Photo-z

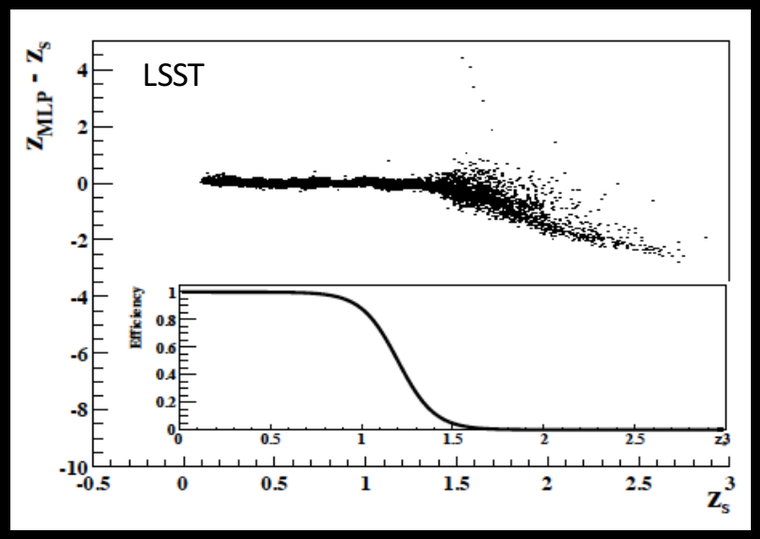
LSST-France Décembre 2015

Photo-z is the key to LSST Science Goals

Specs : bias < 0.003, RMS < 0.05

2 main methods:

Machine learning -> non-completeness bias
Template fiting -> need SED library



Home made TF PZ code developed in LPSC (Gorecki/Ricol)
Same logic as LePhare, less features (extinction laws, 0-point correction …)

SED library

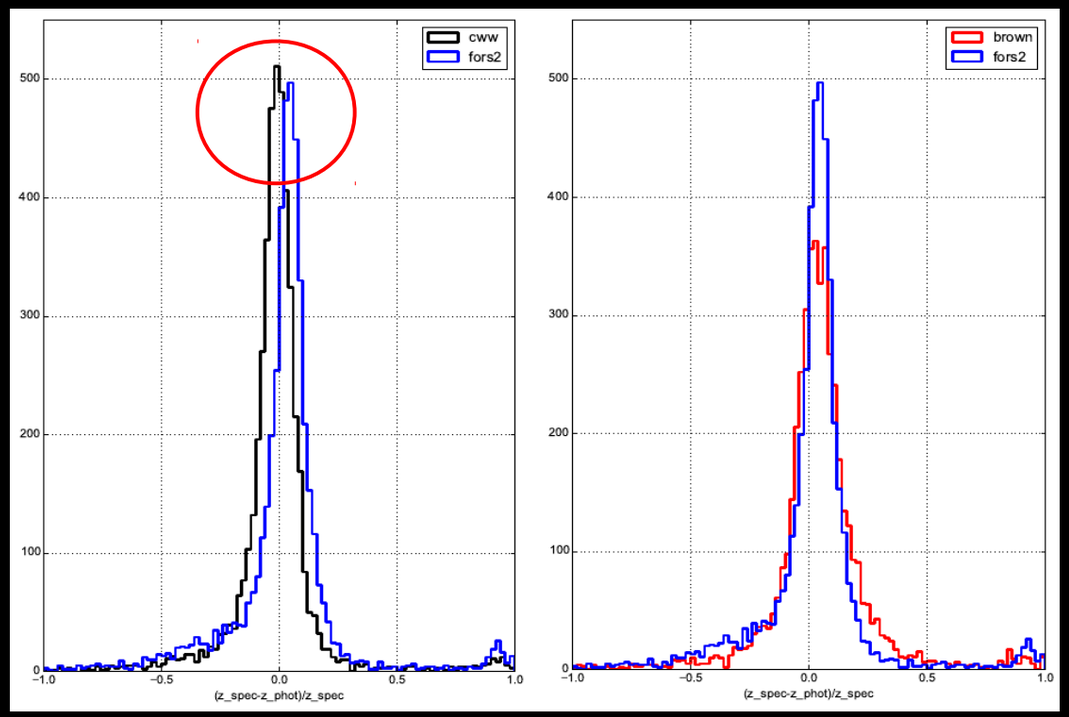
- Needed for simulation (+LF/MF) and template fitting pz
  z + galaxy characteristics (mass, SFR, age …)

