EUCLID photometric redshifts
OU-PHZ

lead: S. Paltani - ISDC/CH

53 members

French members:

S. Arnouts, V. Beckman, S. Charlot, Y. Giraud-Héraud,
O. Ilbert, H.J. McCracken, T. Moutard, R. Pelló, M. Sauvage

Olivier Ilbert - LAM

Context

2 billions of sources in photometry

➢ Need the photometric redshifts to define the weak lensing tomographic bins

OU-PHZ: develop the codes to compute photo-z from the multi-wavelength catalogues assembled by OU-EXT and OU-MER

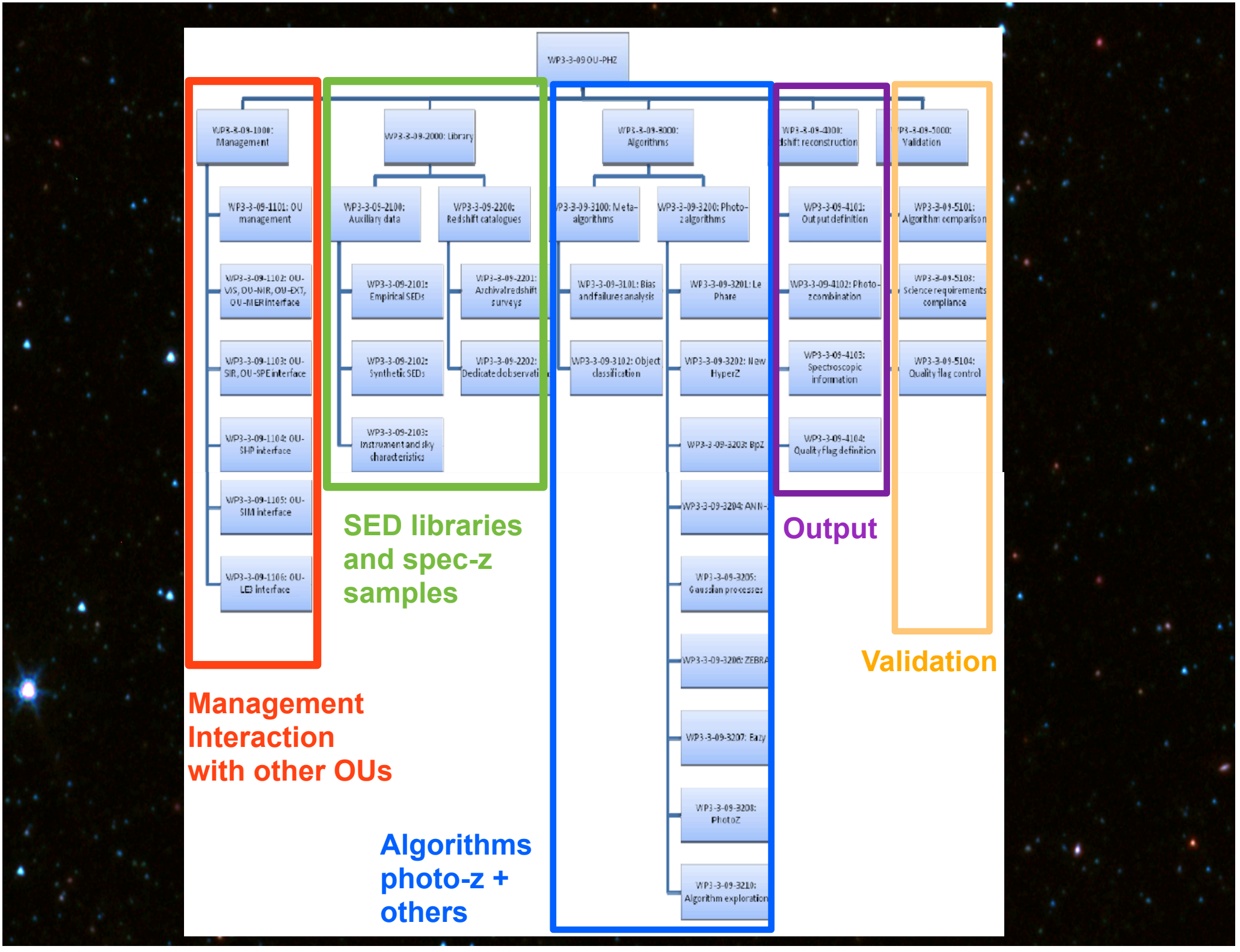

WP3-3-09 OU-PHZ
WP3-3-09-1000: Management
WP3-3-09-1101: OU management
WP3-3-09-1102: OU-VIS, OU-NIR, OU-EXT, OU-MER interface
WP3-3-09-1103: OU-SIR, OU-SPE interface
WP3-3-09-1104: OU-SHP interface
WP3-3-09-1105: OU-SIM interface
WP3-3-09-1106: OU-LE3 interface
WP3-3-09-2000: Library
WP3-3-09-2100: Auxiliary data
WP3-3-09-2200: Redshift catalogues
WP3-3-09-2101: Empirical SEDs
WP3-3-09-2102: Synthetic SEDs
WP3-3-09-2103: Instrument and sky characteristics
WP3-3-09-2201: Archival redshift surveys
WP3-3-09-2202: Dedicated observati
WP3-3-09-3000: Algorithms
WP3-3-09-3100: Meta-algorithms
WP3-3-09-3200: Photo-z algorithms
WP3-3-09-3101: Bias and failures analysis
WP3-3-09-3102: Object classification
WP3-3-09-3201: Le Phare
WP3-3-09-3202: New HyperZ
WP3-3-09-3203: BpZ
WP3-3-09-3204: ANN-
WP3-3-09-3205: Gaussian processes
WP3-3-09-3206: ZEBRA
WP3-3-09-3207: Eazy
WP3-3-09-3208: PhotoZ
WP3-3-09-3210: Algorithm exploration
WP3-3-09-4000: dshift reconstruction
WP3-3-09-4101: Output definition
WP3-3-09-4102: Photo-z combination
WP3-3-09-4103: Spectroscopic information
WP3-3-09-4104: Quality flag definition
WP3-3-09-5000: Validation
WP3-3-09-5101: Algorithm comparison
WP3-3-09-5103: Science requirements compliance
WP3-3-09-5104: Quality flag control
SED libraries and spec-z samples
Output
Validation
Management Interaction with other OUs
Algorithms photo-z + others

