

# WANDELS

A deep VIMOS survey of the CANDELS UDS and CDFS fields

*Unveiling the astrophysics of high-redshift galaxy evolution*

# WANDS

*Unveiling the astrophysics of  
high-redshift galaxy evolution*

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19 COUNTRIES

# VANDELS: motivation

Submitted to ESO call for public spectroscopy surveys with VIMOS. Original proposal was therefore focused on two key aspects:

- ⊙ Legacy value to astronomy community
- ⊙ Different science from previous VIMOS surveys (e.g. VVDS, zCOSMOS, VIPERS, VUDS..)

# VANDELS: motivation

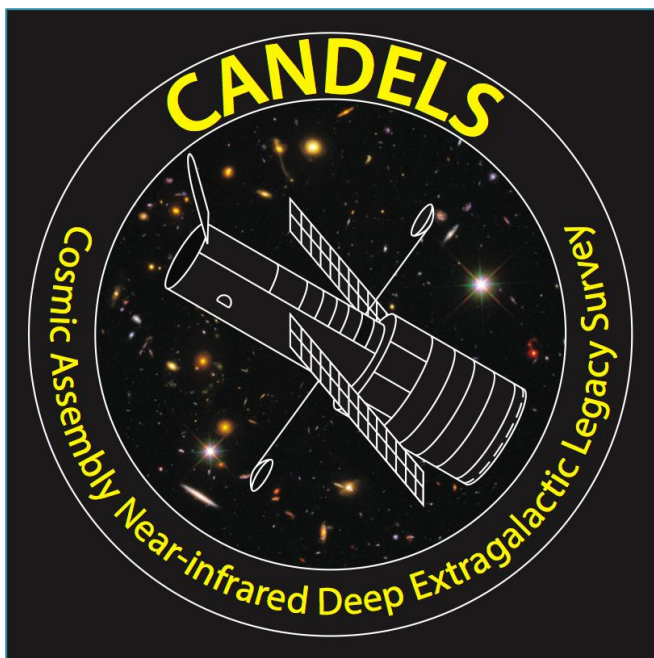
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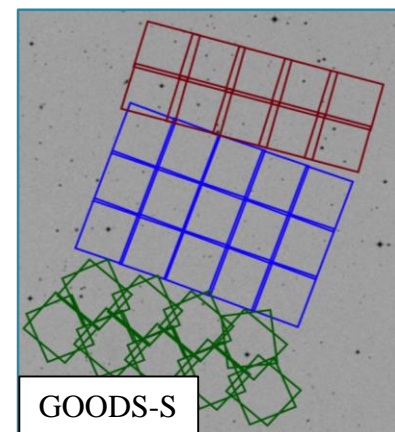
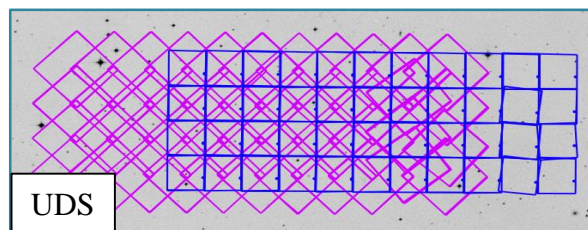
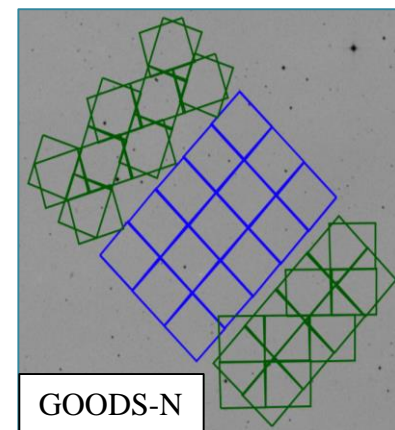
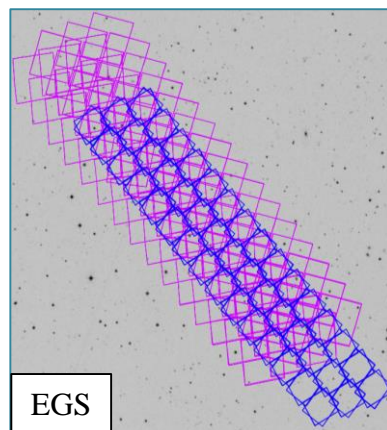
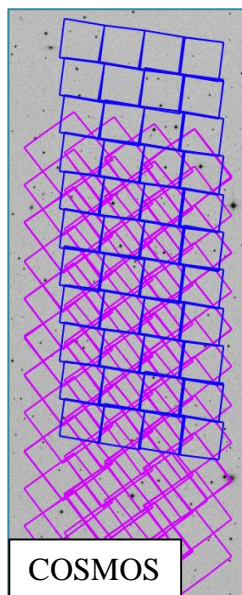
Four key elements of VANDELS:

- ⊙ Small area (0.2 sq. degrees), best available multi-wavelength data
- ⊙ Ultra-long integrations, minimum 20 hours per source (80 hour max)
- ⊙ Medium resolution spectra (MR grism)
- ⊙ Pre-selection biased to very high redshift (85% of targets at  $z > 3$ )

