DES clustering redshift approach in Y1

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Presenting the work of:

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etc.

All plots and numbers to be understood as PRELIMINARY

Overall strategy

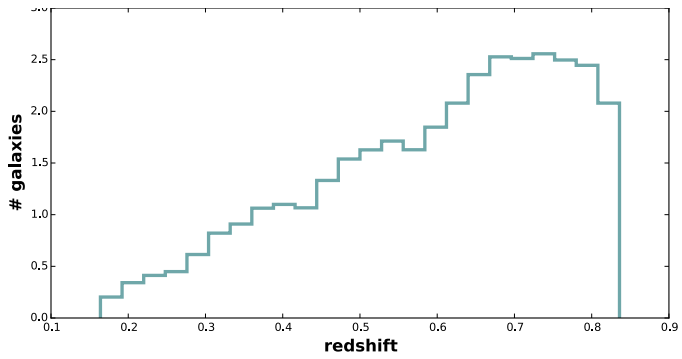
- **Goal:** use cross-correlations to provide Δz shifts to the means of N(z) distributions from photo-z code's posteriors for:
  - **Weak-lensing sample** used in cosmic shear and galaxy-galaxy lensing (sources): 0.20-0.43; 0.43-0.63; 0.63-0.90; 0.90-1.3.
  - **Lens sample:** redMaGiC LRGs used in galaxy-galaxy lensing (lenses), etc.: 0.15-0.30; 0.30-0.45; 0.45-0.60; 0.60-0.75; 0.75-0.90.
- Use redMaGiC "higher-luminosity" photometric sample as reference sample to calibrate the WL sample: 25 bins in range 0.15-0.85 (Δz = 0.028). redMaGiC photo-z resolution is ~0.02.
- Use BOSS spectra as reference sample to calibrate the lens sample.

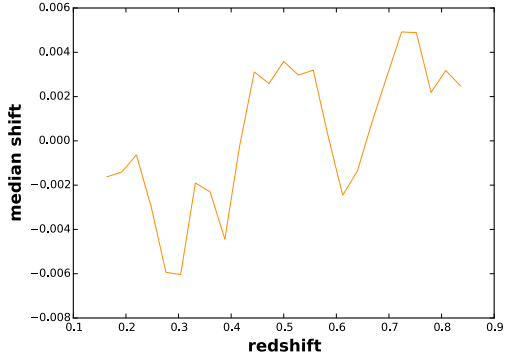
Calibrating the WL sample

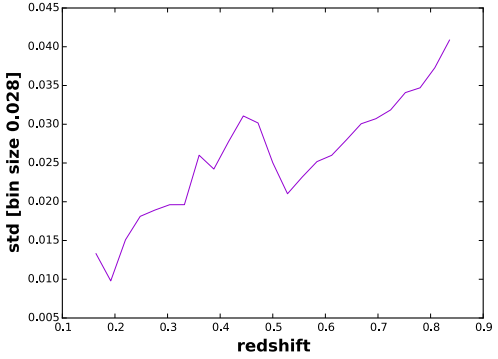
- Start with study on **simulations** to **choose method:**
  - Cross-correlation from a 1-bin estimate in annulus of 500 kpc - 1500 kpc, with pairs inverse-distance weighted ("Schmidt method"). No galaxy-bias correction applied.
  - Then we shift the photo-z posterior N(z) until its mean in a 2-σ interval around the mean matches that of the N(z) from cross-correlations.
- and study **systematic errors**:
  - Bias due to method: redshift-evolution of galaxy bias in both WL and redMaGiC samples, for instance.
  - Bias due to using redMaGiC photo-z's as reference.
  - Bias due to the difference between the shapes of N(z) from the photo-z posterior and cross-correlation.

Galaxy samples

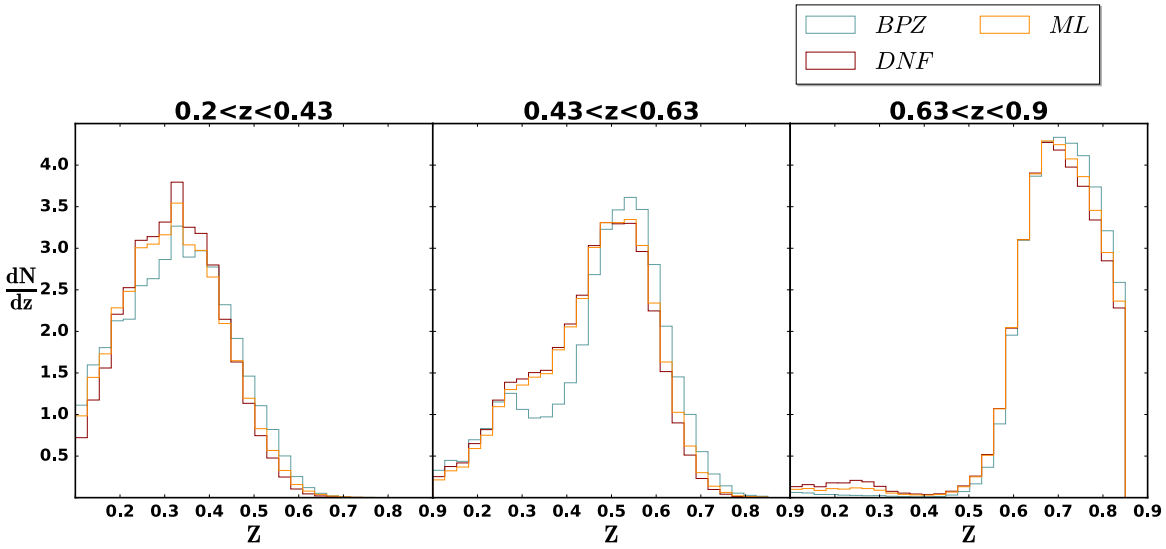
Reference sample: redMaGiC higher-luminosity sample





