EUCLID photometric redshifts
OU-PHZ

lead: S. Paltani - ISDC/CH

64 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
- To measure the mean redshift in each tomographic bin
- For the ancillary science

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

OU-PHZ

Management
Interaction
with other OUs

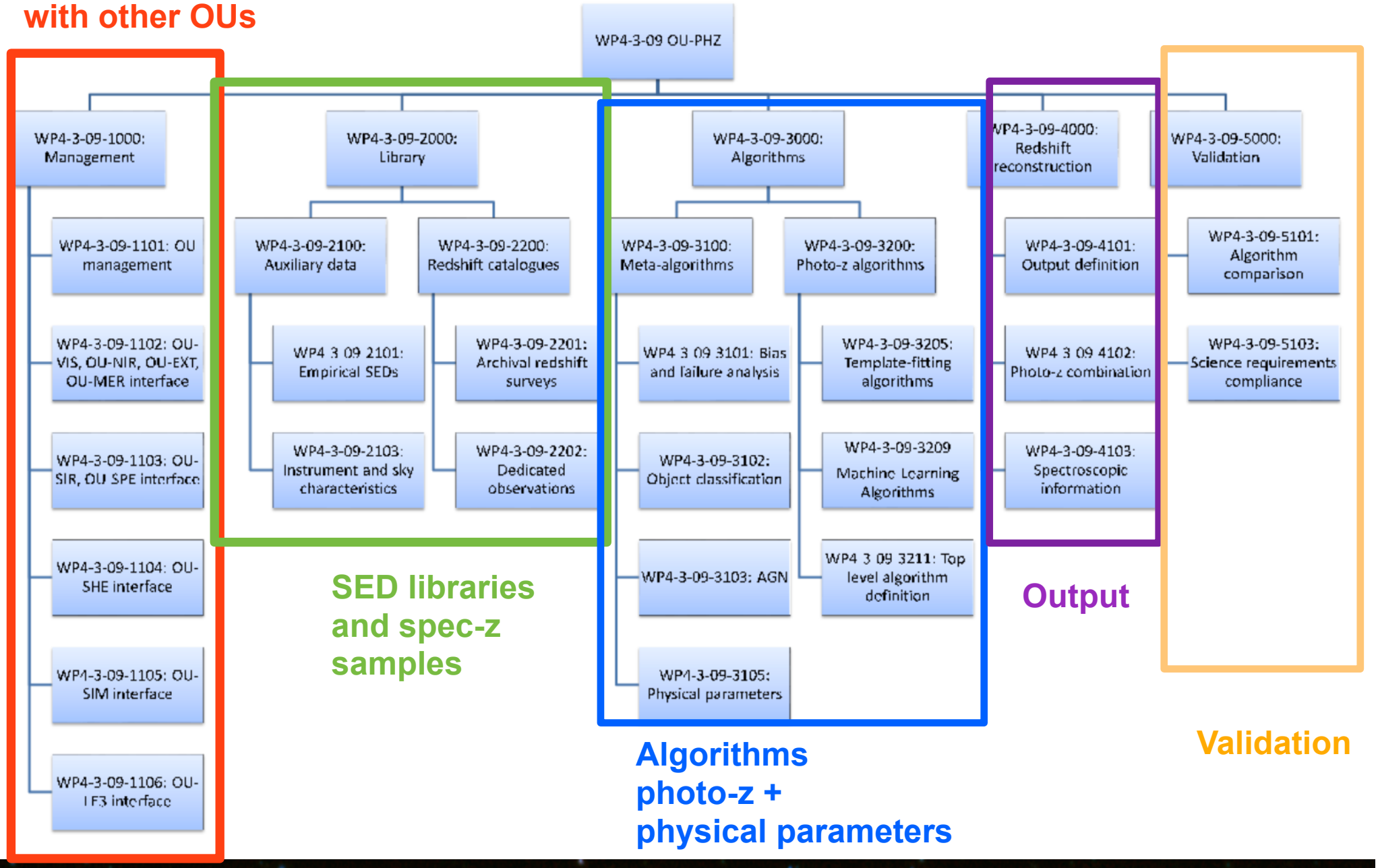


Photo-z algorithms

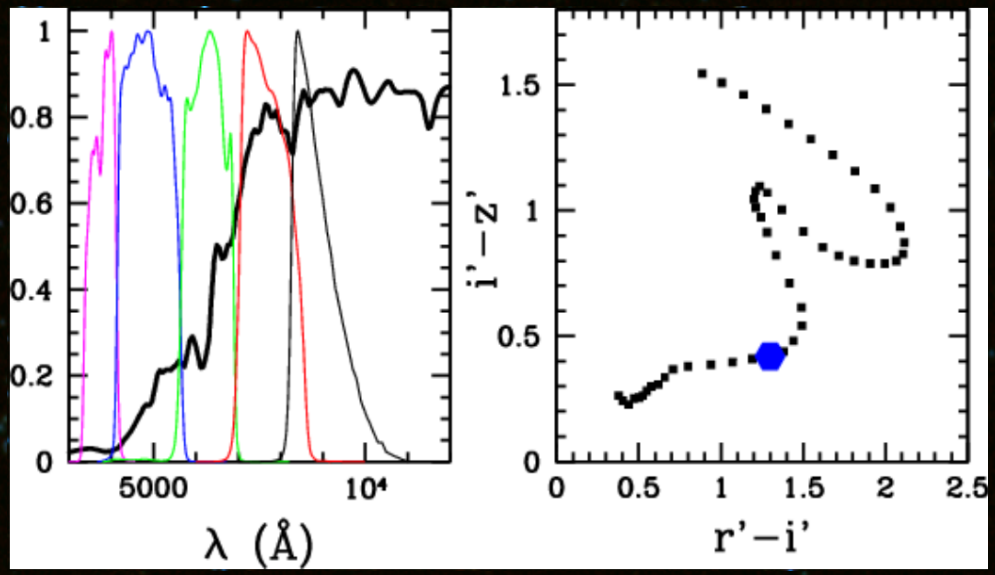
Two main classes

- template-fitting
- empirical methods

Photo-z algorithms

Two main classes

➢ template-fitting



- Templates redshifted along a grid in δz
- Integrated through the filters
- match observed and predicted colors

