3π PhotoZ with PanZ

- Status of PSC: PanZ
- SAS Photometry
  choice of aperture, PSF convolution, residuals ZP issues
- PhotoZ of SDSS galaxies with spectroscopy
  training and spectroscopic data sets
- Great Expectations

Saglia et al., 2012, ApJ 744, 128

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(with the help of R. Senger)

Durham, KP12 PanSTARRS Meeting, 7.1.2013

PCS:
the Photometric Classification Server

Goals:

- Separation of Stars/Galaxies/Quasars (PanDiSCS, MPIA)
- Estimation of PhotoZ for galaxies (PanZ, MPE)
- Estimation of stellar parameters for stars (PanSTeP, MPIA)
- Automatic processing and publishing of data
- Serve the Science Projects

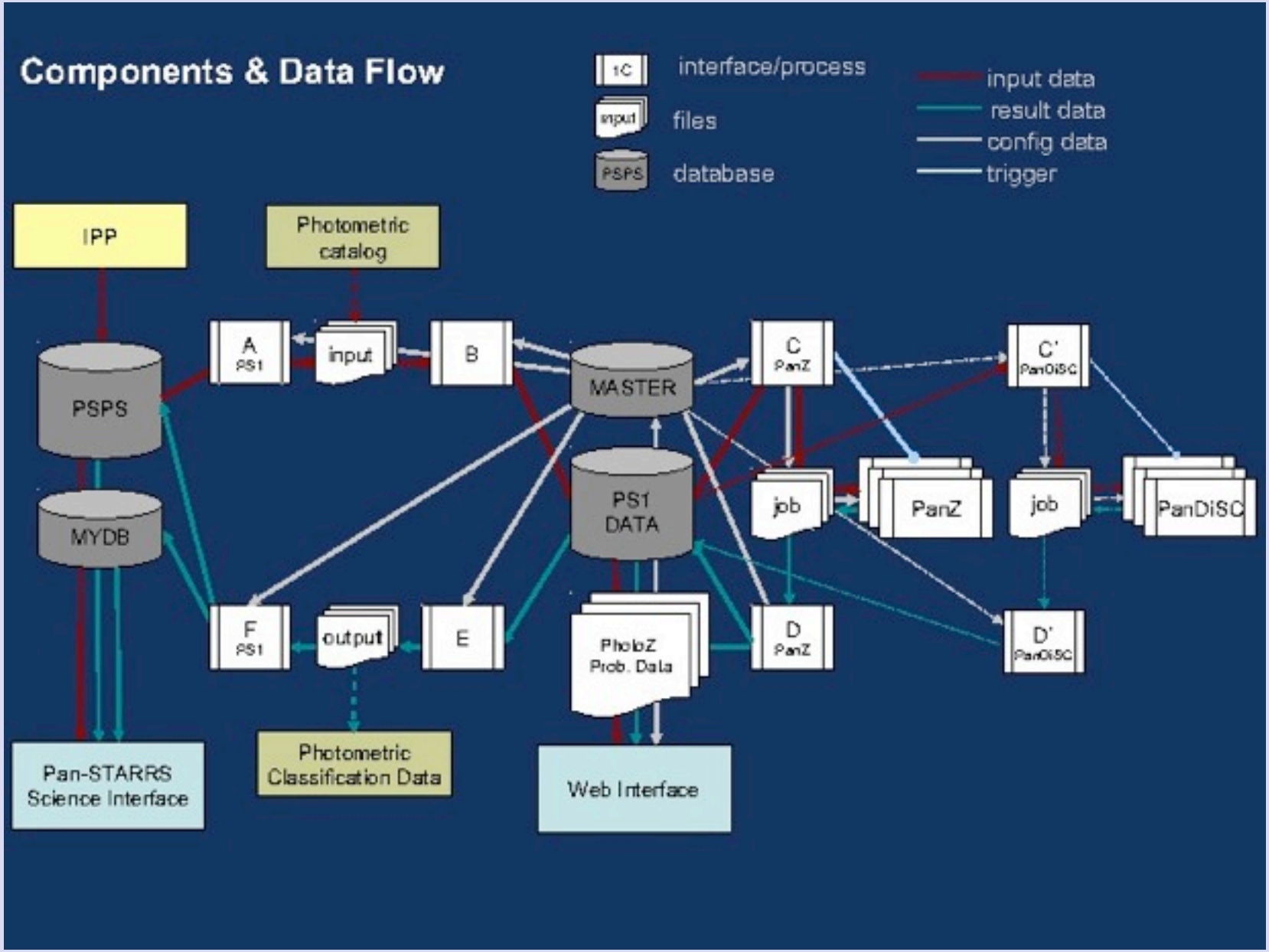
Algorithms:

- Support Vector Machine Classifier (PanDiSCS)
- Bayesian PhotoZ estimation based on SED fitting (PanZ)
- Further algorithms possible

Realization:

- MySQL based database system on Linux
- Linux cluster for parallel processing

PCS: Database implementation



Photometric Redshifts with PanZ

Estimate distances by comparing a set of (discrete) template SEDs to broad band photometry of redshifted galaxies.

$$p(z, T|\{C_i\}, m, \ldots) \qquad p(z) \sim \sum_k p(z, T_k)$$

Using Bayes' theorem:

$$p(z, T|C, m) \propto p(C|z, T)\, p(z, T|m)$$

Prob. of having $\{z, T\}$ given $\{C, m\}$

Prob. of observing $\{C\}$ given $\{z, T\}$

Prior (z and T distribution at magnitude m)