Photo-z algorithms

Various photo-z codes in the OU

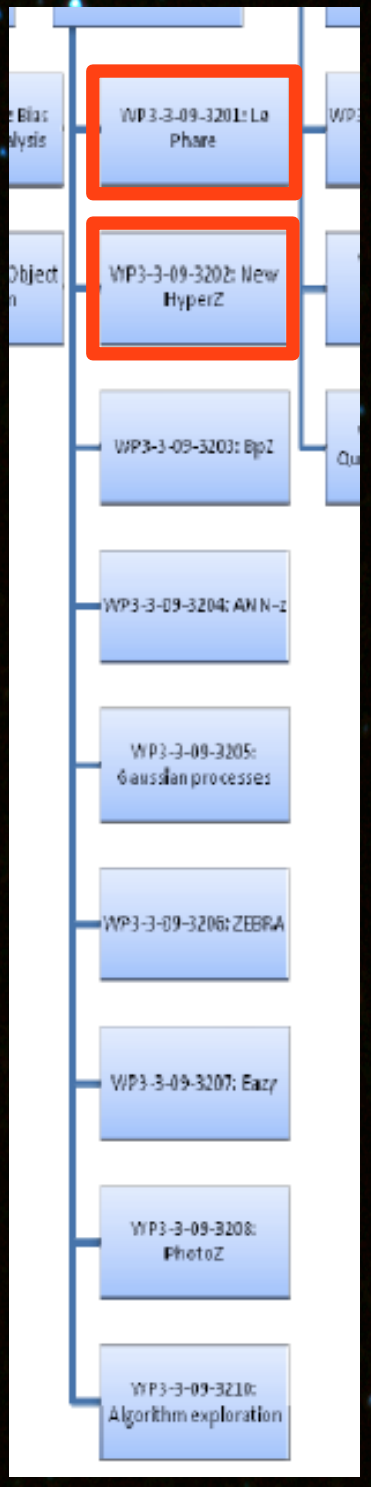
- template-fitting

  le Phare, Hyperz, Zebra, BPZ, Eazy

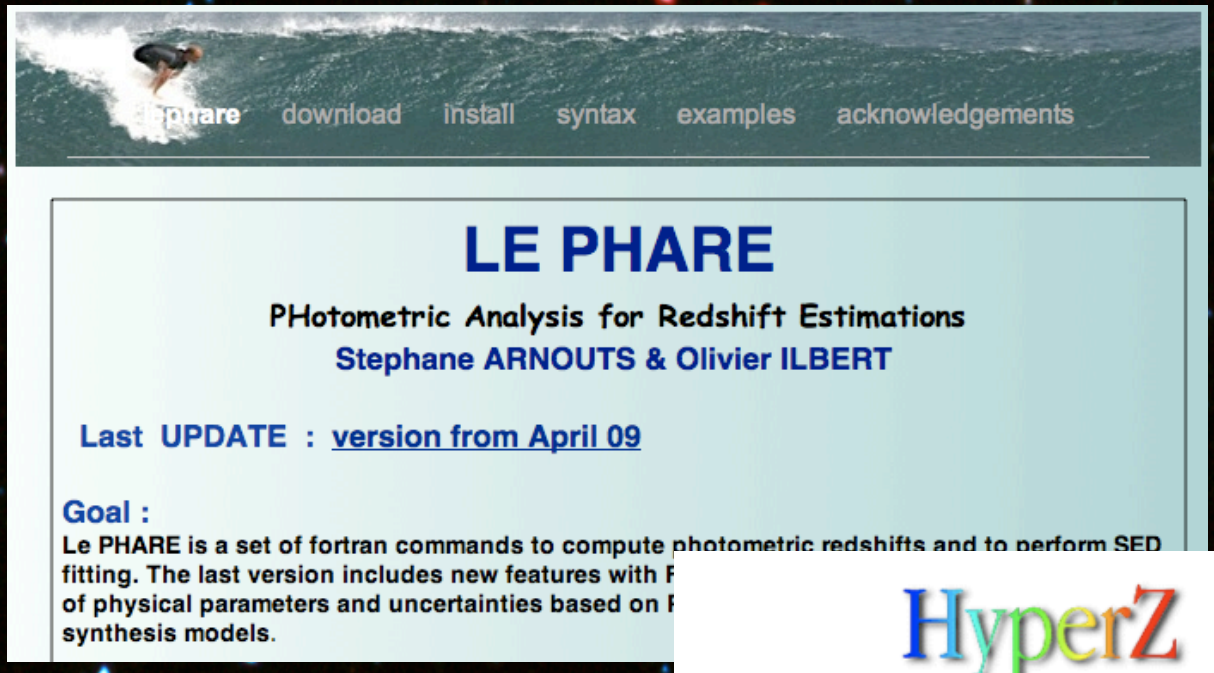
- empirical methods

  ANNz, gaussian processes

Test bench to run the various photo-z codes and test them (N. Fourmanoit)