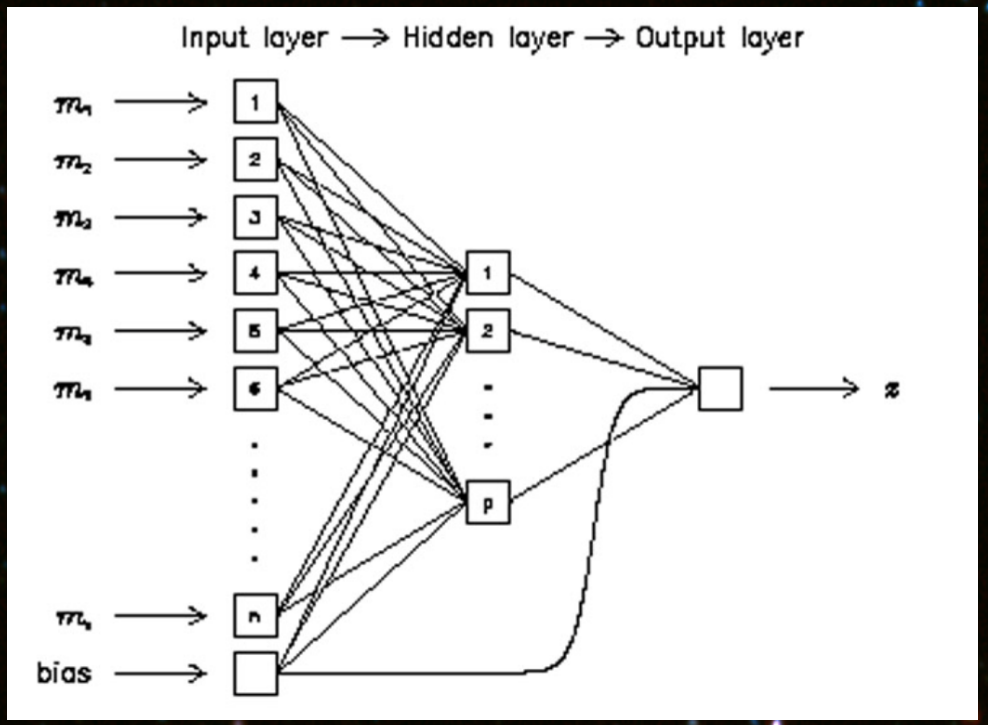
➢ empirical methods

Photo-z algorithms

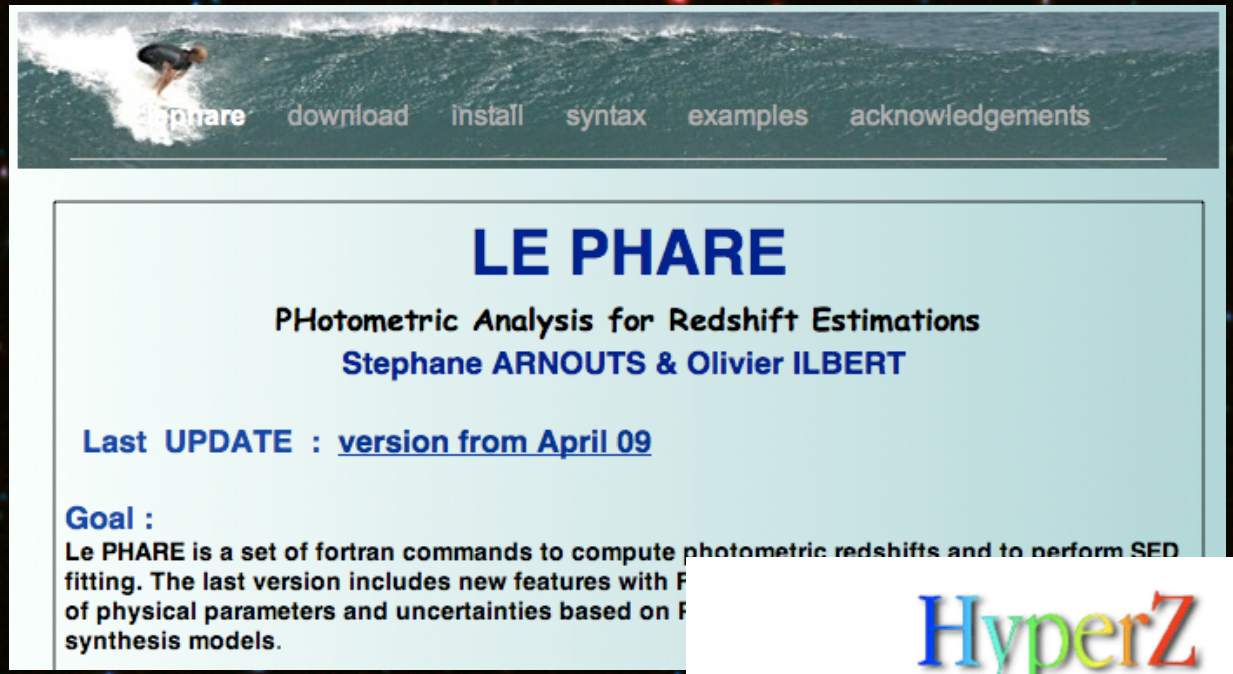
Two main classes

- template-fitting
- empirical methods

Training with a large and representative spec-z sample

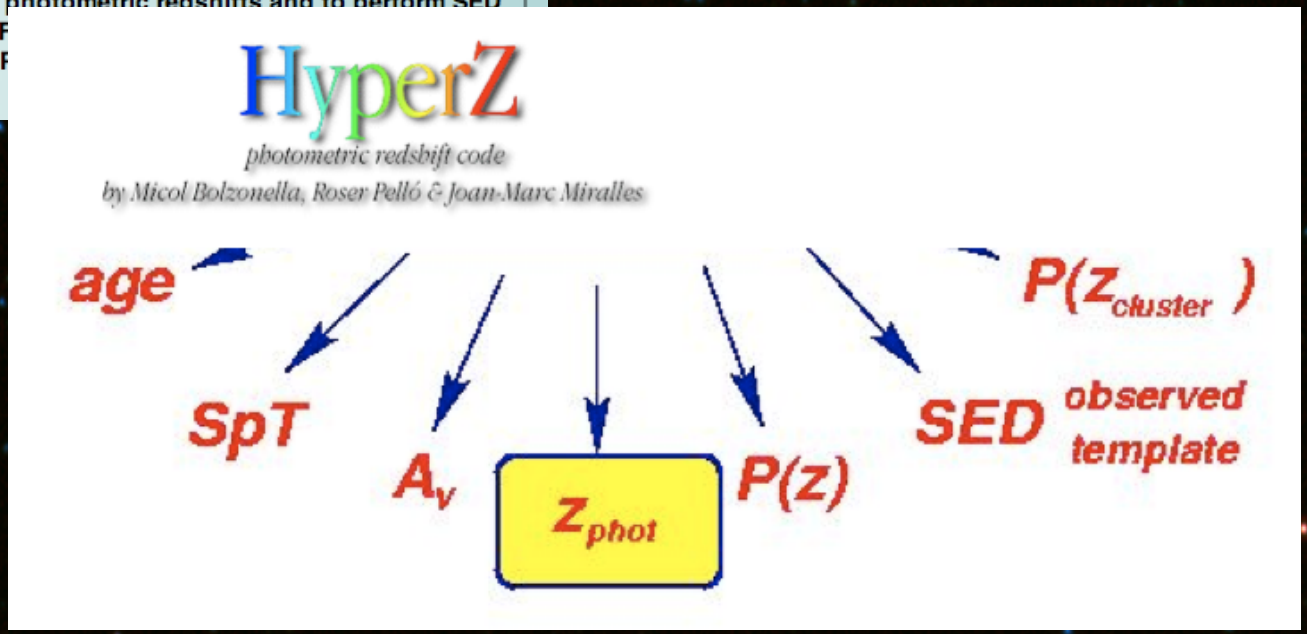


Template fitting method



S. Arnouts &
O. Ilbert

R. Pelló
M. Bolzonella



WP template-fitting algorithms

WP4-3-09-3205 Responsible: R. Pelló, R. Saglia

Define the « optimized solutions » that the SDC needs to implement in the new algorithm they develop

- tuning of the zero-points
- priors in N(z), luminosity function, etc
- propagate uncertainties of the templates
- ...

WP4-3-09-2101 Provide empirical SEDs (resp: S. Arnouts)