Status of PanZ and developments

- Reads from PSPS and runs automatically
- Results cannot yet be copied back into PSPS action from Hawaii needed.
- Not clear yet how to save P(z):

```
For full probability function, we require one floating point value per object per
model per photoz interval.
-- For example, if we use a z range from z=0 to z=10 with stepsize 0.01, we get 1000
floating point values for each object and each model. Most are zero.
-- For splines, we get (zmax-zmin)/deltaz+n floating point values per object per
model. For example, if we calculate splines in the z range from z=0 to z=10 with
stepsize 0.4 between the nodes, we get 30 floating point values per object per model.
   -- Publication of the probability distribution function  of only the best and second
best fitting model will thus result in 2000 or 60 floating point values, for the above
examples.
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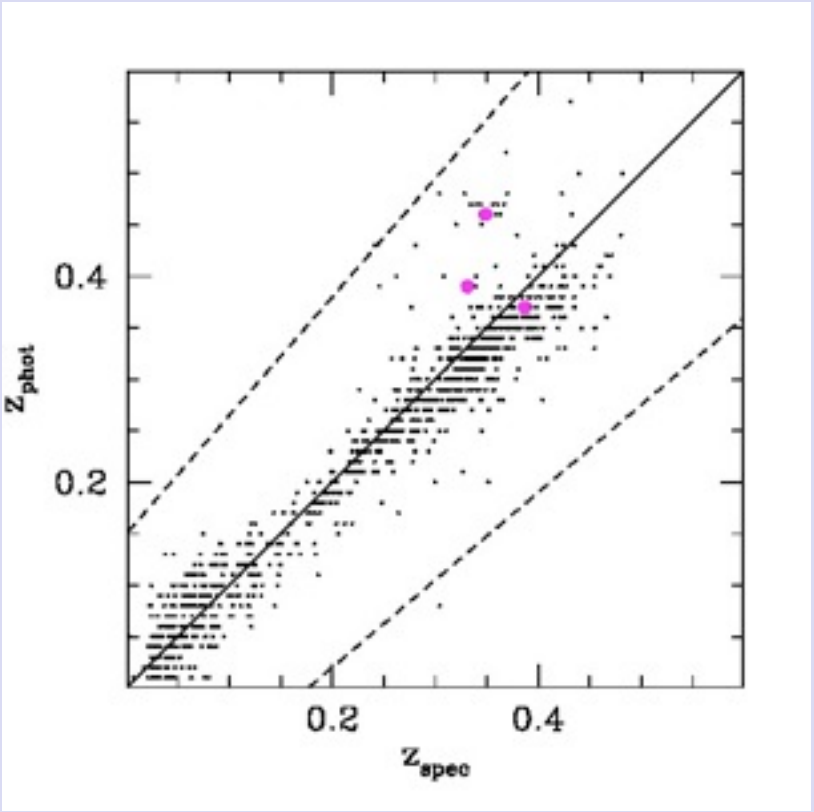
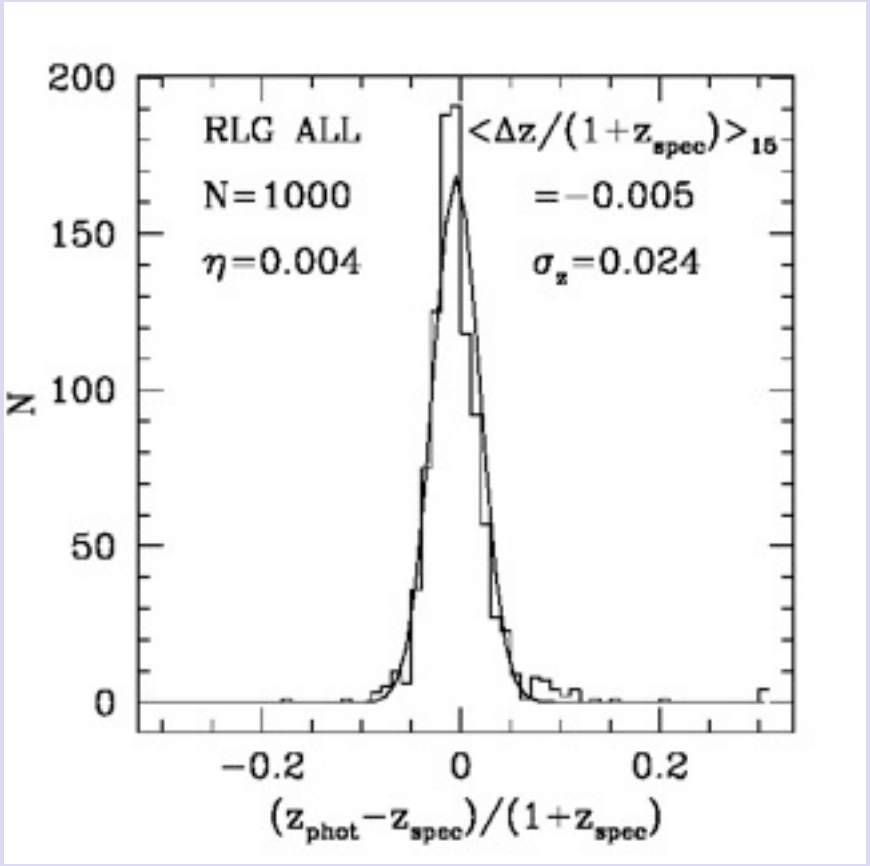
- Implementation of ANNZ planned

RLGs in the MDFs



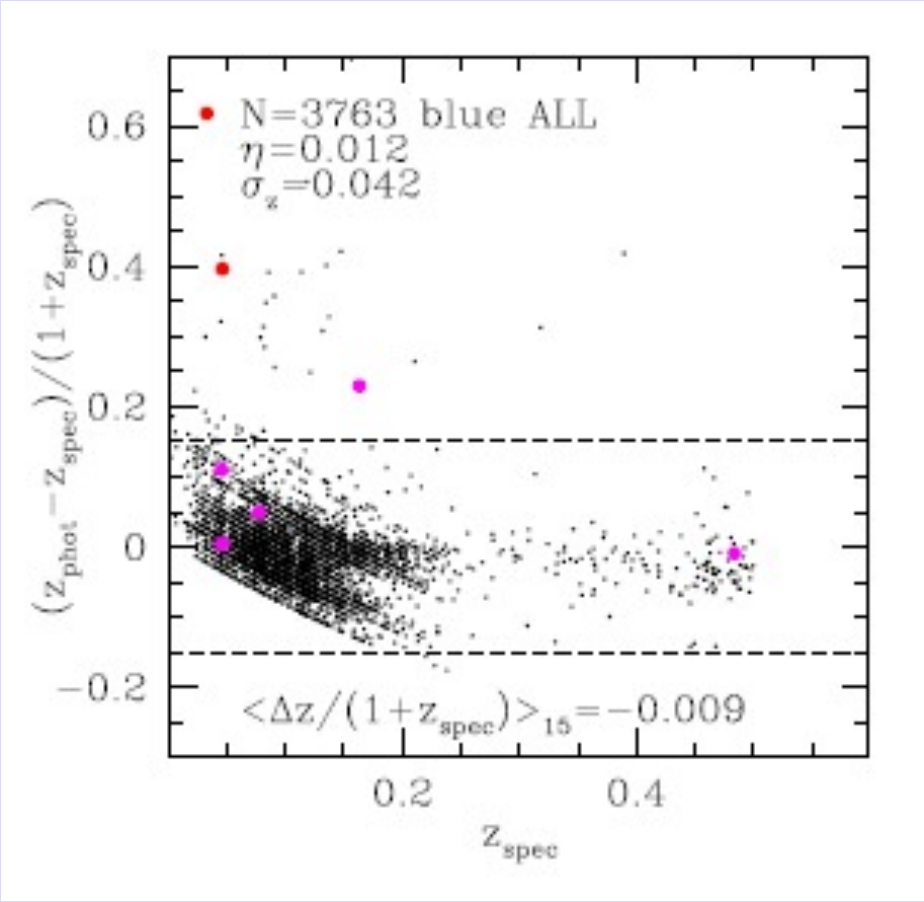


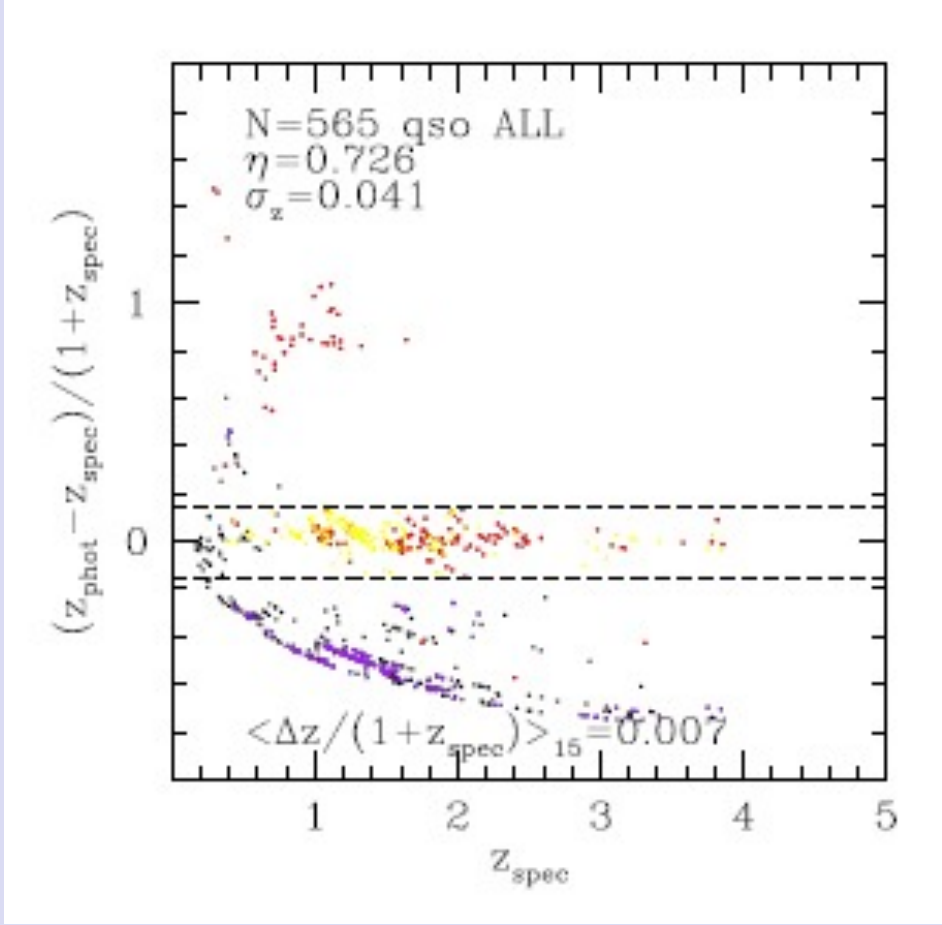
$$\eta : \frac{|\Delta z|}{1+z_{spec}} > 0.15$$