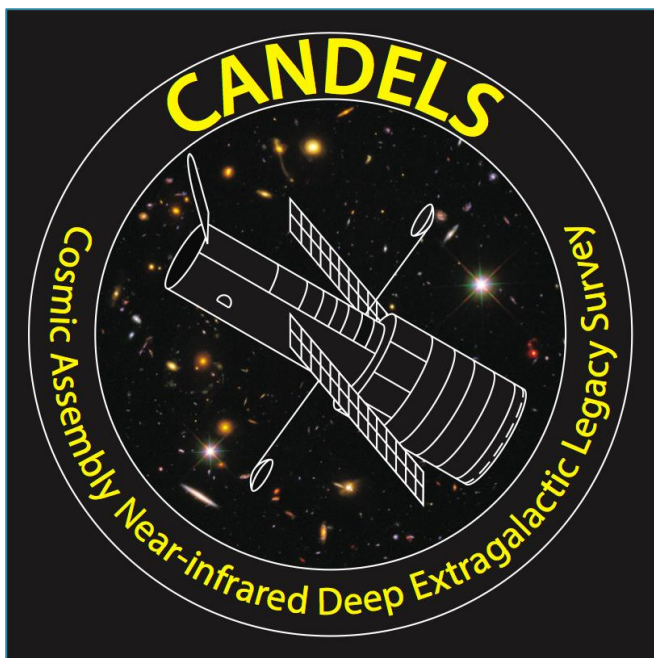
# VANDELS: survey fields



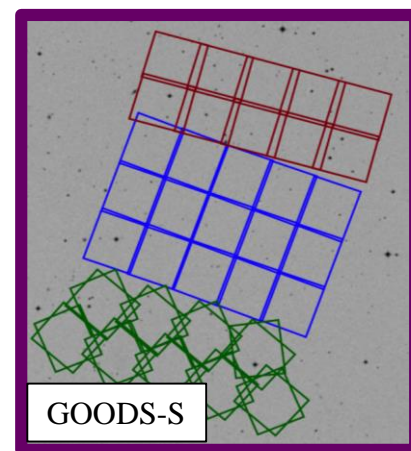
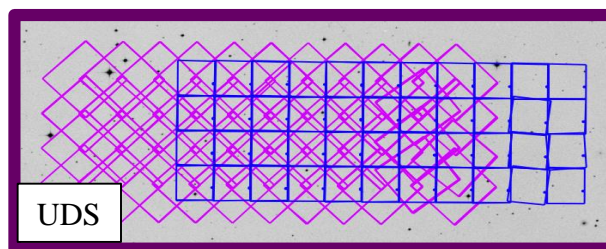
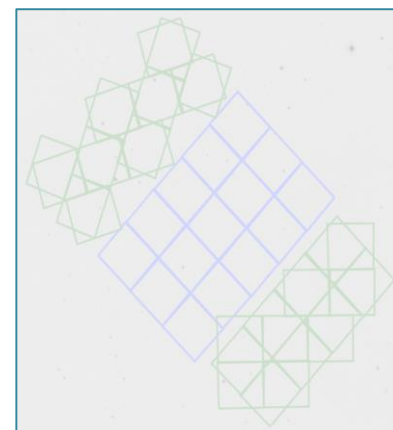
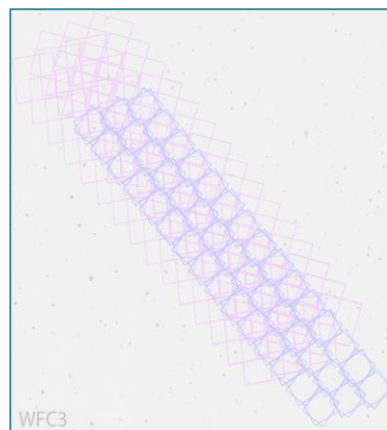
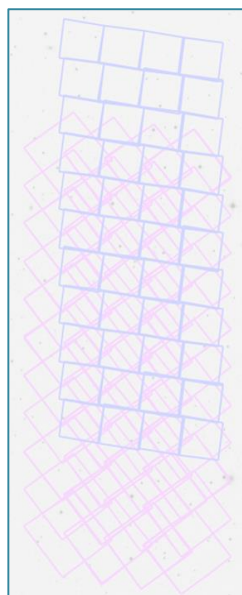
*HST* optical/near-IR imaging survey covering 0.2 square degrees split over 5 survey fields



# VANDELS: survey fields



*HST* optical/near-IR imaging survey covering 0.2 square degrees split over 5 survey fields



VANDELS targets the two southern CANDELS fields, exploiting unrivalled 15+ band ( $0.3\mu\text{m}$ - $4.5\mu\text{m}$ ) photometry and near-IR grism spectra (3D-HST)

# VANDELS: motivation

## Primary Targets

- ⊙ Star-forming galaxies at  $2.5 < z < 5.0$  ( $H_{AB} < 24$ )
- ⊙ Passive galaxies at  $1.5 < z < 2.5$  ( $H_{AB} < 22.5$ )
- ⊙ Lyman-break galaxies at  $3.0 < z < 7.0$  ( $H_{AB} < 26.5$ )

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Combine ultra-deep optical spectroscopy with near-IR grism spectroscopy and  $0.3\mu\text{m}$ - $4.5\mu\text{m}$  photometry to measure *physical* tracers of galaxy evolution: age, mass, dust, SFR, outflows, stellar+gas metallicity....

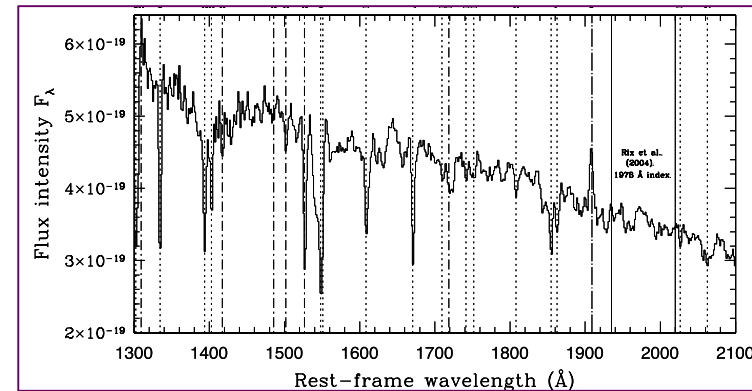


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## Absorption line metallicities



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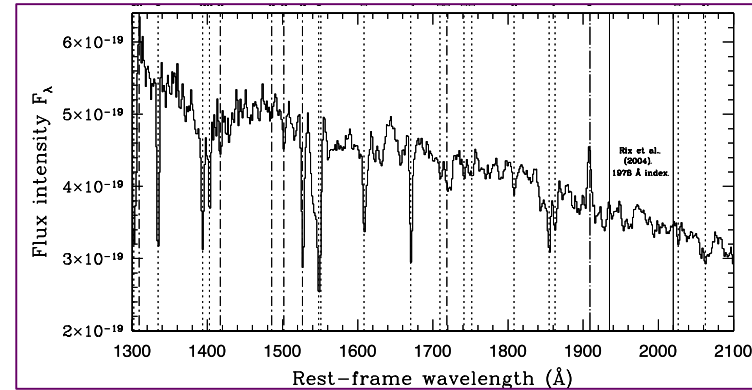
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## Primary Targets