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

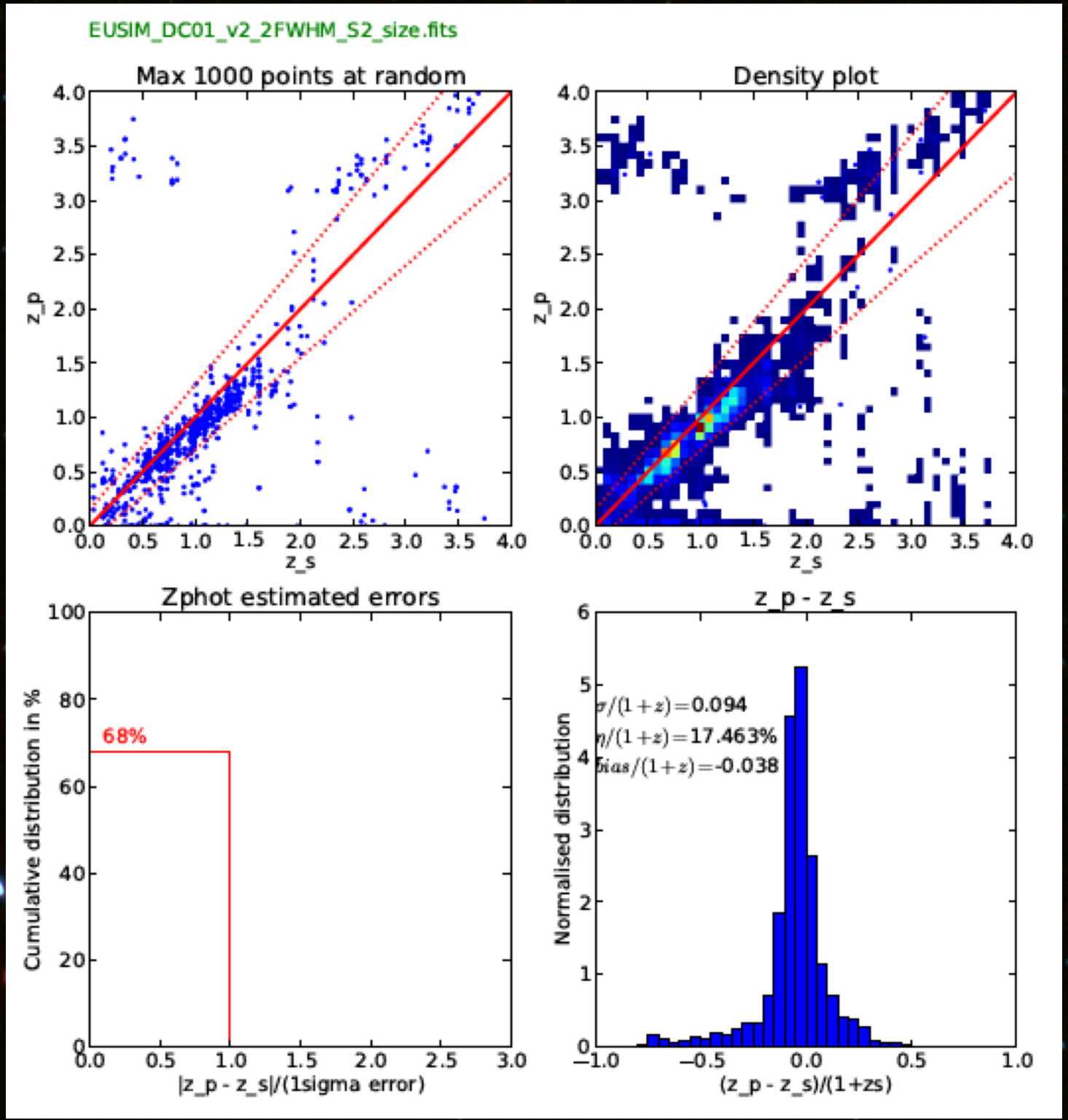
Data challenge 1: WP algorithm comparison

OU-MER generated an EUCLID-like catalogue based on the CANDELS/GOODS data (DES sensitivity)

All comparisons done by J. Coupon (WP leader)

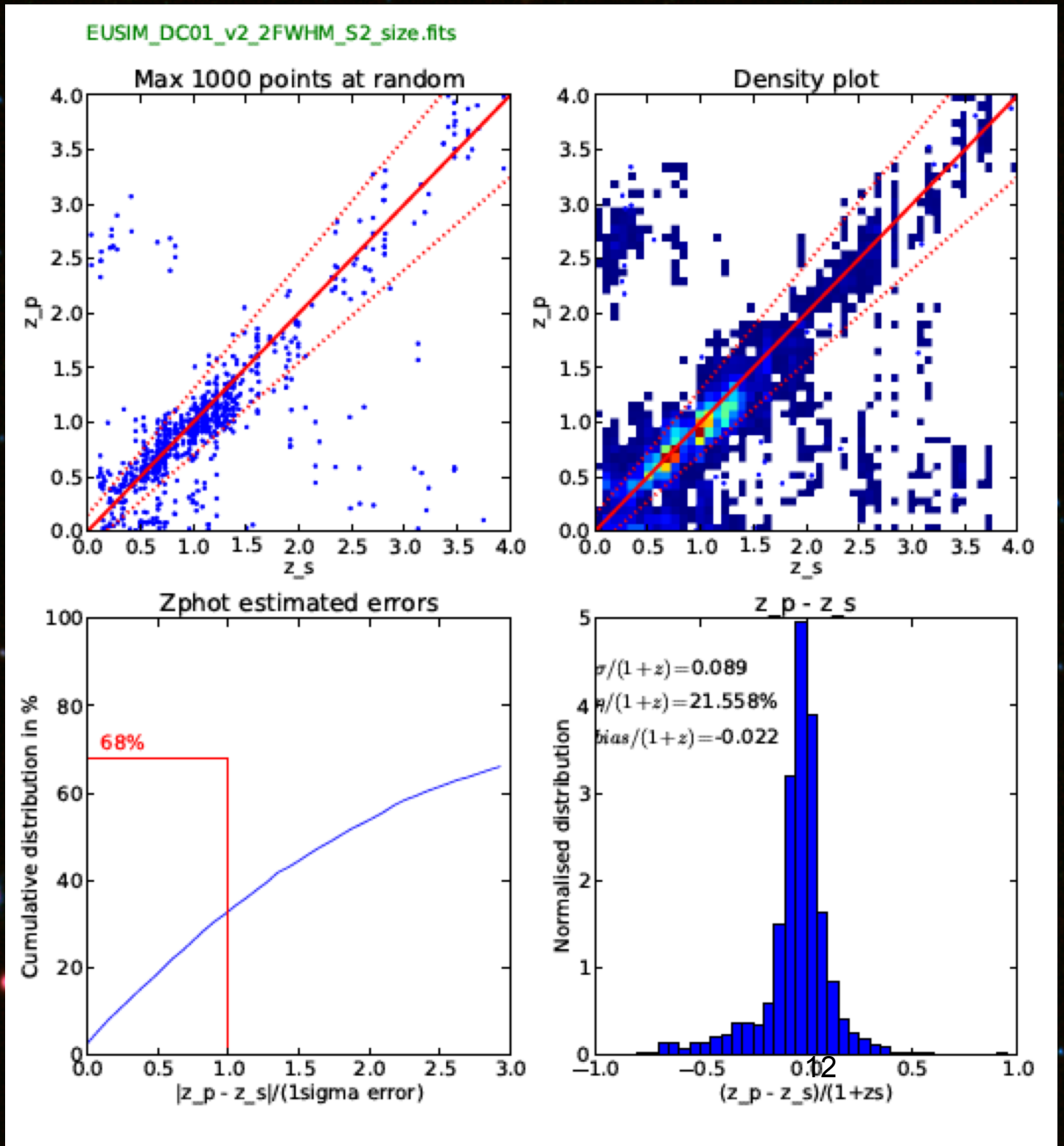
- Christopher Bonnett: machine learning — Neural Network and Random forest
- Massimo Brescia: machine learning — Neural Network
- Ranga Cham Chary: SED template fitting
- Sotiria Fotopoulou: SED template fitting — Le Phare
- Thibaud Moutard: SED template fitting — Le Phare
- Roser Pello: SED template fitting — Hyperz
- SDC-CH (Pierre Dubath, Nikolaos Apostolakos, Hubert Degaudenzi): SED template fitting — New SDC
- Markus Rau: machine learning — Neural Network ANNz
- Mara Salvato (AGN classification)
- Stella Seitz: SED template fitting

SDC-code (official code of the OU-PHZ)



