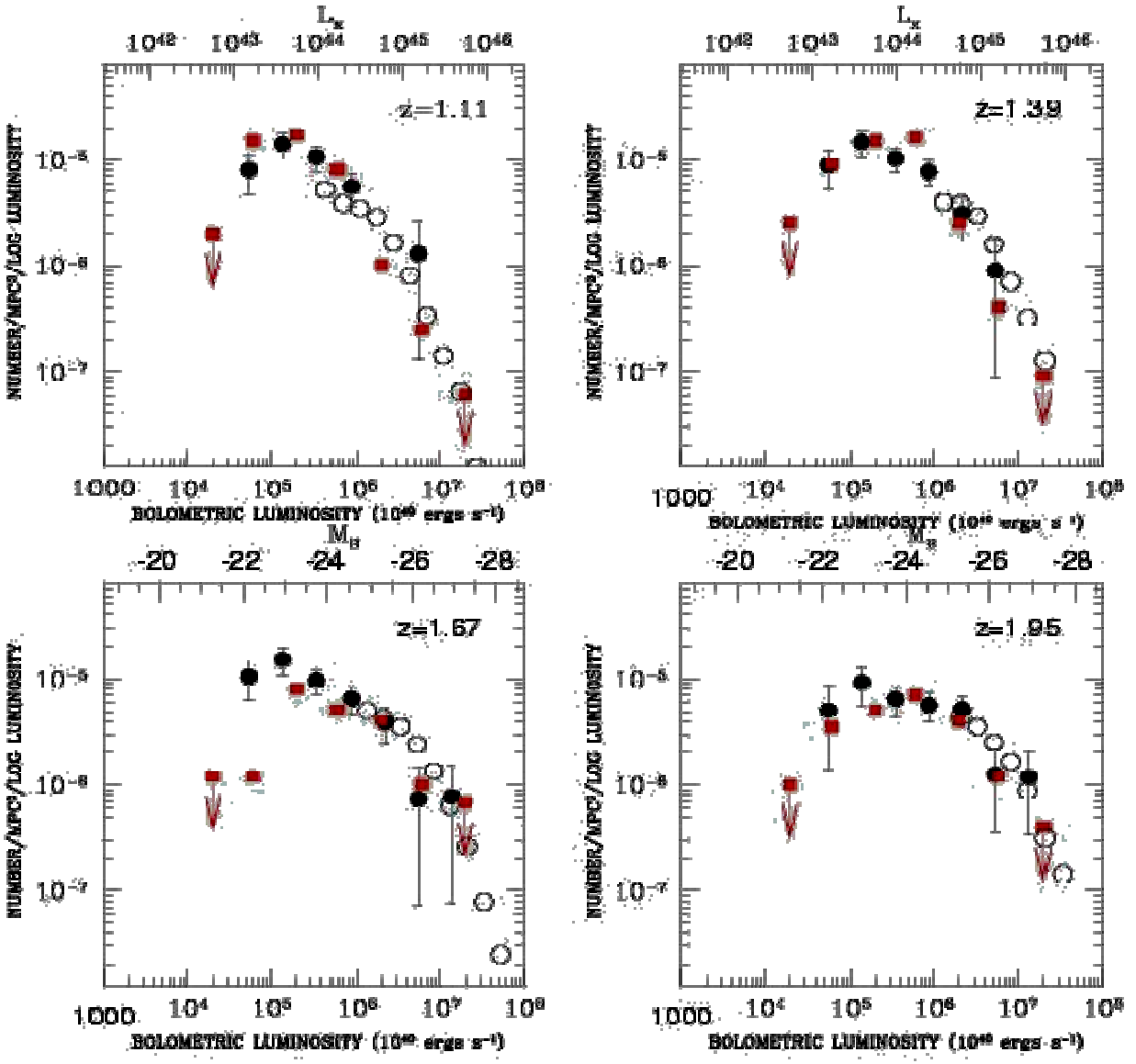
Pei z=3
Hunt z=3

● VVDS 2.0<z<3.6
○ Hunt et al. z=3
☆ COMBO−17 2.4<z<3.6
✳ Warren et al. 2.2<z<3.5
□ SDSS 3.6<z<3.9



Comparison with results from X-ray surveys

Black dots: our data
Open circles: 2dF data
Red squares: X data
(Barger et al. 2005)