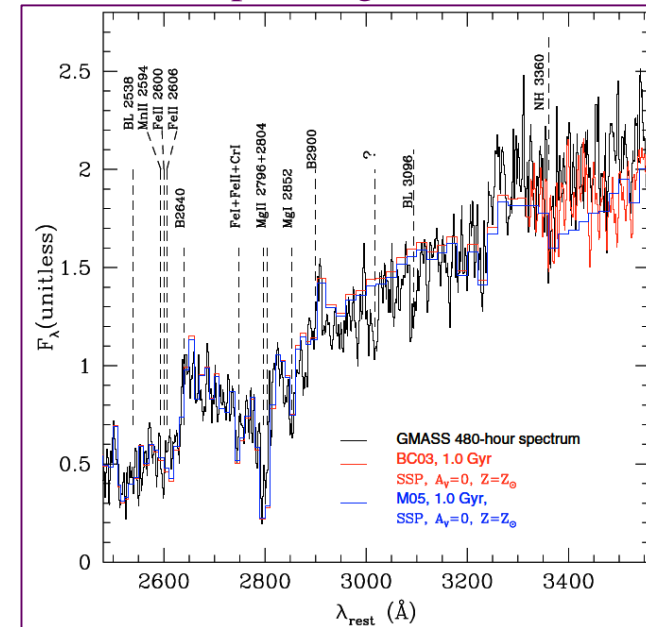
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## Absorption line metallicities



## UV+optical age constraints

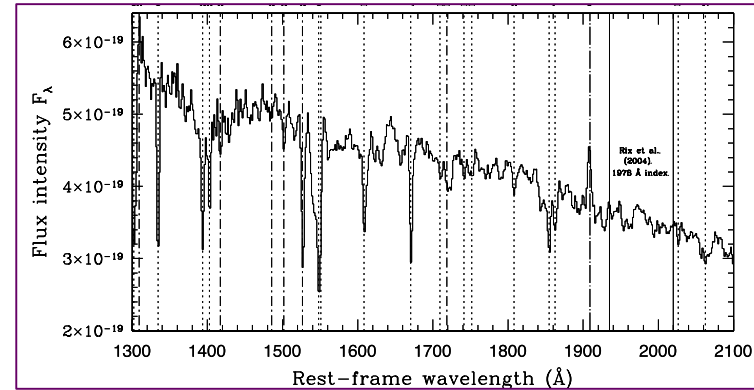


# VANDELS: motivation

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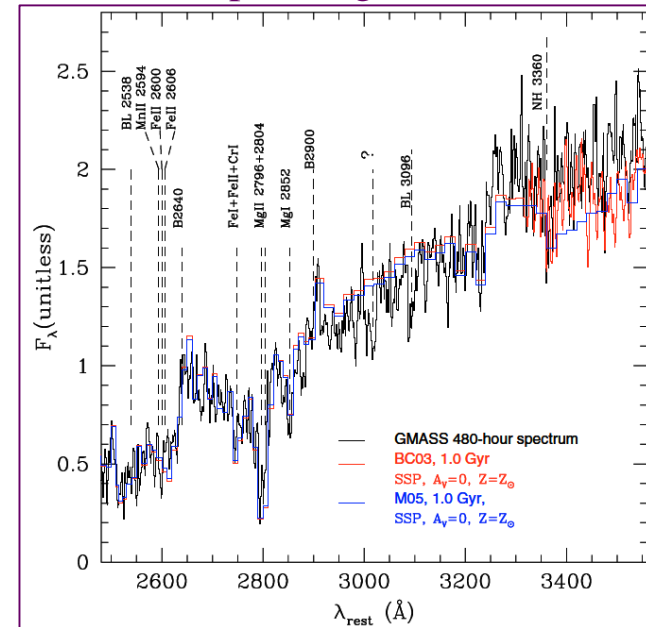
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## UV+optical age constraints



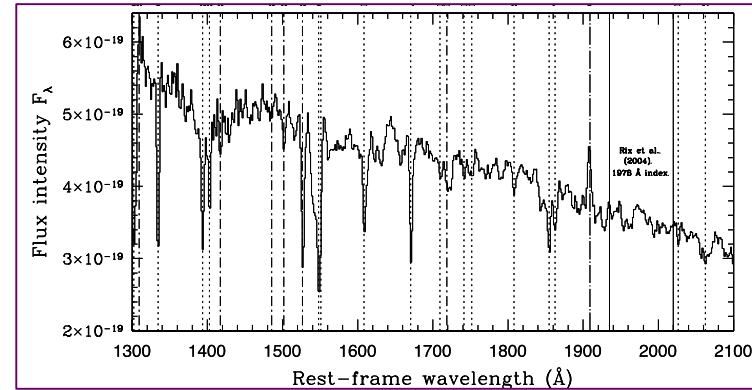
Provide sufficient signal-to-noise and resolution to measure physical properties from *individual* spectra as well as stacks

# VANDELS: motivation

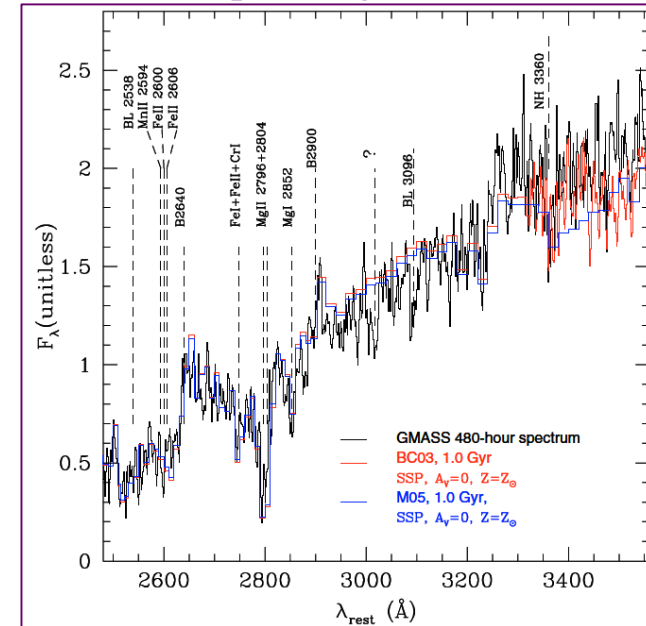
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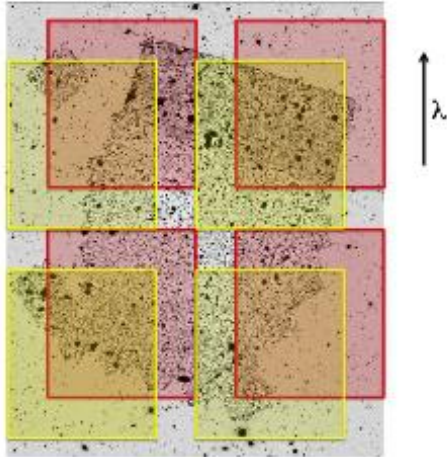
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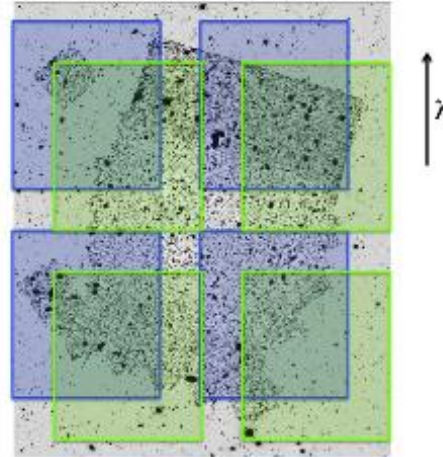
Fundamental aim is to move beyond redshift measurement and extract *physical* information from the spectra