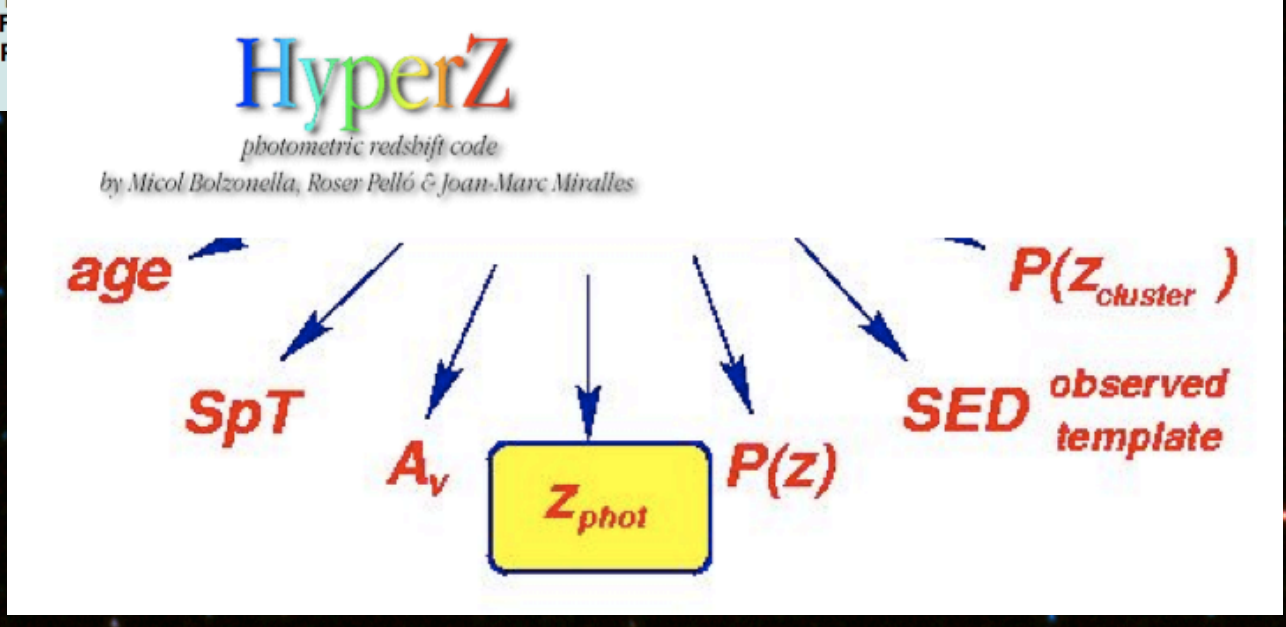


Template fitting method

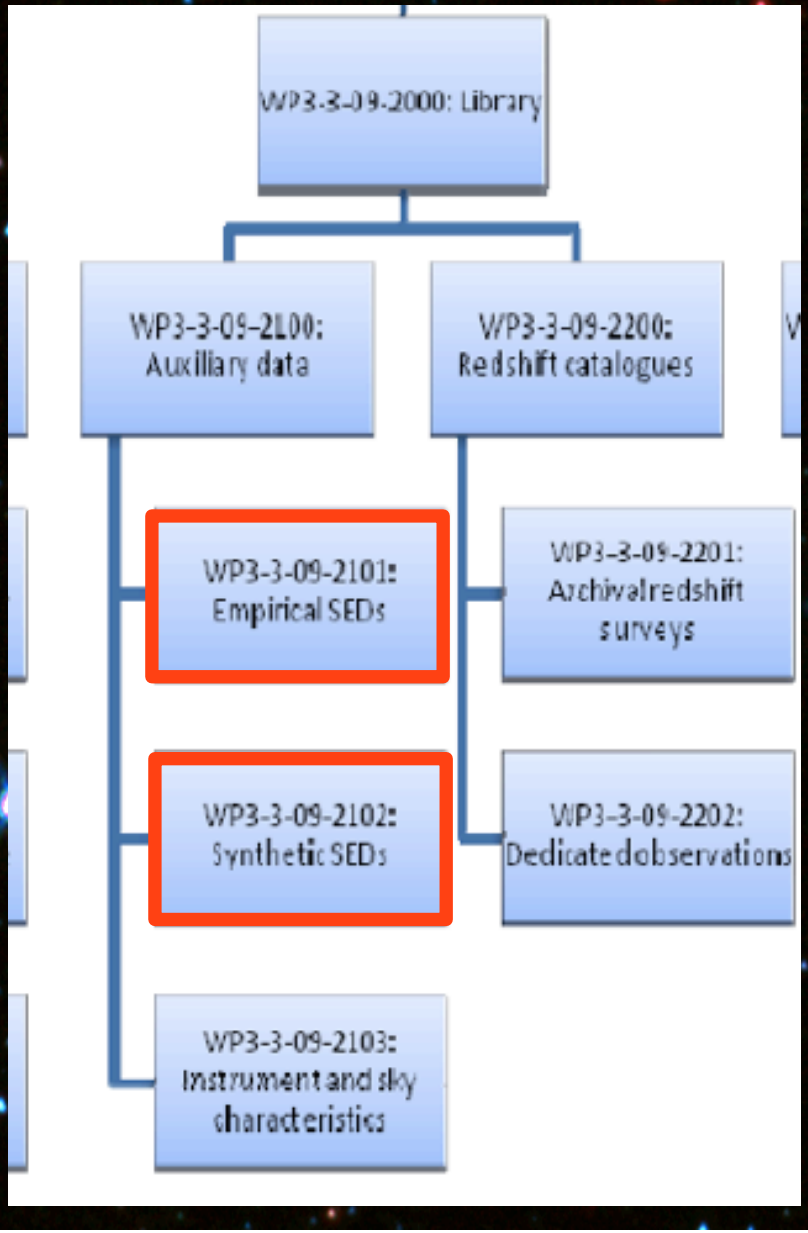


(resp: S. Arnouts)

(resp: R. Pelló)



Work package - SEDs



Provide empirical (resp: O. Ilbert) and modeled SEDs (resp: S. Charlot)