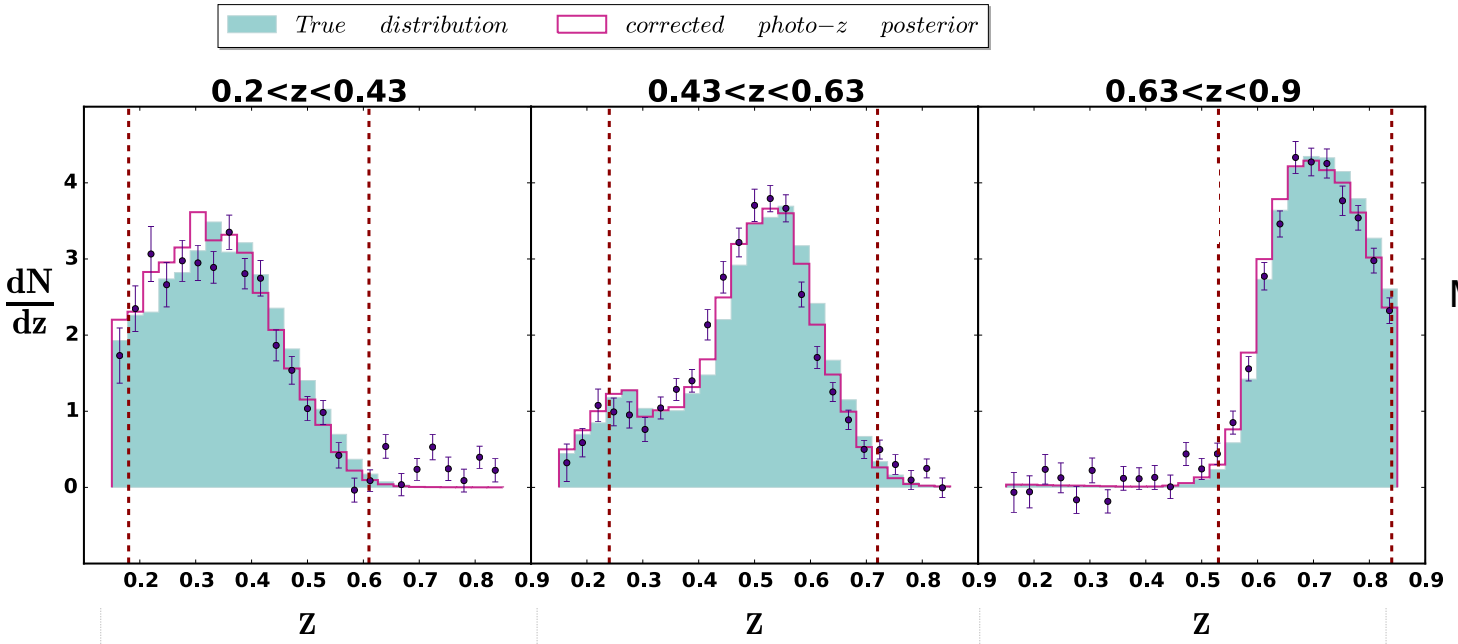


WL Sample: 3 different photo-z codes **BPZ**, DNF (near-neighbors), random forest



Systematic 1: biases in the method

Test: We assume photo-z posterior to have the same shape as the *true distribution.* We also use redMaGiC spec-z as a reference. After correcting photo-z posterior with a shift, residual differences in <z> with true should be due to the biases in the method.