# VANDELS: observations

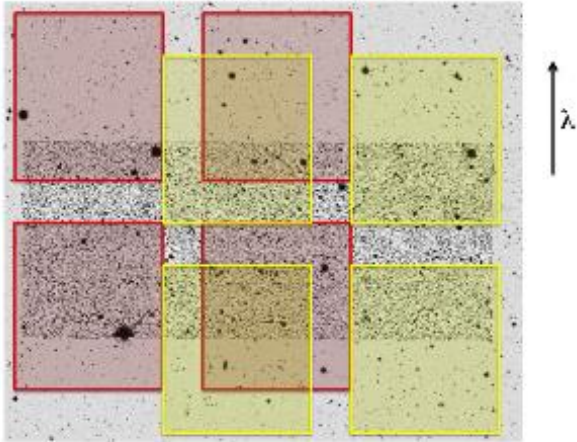
CDFS: Pointings 1+2



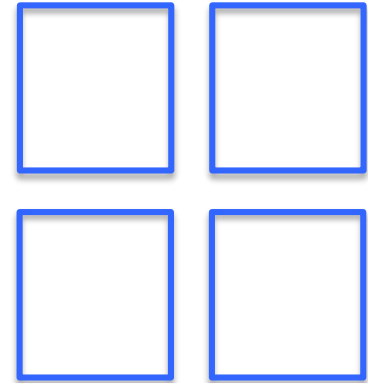
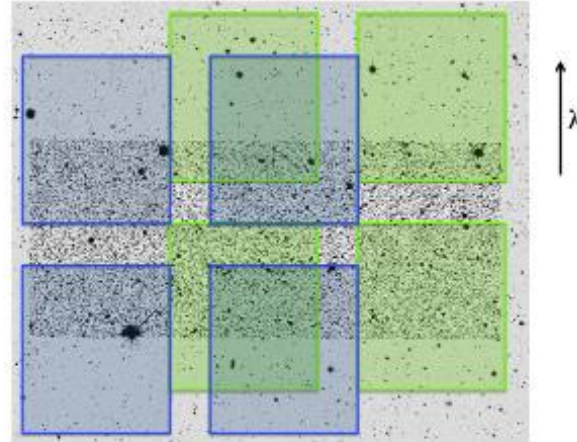
CDFS: Pointings 3+4



UDS: Pointings 1+2



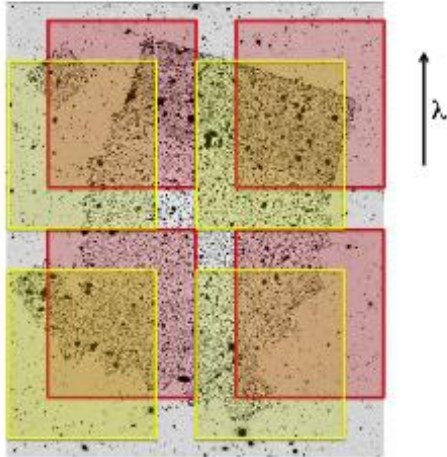
UDS: Pointings 3+4



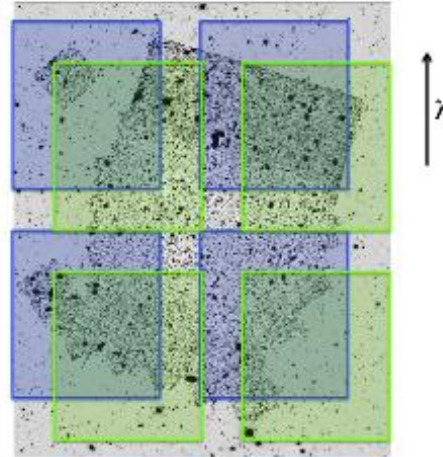
VIMOS FOOTPRINT

# VANDELS: observations

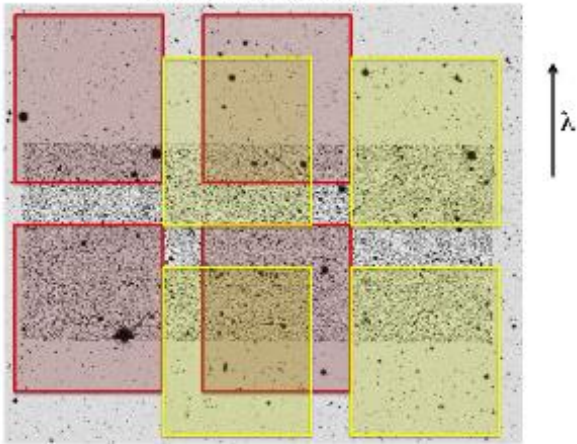
CDFS: Pointings 1+2



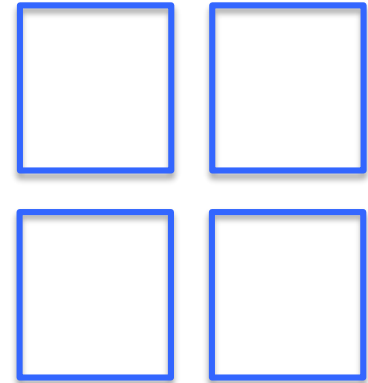
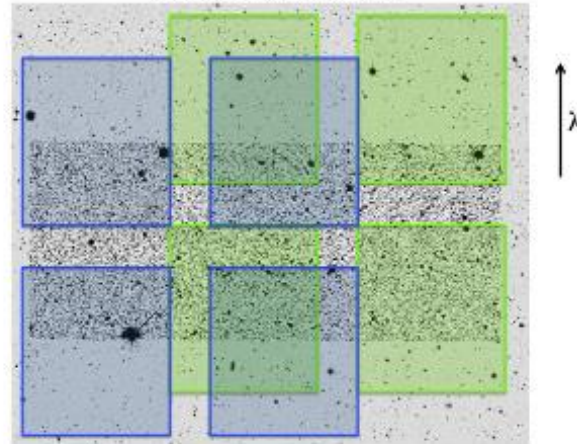
CDFS: Pointings 3+4