Main ingredient for template-fitting methods

Work package - physical parameters

Measure the physical parameters for the photo-z sample, e.g. stellar masses, SFR

➢ for Galaxy Evolution SWG

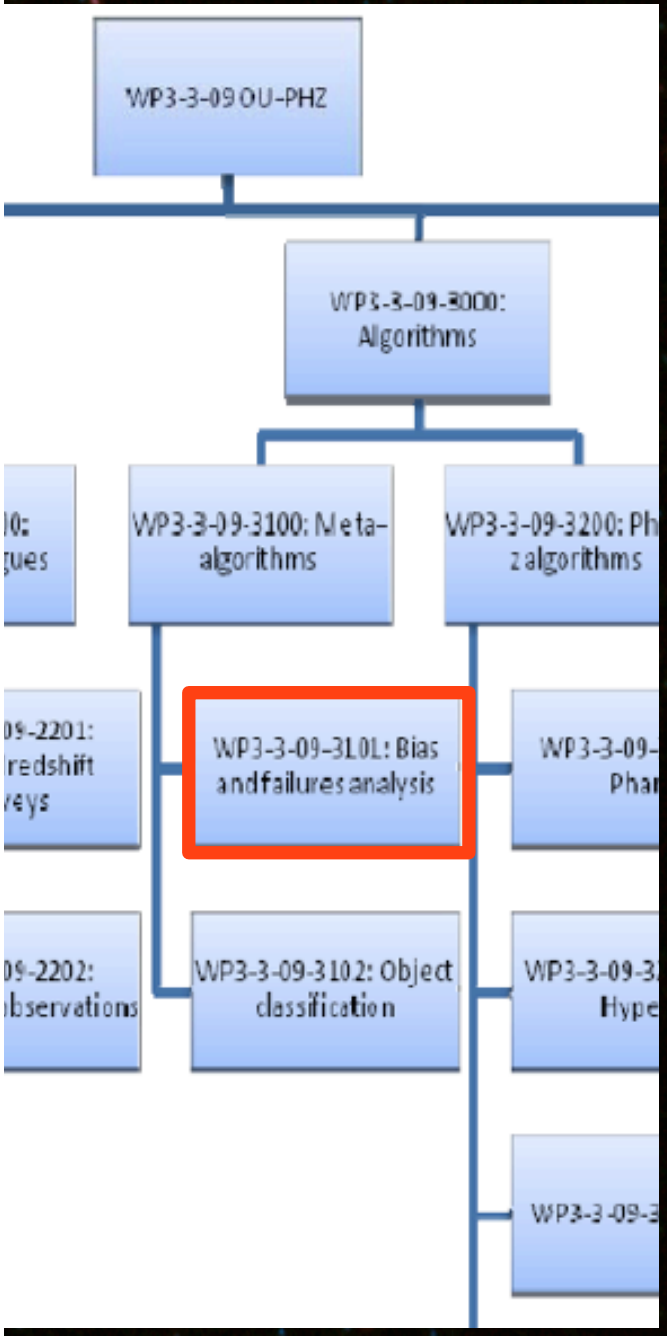
Resp: C. Maraston

Strong french contribution:

Arnouts, Charlot, Ilbert, Moutard

Same codes as for template-fitting

Bias and failure analysis



Resp: O. Ilbert

Participants: F. Abdalla, M. Bolzonella, P. Capak, A. Choi, J. Coupon, H. Hildebrandt, S. Jouvel, T. Moutard, R. Pello, F. Raison

Characterize the precision, the fraction of catastrophic failures that we get on the photo-z and the mean redshift of each photo-z subsample.

- ➢ check that we respect the requirements
- ➢ "a posteriori" treatment if necessary

Requirements

Requirements on the precision of the photo-z for the weak-lensing sample (mag_{RIZ}< 24.5, 0.2<z<2)

Precision: $\sigma_{(zp-zs)/(1+zs)}$=0.05 (required) 0.03 (goal)

Catastrophic failures: 10% (required) 5% (goal)

Req. ID	Parameter	Requirement	Goal
WL.1-5	Redshifts error ($\sigma(z)/(1+z)$)	≤ 0.05	≤ 0.03
WL.1-6	Catastrophic failures	10%	5%
WL.1-7	Error in mean redshift in bin	<0.002	

➪ capacity to well define the tomographic bins

EUCLID combined with ground based optical data

5σ sensitivity in NIR

Y_{AB}=24, J_{AB}=24, H_{AB}=24

South:

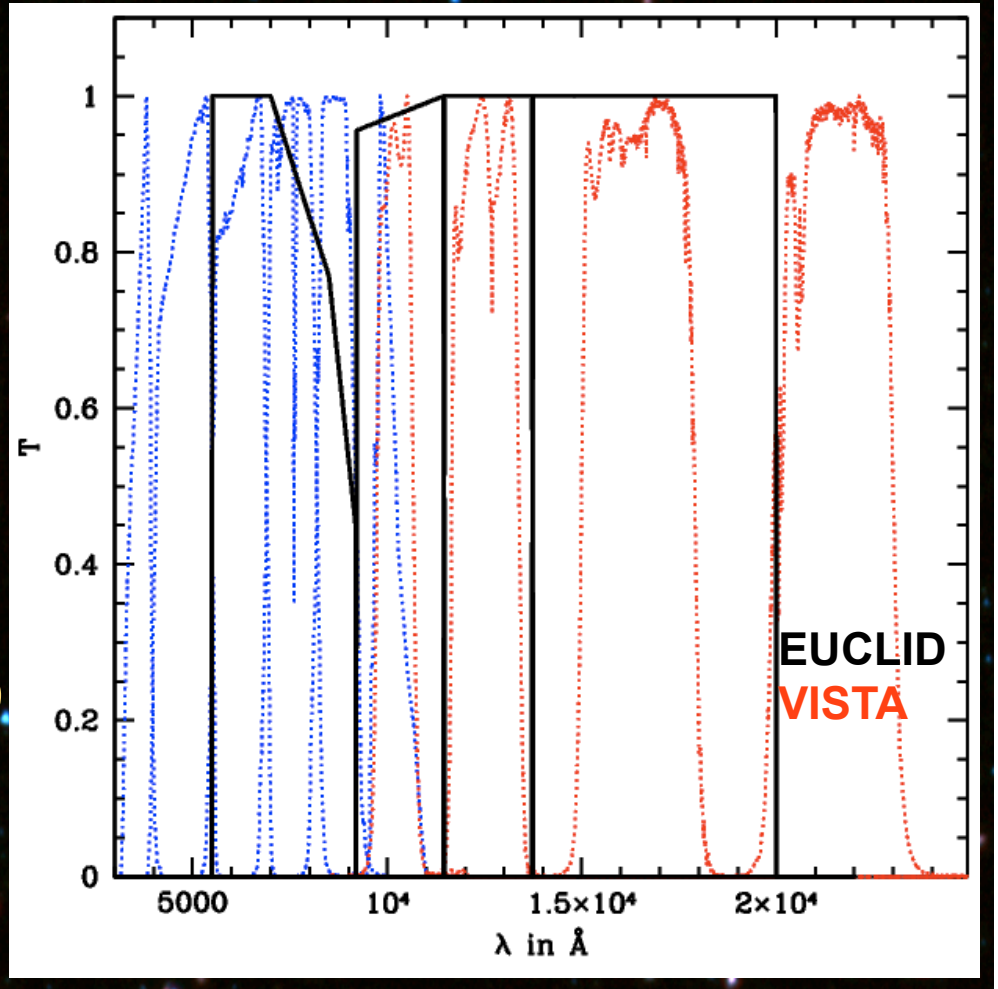
DES - 5000 deg^2

10σ sensitivity

g=24.6 r=24.1 i=24.0 z=23.9

North:

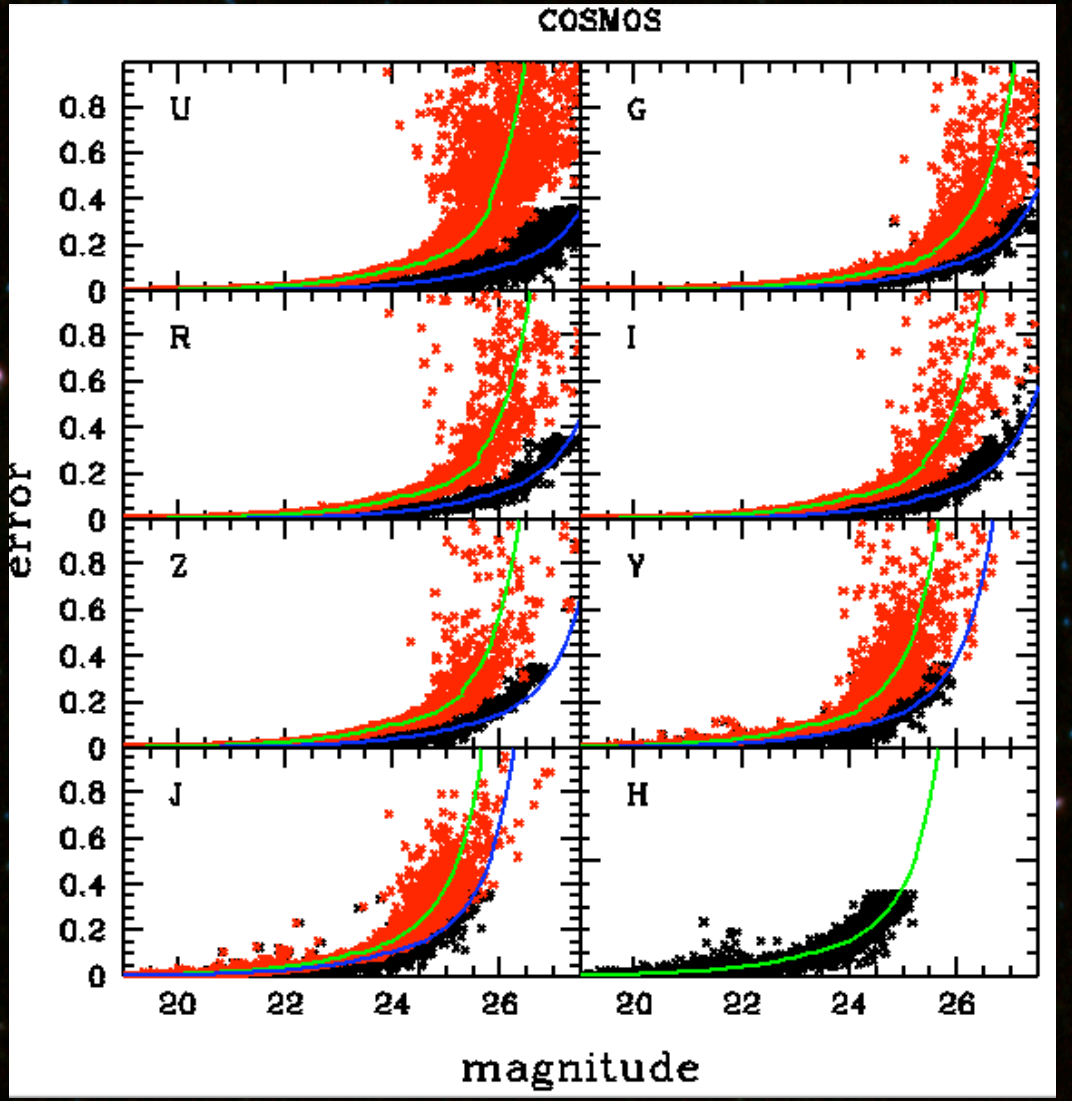
CFHT, Pan-STARRS, HSC, LSST



Test the EUCLID photo-z accuracy using real data

Numerous studies already tackle this problem with simulations

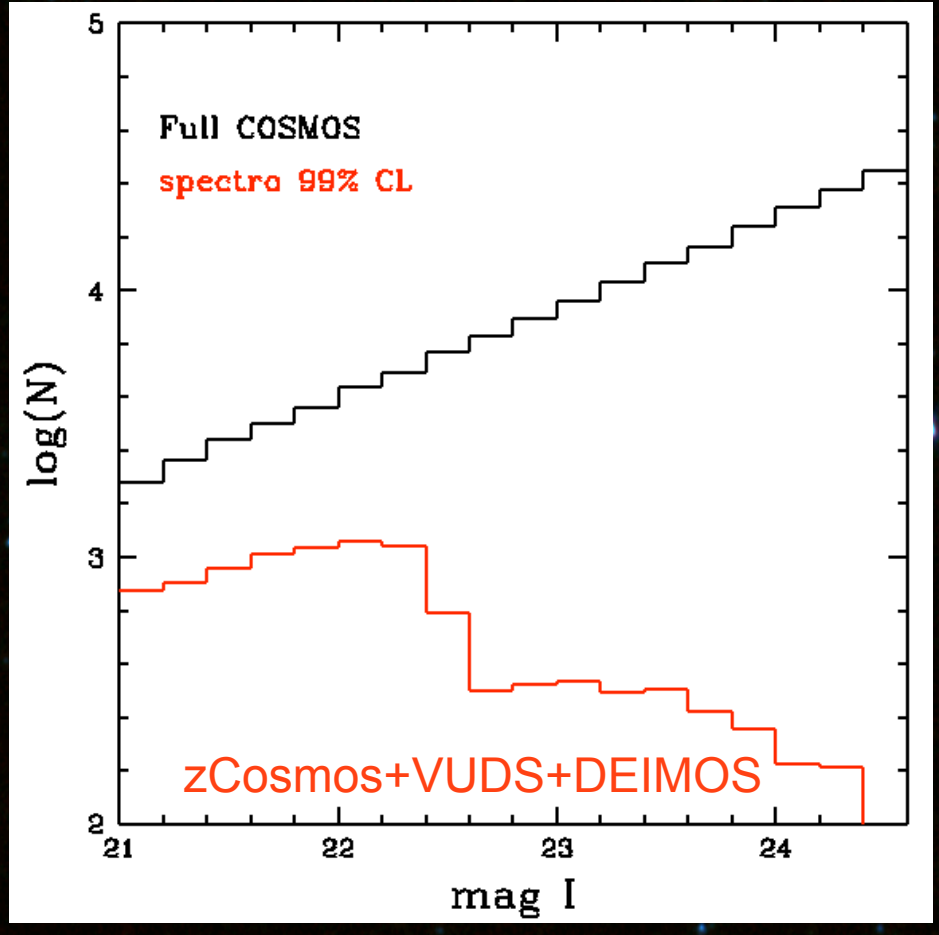
Degrade the observed COSMOS magnitudes to get DES sensitivity



