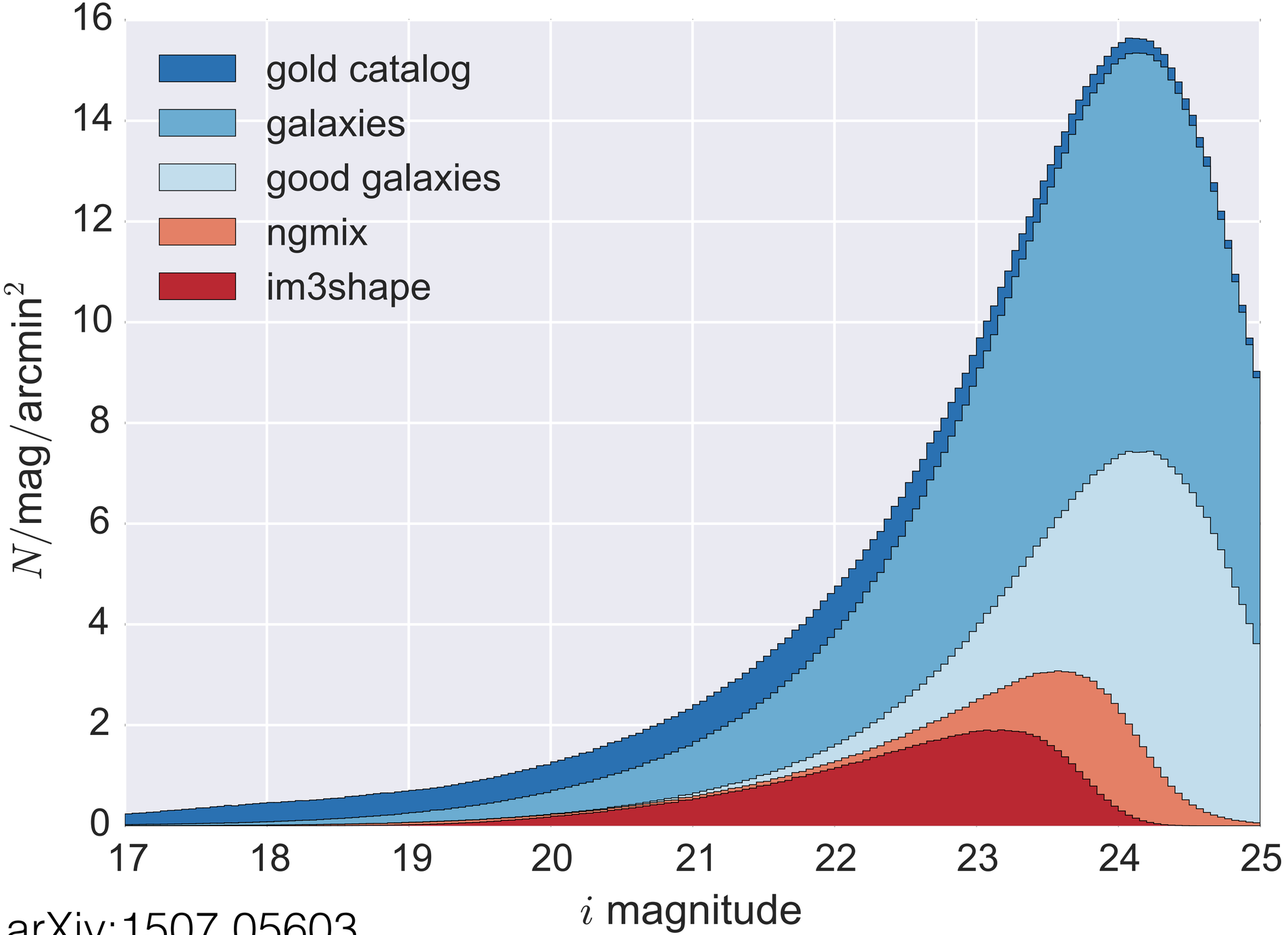
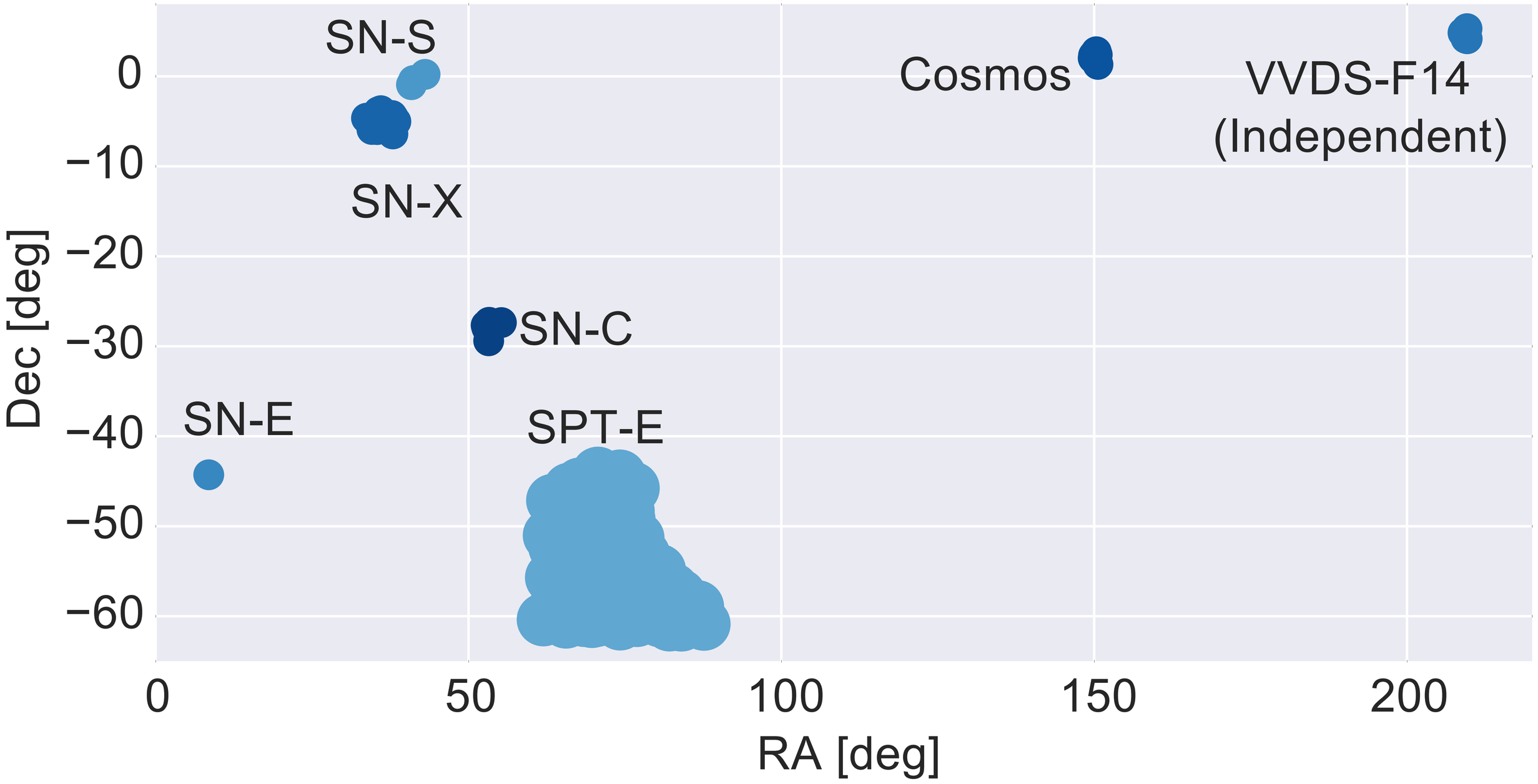
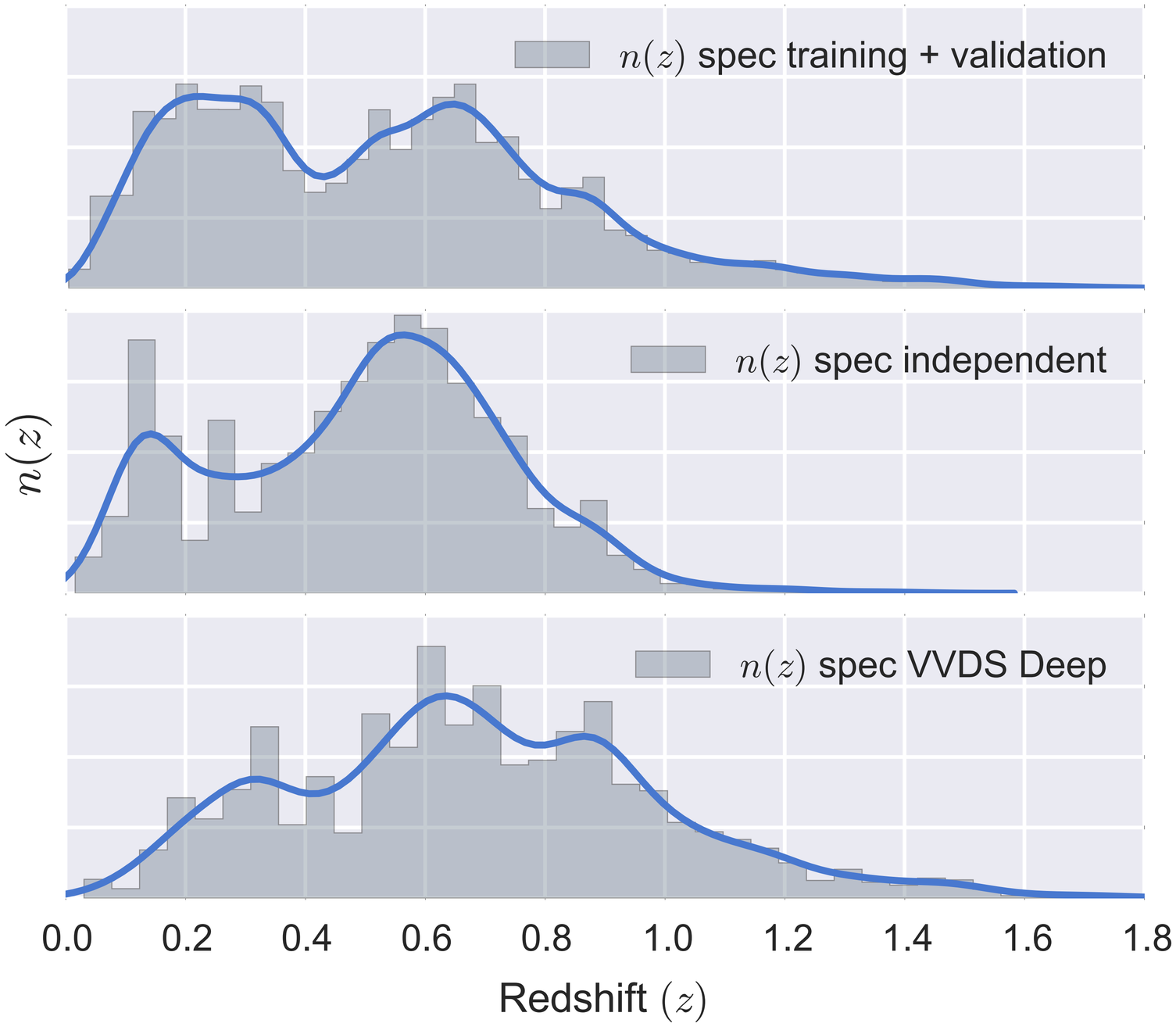
Photo-z for Weak Lensing In DES-SV