UDS: Pointings 1+2



UDS: Pointings 3+4



VIMOS FOOTPRINT

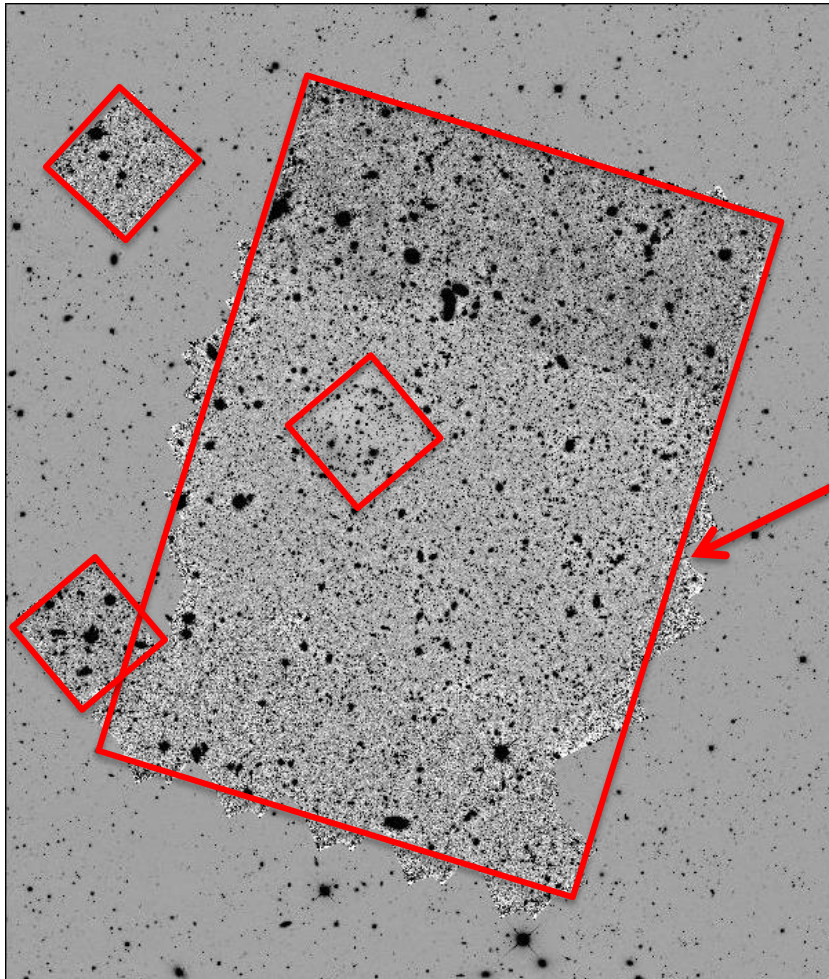
8 pointings in total, designed to cover HST imaging area  
(75% of slits allocated to HST area)

# VANDELS: photo-z pre-selection

VANDELS will exploit the multi-wavelength photometry in UDS and CDFS to do uniquely robust photometric redshift pre-selection....

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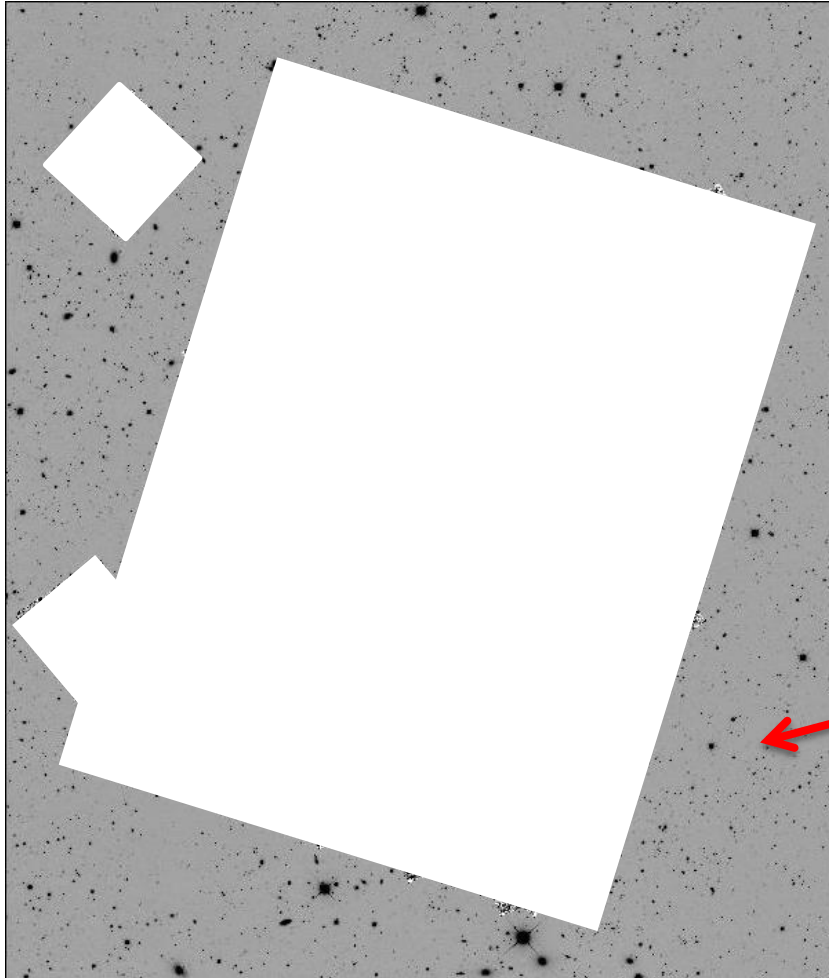
In area covered by CANDELS HST imaging use the Guo et al. (2013) TFIT catalogues featuring aperture matched, 14-band photometry 0.3-4.5 $\mu$ m