Deep and large spec-z samples to estimate the photo-z accuracy

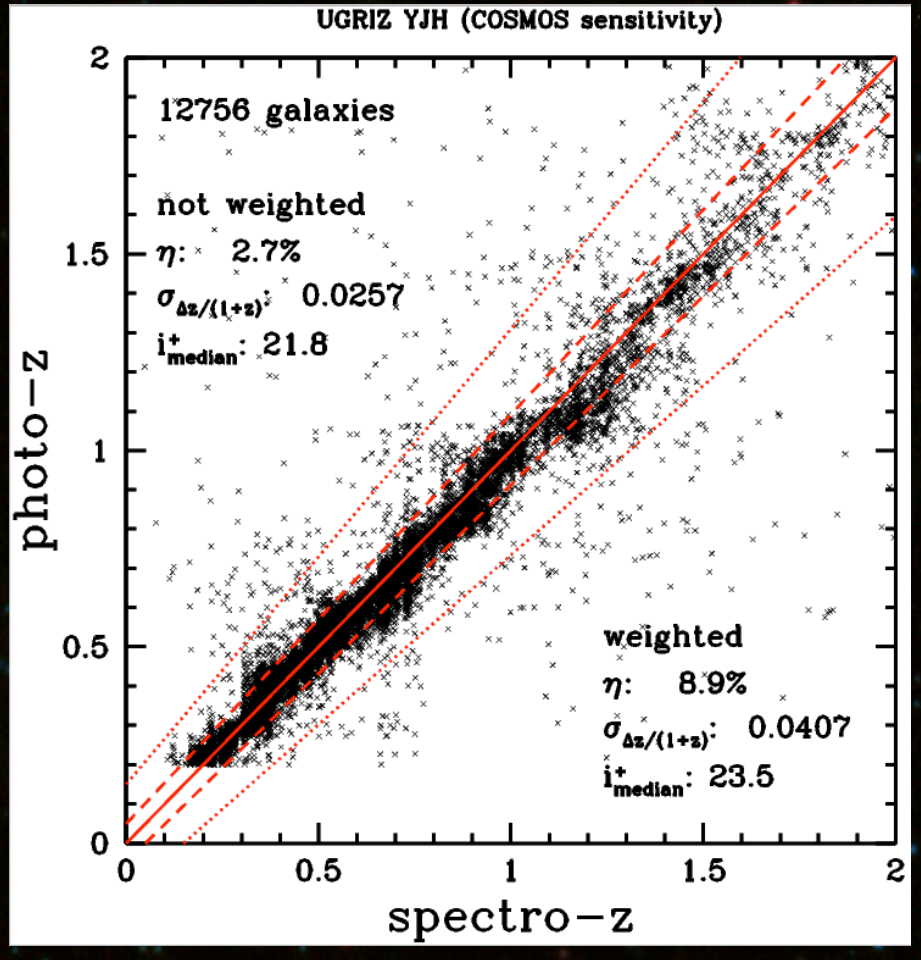
Use only the spec-z with a confidence level >97%

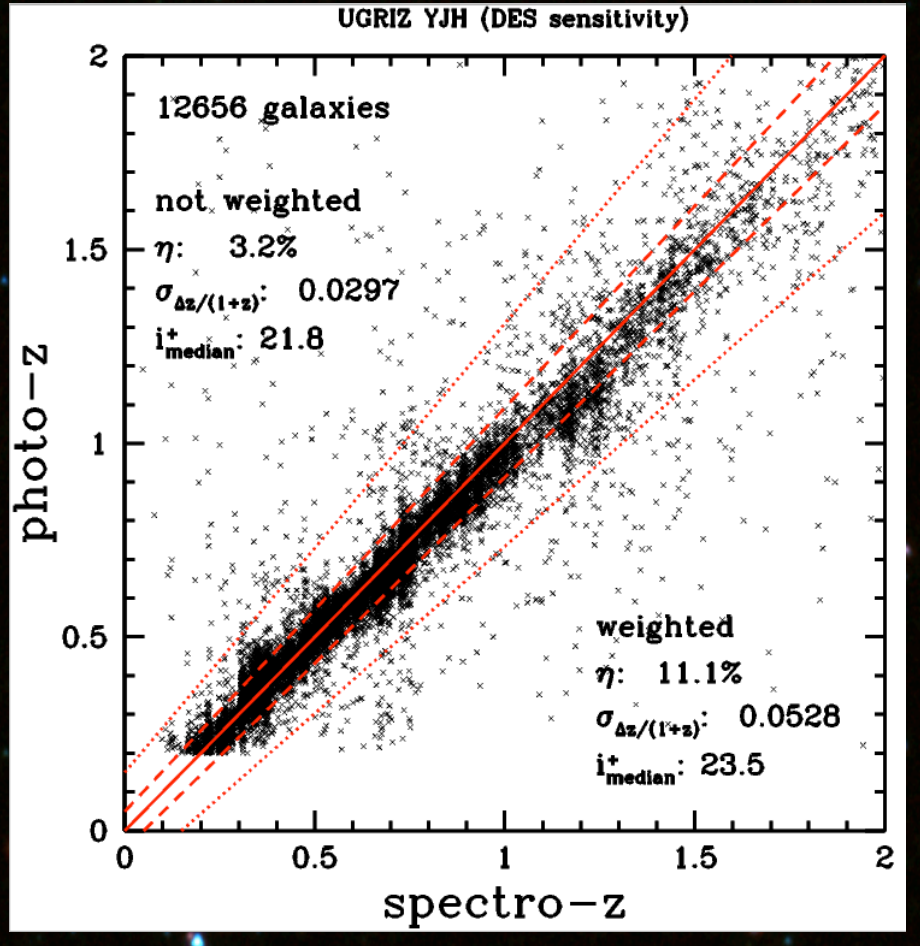
➢ not a random selection of the weak lensing sample