C. Bonnett, M. Troxel, W. Hartley A. Amara, B Leistedt, DES Collaboration arXiv:1507.05909

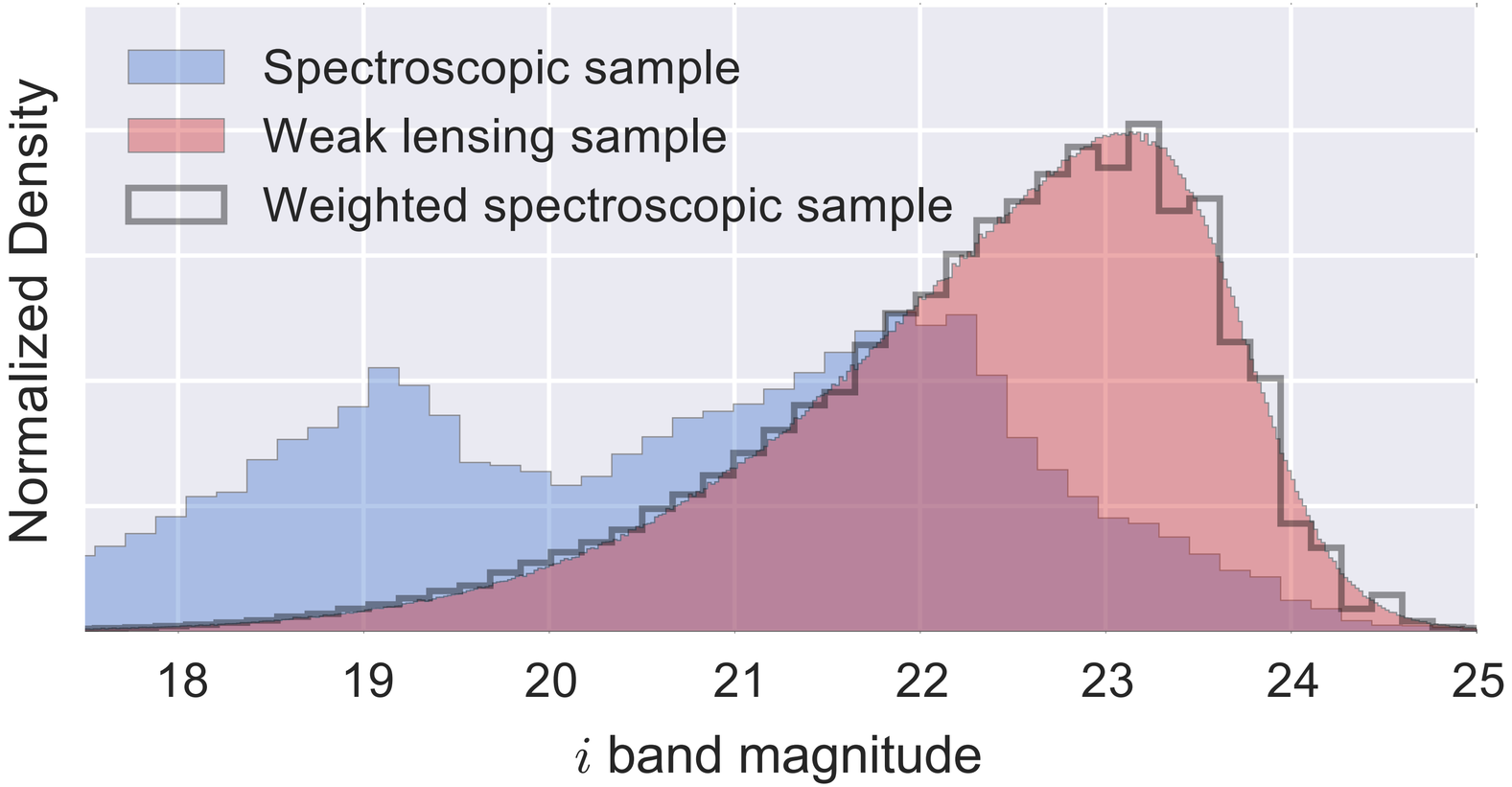


Jarvis et al arXiv:1507.05603


SN-S
Cosmos
VVDS-F14
(Independent)
SN-X
SN-C
SN-E
SPT-E
0
−10
−20
−30
−40
−50
−60
Dec [deg]
0
50
100
150
200
RA [deg]