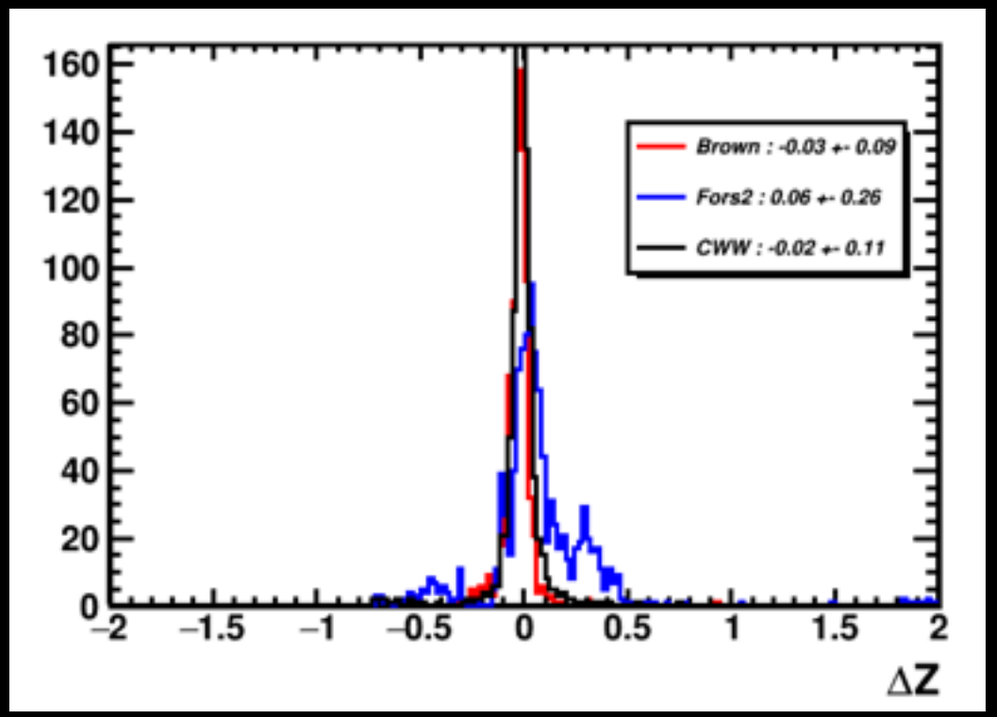
- Priority in DESC PZ WG

- CWW&K, Poletta, Brown, Fors2 (see E. Nuss presentation)
  + simulation (BC/Gissel/Starlight)
  z(Brown)<0.05, z(Fors2)<1.05

CFHTLS + LePhare : CWWK > Fors2 > Brown

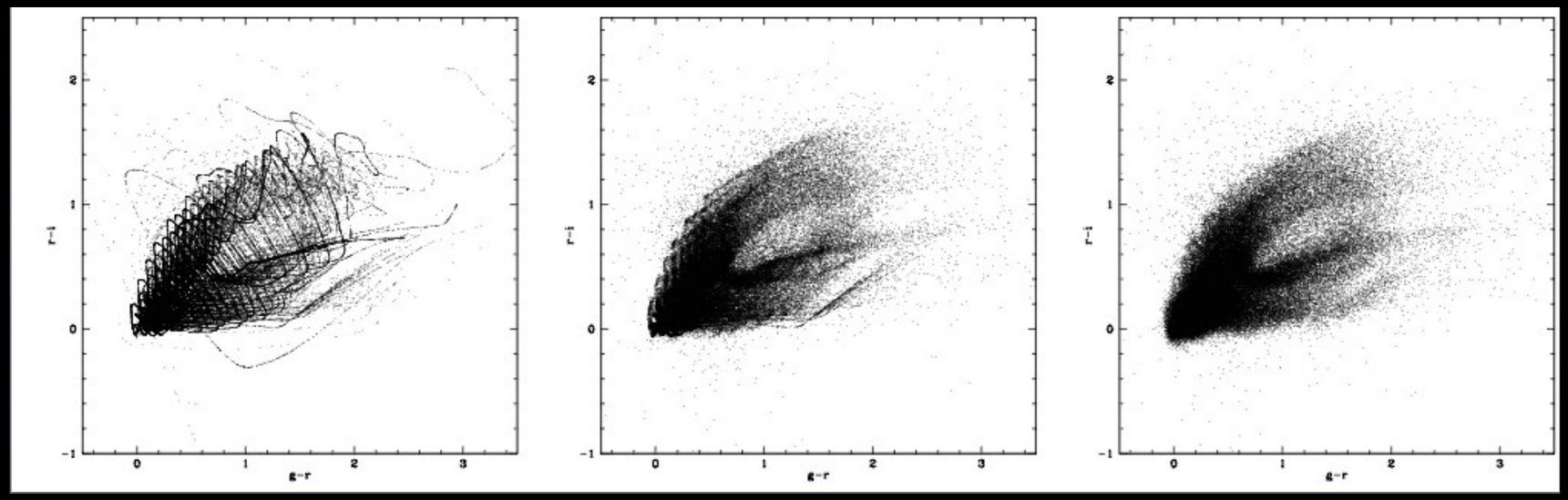
Candels-goods + LPSC PZ code : CWWK=Brown >> Fors2



