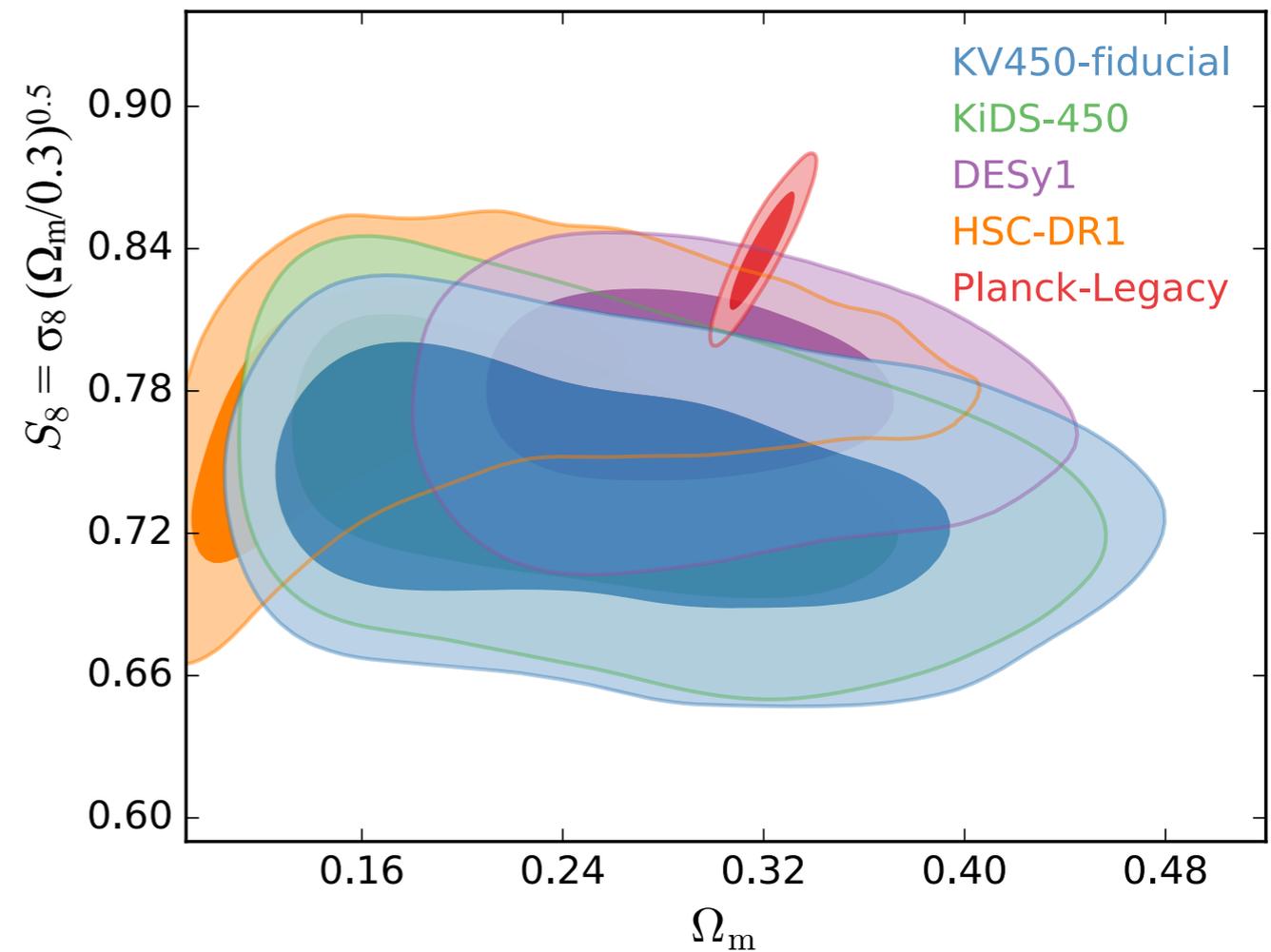