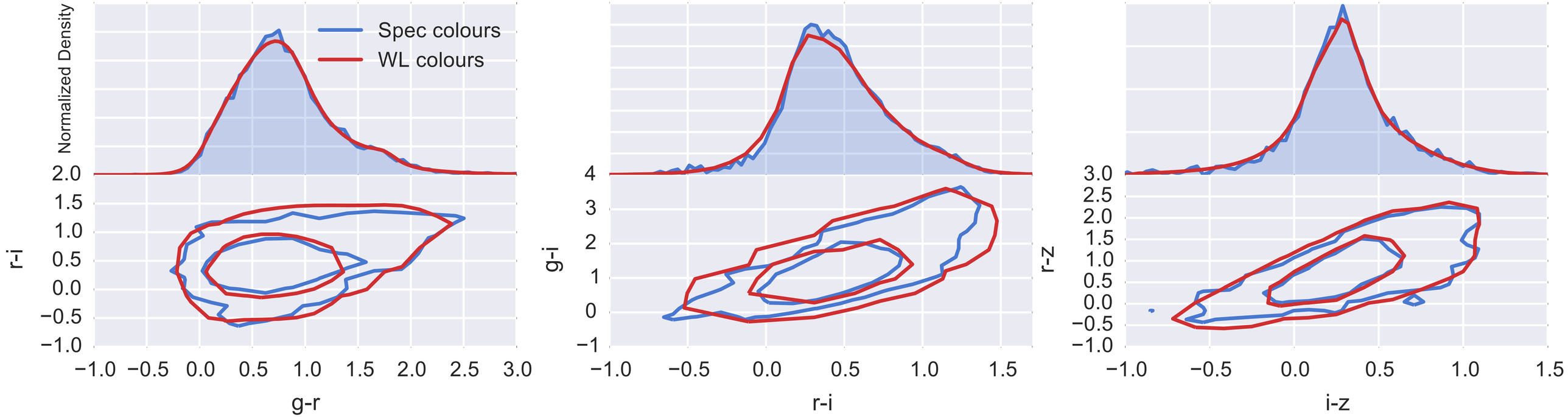


Training	~28,000
Validation	~14,000
Independent	~4000



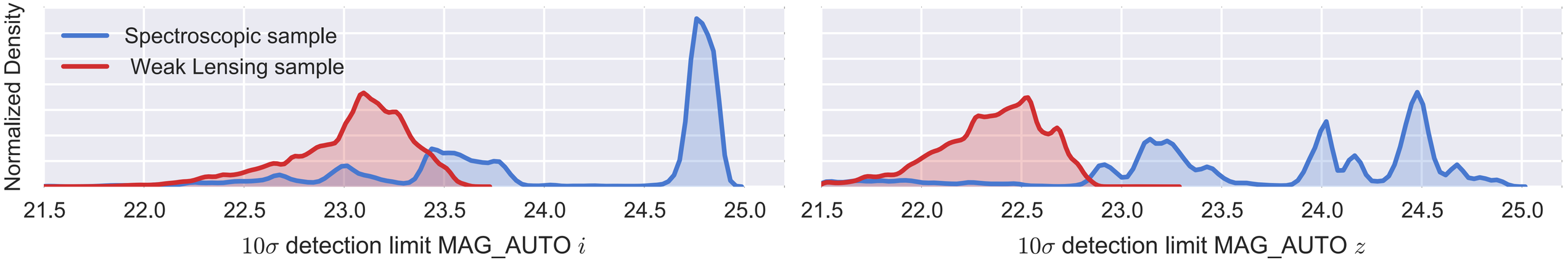
How representative are the properties of galaxies with spectra ?

Apply weighting scheme


Normalized Density
Spec colours
WL colours
r-i
g-r
g-i
r-i
r-z
i-z

S/N

Majority of spectra are in the frequently observed supernova fields
S/N tends to be much higher


Normalized Density
Spectroscopic sample
Weak Lensing sample
21.5
22.0
22.5
23.0
23.5
24.0
24.5
25.0
10σ detection limit MAG_AUTO i
21.5
22.0
22.5
23.0
23.5
24.0
24.5
25.0
10σ detection limit MAG_AUTO z

Solutions

1 Re-stack individual exposures - Independent Field
2 Algorithmically degrade photometry - Training- Validation

Important : Machine Learning does not explicitly take noise into account !

ANNZ2

Neural Nets, randomised regression (Sadeh et al. arXiv:1507.00490)

BPZ

Template fitting, calibrated on BCC-UFIG simulations
(Benitez et al ArXiv:9811189, Busha et al ,
Chang et al. arXiv:1411.0032, Leisted et al. arXiv:1507.05647)

SkyNet

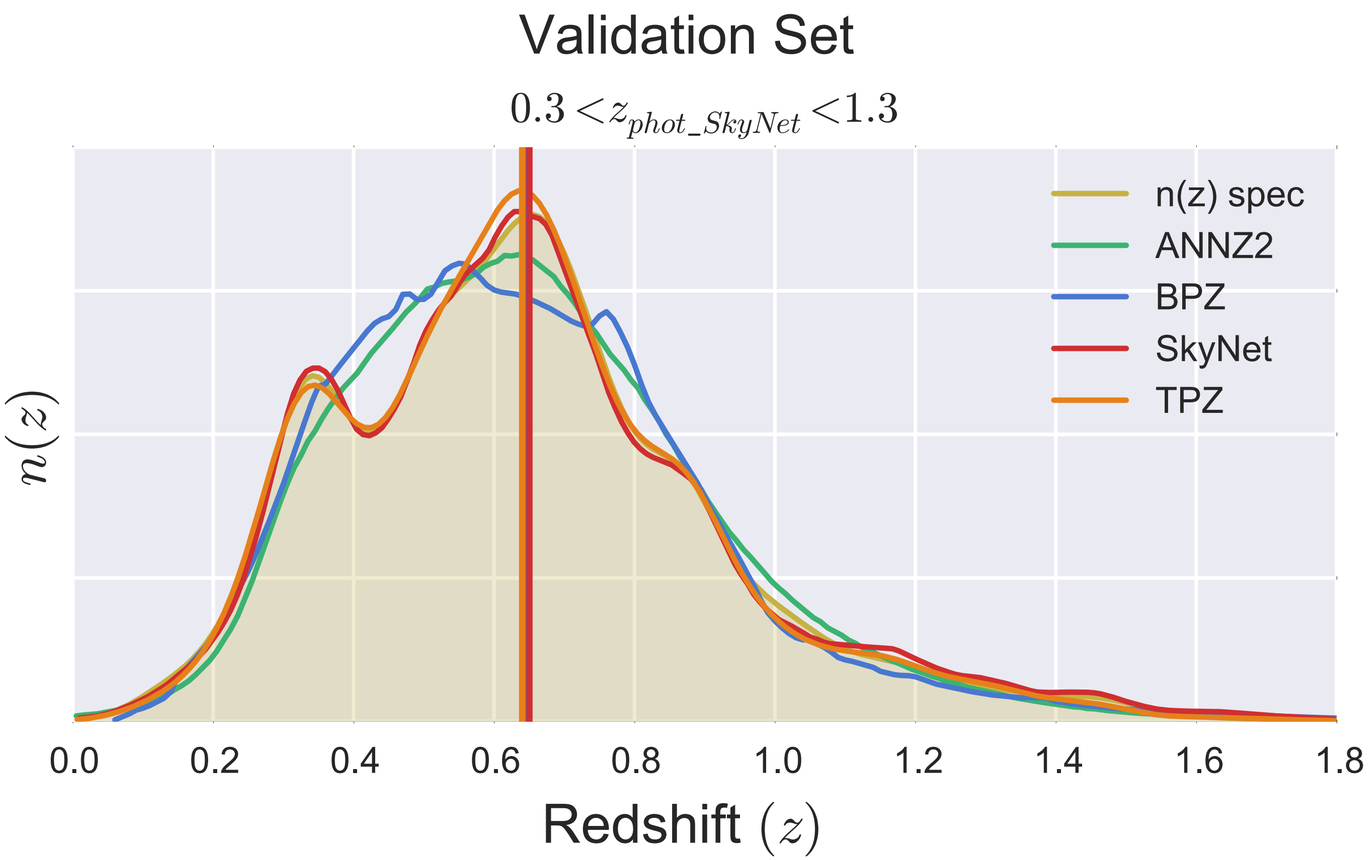
NeuralNet for classification (Bonnett et al. arXiv:1312.1287)