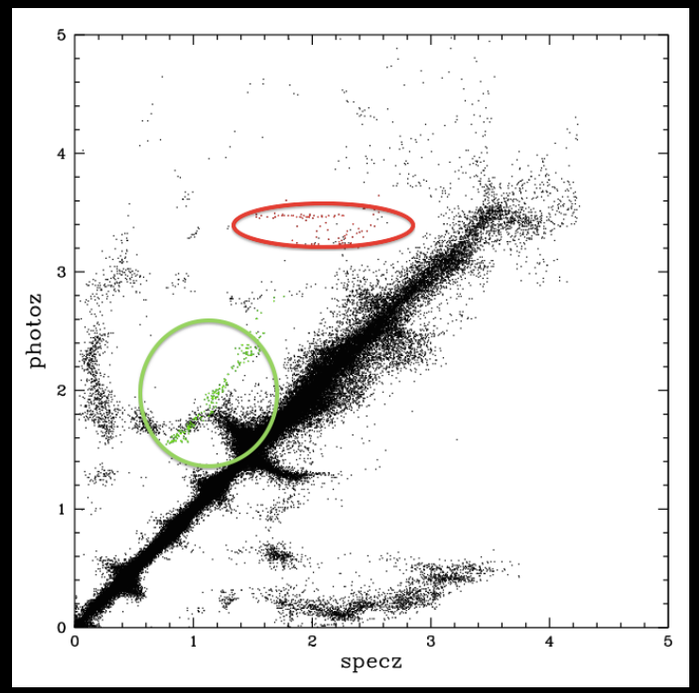


Continuous library
Continuous color distribution, smooth PDF(T)

- Select few representative SEDs (CWWK) —> interpole them
- PCA : scatter the eigenvalues to produce « continuous » templates



Problems with
negative flux



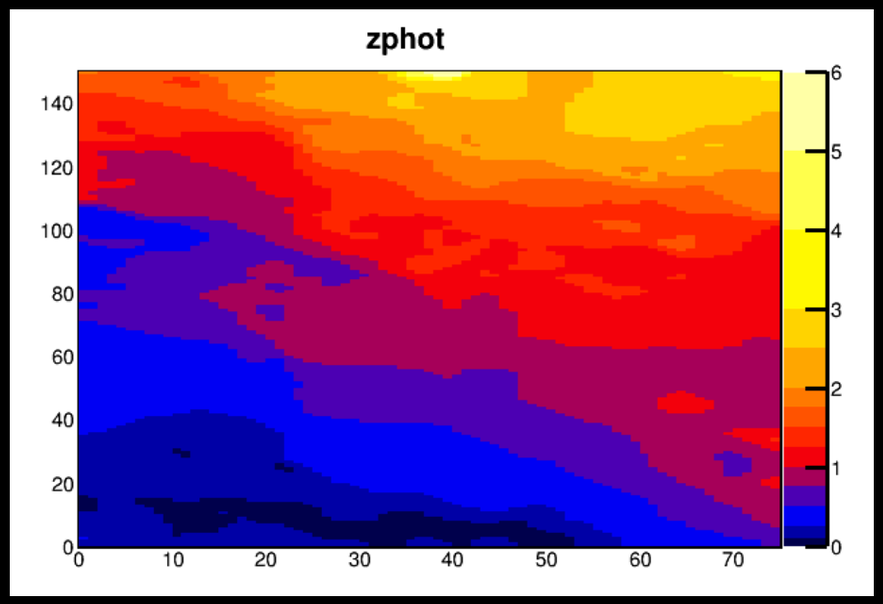
Is a linear distribution in eigenvector space more meaningful than in the real space ?

Continuous library

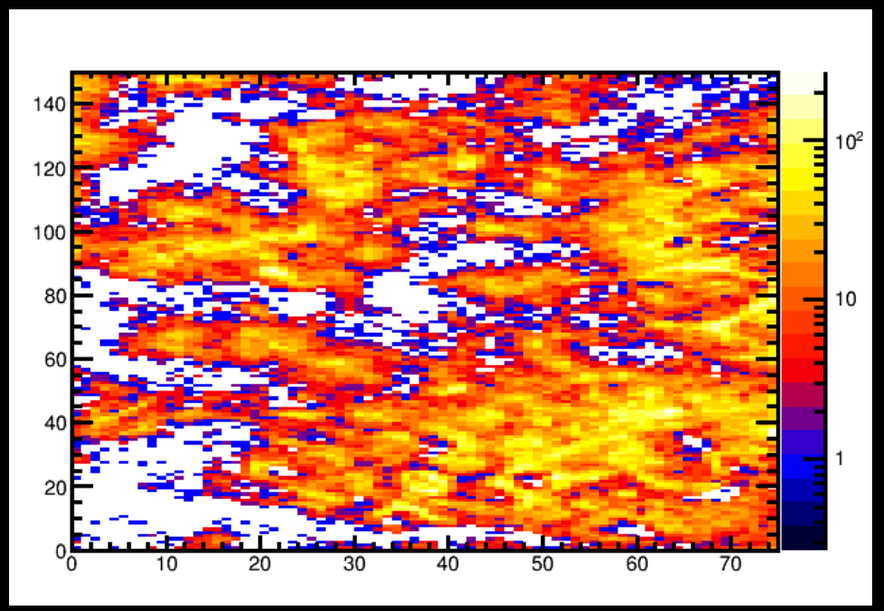
- SOM : 2D representation of a ndim space where each cell represents 1 vector, neighboring cells have similar parameters see for instance Master et al arXiv:1509.03318

First tentative on Cosmos->LSST catalog (LePhare)

SOM



BMU w/ CWWK



Can point a lack of SEDs, useful to map extinction …
Can it be used to build a library ?