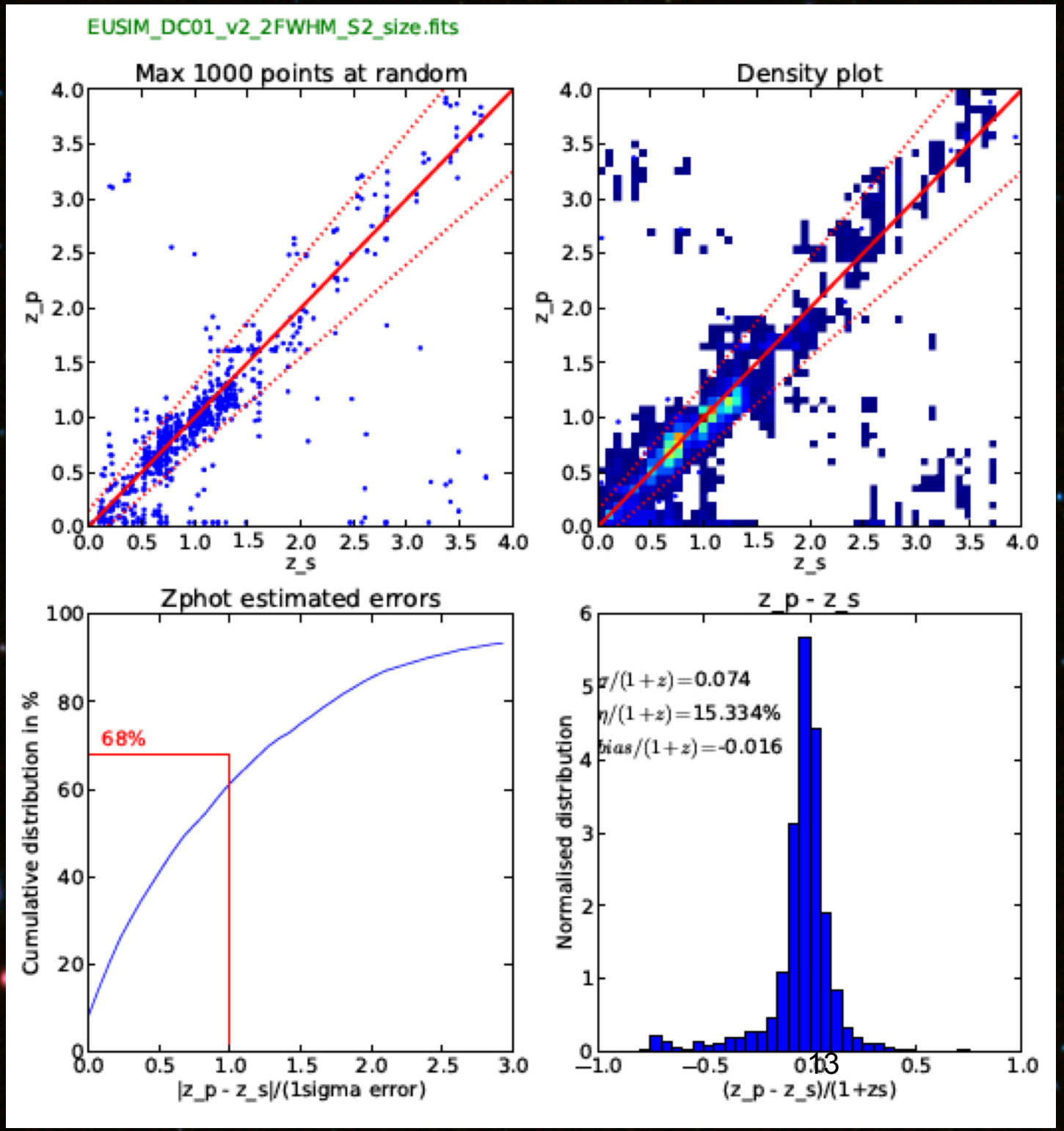
HYPERZ

(Roser Pello)



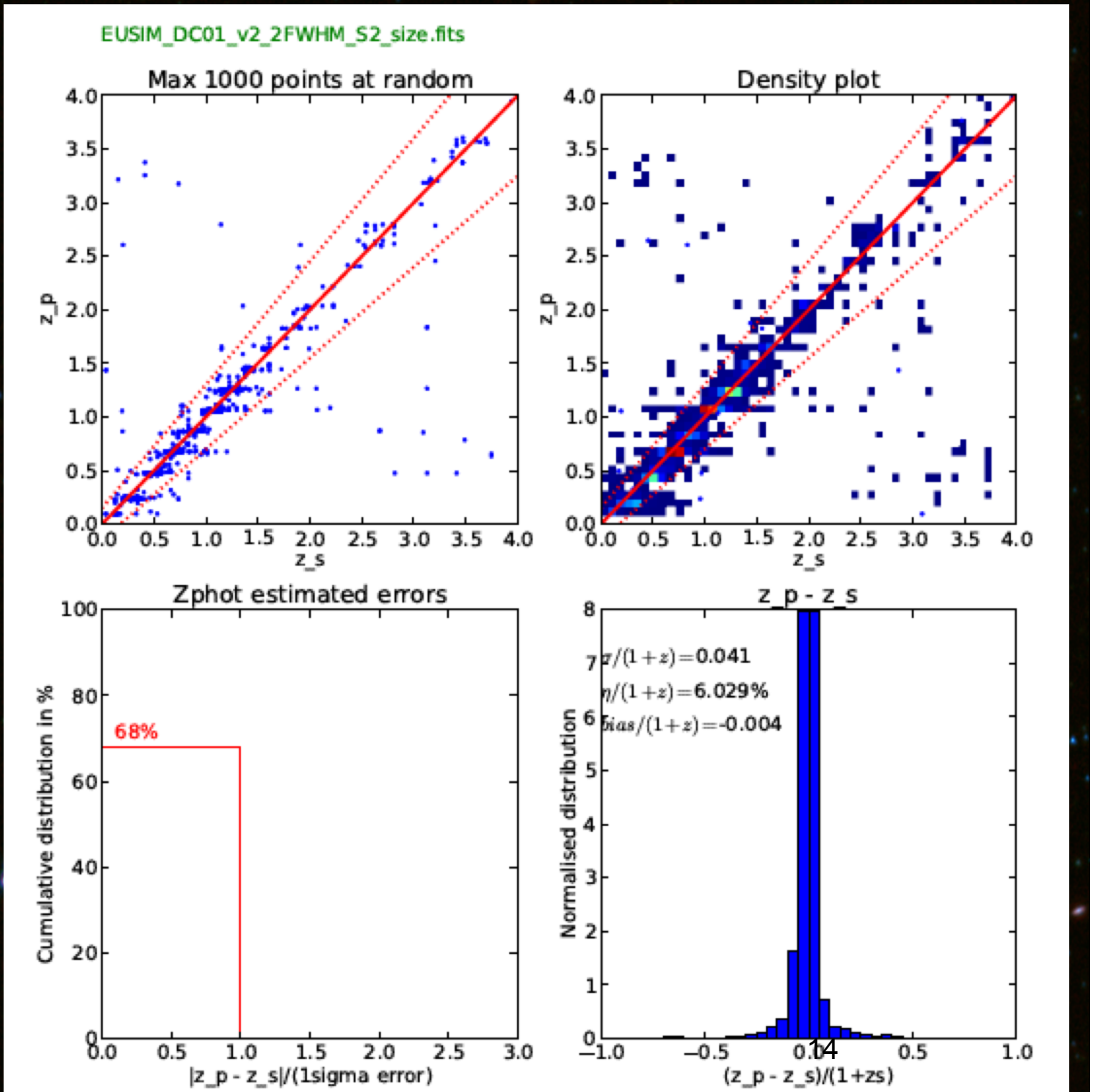
Le Phare

(Thibaud Moutard)



Neural network

(Christopher Bonnet)