TPZ

Random Forest (Carrasco kind et al. arXiv:1303.7269)

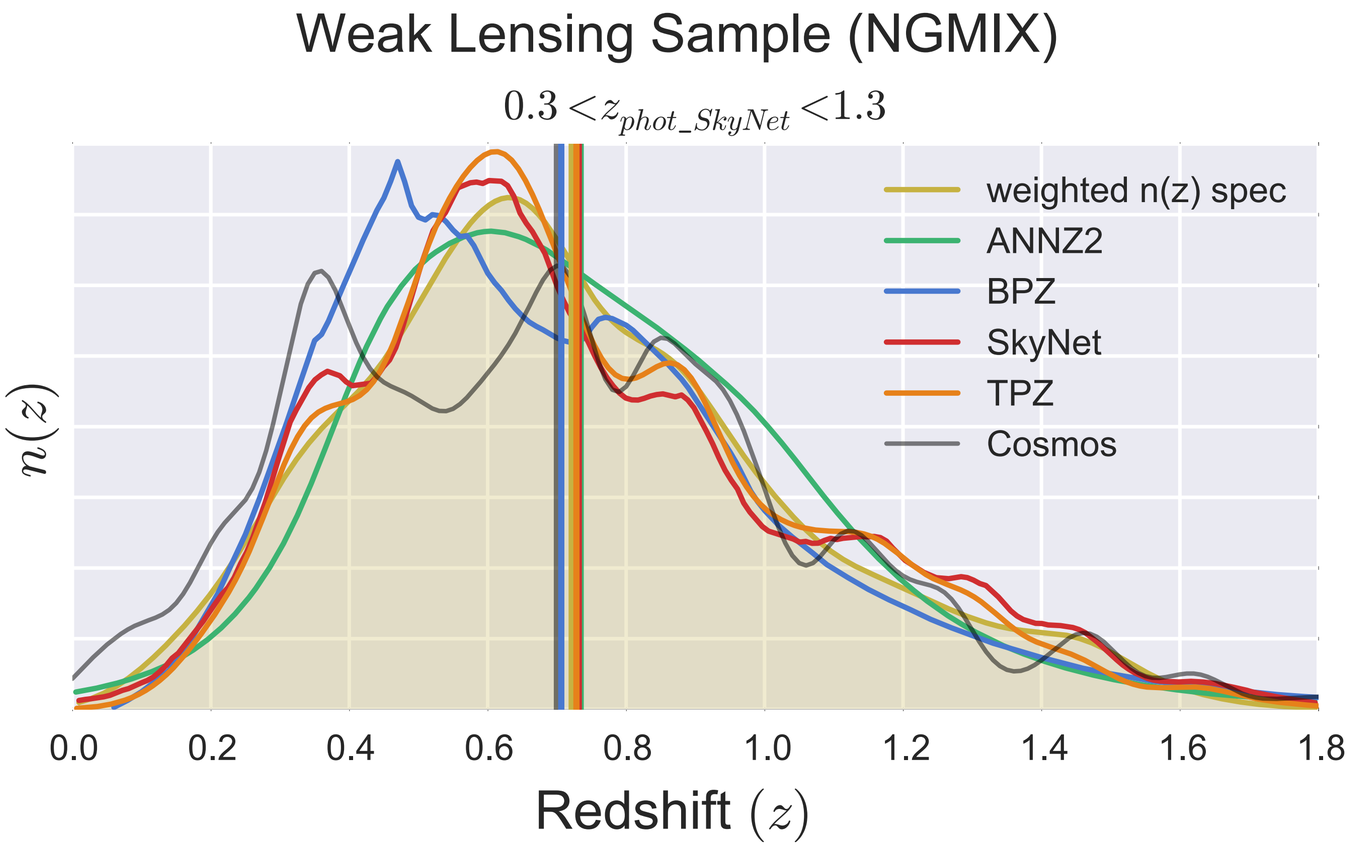
Error on the mean of n(z) indictor weak lensing performance