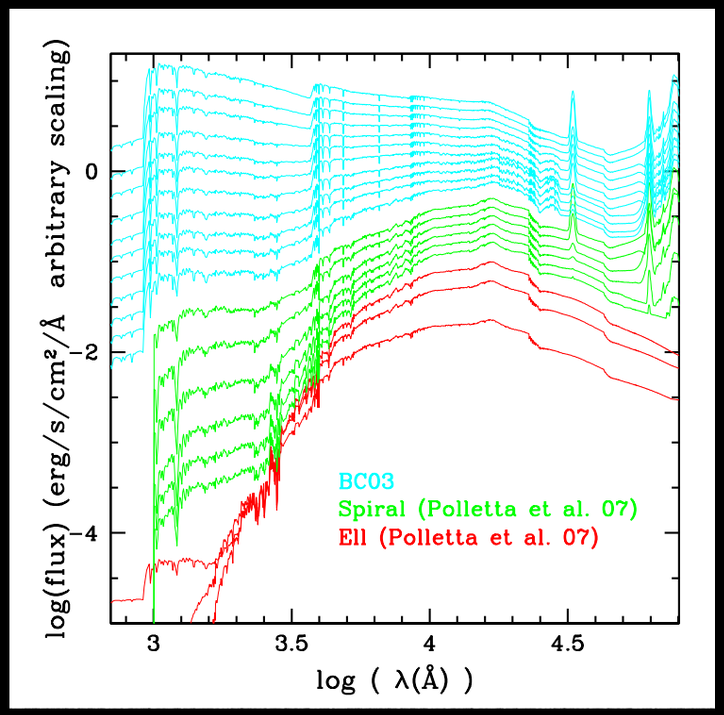
Spectro-photo catalogs

- Candels_goods
  14 bands, 1169 galaxies, z=[0, 4.5], <z>=1.7
  see my talk in Montpellier

- CFHTLens
  5 bands, ~26000 galaxies, z=[0, 4.5], <z>=0.7
  see Cécile Rousselle's presentation

- COSMOS
  30 bands, 4296 galaxies (2009), z=[0,3], <z>~1
  more bands => more constraints on SEDs
  —> we can also use a LSST-like catalog from COSMOS-LePhare data