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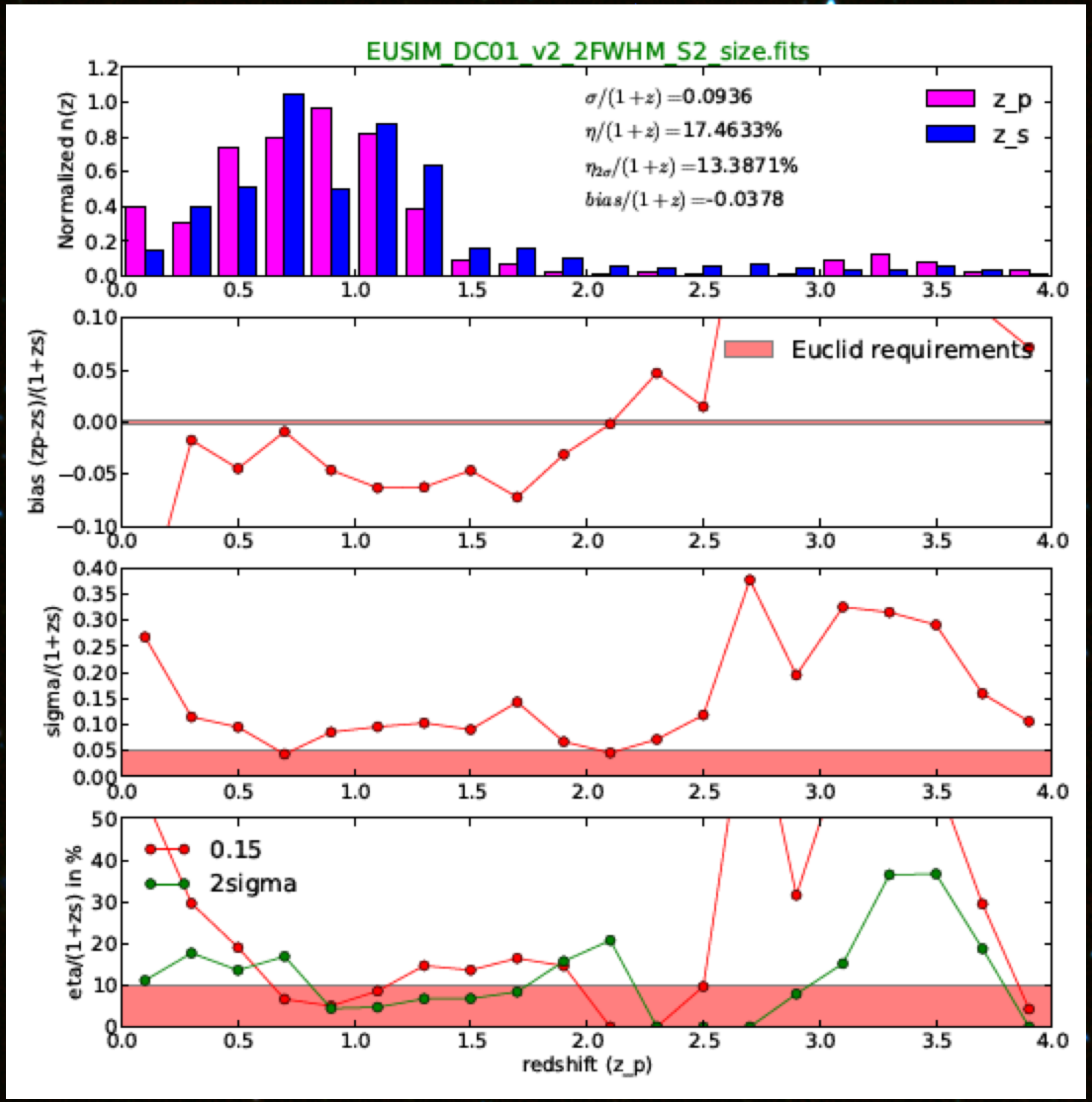
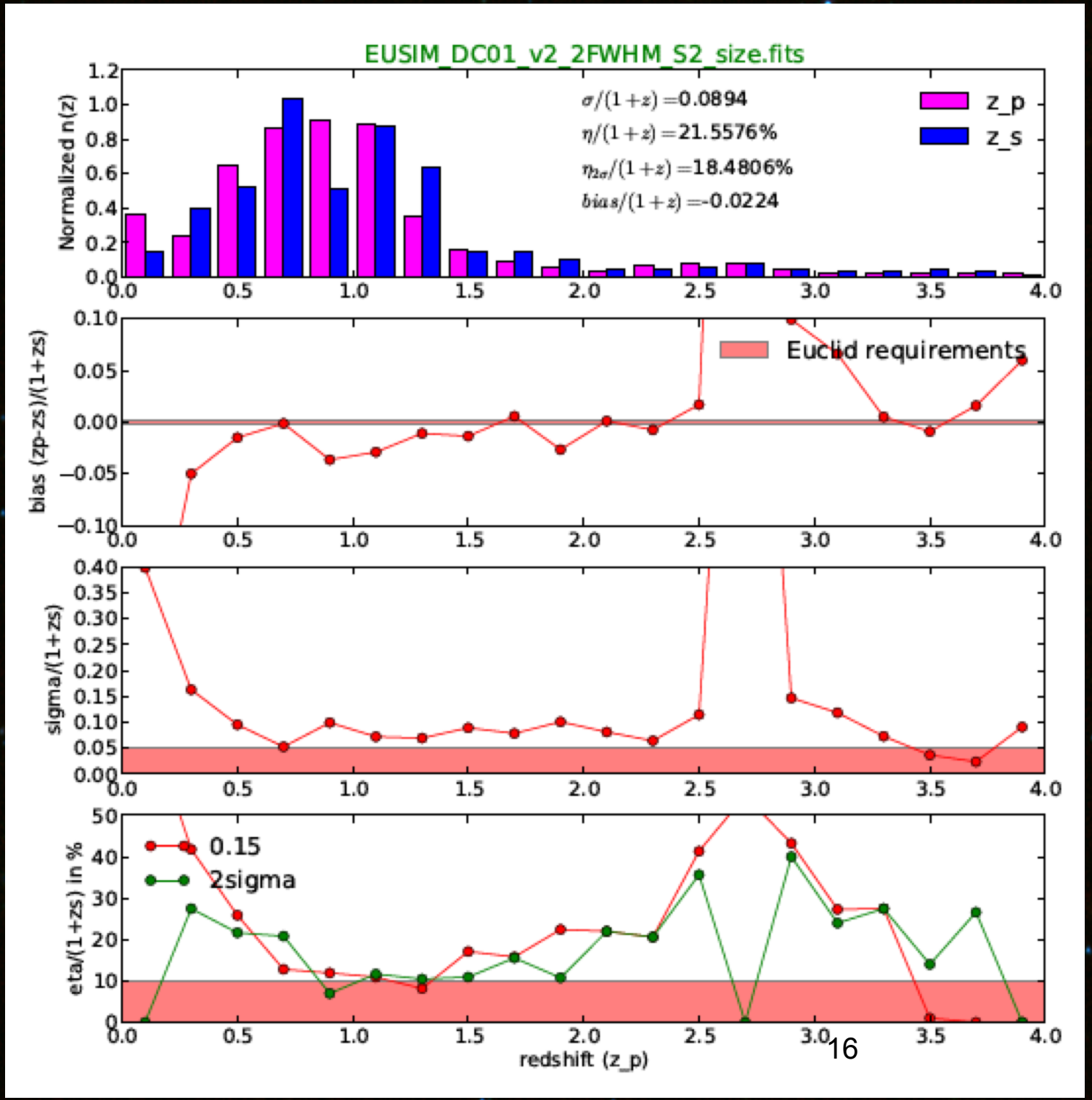


HYPERZ (Roser Pello)



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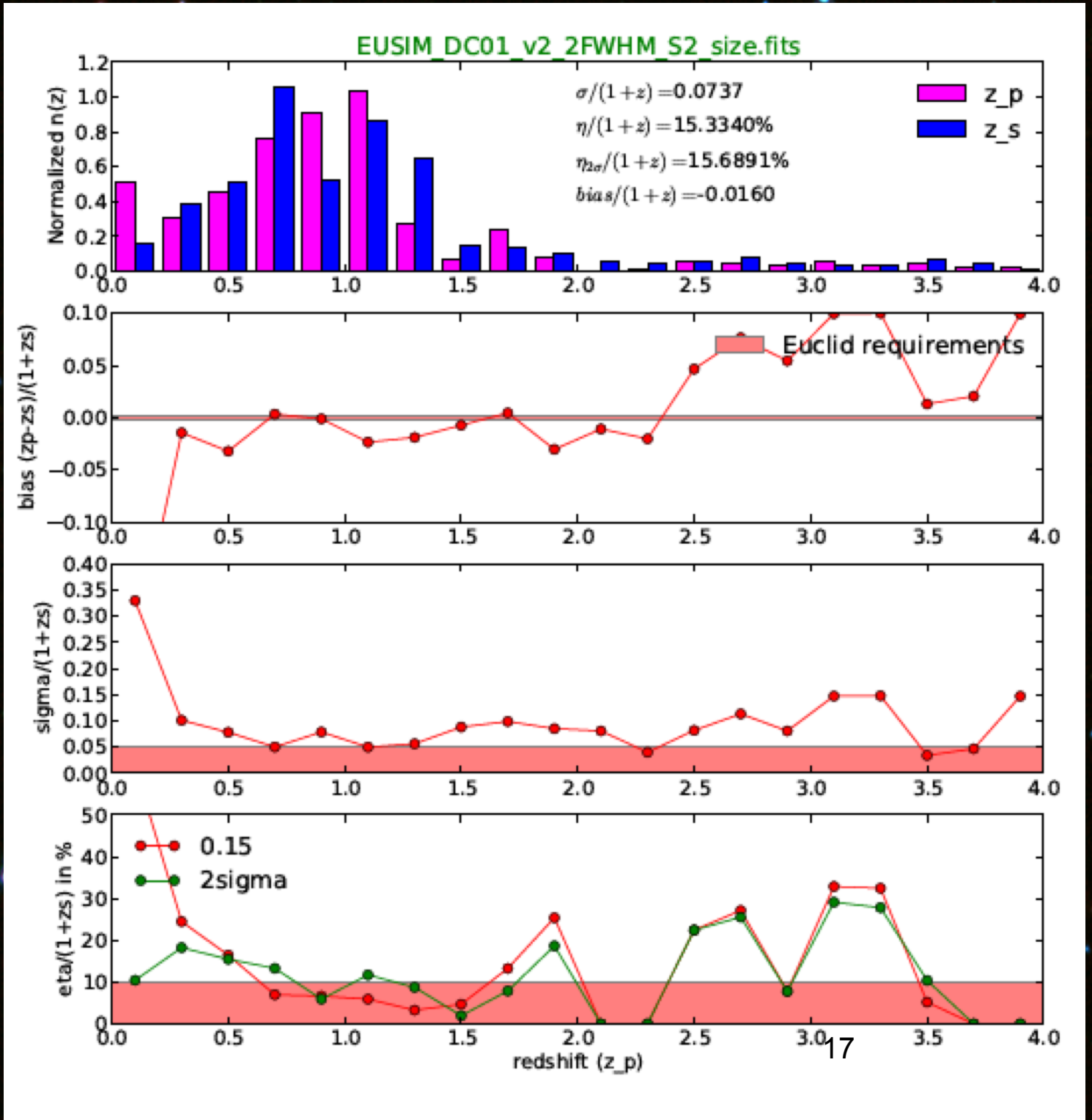