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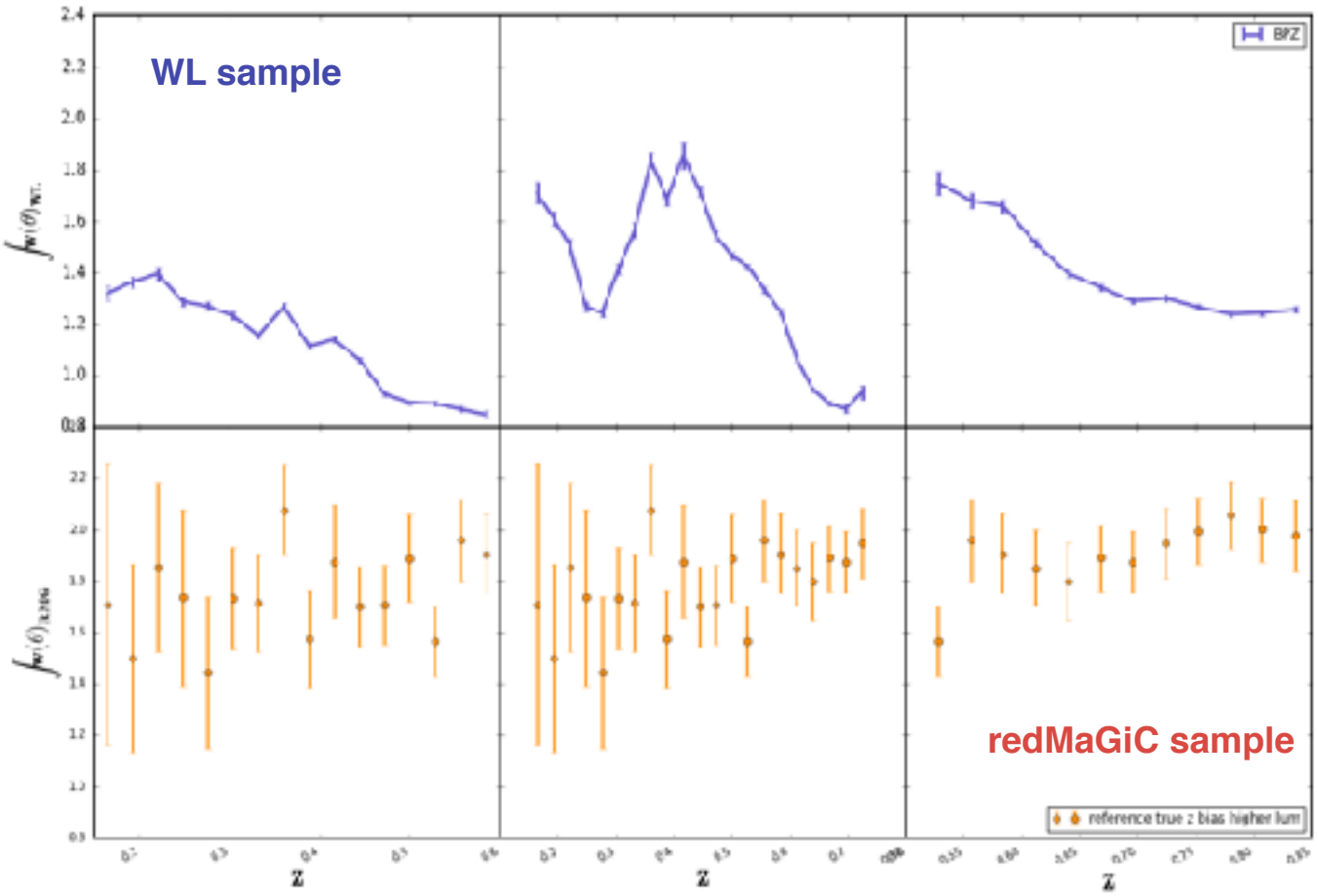
	1st tomo bin	2nd tomo bin	3rd tomo bin	average
systematic in the method	0.020+-0.006	0.010+-0.004	0.008+-0.003	0.013+-0.005

Systematic 1: is it due to bias evolution?

DARK ENERGY SURVEY

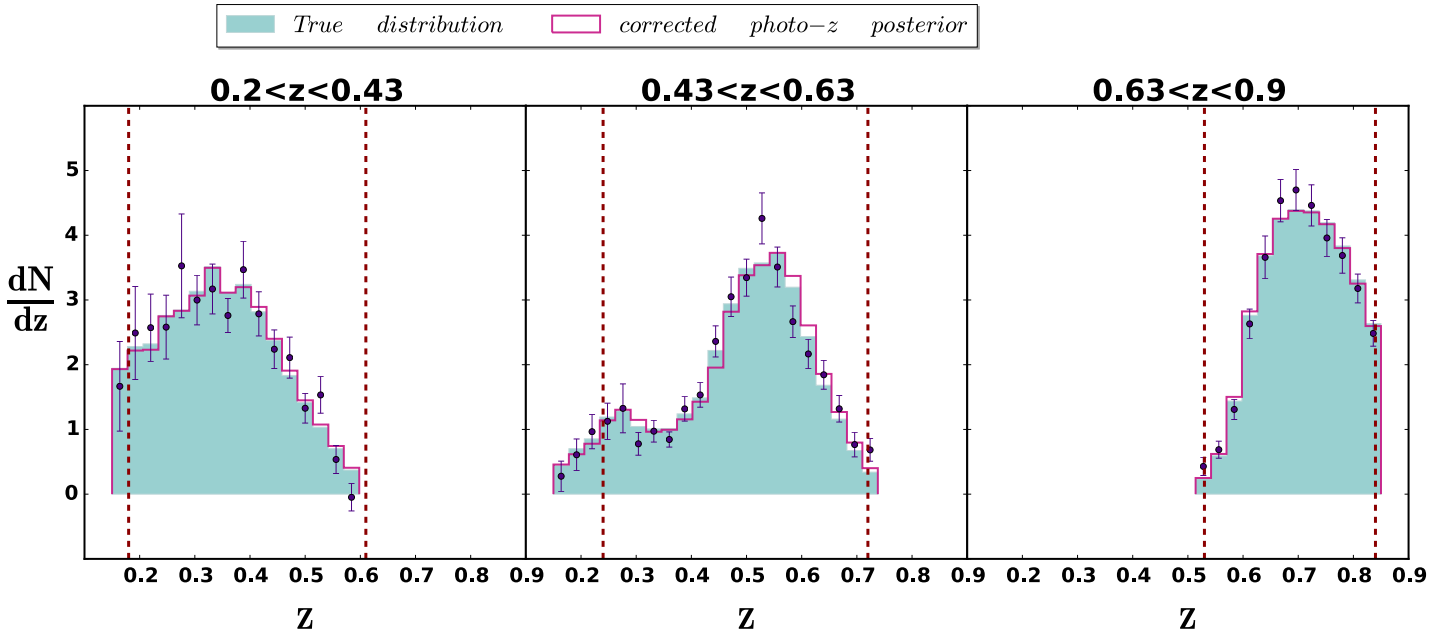
In simulations, we can bin the two samples with true redshift and use the 1-bin estimate of the autocorrelation function as a probe of galaxy bias:



Marco, Pauline

Systematic 1: it is due to bias evolution

Then, we can correct the cross-correlation with the measured auto-correlations

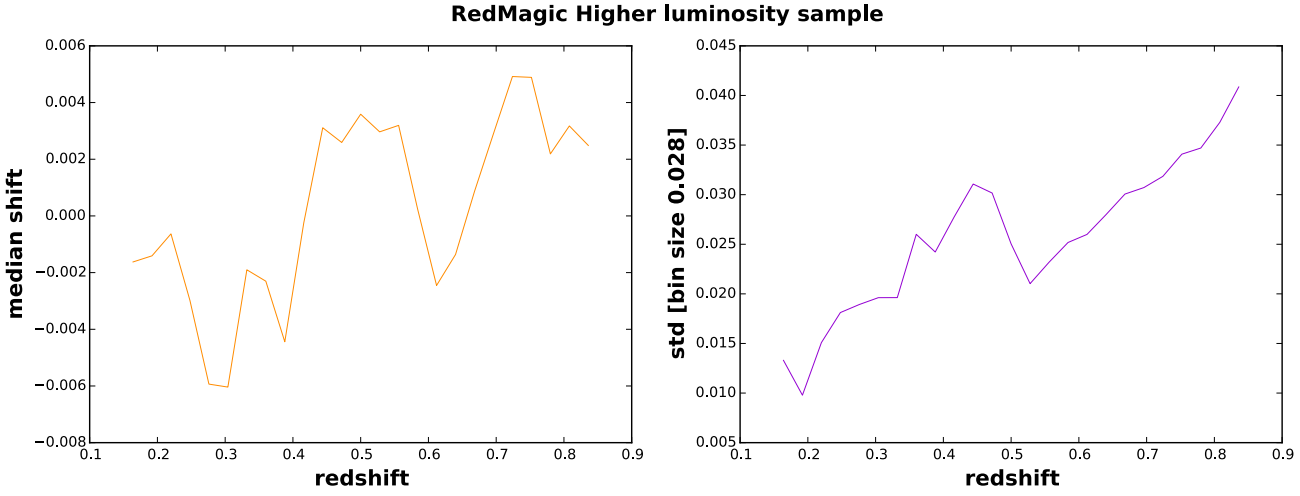


Marco, Pauline

	1st tomo bin	2nd tomo bin	3rd tomo bin	average
systematic in the method	0.020+-0.006	0.010+-0.004	0.008+-0.003	0.013+-0.005
after galaxy bias correction	0.004+-0.013	0.007+-0.007	0.002+-0.003	0.004+-0.009

Systematic 2: redMaGiC photo-z's

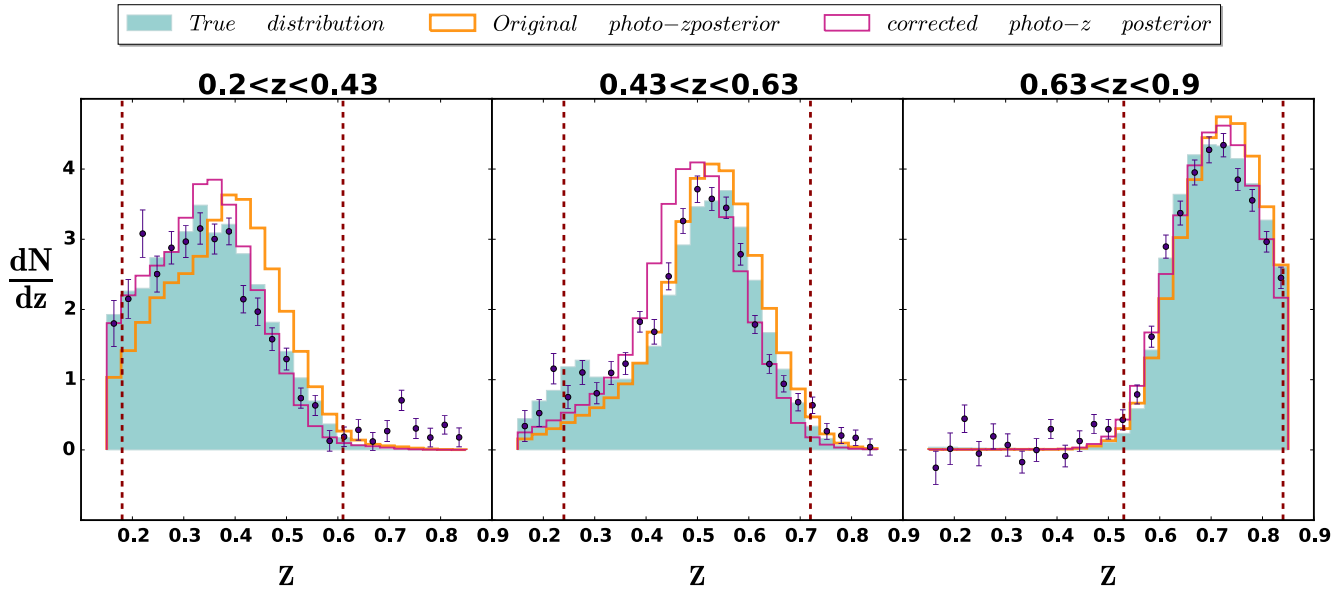
Test: We assume photo-z posterior to have the same shape as the *true distribution.* We use redMaGiC photo-z as a reference. After correcting photo-z posterior with a shift, we define the redMaGic photo-z systematic as the difference in the shift between this test and the test for the systematic due to the method.