VANDELS CDFS FIELD



# VANDELS: photo-z pre-selection

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VANDELS CDFS FIELD

For extended CDFS region, Edinburgh VANDELS catalogue, utilizing a combination of 16-band photometry:

VIMOS U+R imaging

GEMS HST imaging in  $V_{606}$  and  $Z_{850}$

Subaru medium band imaging (7 bands)

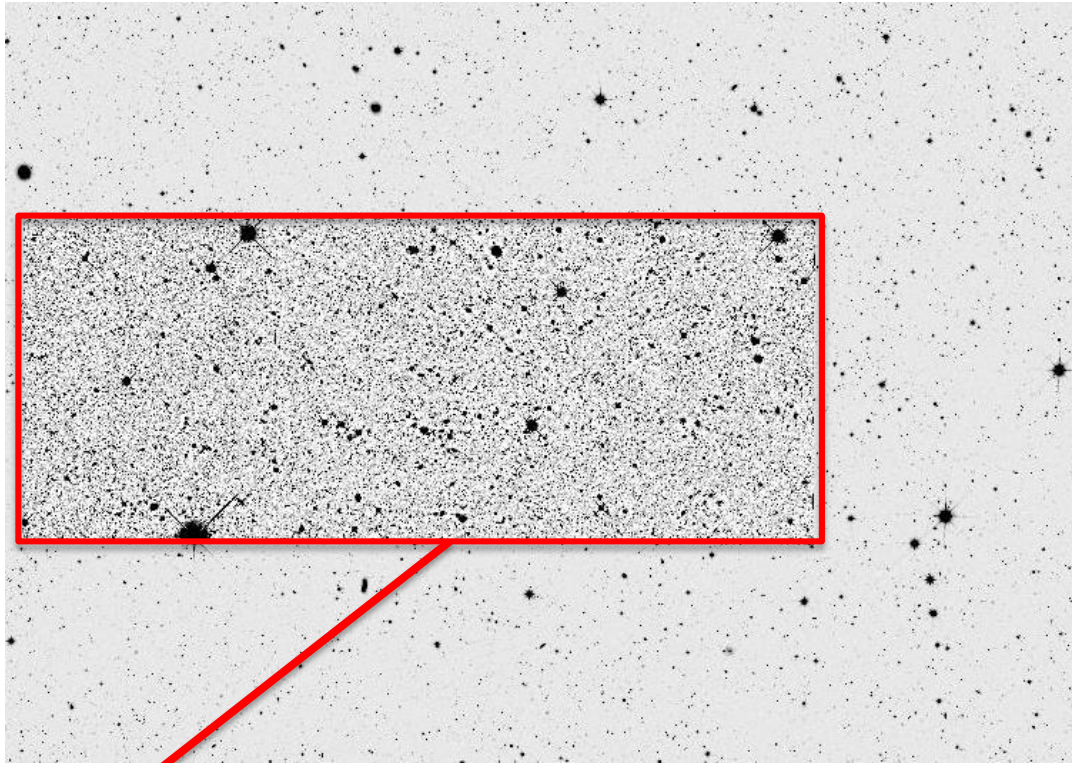
J+K imaging from TENIS survey on CFHT

H-band imaging from VISTA VIDEO survey

IRAC “supermap” of all CDFS Spitzer programmes

# VANDELS: photo-z pre-selection

VANDELS will exploit the multi-wavelength photometry in UDS and CDFS to do uniquely robust photometric redshift pre-selection....



VANDELS UDS FIELD

Within CANDELS HST region, exploit Galametz et al. (2013) TFIT catalogue, which features 15-band aperture matched photometry covering 0.3-4.5 $\mu$ m

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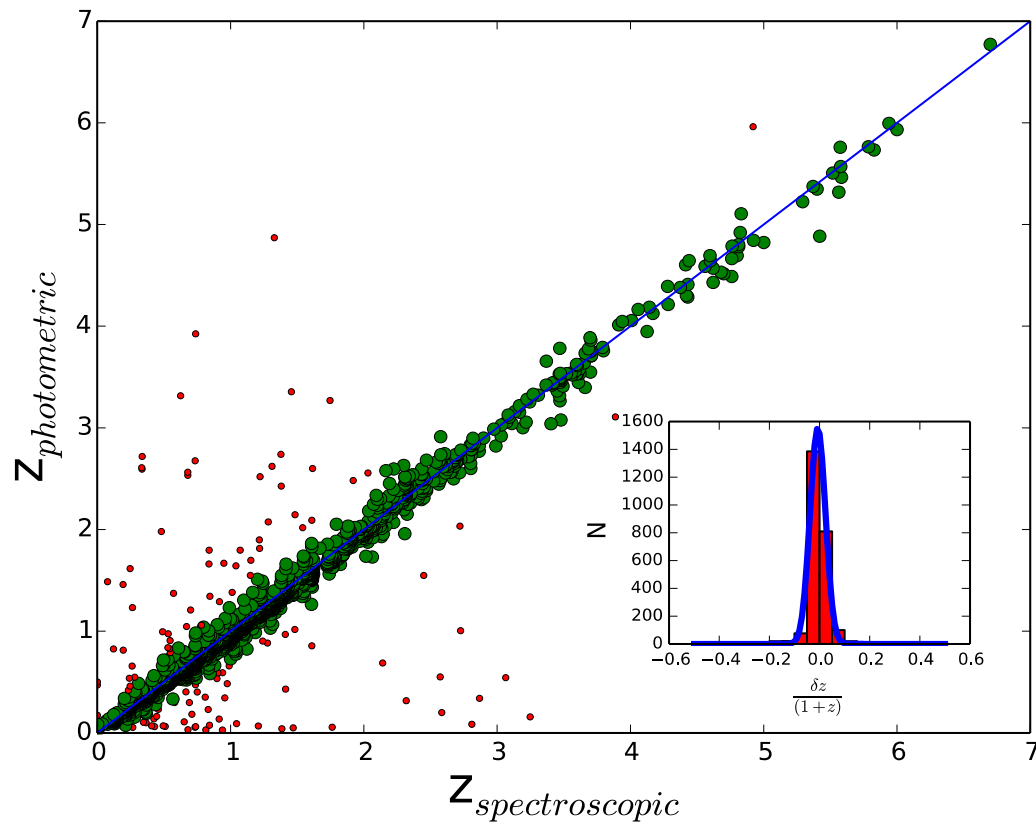