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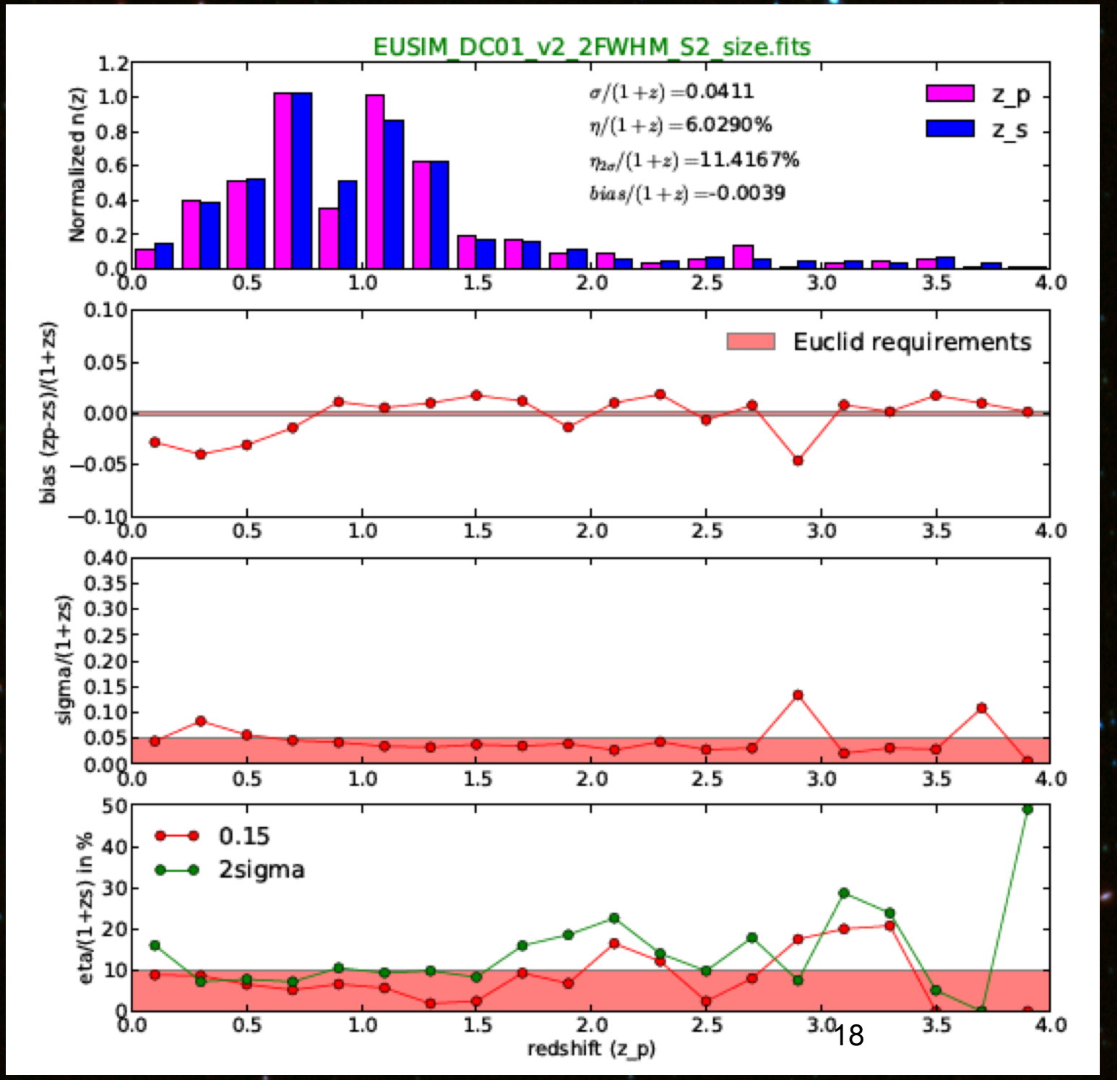
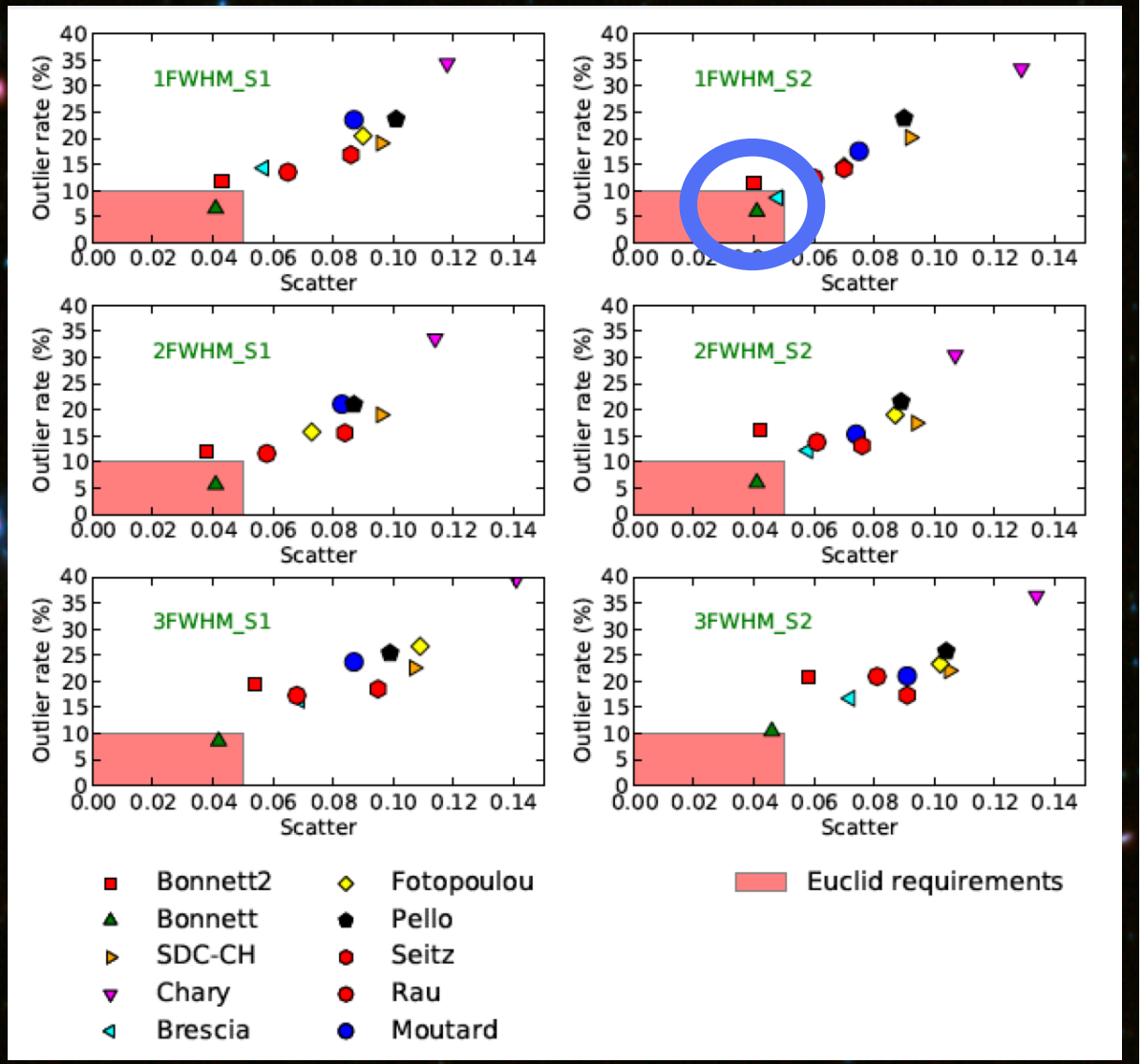