LePhare



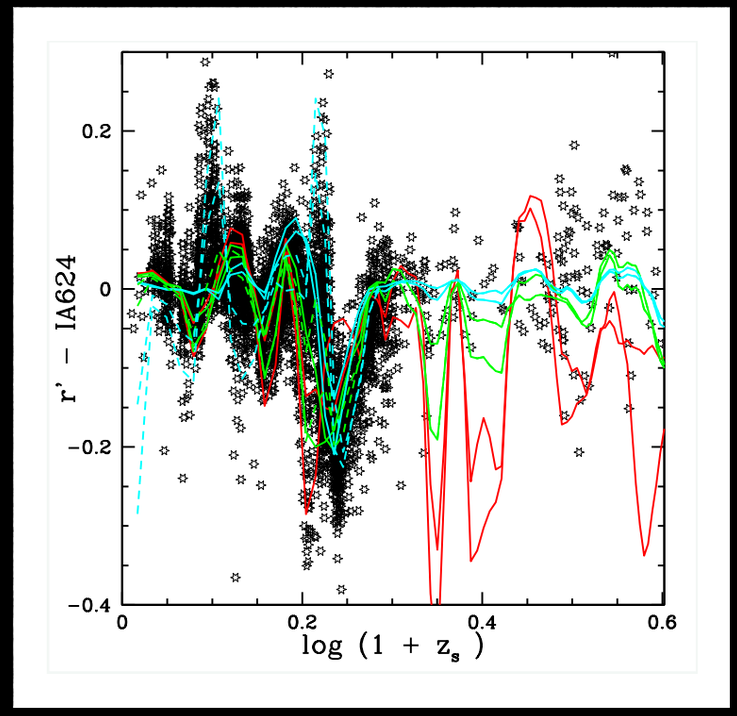
21 SEDs

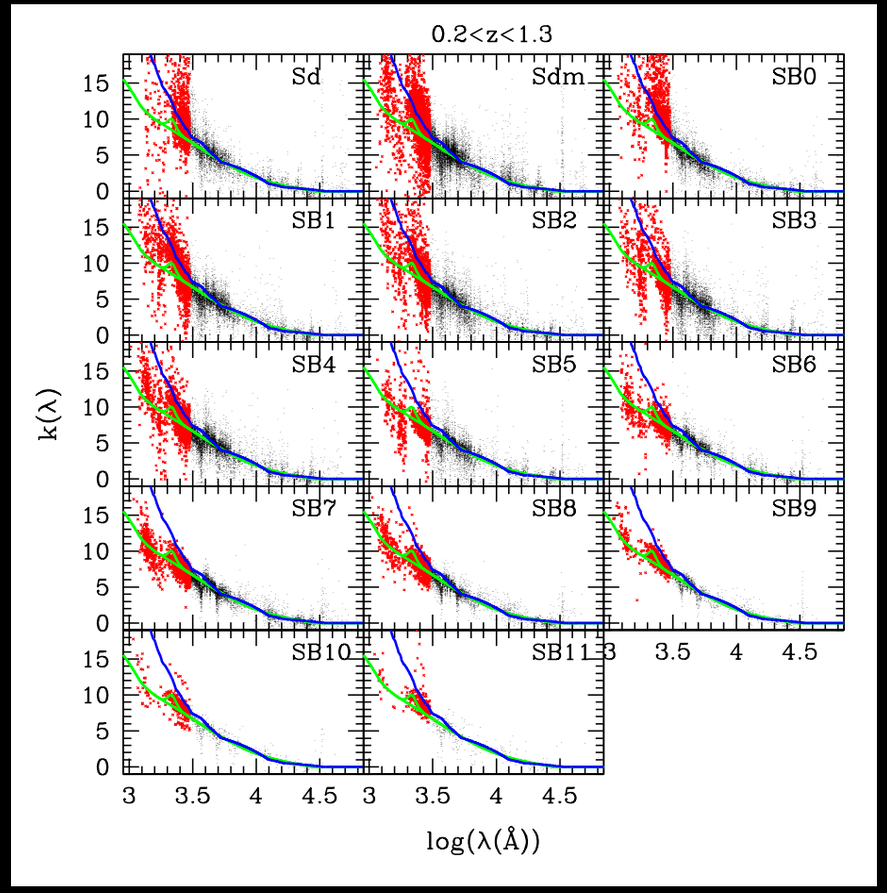
Emission lines

Kennicut 1998

$$log(F_{[\mathrm{OII}]}) = -0.4 \times M_{\mathrm{UV}} + 10.65 - \frac{DM(z)}{2.5}$$