VANDELS UDS FIELD

Within extended UDS region, Edinburgh VANDELS catalogue using 13-band photometry:  
CFHT U-band, Subaru BVR<sub>i</sub>z<sub>nb</sub>, VIDEO Y-band, JHK from UKIDSS UDS, IRAC from SEDS

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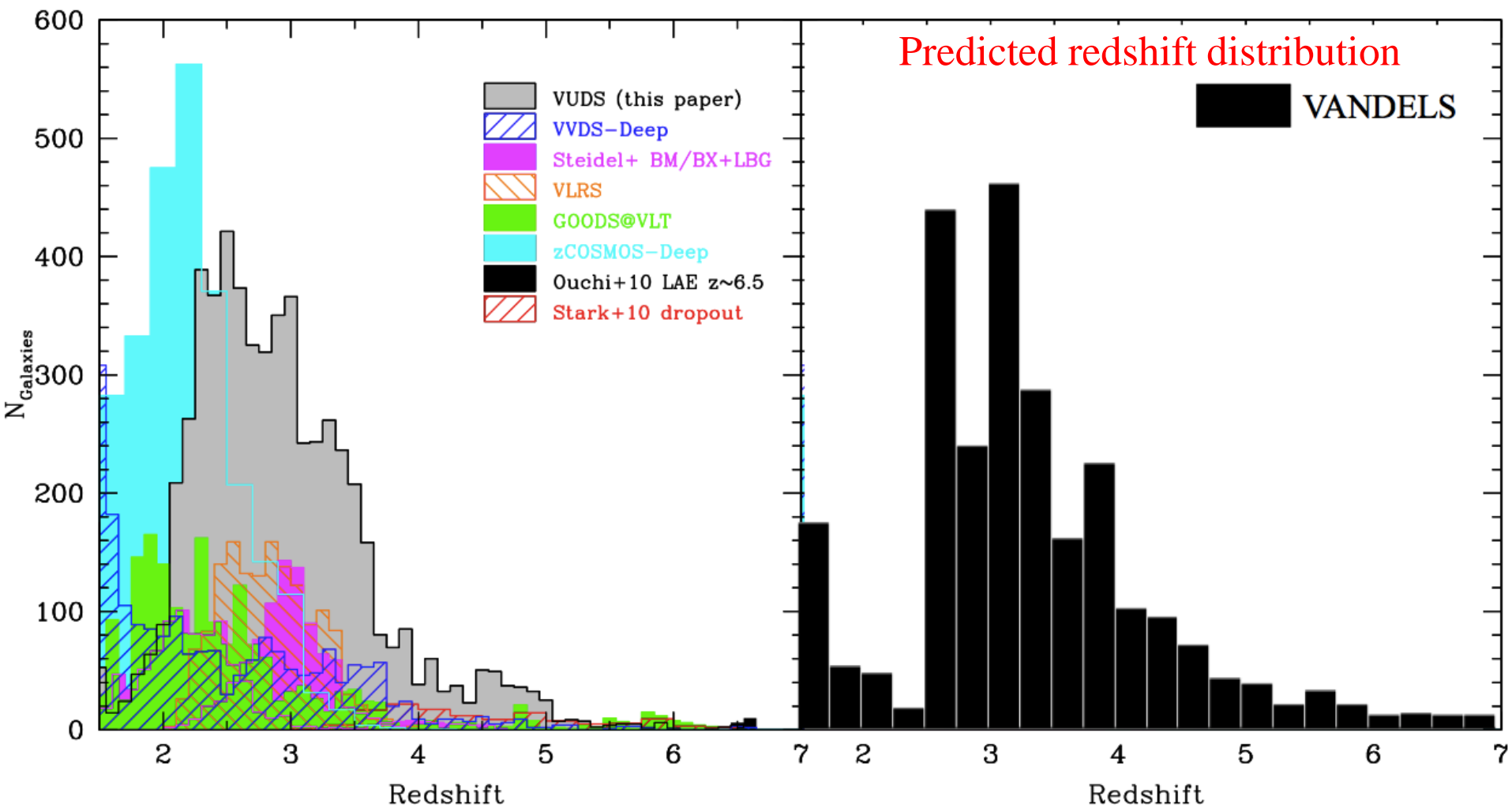
CDFS photometric redshifts

$$\sigma_{\text{MAD}}=0.013$$

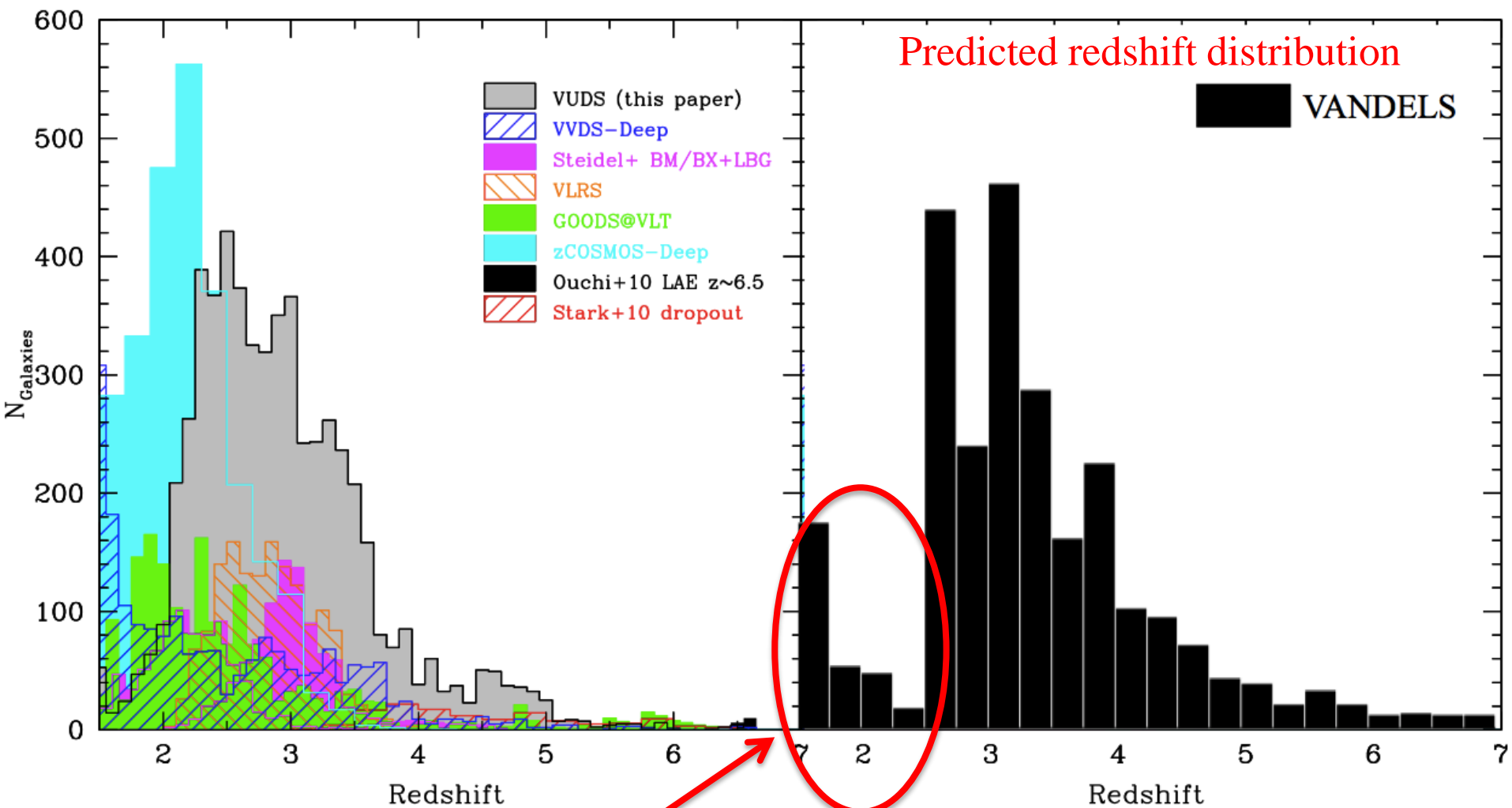
Outlier fraction < 4%  
down to  $H_{\text{AB}}=26$