Depth of the optical data crucial to meet the requirements

Test with COSMOS data degraded to DES





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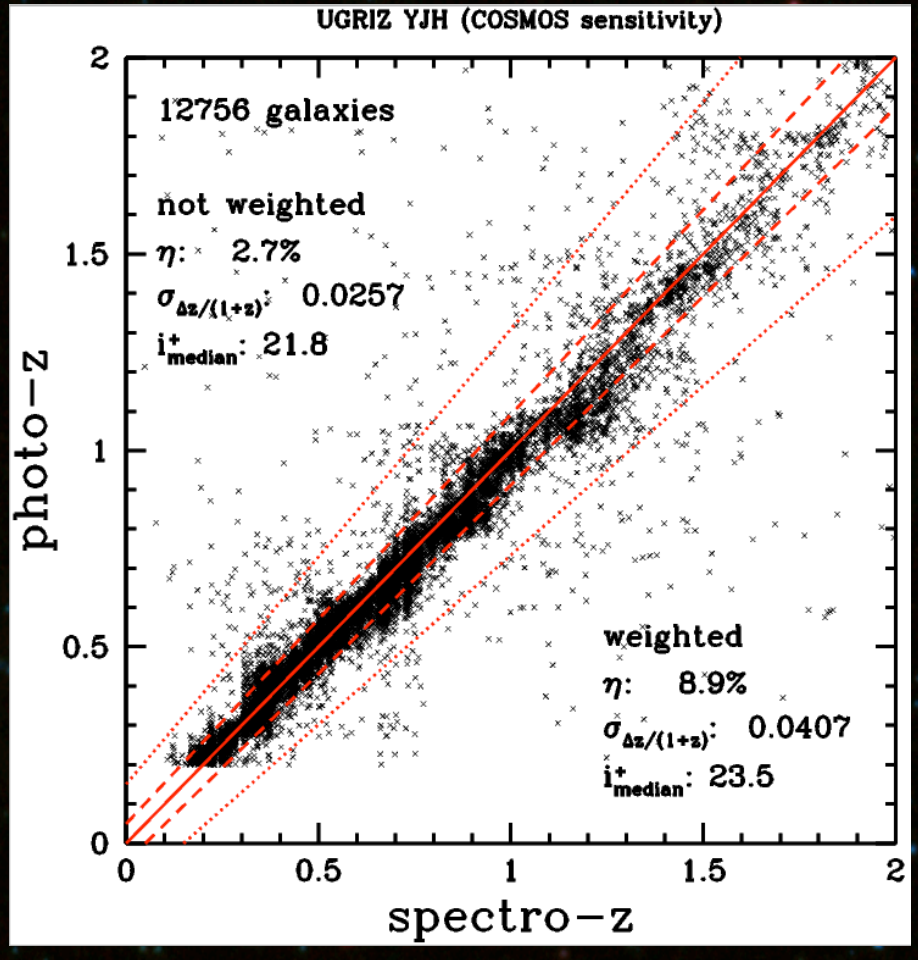