	1st tomo bin	2nd tomo bin	3rd tomo bin	average
redMaGiC photo-z systematic	0.009+-0.009	0.001+-0.006	0.001+-0.003	0.004+-0.007

Systematic 3: diff. in N(z) shapes

Test: We use BPZ photo-z posterior and redMaGiC photo-z as a reference. After correcting photo-z posterior with a shift, we define the *shape systematic* as the difference in the correction between this test and the test for the redMaGiC photo-z systematic.



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	1st tomo bin	2nd tomo bin	3rd tomo bin	average
shape systematic	0.011+-0.008	0.012+-0.006	0.004+-0.003	0.009+-0.006

Final systematic error

We repeat the matching in <z> within 2 and 2.5σ and take the largest shift in each case.

	1st tomo bin	2nd tomo bin	3rd tomo bin
systematic in the method (bias evol.)	0.020+-0.006	0.010+-0.004	0.014+-0.003
redMaGiC photo-z systematic	0.009+-0.009	0.005+-0.006	0.002+-0.004
shape systematic	0.011+-0.008	0.012+-0.006	0.004+-0.003

	1st tomo bin	2nd tomo bin	3rd tomo bin
Total in quadrature	0,025	0,016	0,014
Total in quadrature after marginalizing over statistical errors	0,029	0,019	0,016