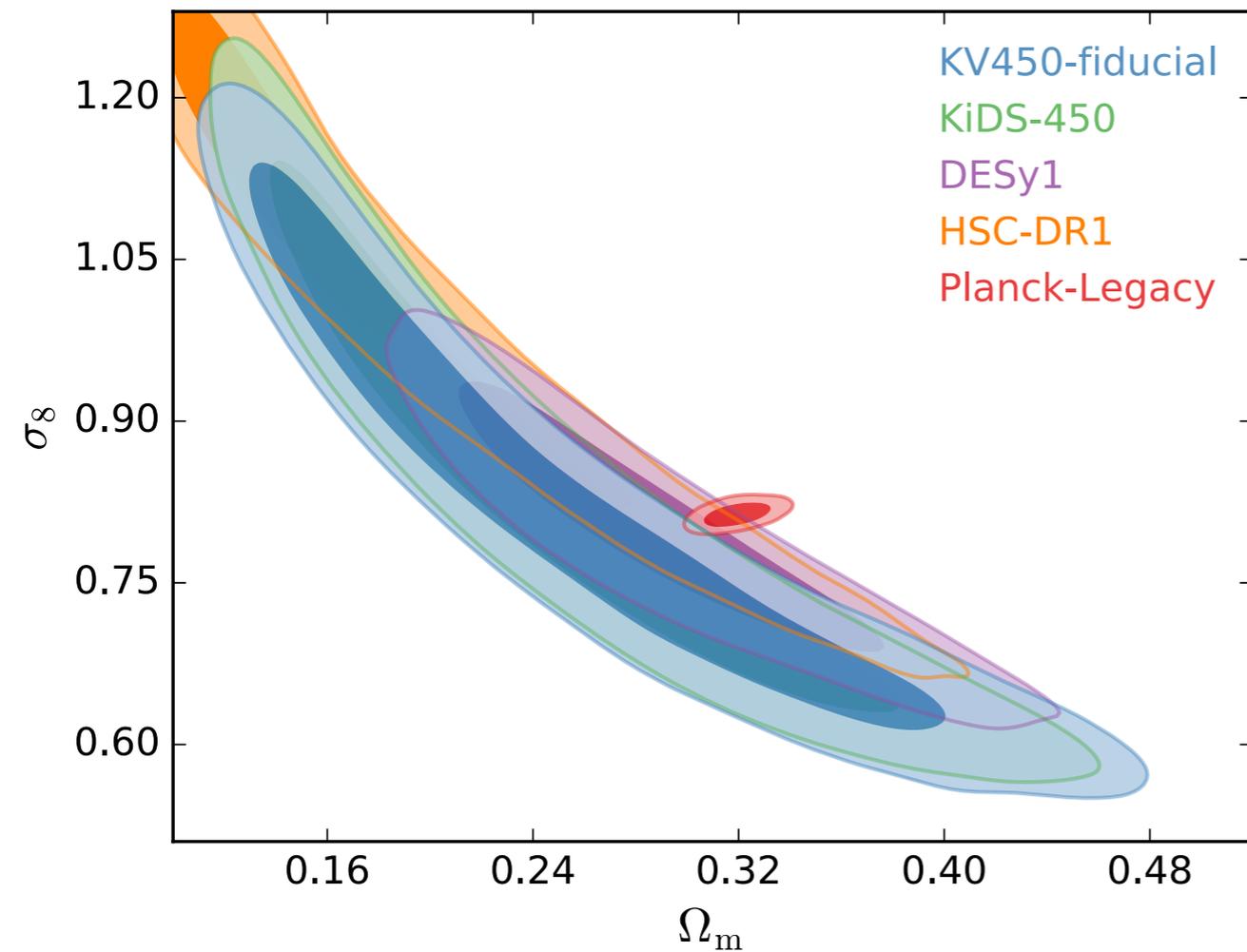