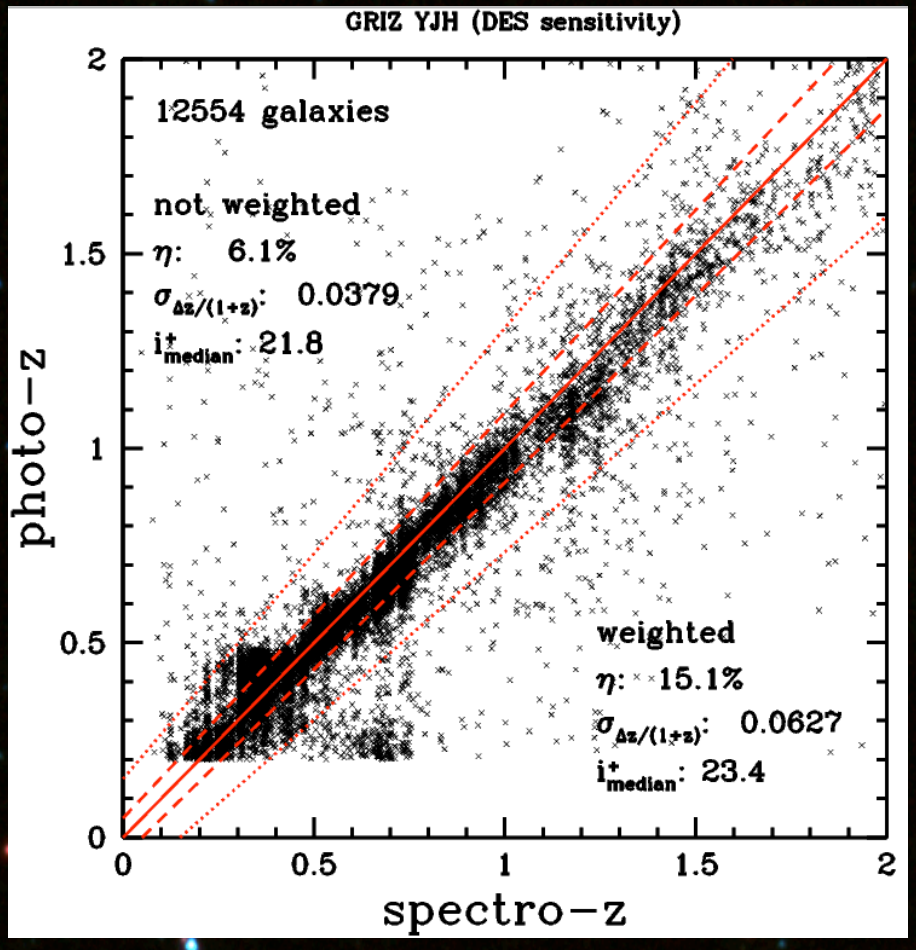

➢ could add additional cleaning based on the PDF

Requirements on the mean redshift

- to insure an uncertainty below 1% on w, we need to determine <z> better than 0.2(1+z)%.

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WL.1-5	Redshifts error ($\sigma(z)/(1+z)$)	≤ 0.05	≤ 0.03
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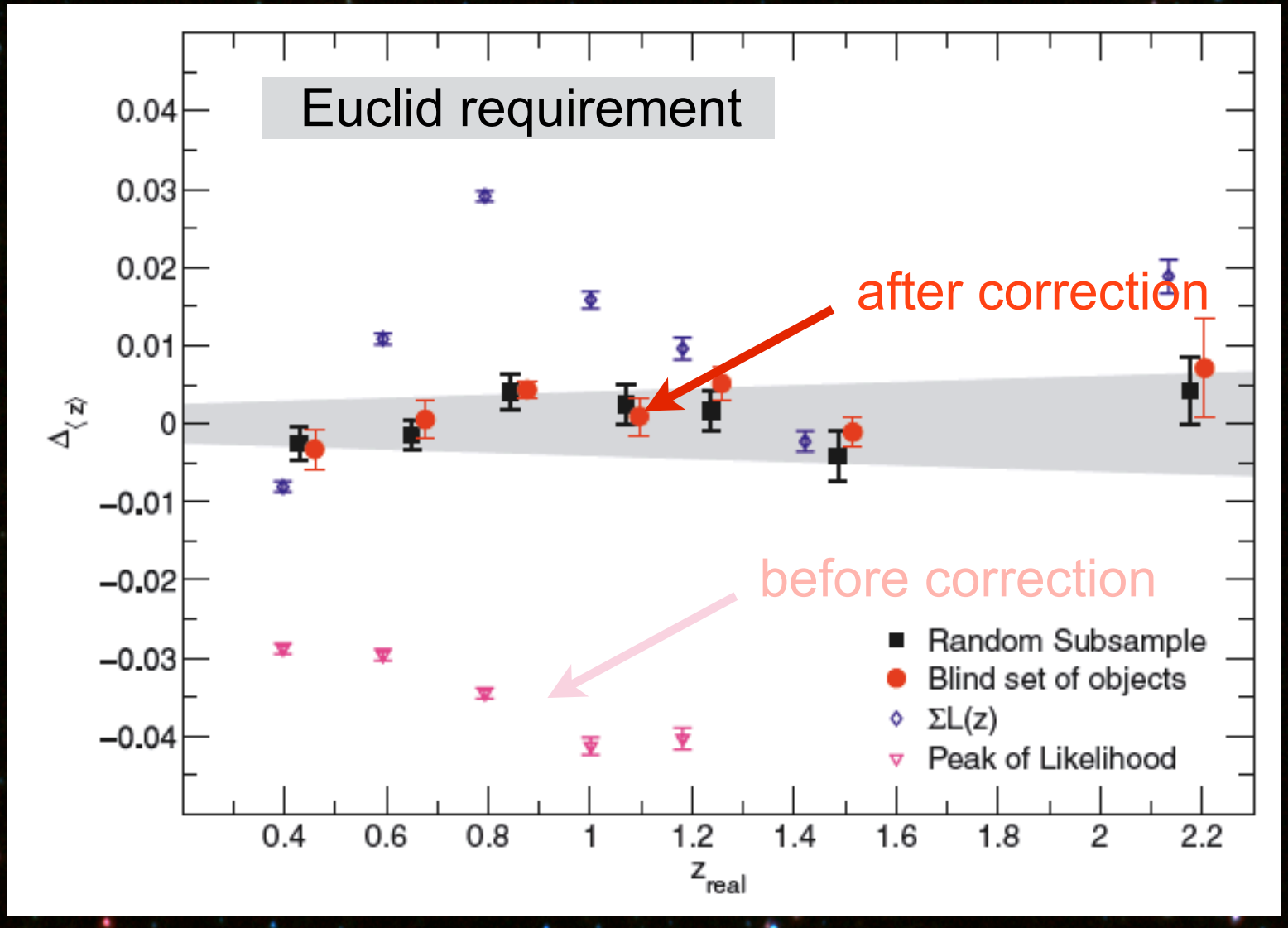
any uncertainties on the templates, relative calibration of the photometry tile-to-tile, etc create a bias >>0.2% in the photo-z

➢ can not use the photo-z directly

Possible solutions to get the mean redshift at 0.2%

1. Brute force: organize a spectroscopic follow-up of a representative I<24.5 sample to get the exact redshift distribution. Need to beat the cosmic variance, acquire a representative spec-z sample
2. Use the spatial information, as Newmann 2008. A. Choi and H. Hildebrandt test it on CFHTLens
3. Use a spec-z sample to define the bias and correct the photo-z or the PDF(z).
   - ➢ Bordoloi method 2010 and 2012

Correct the bias using the spec-z



Bordoloi et al. 2010

Conclusions

1. Strong french implication in template-fitting methods for photo-z and physical parameters
2. Possible to get the mean redshift at 0.2% by correcting the photo-z bias or using the spatial information
3. DES is the minimum survey sensitivity to reach the requirements on the precision and failure rate

Next steps:

- ⋆ data challenge with a catalogue produced by OU-MER based on CANDELS GOODS-S
- ⋆ DES data taken in the COSMOS field