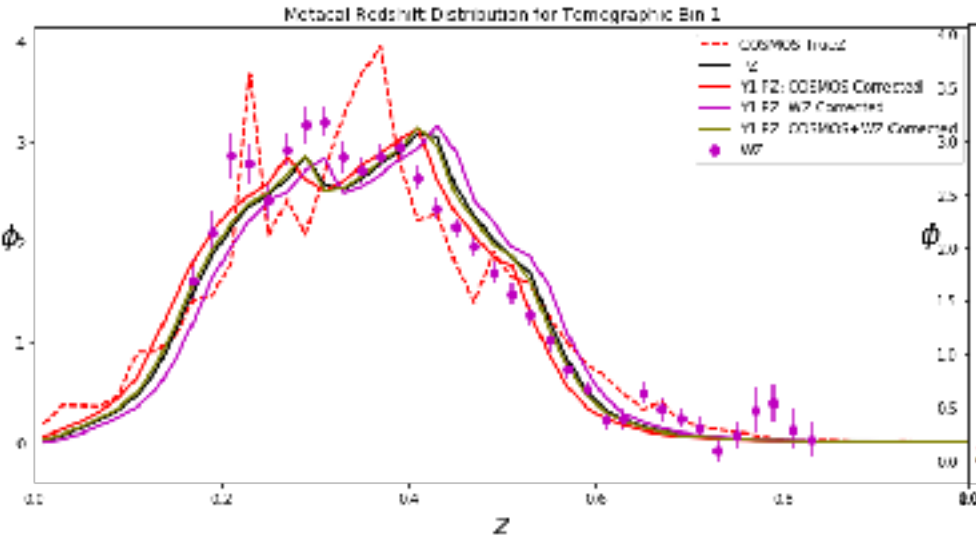
Cross-check

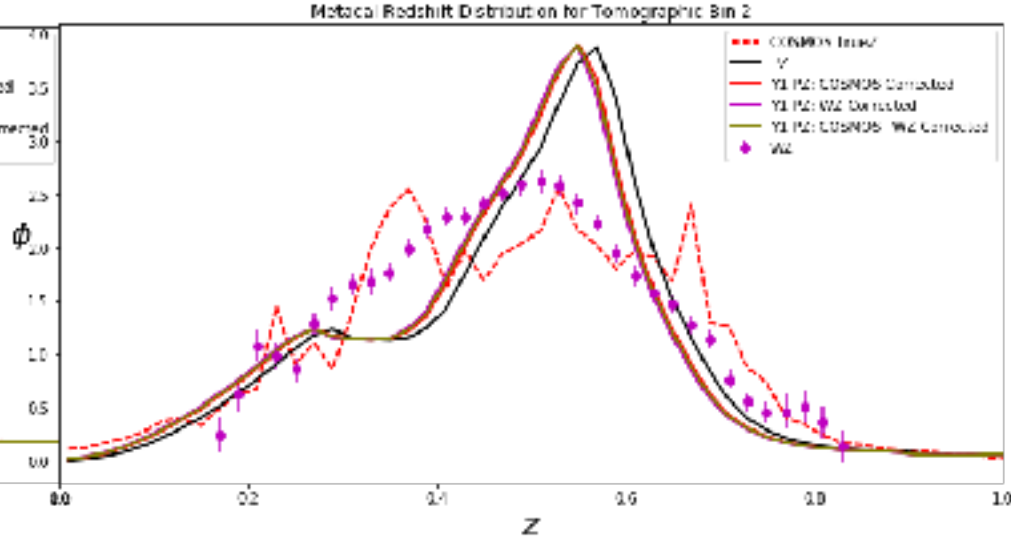
In simulations, we can measure the shift for the complete method (redMaGiC photo-z, BPZ posterior). The residual difference between the mean of the corrected posterior and that of the true distribution should be compatible with 0 within errors.

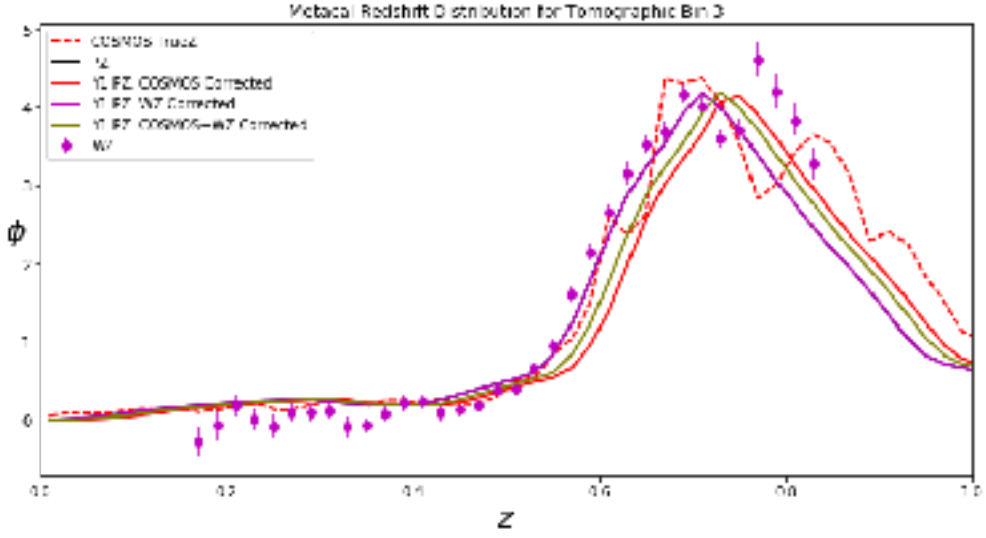
	1st tomo bin	**2nd tomo bin**	**3rd tomo bin**
overall shift	0.000+-0.029	-0.003+-0.019	0.011+-0.016

Note that we do NOT attempt to correct the shifts we see in simulations, and we add the whole value of the individual shifts in quadrature, not taking advantage of any cancellations.