OIII, Hb, Ha, Lya from OII

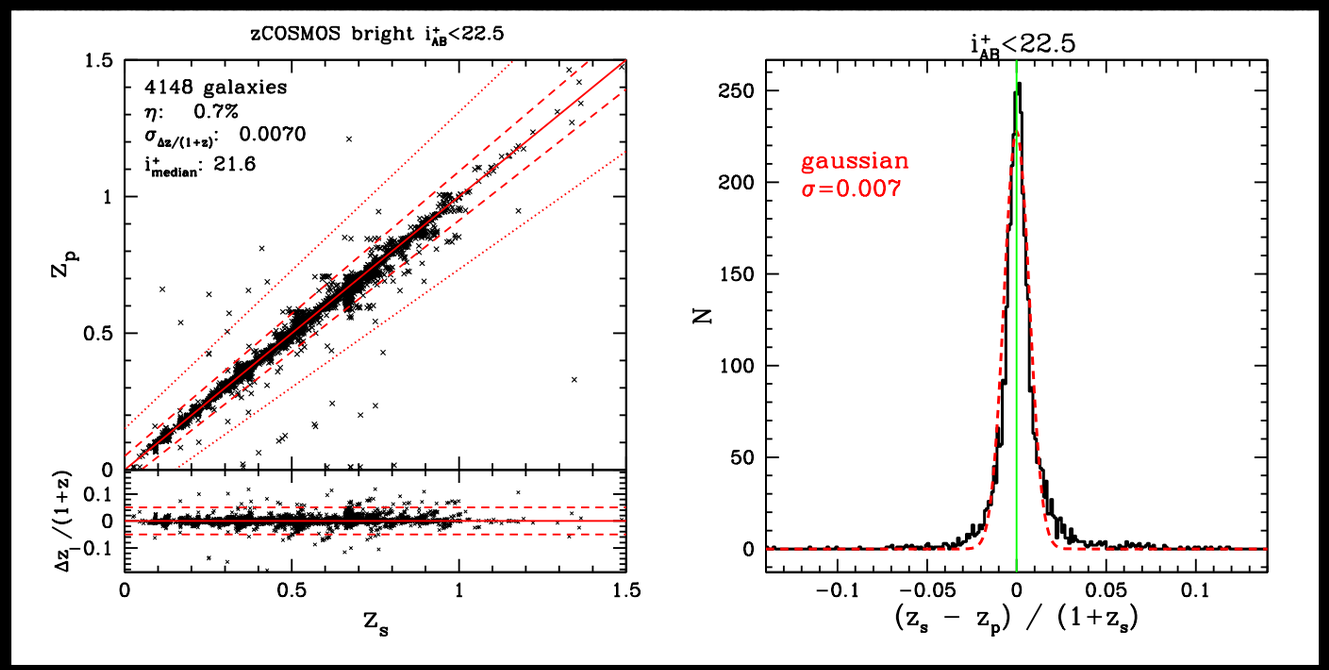


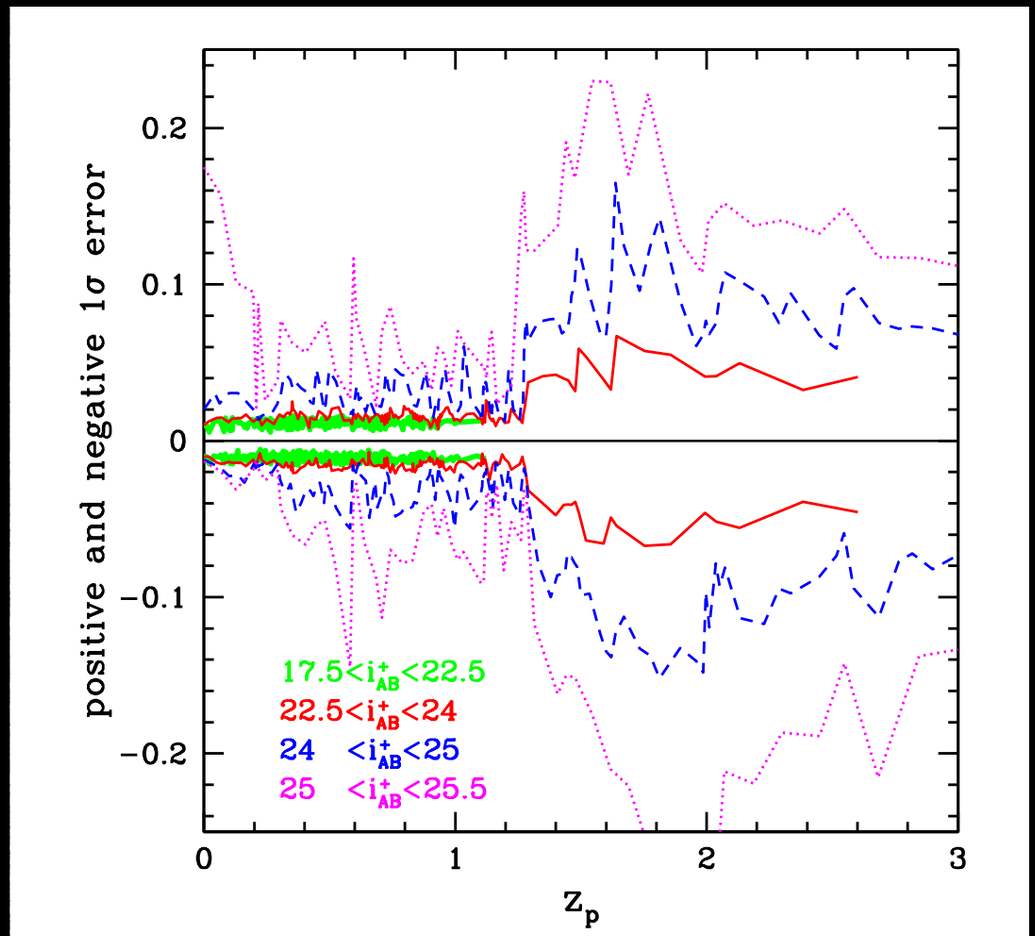


3 extinction models :