Aim is for <100 low-redshift interlopers in final sample of 2600 galaxies

# VANDELS: photo-z pre-selection



# VANDELS: photo-z pre-selection



Passive galaxy sub-sample at  $1.5 < z < 2.5$

# VANDELS: test observations

Allocated two observing runs in Nov/Dec 2014 to test mask preparation and observing strategy. Obtained ~10 hours of integration in both UDS and CDFS on two masks.

Example 2D spectra from UDS mask:



LAE at  $z=3.72$



Type 1 AGN at  $z=3.97$



LAE at  $z=4.62$

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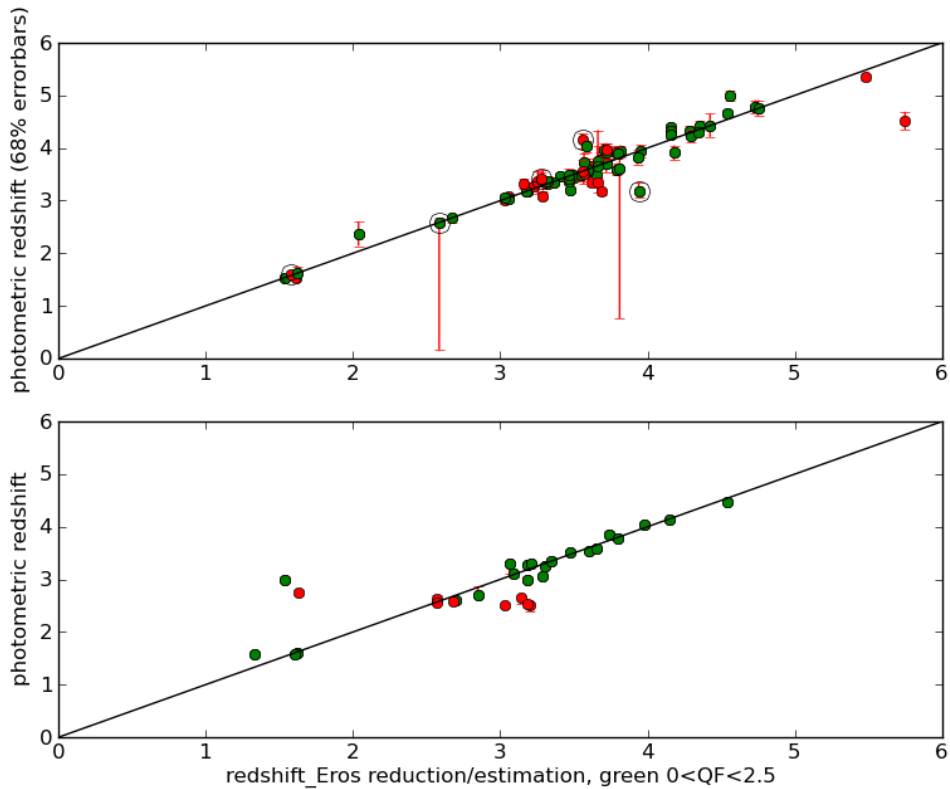
LAE at  $z=4.62$

data not obtained in the best conditions, but still clearly useful for testing target selection....



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$Z_{\text{spec}} - Z_{\text{phot}}$  comparison from test mask in CDFS:

Green = high quality redshift

Red = low quality redshift

Target selection appears to be working well...

# VANDELS: schedule

VANDELS has been allocated 912 hours of visitor mode observations, to be carried out in four observing seasons (Aug-Dec) during 2015-2018. All raw data are immediately public on ESO archive, and reduced data will be released ~9 months after observations.

## Provisional Data Release Schedule:

Data release	Date	No. of completed spectra			No. of partially complete spectra			Total
		20-hrs	40-hrs	80-hrs	40-hrs(50%)	80-hrs(25%)	80-hrs(50%)	
DR1	Sept 2016	160	160	0	320	320	160	1120
DR2	Sept 2017	320	480	160	320	320	160	1760
DR3	Sept 2018	480	960	320	0	0	320	2080
DR4	Sept 2019	640	1280	640	0	0	0	2560

## Data Reduction:

Data reduction is being carried out in Milan, by the team responsible for reducing VIMOS data obtained in VVDS, zCOSMOS, VIPERS and VUDS surveys

# Summary

- ⊙ 912 hours of VIMOS visitor time: 2015-2018
- ⊙ 20-80 hour integrations focused on  $z > 3$  star-forming galaxies
- ⊙ Science goals: ages, masses, metallicities and outflows at high- $z$
- ⊙ Raw data immediately public
- ⊙ Reduced data released  $\sim 9$  months after observations taken
- ⊙ Full details can be found at: [vandel.inaf.it](http://vandel.inaf.it)



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