$$\sigma_{\Delta z/(1+z)} = 1.48 Median \left(\frac{|\Delta z|}{1+z_{spec}} \right)_{non-outliers}$$

[based on Tonry's reduction of MDFs]

Blue galaxies and QSOs





[based on Tonry's reduction of MDFs]

SAS Aperture photometry

- PSPS provides 3 types of aperture fluxes:

flxR1,..., flxR10: measured on stacks convolved to a uniform seeing
c1flxR1,..., c1flxR10: measured on stacks convolved to PSF=1.5”
c2flxR1,..., c2flxR10: measured on stacks convolved to PSF=2.0”

Moreover, one can use also:

MeanPSFMag (good for stars) and
MeanKronMag (good for galaxies)

Aperture Radii in arcsec

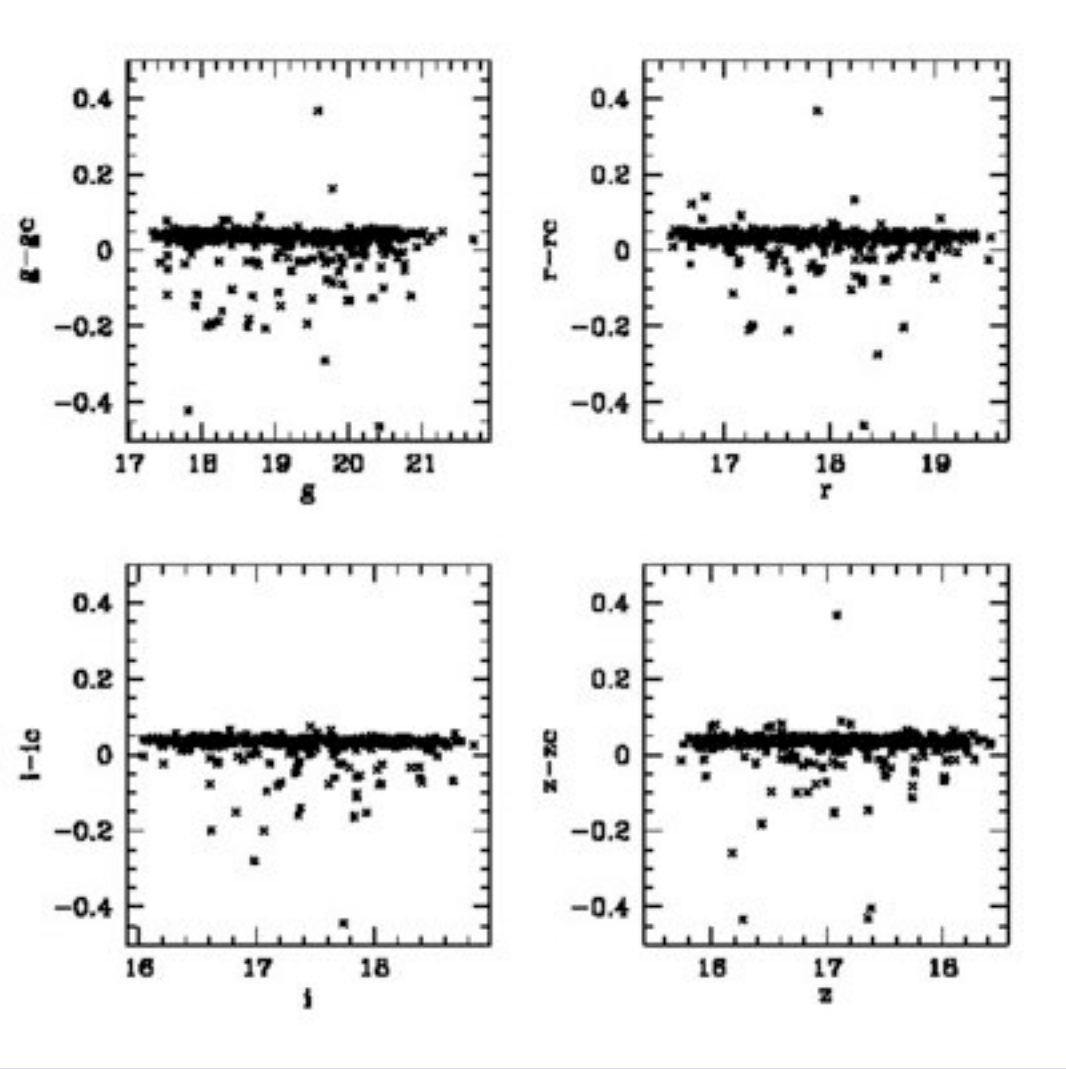
R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
0.24	0.68	1.04	1.76	3	4.64	7.44	11.42	18.2	28.2

Statistics

In SAS9 only 1/3 of the objects have at least one entry in the stack table, and only 1/5 have aperture photometry in all the bands. Moreover, the numbers decrease drastically as the aperture radius increases:

R1: 3171435
R2=R3=R4=R5: 414368
R6: 226021
R7: 84523
R8: 5882
R9: 165

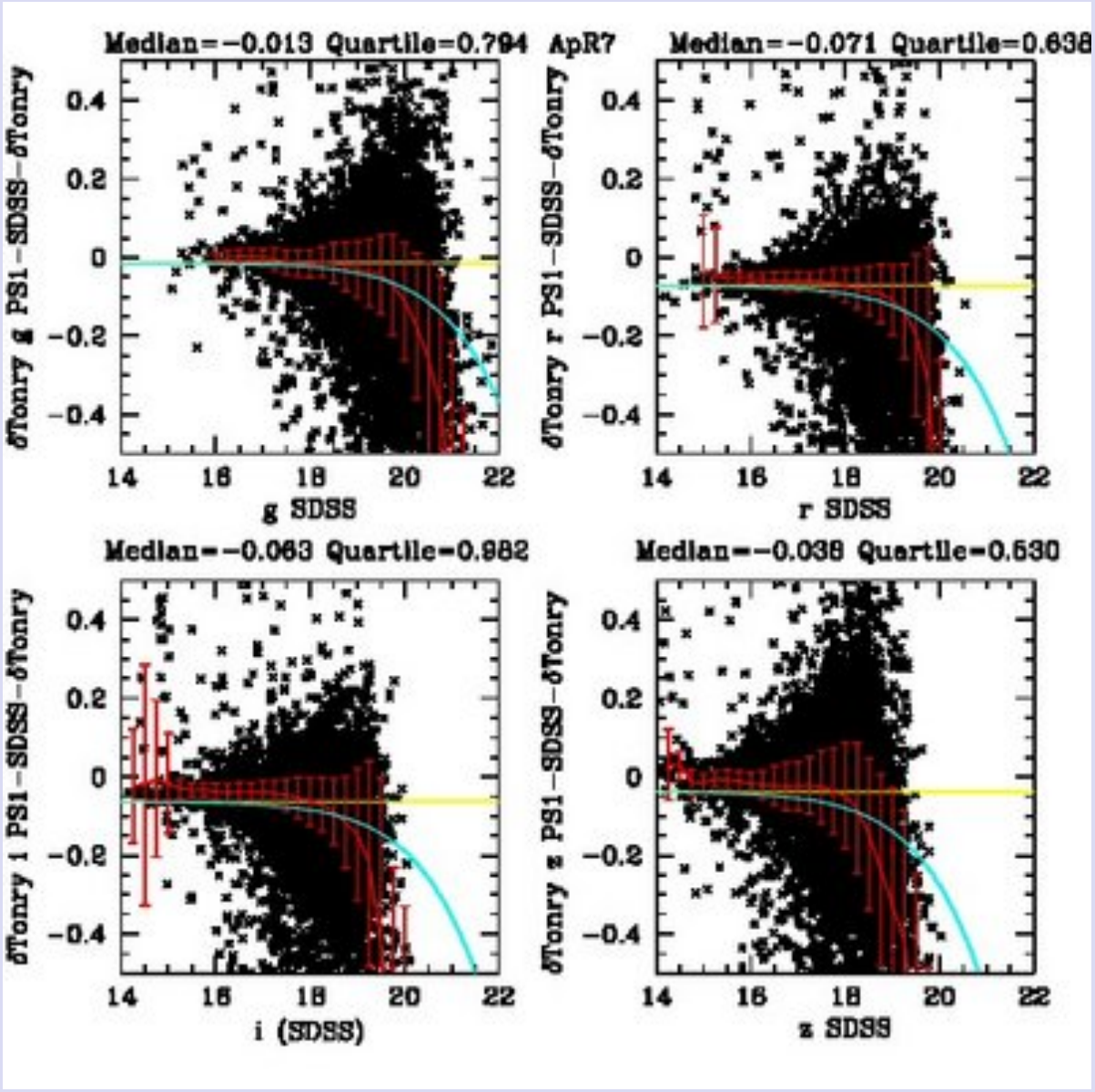
cFluxes are systematically brighter