- LePrevot et al if redder than SB3
- Calzetti et al (+ 2175A° UV bump) if bluer

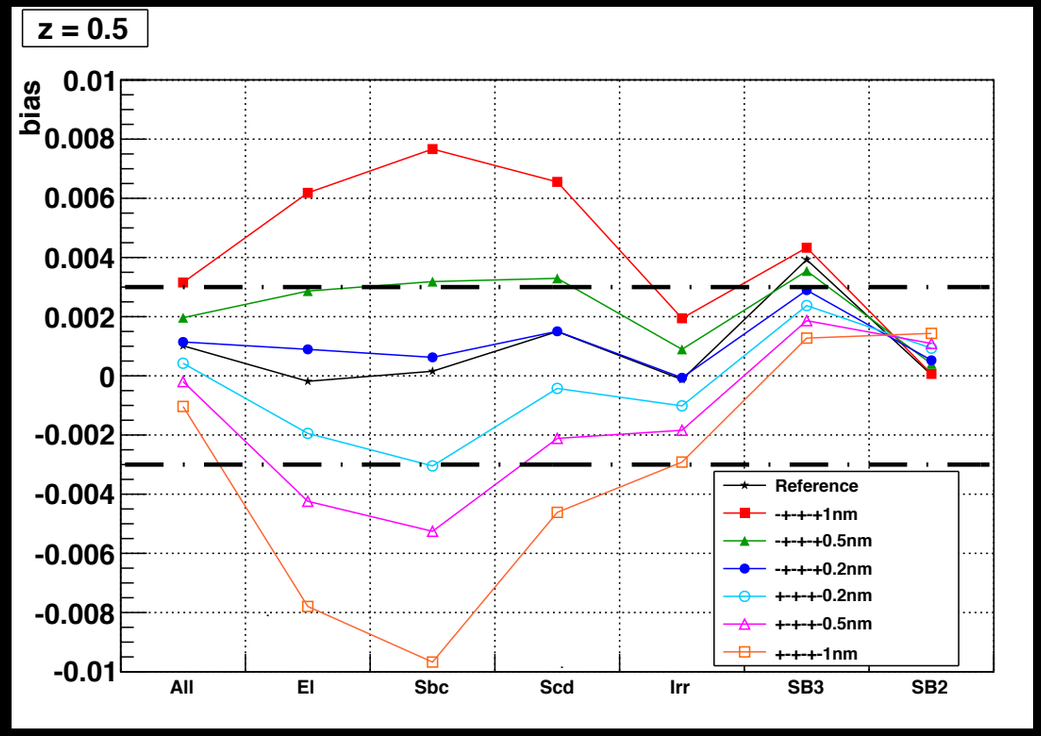
LePhare performances on COSMOS



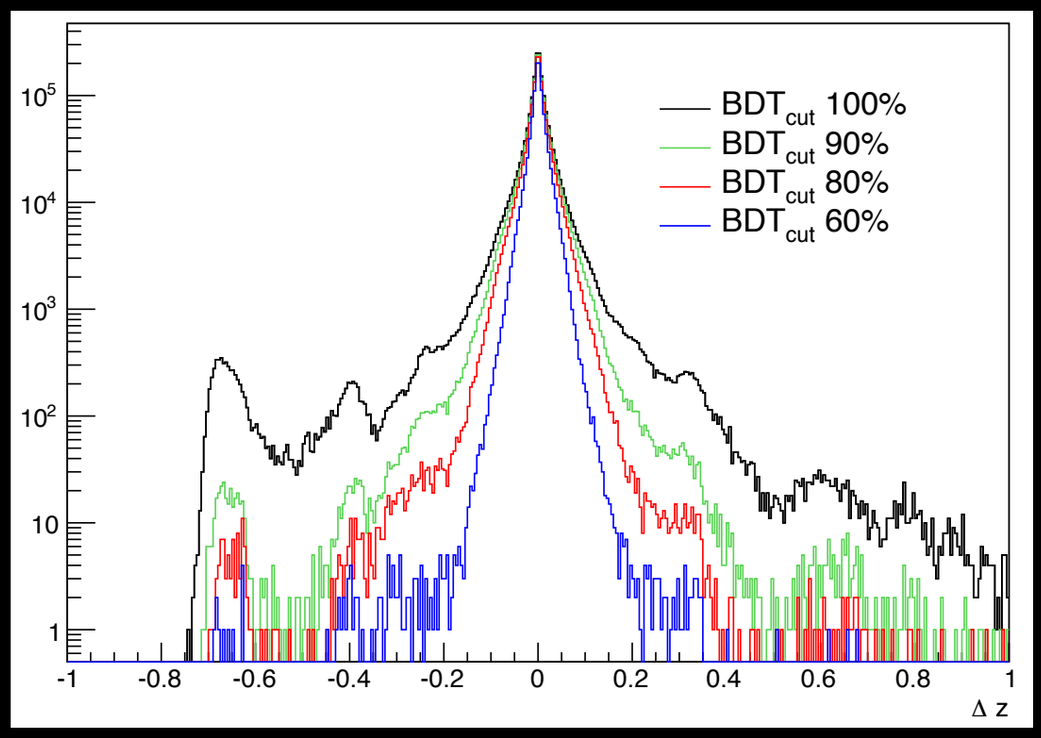


Other activities

- Filters study : impact of slopes, bandwidth mis-calibration, spatial inhomogeneities … on pz
  See Adeline Choyer PhD thesis
  (LSST note / article in progress)



- BDT / LR tool to remove outliers :
  see Gorecki et al 2014
  Will soon be tested on COSMOS-LePhare P(z) (O. Ilbert)