Luminosity function fit: maximum likelihood

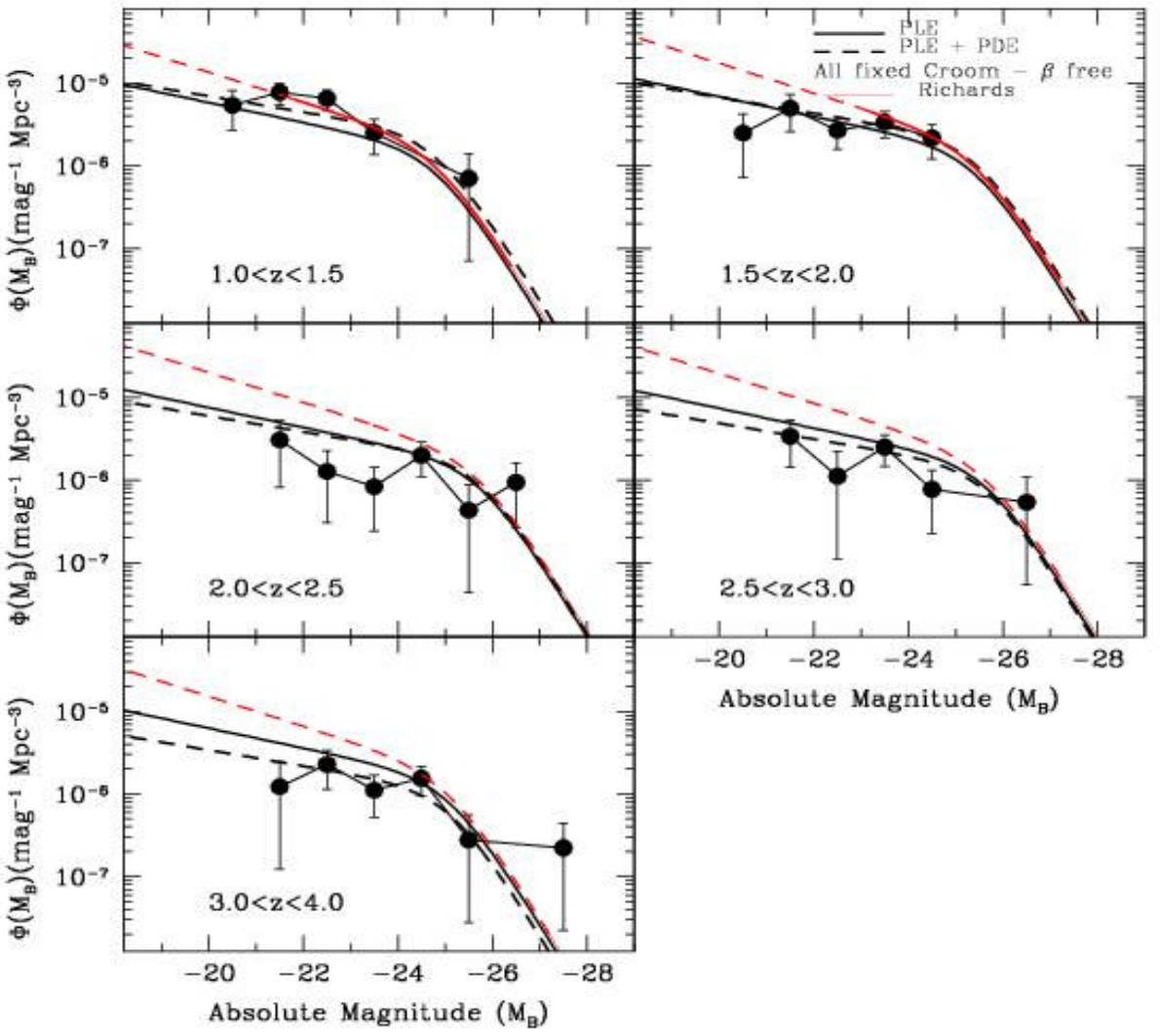
$$\phi(M,z) = \frac{\phi(M^*)}{10^{0.4(\alpha+1)(M-M^*)} + 10^{0.4(\beta+1)(M-M^*)}}$$

$$M^*(z) = M^*(0) - 2.5(k_1 z + k_2 z^2)$$

$$\phi^*(z) = \phi^*(0) \cdot 10^{(k_3 z + k_4 z^2)}$$

FAINT END SLOPE

2dF-Croom (2004)	β=-1.58
(2dF-Boyle 2001)	β = -1.09
VVDS-PLE	β =-1.30
VVDS-PLE+PDE	β =-1.24
2SLAQ-Richards(2005)	β =-1.45



Summary

✓ VVDS-AGN Sample: 130 type-1 AGN (~700 at the end of the survey)

✓Free of morphological or colour selection biases

✓ Surface Density $I_{AB}<24$ N=470±65 BLAGN deg^{-2}

✓Applying a morphological and colour analysis to our AGN sample:

- **23% I<22.5 extended**
- **35% I<22.5 z<2.3 missed**

✓ Composite spectrum: continuum shape much redder at λ>3000 Å

✓ Host galaxy contamination as expected from the faint absolute magnitudes sampled by our survey

✓ Low redshift LF: consistent with a PLE model, but with an excess in the faint part of the first redshift bin

✓ High redshift LF: good agreement with previous data

✓ X-ray LF comparison: good agreement

✓ Data fit: PLE (+PDE)