Spectra	0.64
ANNZ2	0.65
BPZ	0.64
SkyNet	0.65
TPZ	0.64

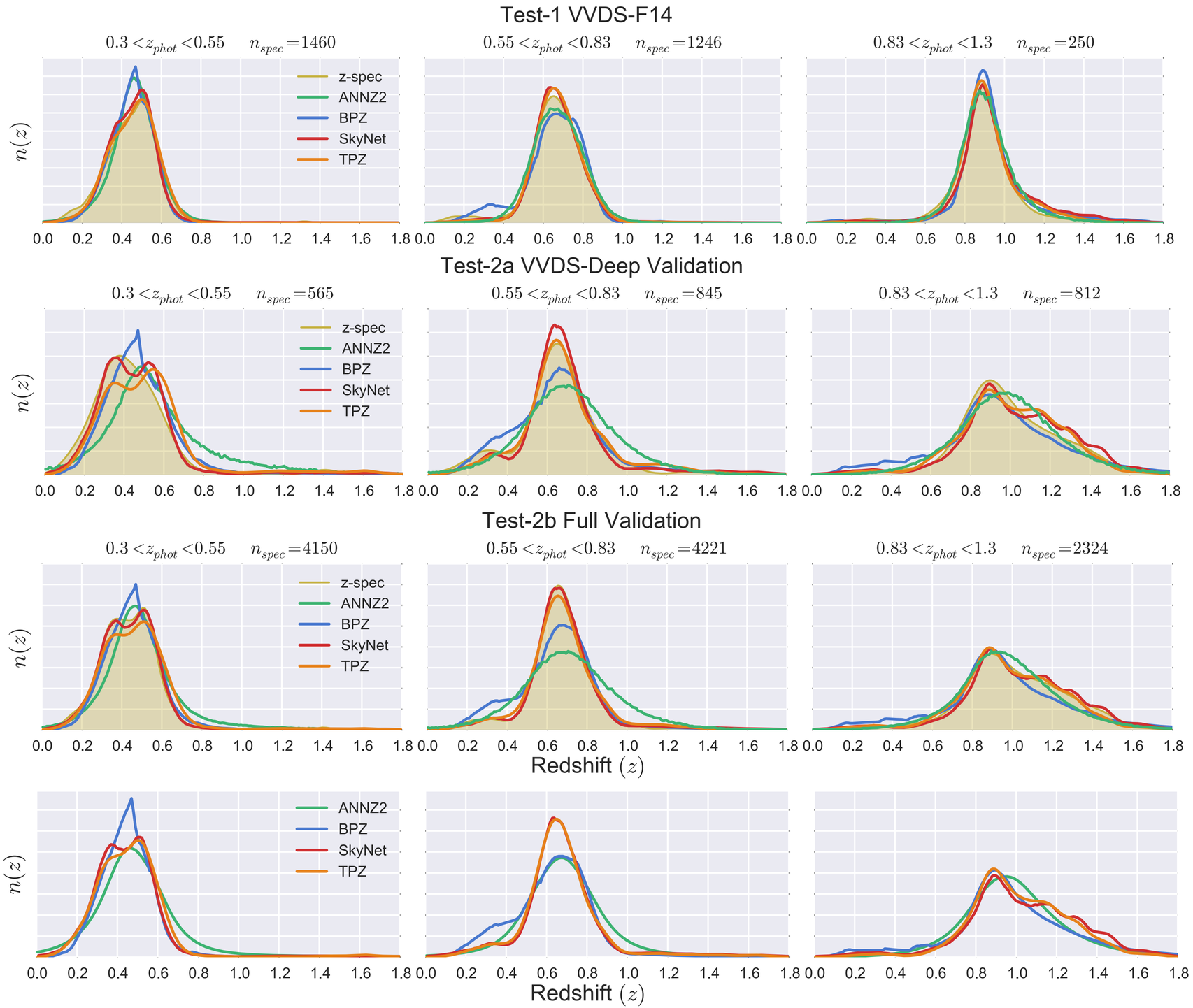


Error on the mean of n(z) indictor weak lensing performance

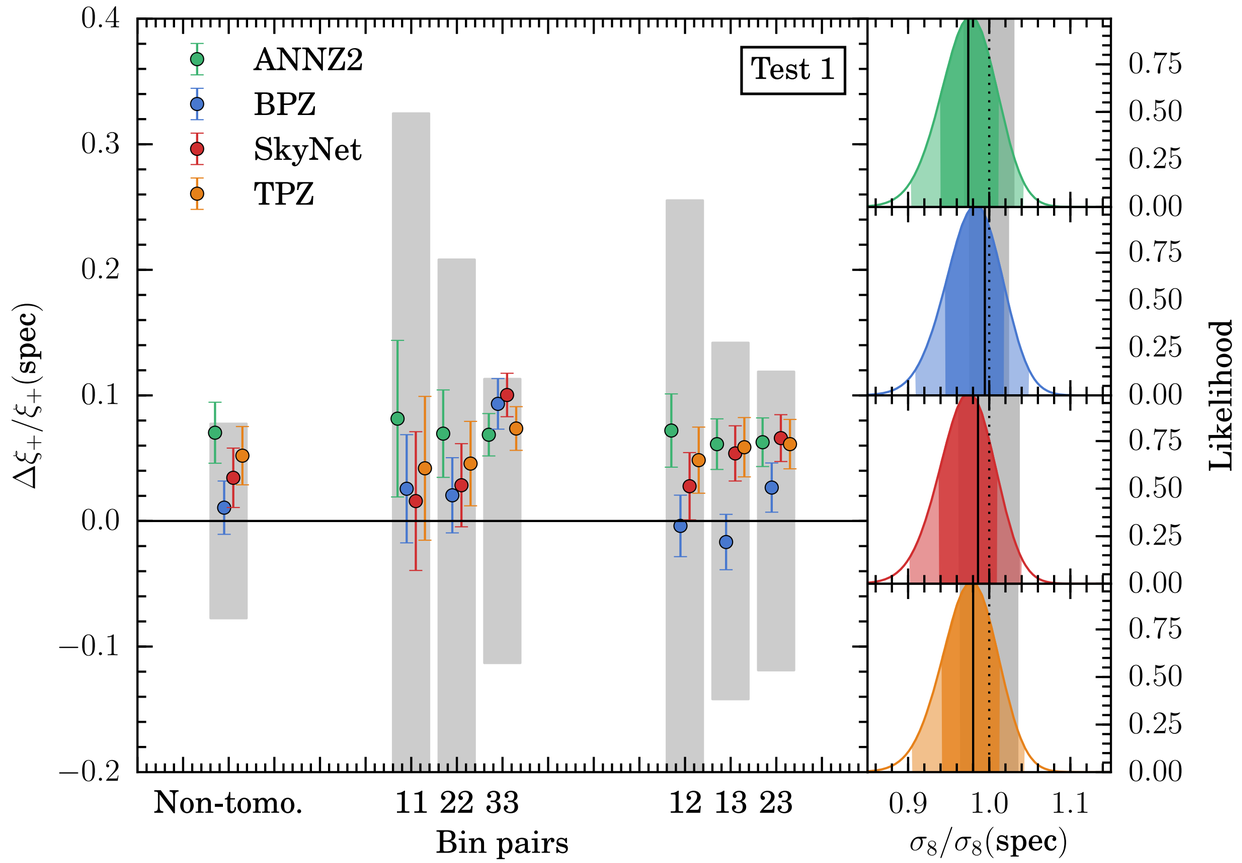
Spectra (weighted)	0.72
ANNZ2	0.73
BPZ	0.71
SkyNet	0.73
TPZ	0.73
Cosmos 30-band	0.70