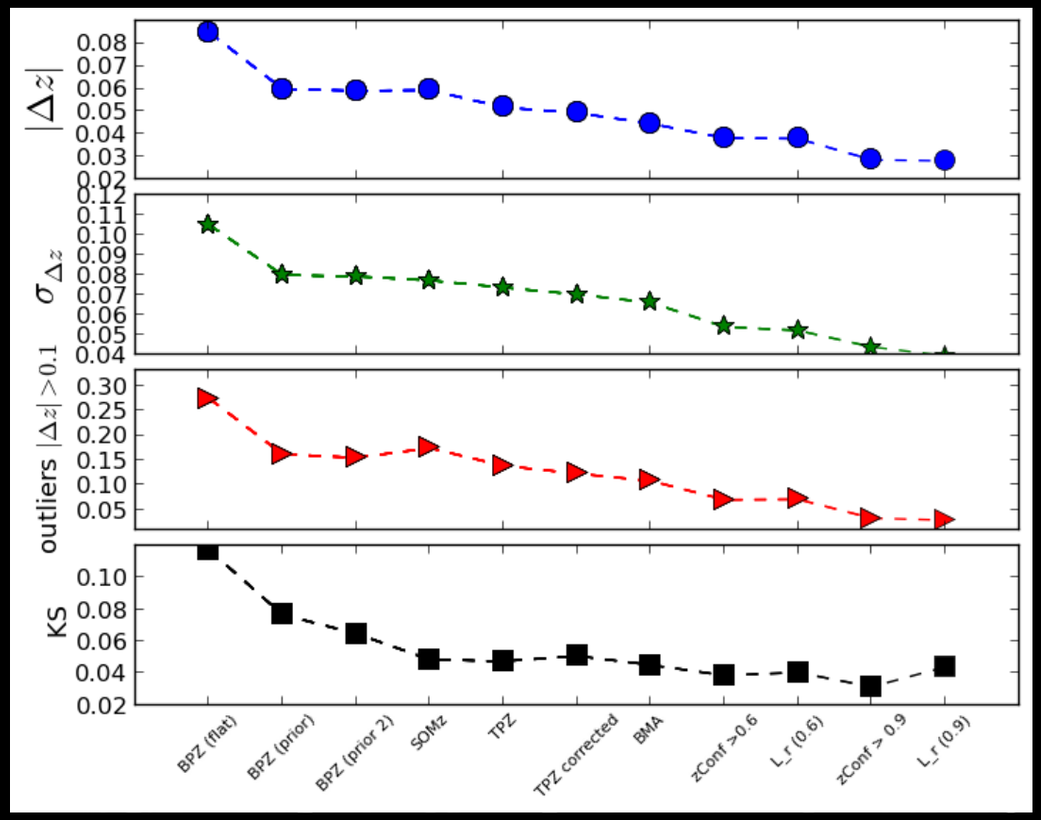


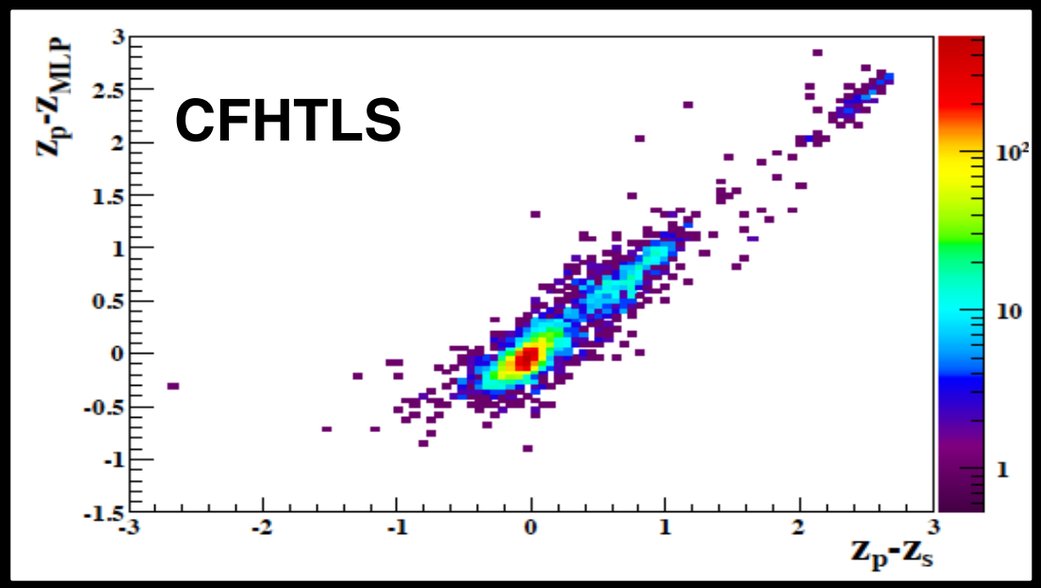
Other activities

- Photo-z and atmosphere : use Y effective filter (airmass) to (try to) improve photo-z performances, under progress
- Extinction law(s) : in principle extinction law should be a free parameter in the fit (hyperz)
Chevalard et al 2013 predict a quasi-universal relation between slope of the attenuation curves and V-band attenuation optical depth at all galaxy inclinations —> this should simplify the dust treatment
PhD thesis proposed in LAM

PZ codes

- If the C++ version is developer-friendly we will likely use LePhare
- Compare performances with other codes
- P(z) combination (Carrasco-Kind)
- ML/TF :
  - cross analysis to tag outliers
  - LF built with ML (low z)
  - ML trained with LF (high z)





Conclusion

- Photo-z is (one of) the key to LSST science
- OCEVU : started collaboration with LePhare experts
- We must increase french contribution