Application to Y1 WL sample

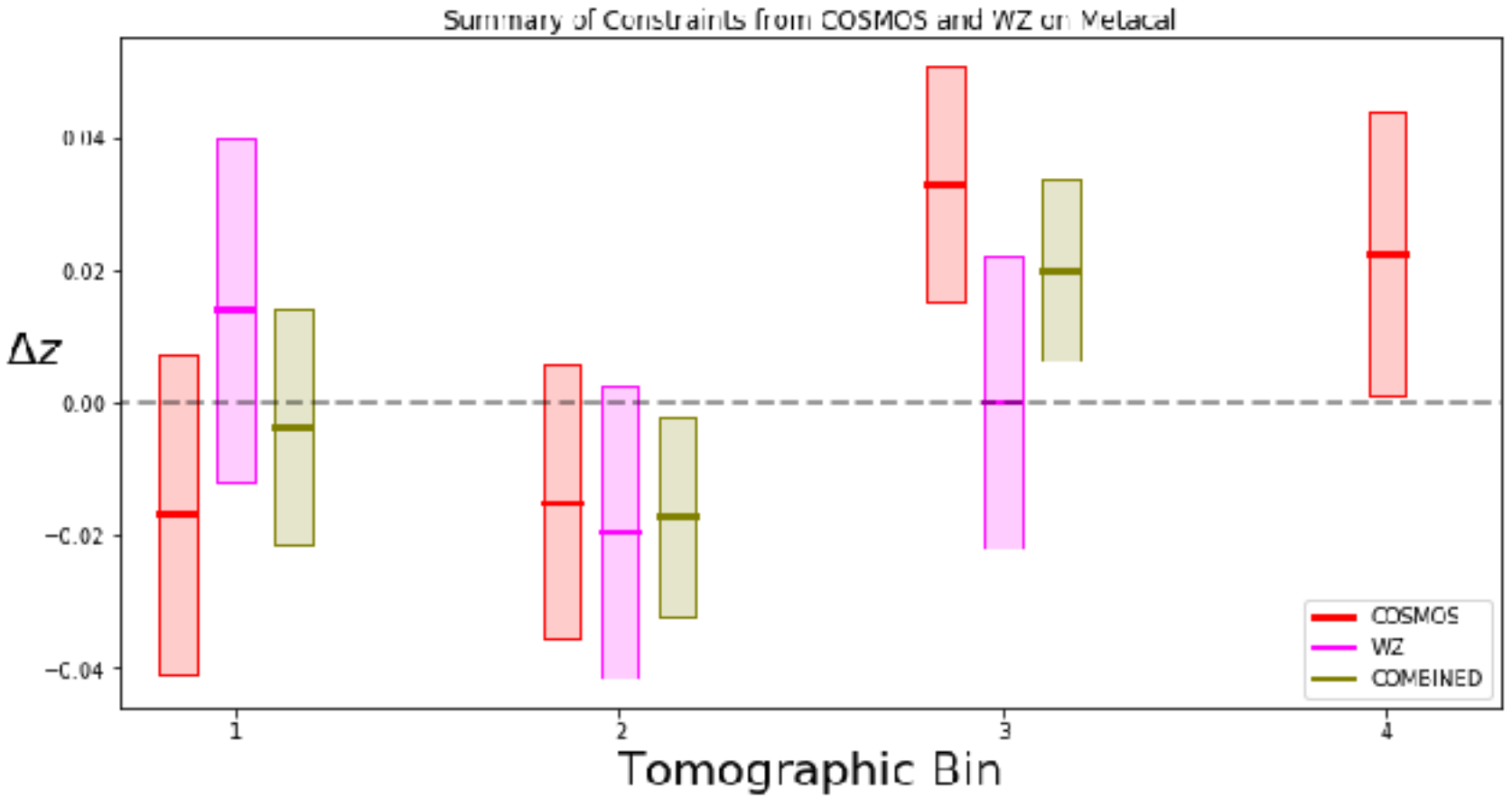






Chris

Application to Y1 WL sample

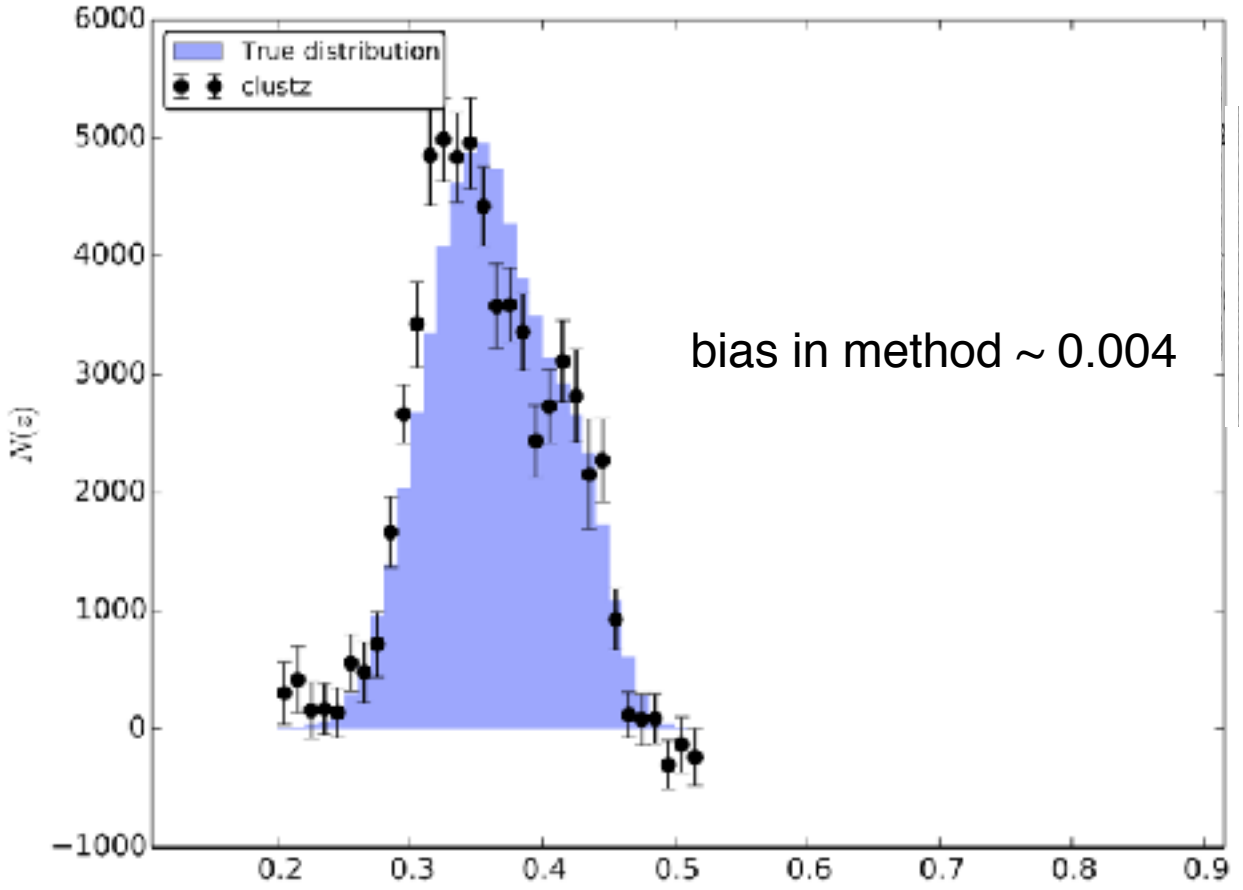


Calibrating the lens sample (redMaGiC)

Calibrate mean of redMagiC photo-z's with cross-correlation method using

- **Method:** "Schmidt" using galaxy-bias correction with a fit to power law.
- **Reference sample:** BOSS DR12 LRG spectra (LOWZ + CMASS).