Data challenge 1: WP algorithm comparison

Best results with machine learning

➢ one is able to fill the requirement

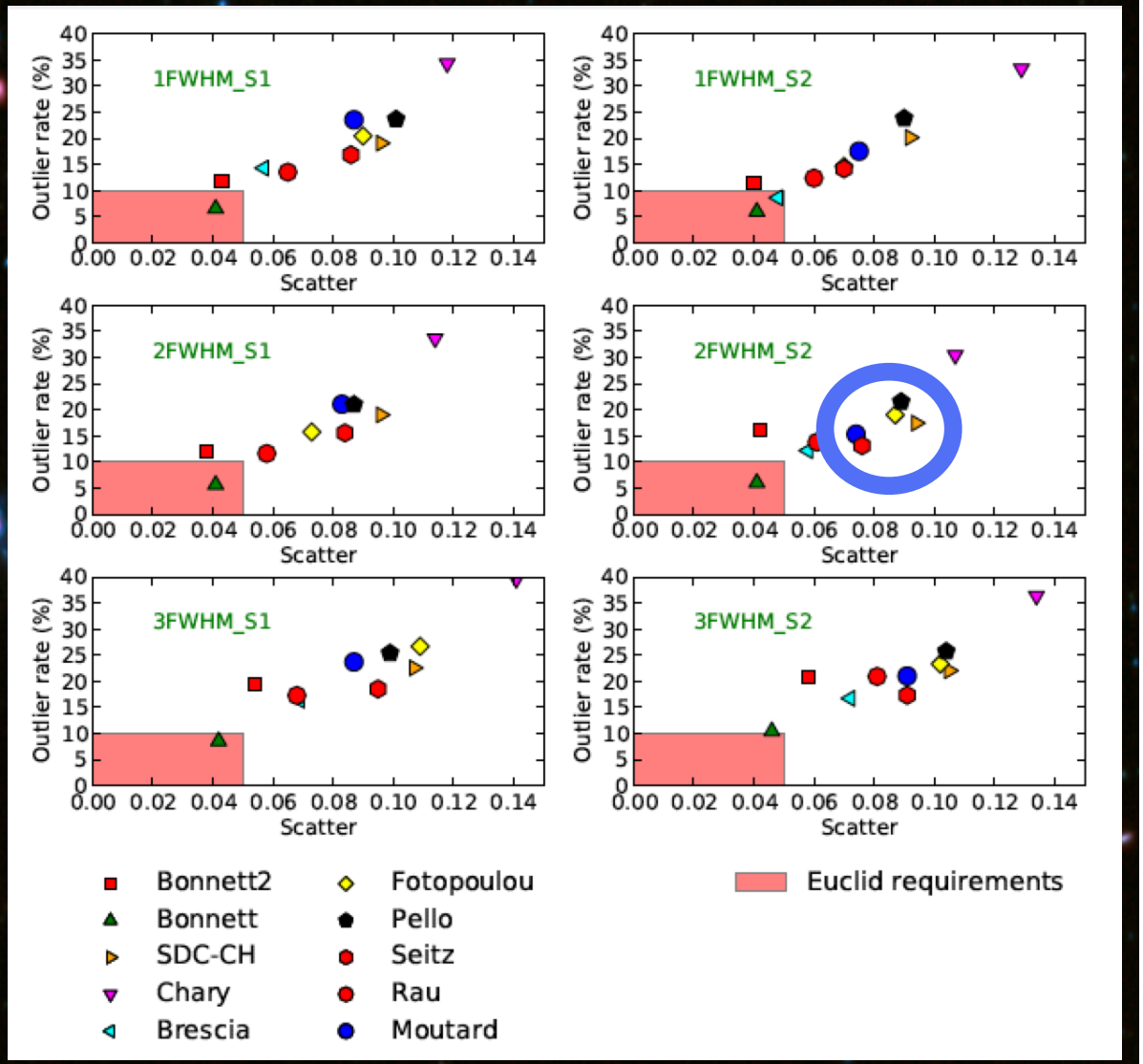
Need a larger and independent spec-z sample to confirm



Data challenge 1: WP algorithm comparison

Template fitting slightly out of the requirements σ~0.08, failures~15%

Need to gain on the method to extract the photometry and to measure the photo-z

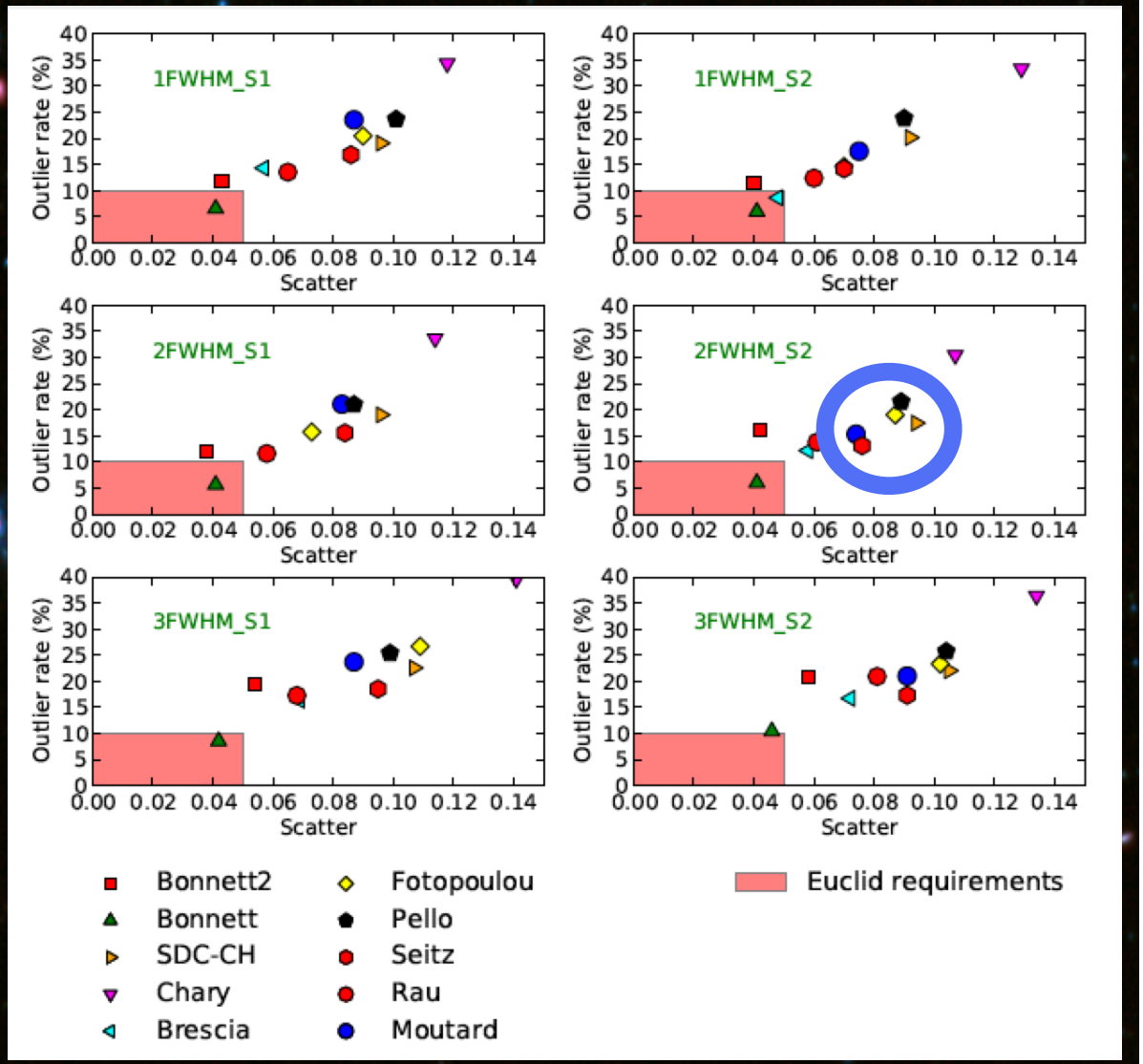


Data challenge 2: WP algorithm comparison

In the next months

Real DES data + VISTA and the large spec-z sample of COSMOS

Try other options for the sensitivity (e.g. Megacam survey)