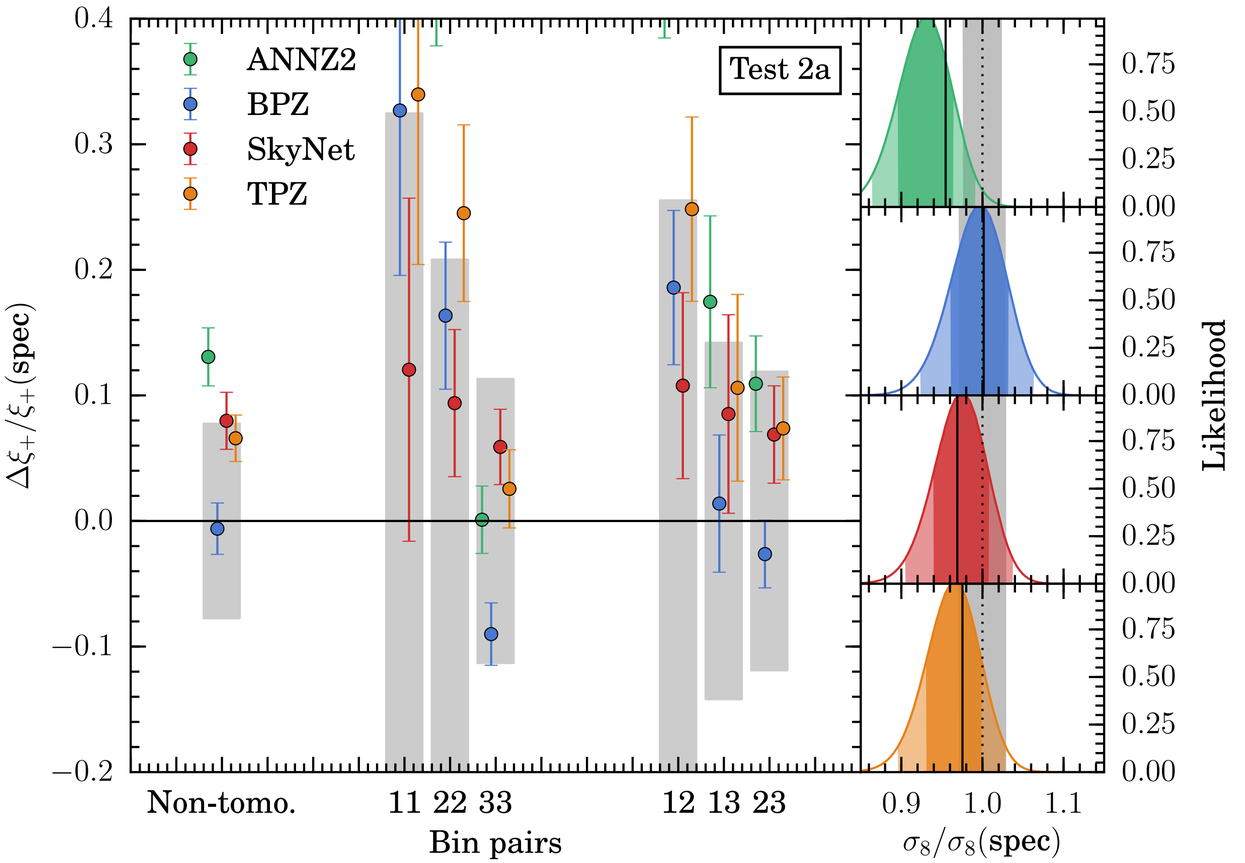


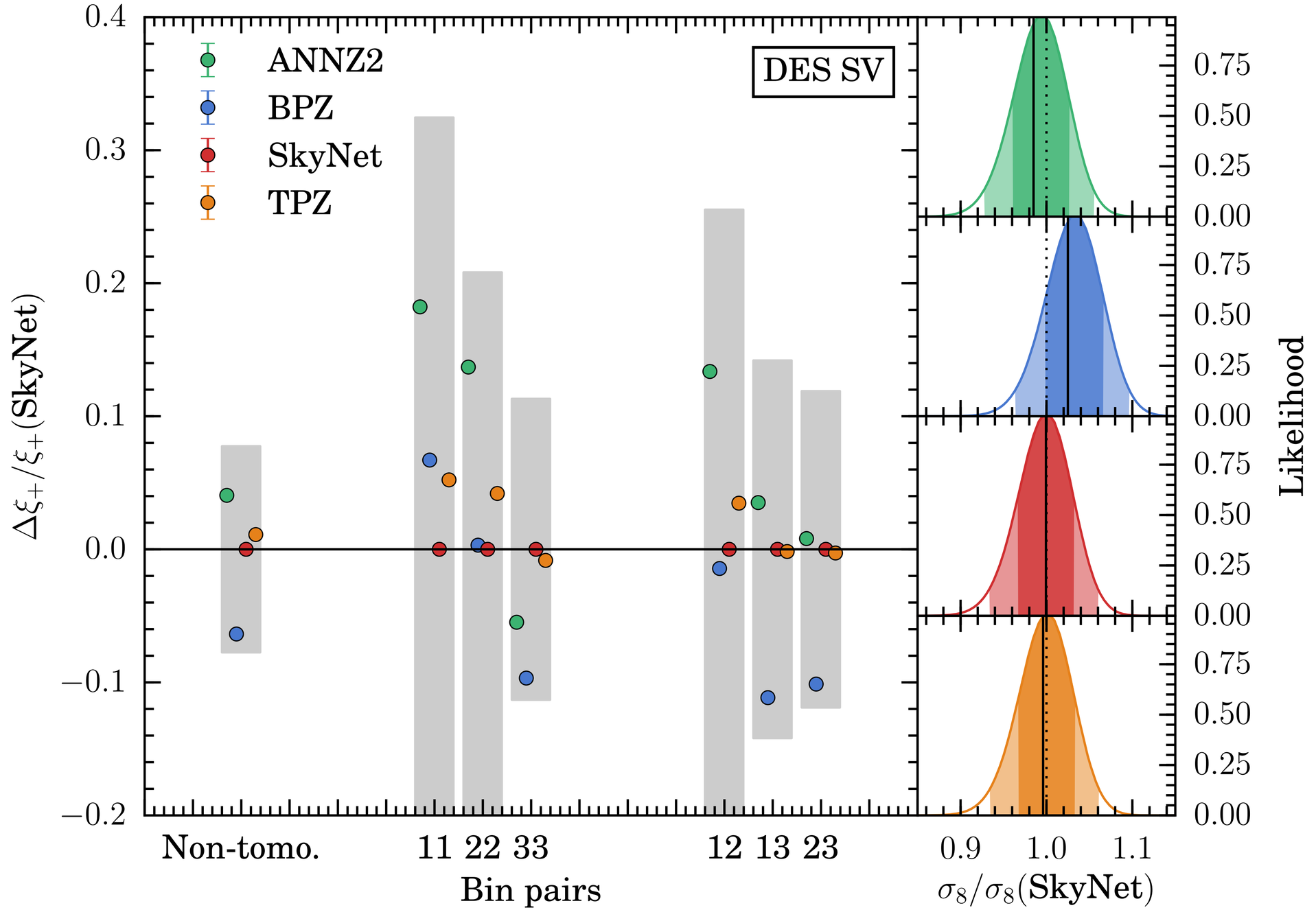
Error on the mean
~<0.05

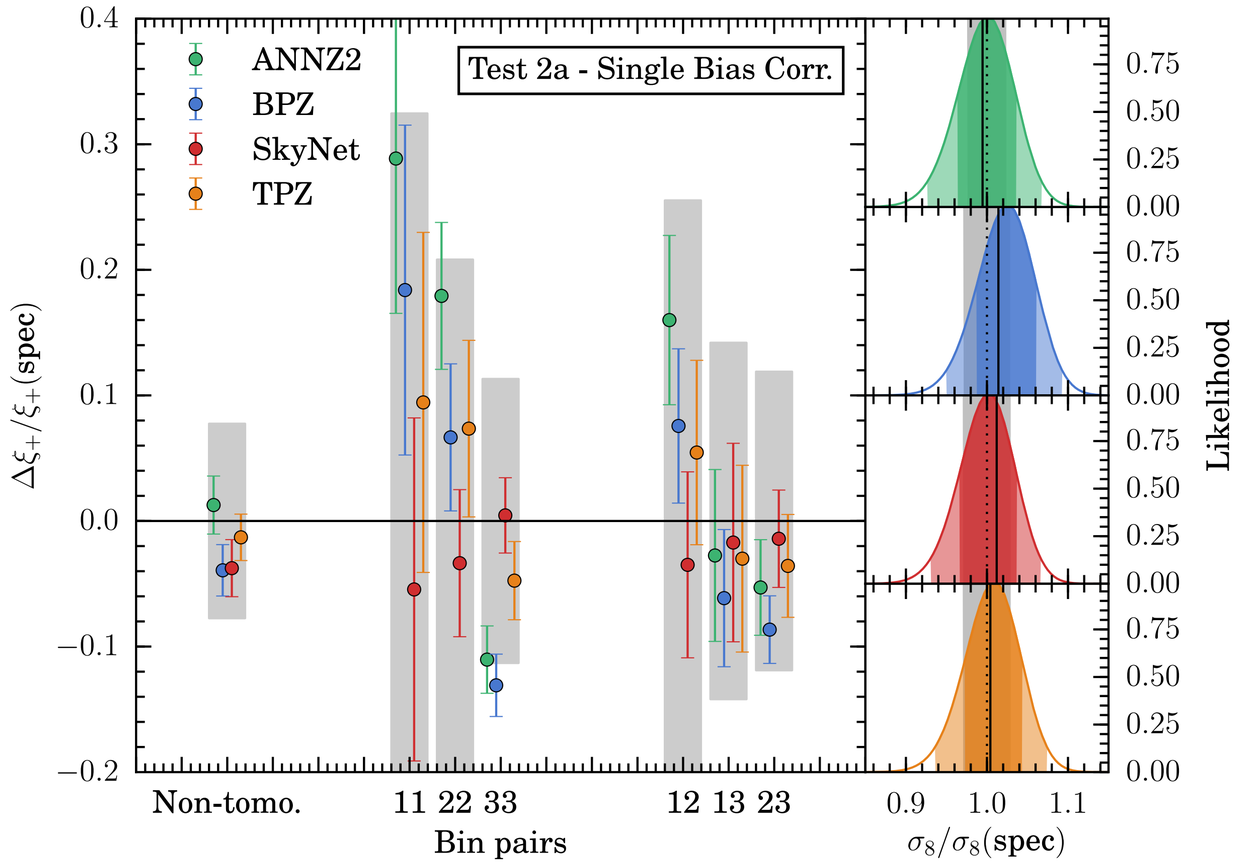


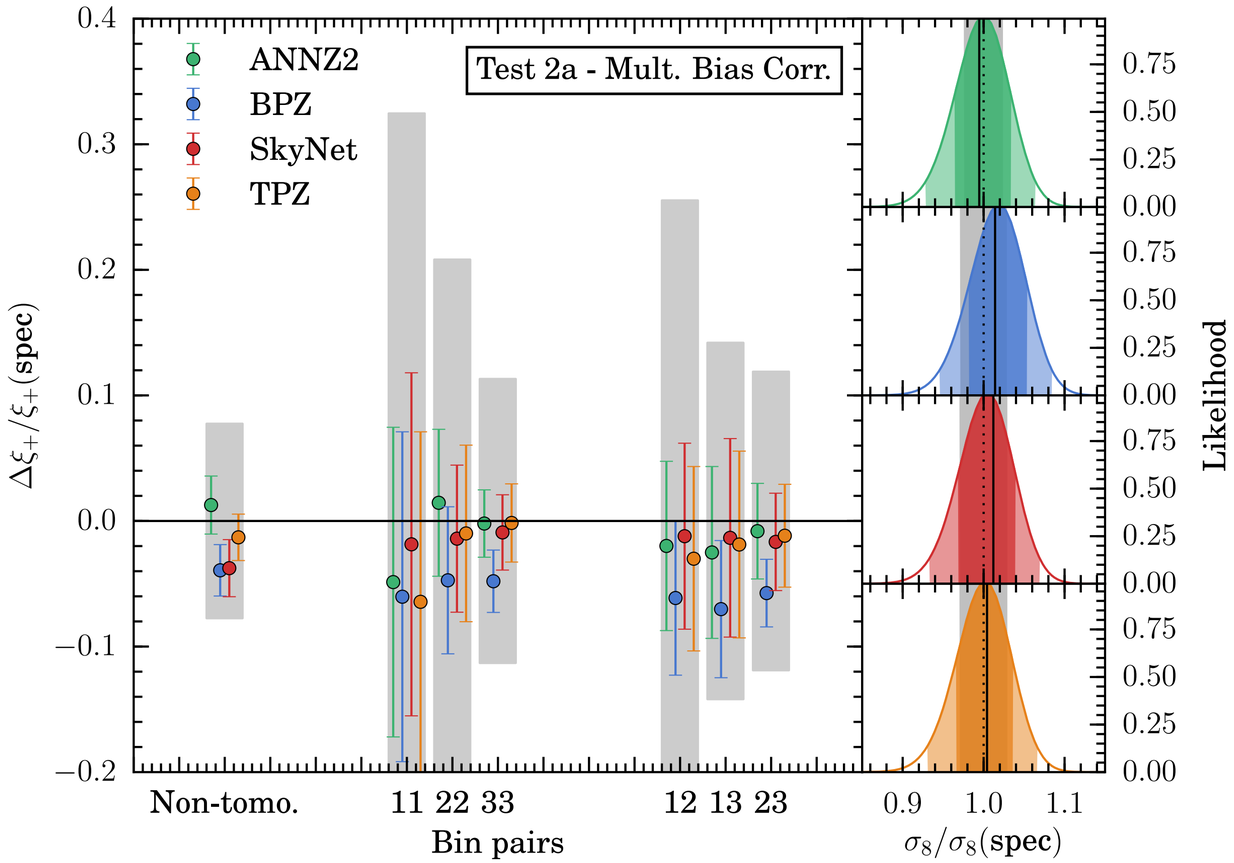
Implications for weak lensing

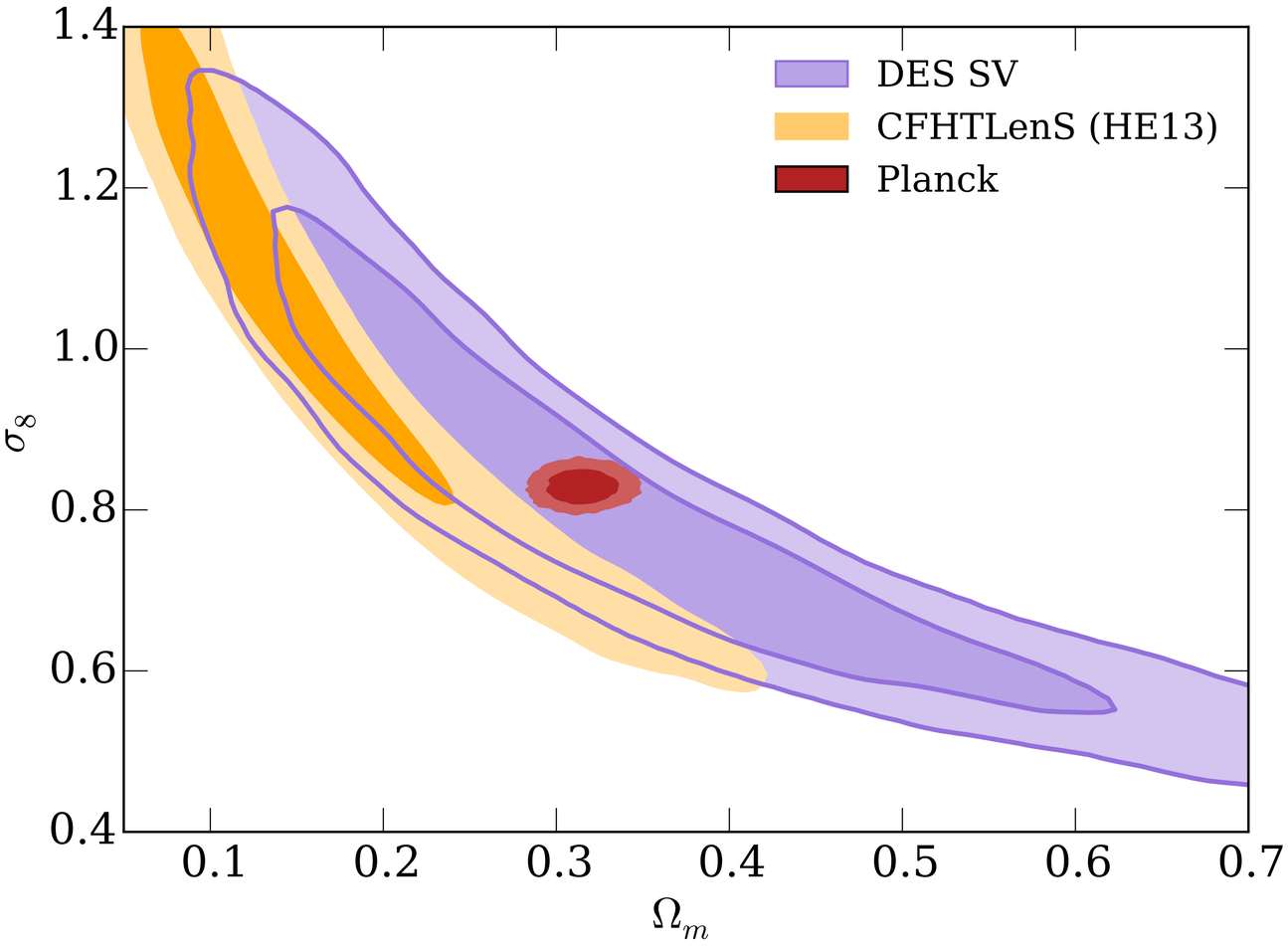

ANNZ2
BPZ
SkyNet
TPZ
Test 1
$\Delta\xi_+/\xi_+$(spec)
Non-tomo.
11 22 33
12 13 23
Bin pairs
σ_8/σ_8(spec)
Likelihood

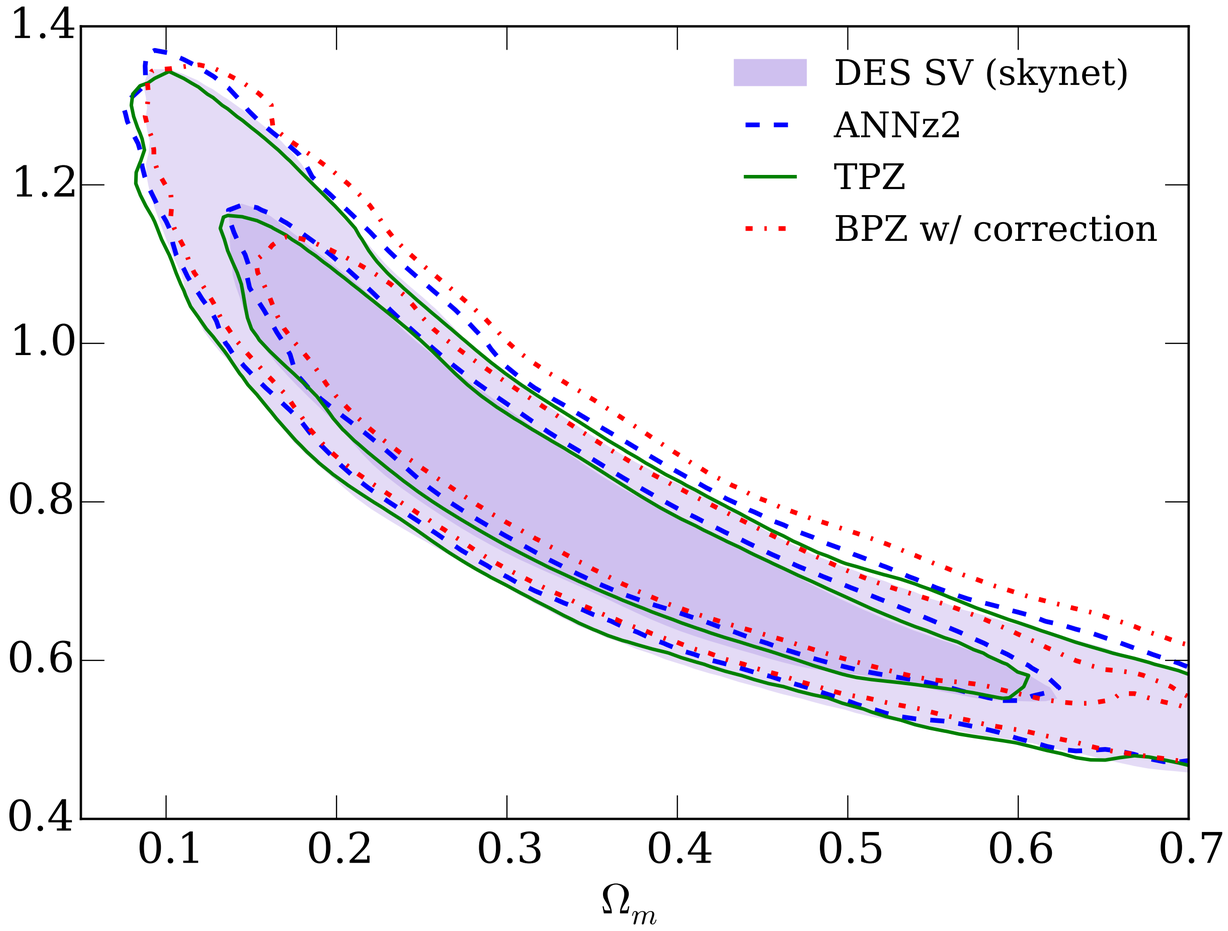

ANNZ2
BPZ
SkyNet
TPZ
Test 2a
$\Delta\xi_+/\xi_+$(spec)
Non-tomo.
11 22 33
12 13 23
Bin pairs
σ_8/σ_8(spec)
Likelihood


ANNZ2
BPZ
SkyNet
TPZ
DES SV