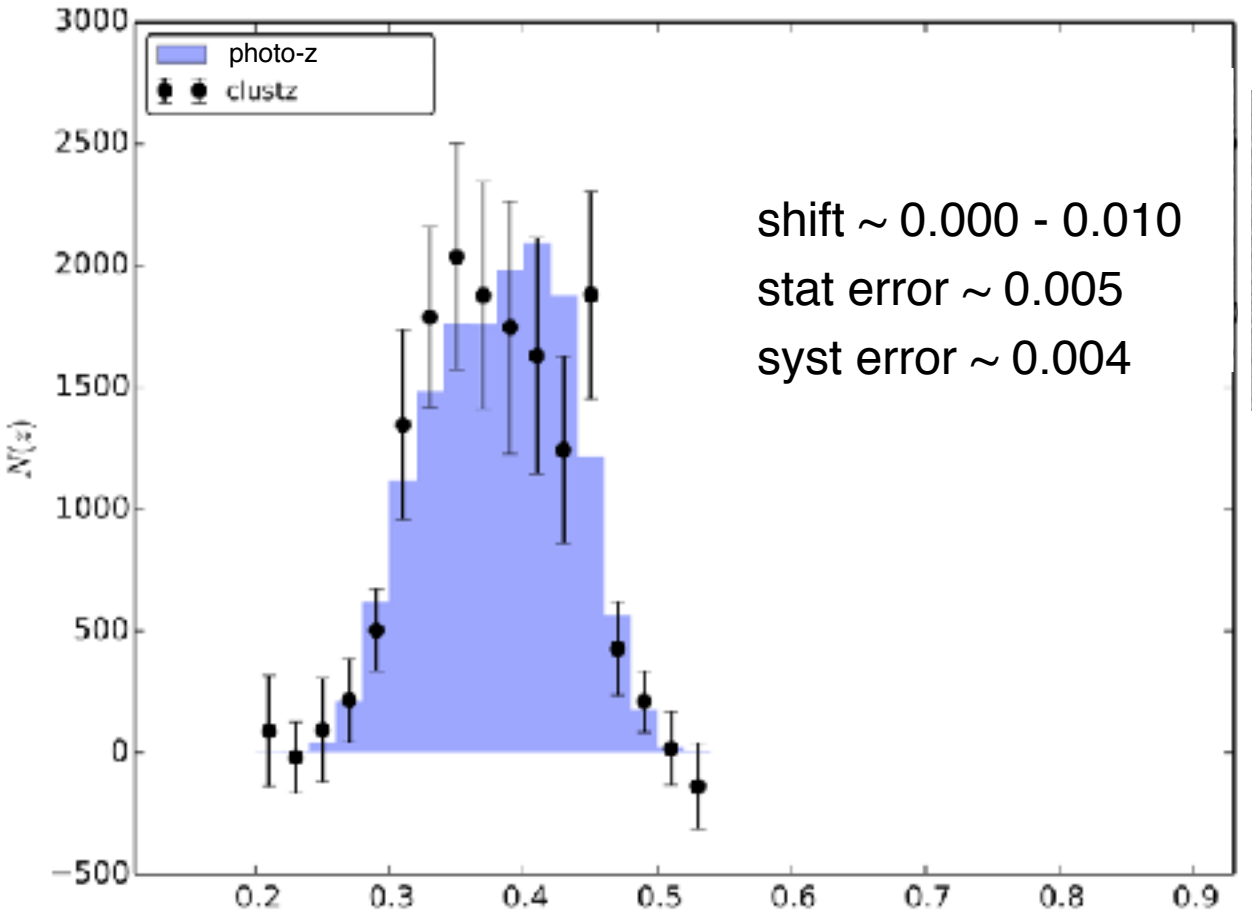
Test using BOSS redMaGiC as unknown



bias in method ~ 0.004

Ross

Application to Y1 lens sample



shift ~ 0.000 - 0.010

stat error ~ 0.005

syst error ~ 0.004

Ross

Summary

- Cross-correlations using redMaGiC photometric sample as reference are being successfully used to provide shifts +/- errors to means of N(z) for WL source sample for $z < 0.9$.
  - Shifts are in good agreement with those provided by direct calibration of N(z) using the COSMOS field.
  - Systematic errors are around 0.02.
- Calibration of the lens (redMaGiC) sample performed with cross-correlations using BOSS LRG spectra as reference sample.
  - Systematic errors are around 0.004.
- **All this looks good enough for Y1, but not for Y3 and beyond…**