KIDS+VIKING: Cosmic shear tomography with optical+IR data

Hendrik Hildebrandt - Ruhr-University Bochum



KiDS-VIKING-450



KV450: 1/3 of the data, full depth

DES: 1/3 of the data, half depth

HSC: 1/10 of the data, full depth

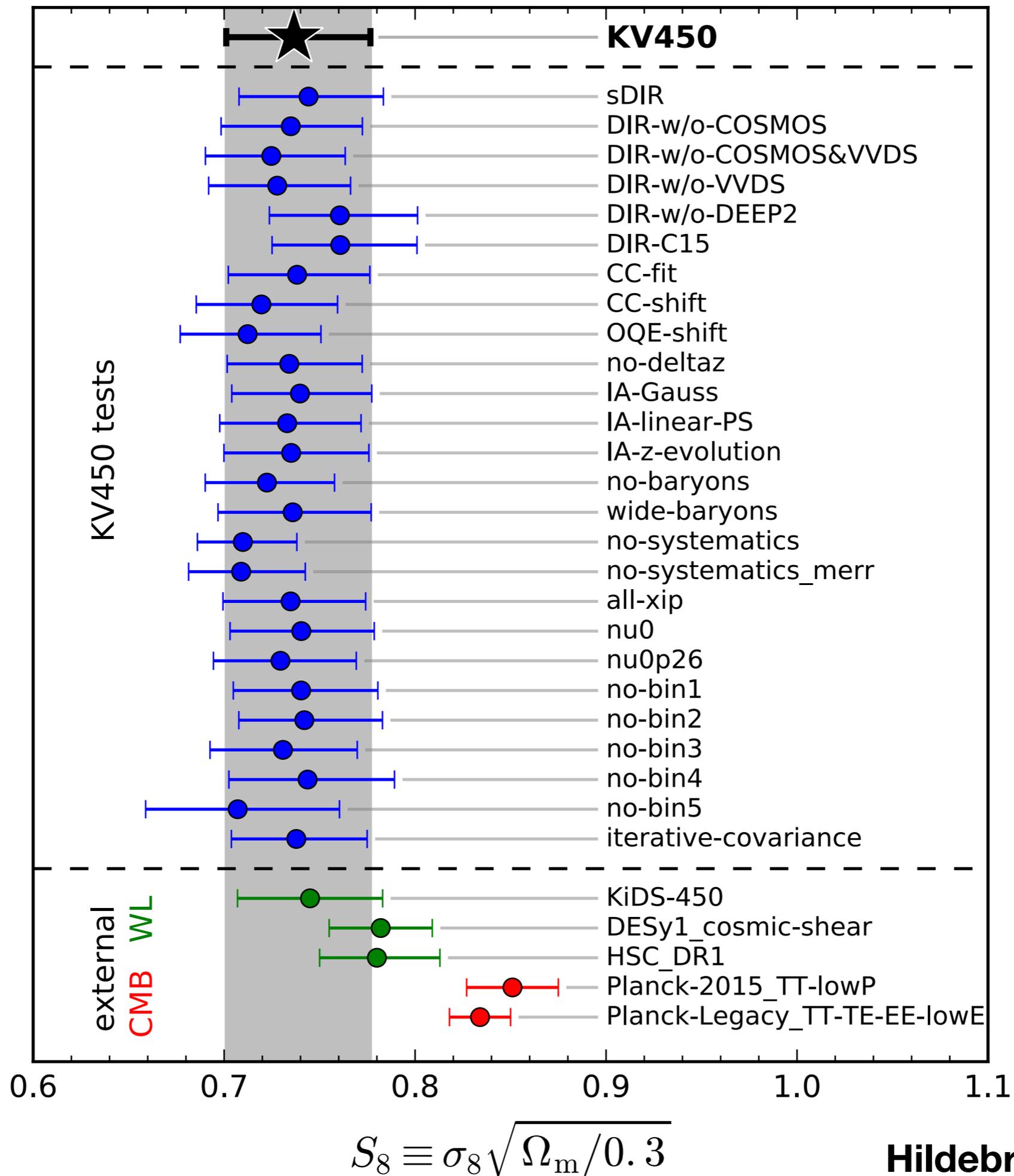
Observation \rightarrow theory

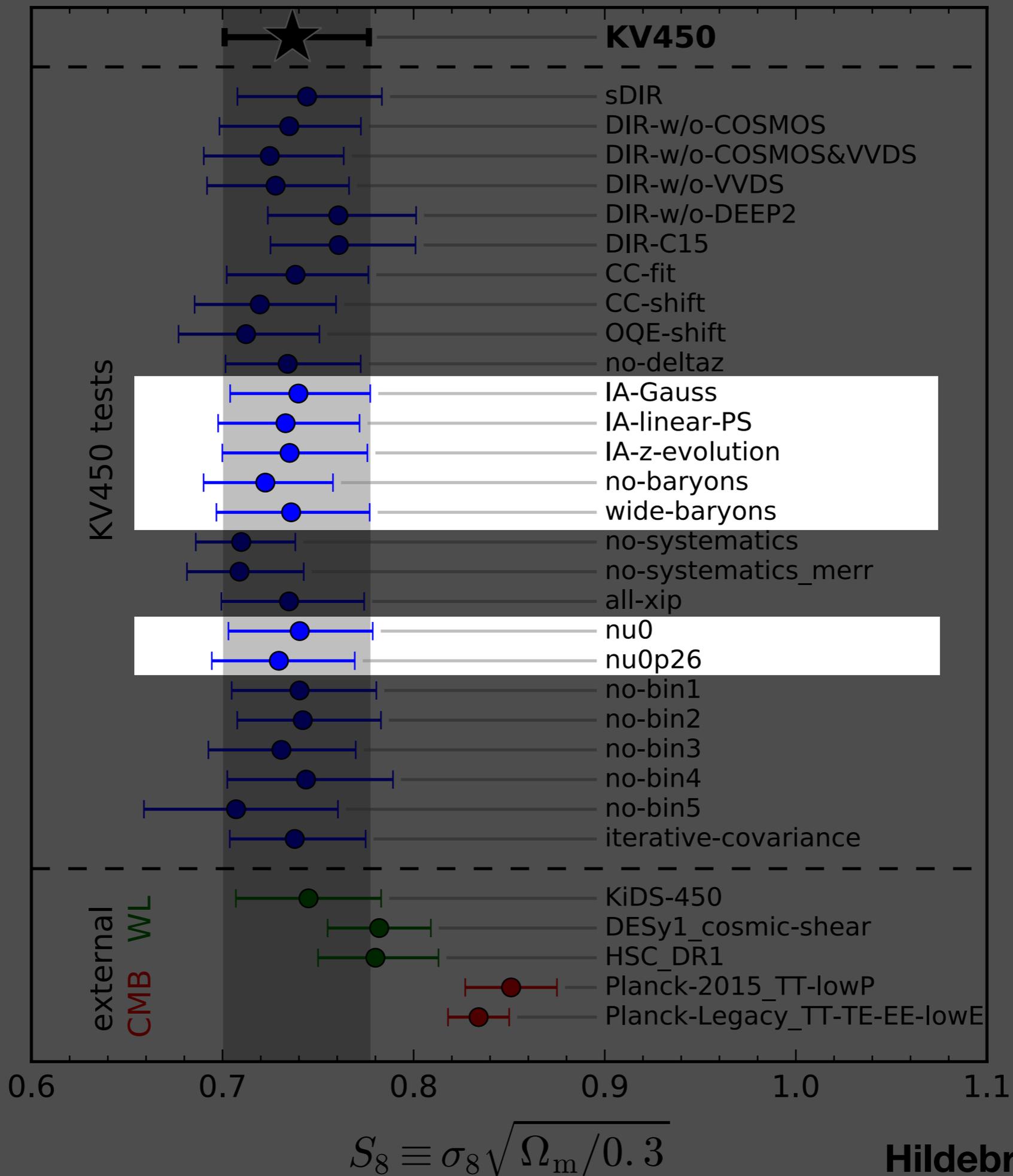
$$\xi_{\pm}(\theta) = \langle \gamma_t \gamma_t \rangle (\theta) \pm \langle \gamma_x \gamma_x \rangle (\theta)$$