$\Delta\xi_+/\xi_+$(SkyNet)
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
Non-tomo.
11 22 33
12 13 23
Bin pairs
0.9
1.0
1.1
σ_8/σ_8(SkyNet)
0.75
0.50
0.25
0.00
Likelihood


ANNZ2
BPZ
SkyNet
TPZ
Test 2a - Single Bias Corr.
$\Delta\xi_+/\xi_+$(spec)
Non-tomo.
11 22 33
12 13 23
Bin pairs
σ_8/σ_8(spec)
Likelihood


ANNZ2
BPZ
SkyNet
TPZ
Test 2a - Mult. Bias Corr.
$\Delta\xi_+/\xi_+$(spec)
Non-tomo.
11 22 33
12 13 23
Bin pairs
σ_8/σ_8(spec)
Likelihood





Marginalise over 0.05 gaussian error on the mean in each tomo-bin

arXiv:1507.05552

So what about the future and stuff?

Accurate photometry:
PSF- Gaussianized photometry -GAaP (KiDS, CFHTLenS, arXiv:1507.00738)
NGMIX- multi-epoc mulity band model fitting (DES, https://github.com/esheldon/ngmix)
BCC-UFIG- image simulations
Balrog (Suchyta et al in prep, https://github.com/emhuff/Balrog)
Tractor- probabilistic estimates (Lang & Hogg)

Non traditional:
Cross correlations with Spec or Clusters (Newmann et al , Menard et al, …)
(Depends on bias evolution, and lensing magnification)
Inference with log-normal density field (Haydes, Jasche & Wandelt)
(Current iteration one needs to choose a cosmology, changes on the way…)