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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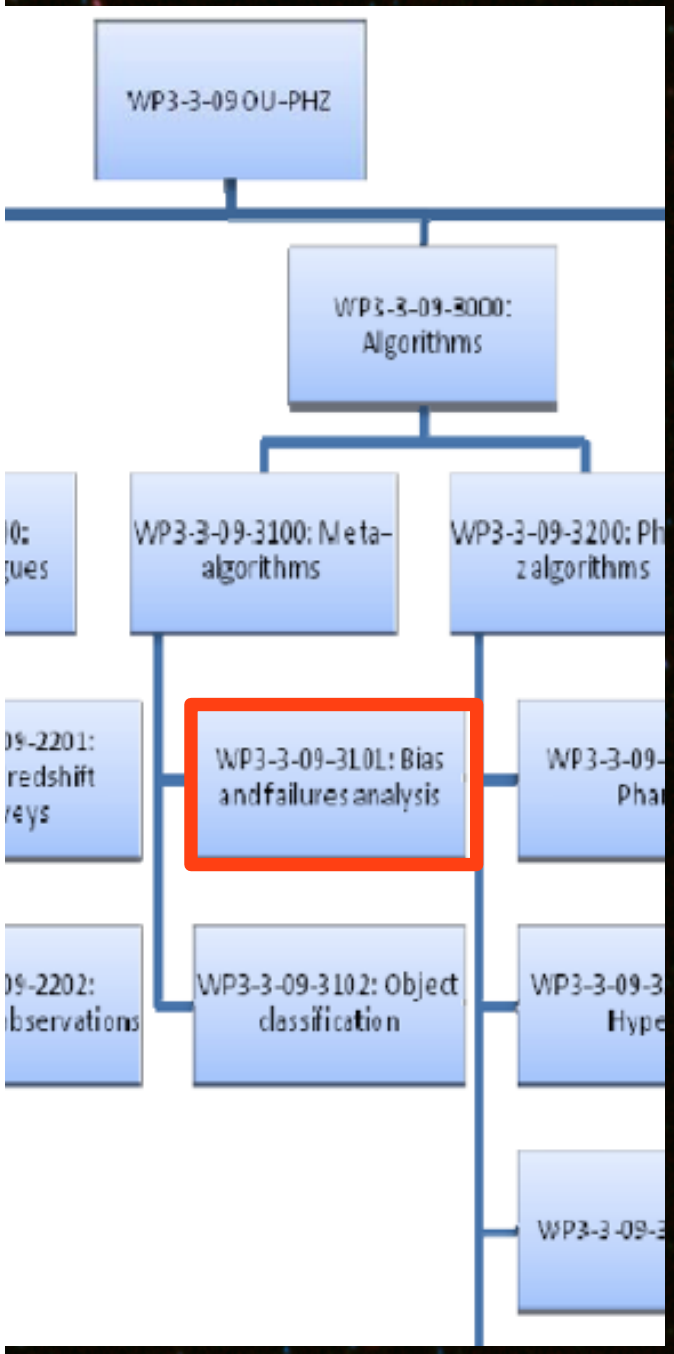
any uncertainties on the templates, relative calibration of the photometry tile-to-tile, etc create a bias >>0.2% in the photo-z

➢ can not use the photo-z directly

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

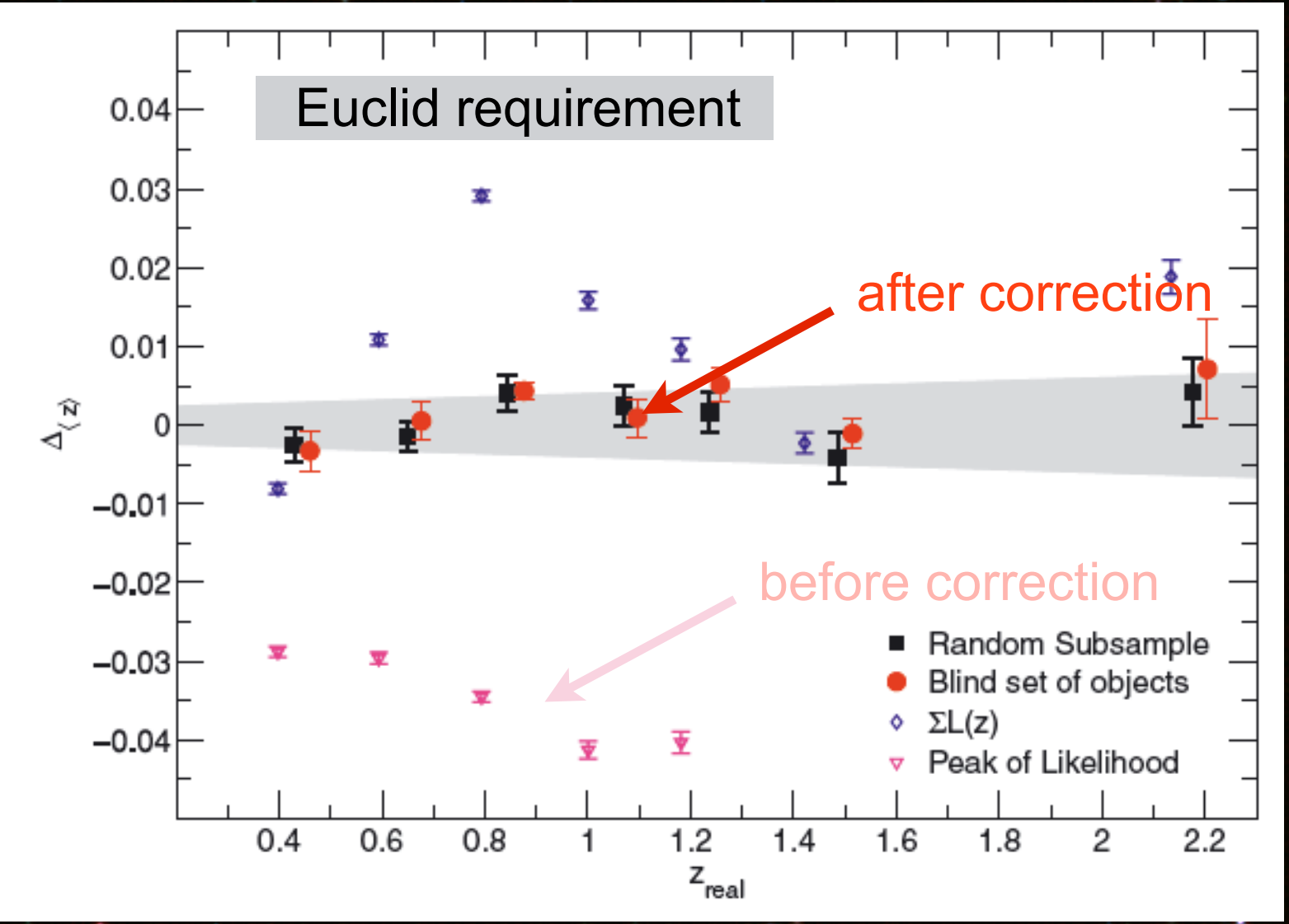
Characterize the precision, the fraction of catastrophic failures that we get on the photo-z and the mean redshift of each photo-z subsample.

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

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

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

Next steps

- ⋆ data challenge 2 with DES data taken in the COSMOS field
- ⋆ progress on the SDC code development including all features from other codes
- ⋆ investigate how to get the mean redshift at 0.2% by correcting the photo-z bias or using the spatial information