There is a bug in the ipp convolution software. This affects also the R-fluxes, because the stacks have an homogenized PSF.

The bug will be fixed after the current reprocessing is finished.

Comparison with SDSS photometry

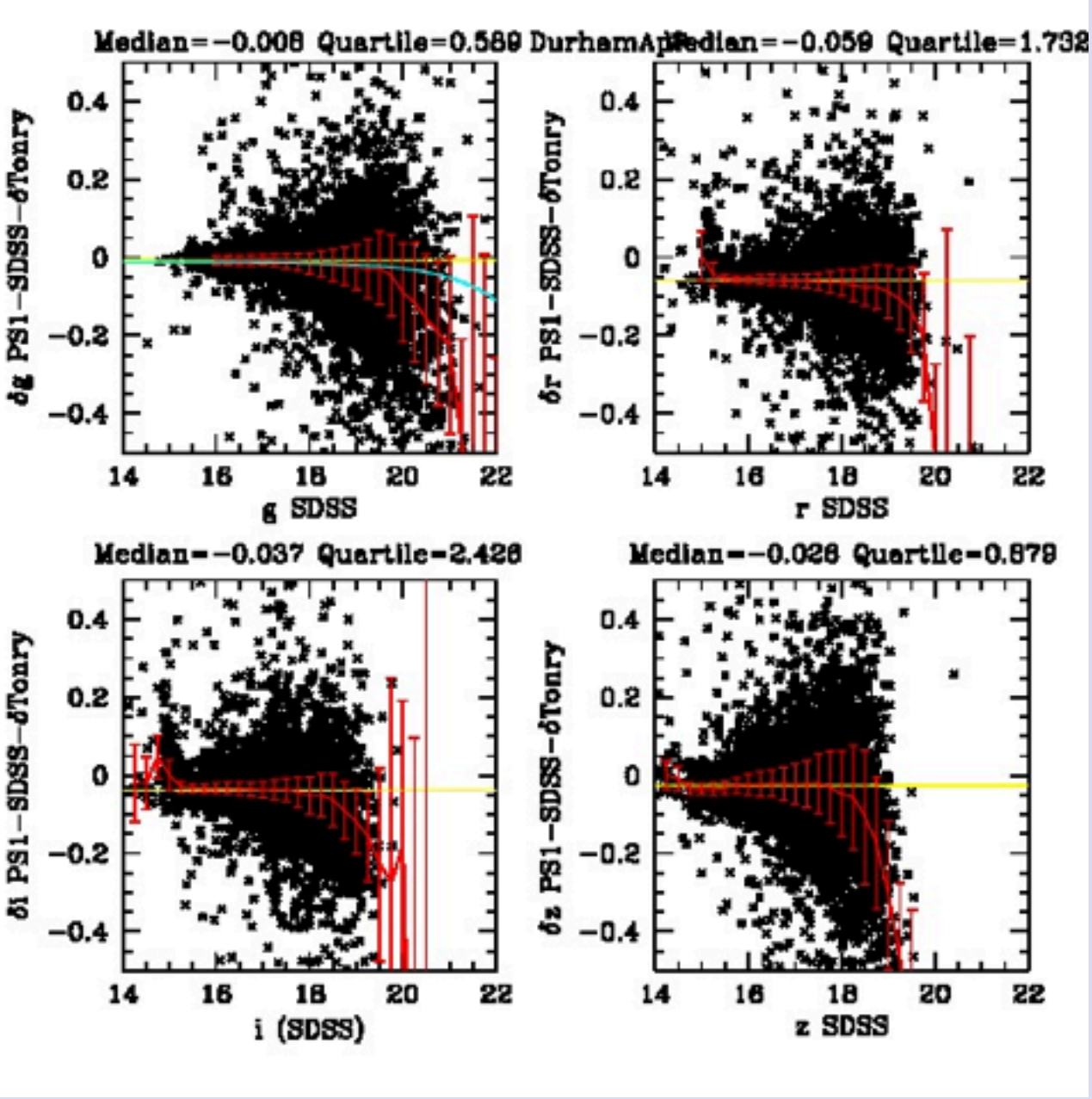


There are small shifts that increase at fainter magnitudes, with PS1 becoming increasingly brigher.

This is qualitatively explained by if IPP underestimates the sky subtraction.

The bug in the convolution software could also play a role.

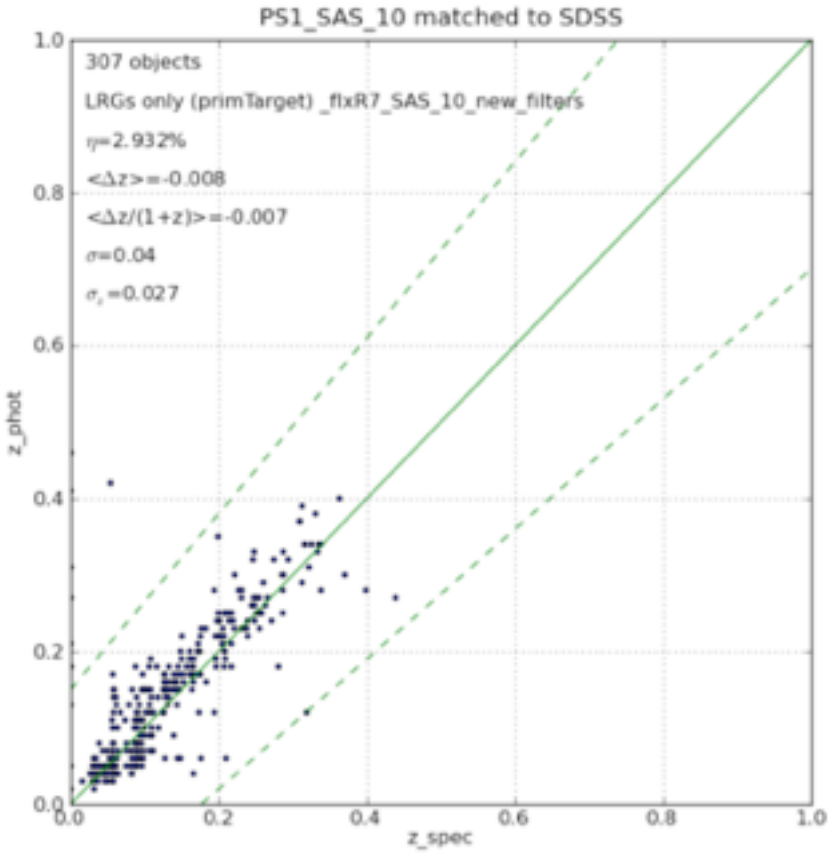
‘Durham’ photometry

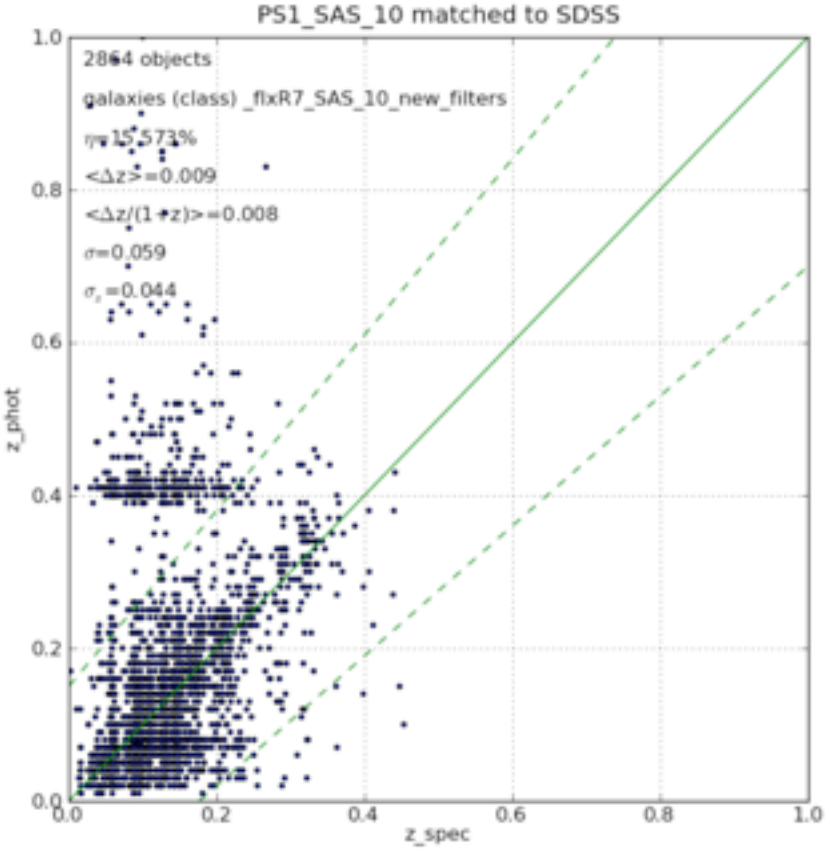