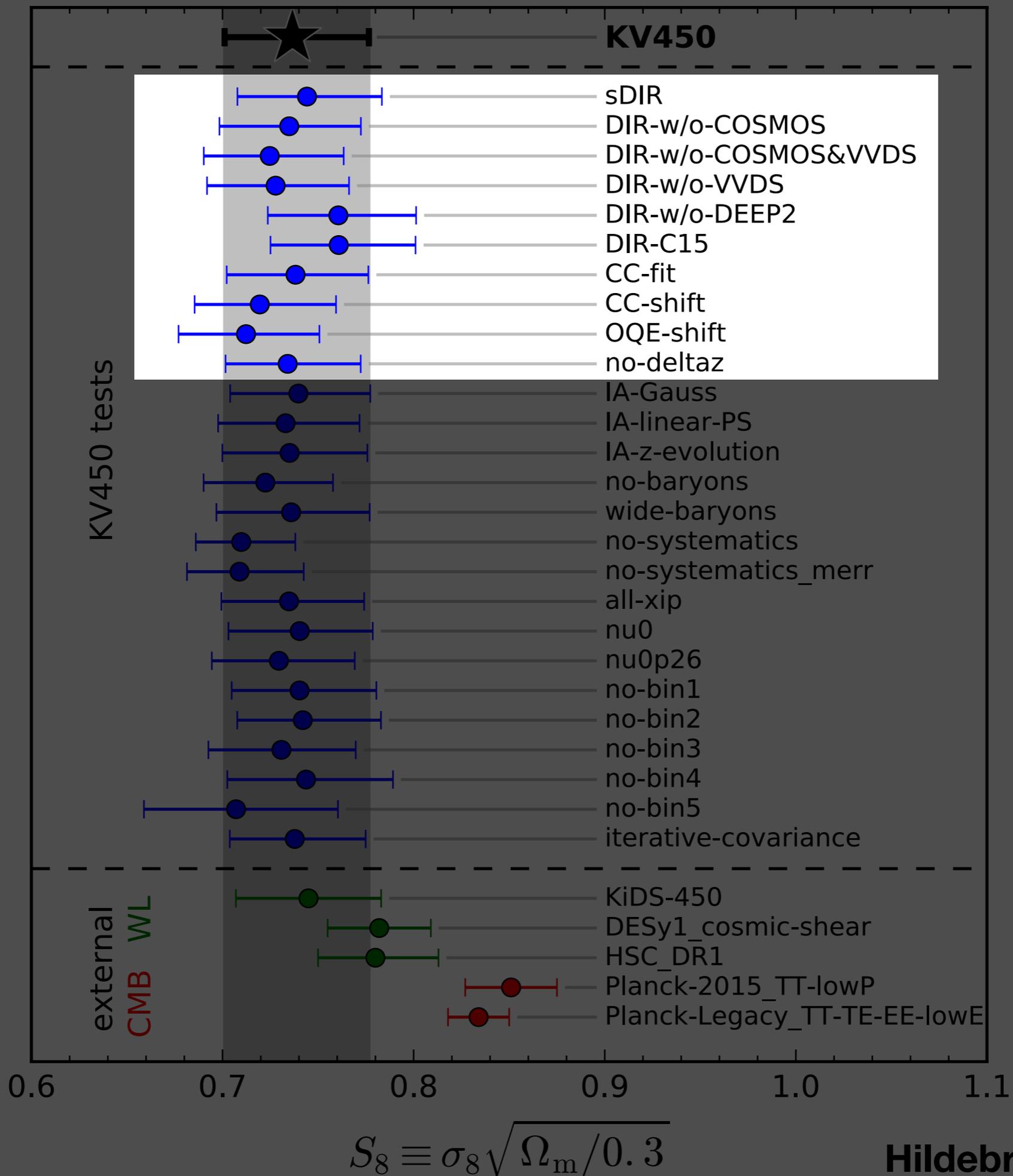
$$\xi_{+}(\theta) = \int_0^{\infty} \frac{d\ell \ell}{2\pi} J_0(\ell\theta) P_{\kappa}(\ell) ; \quad \xi_{-}(\theta) = \int_0^{\infty} \frac{d\ell \ell}{2\pi} J_4(\ell\theta) P_{\kappa}(\ell)$$