Durham performed aperture photometry without convolution. The comparison with SDSS (using R7) is somewhat better, but the magnitude dependence is still there: sky subtraction is the issue?

SAS PhotoZ: comparison with SDSS

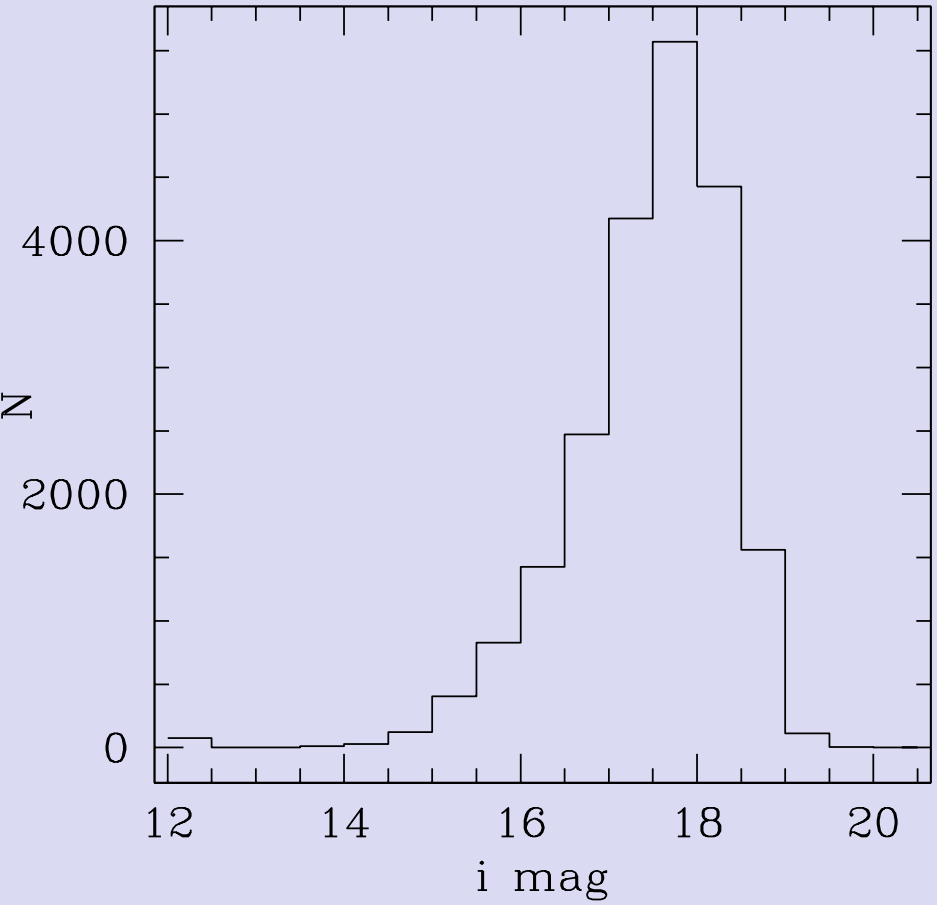
Nevertheless, the PhotoZ for (bright) RLGs are good and blue galaxies are not too bad either. (R7 gives the best results)

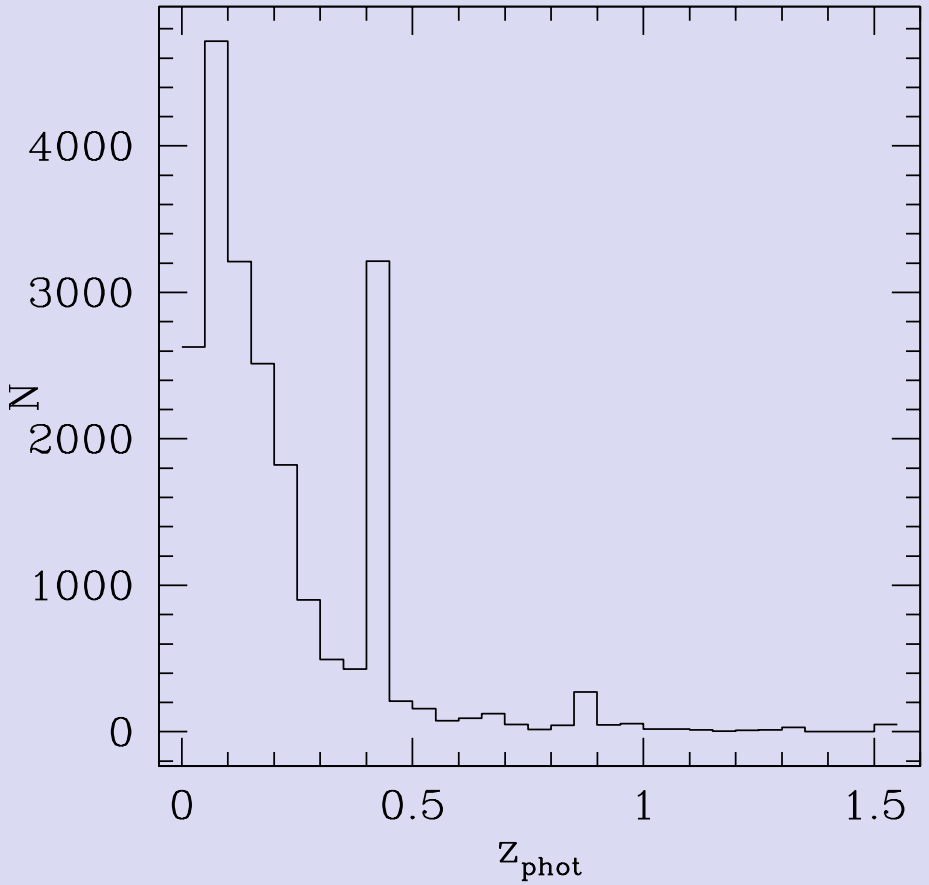




PhotoZ in SAS

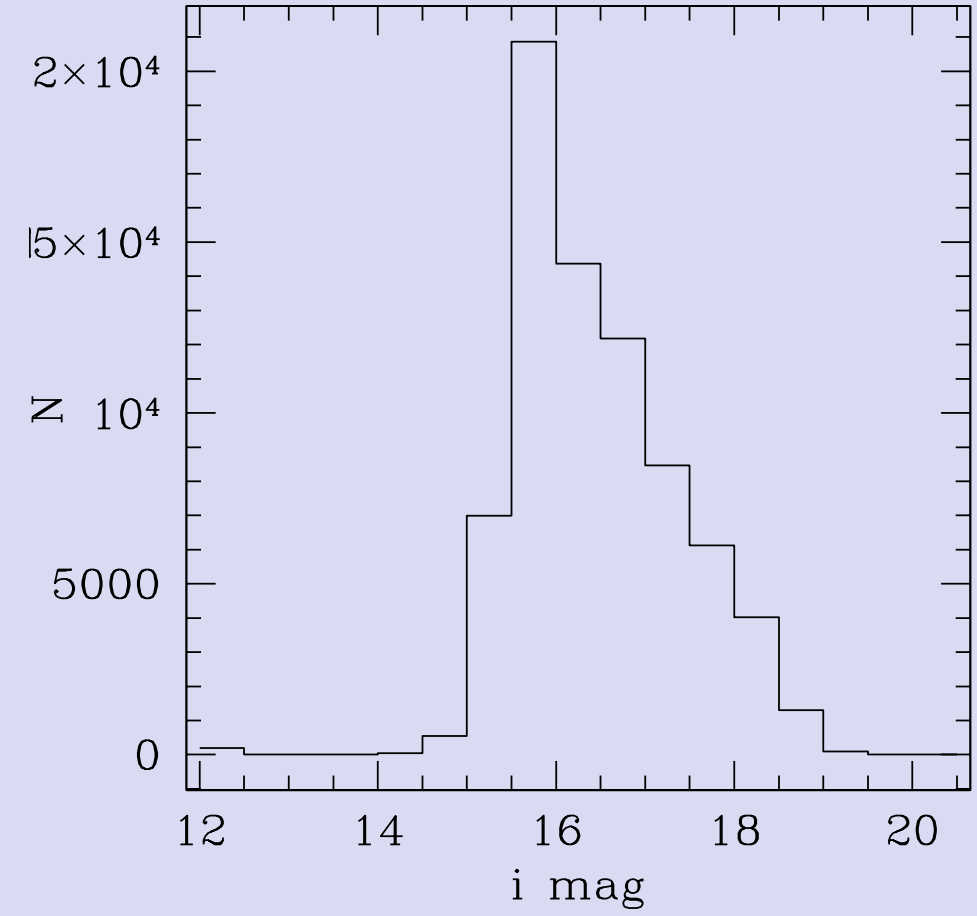
- Objects classified as ‘galaxies’ in SDSS(21226)

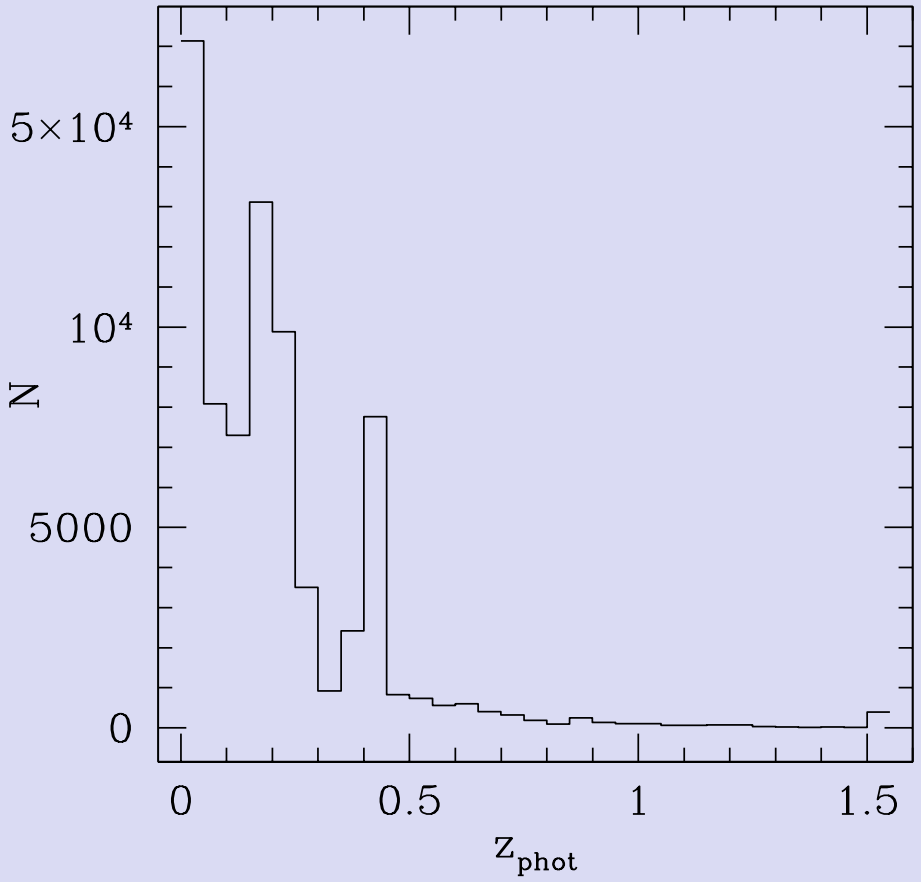




PhotoZ in SAS

- 75219 Objects with R7 photometry





Great Expectations

As soon as PSPS starts the ingestion of the reprocessed 3π and/or the data become available, we will start the industrial production of photo-classifications and photoz.
We can keep the pace of the ingestion--> end of March 2013 first 3π catalogue could be available.

Several spectroscopic catalogues (SDSS, 2dFGS, VVDS, BOSS, VIPERS) are already available in our system.
Pending actions from Hawaii, the results can be distributed from PSPS.

Pending issues that need to be solved when reprocessing will start again: convolution, sky subtraction, residual ZP