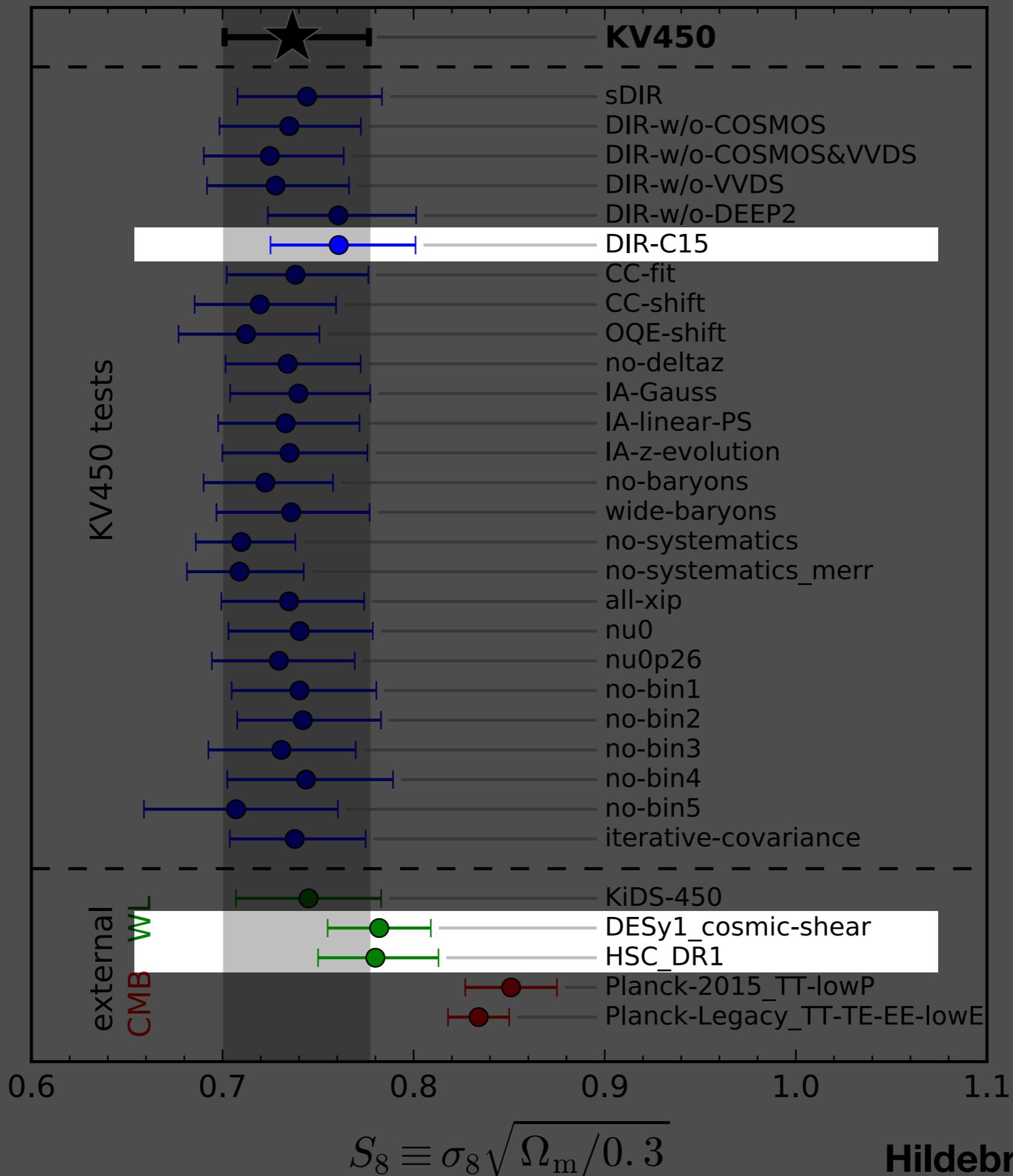
$$P_{\kappa}(\ell) = \frac{9H_0^4 \Omega_m^2}{4c^4} \int_0^{\chi_h} d\chi \frac{g^2(\chi)}{a^2(\chi)} P_{\delta} \left(\frac{\ell}{f_K(\chi)}, \chi \right)$$

$$g(\chi) = \int_{\chi}^{\chi_h} d\chi' p_{\chi}(\chi') \frac{f_K(\chi' - \chi)}{f_K(\chi')}$$

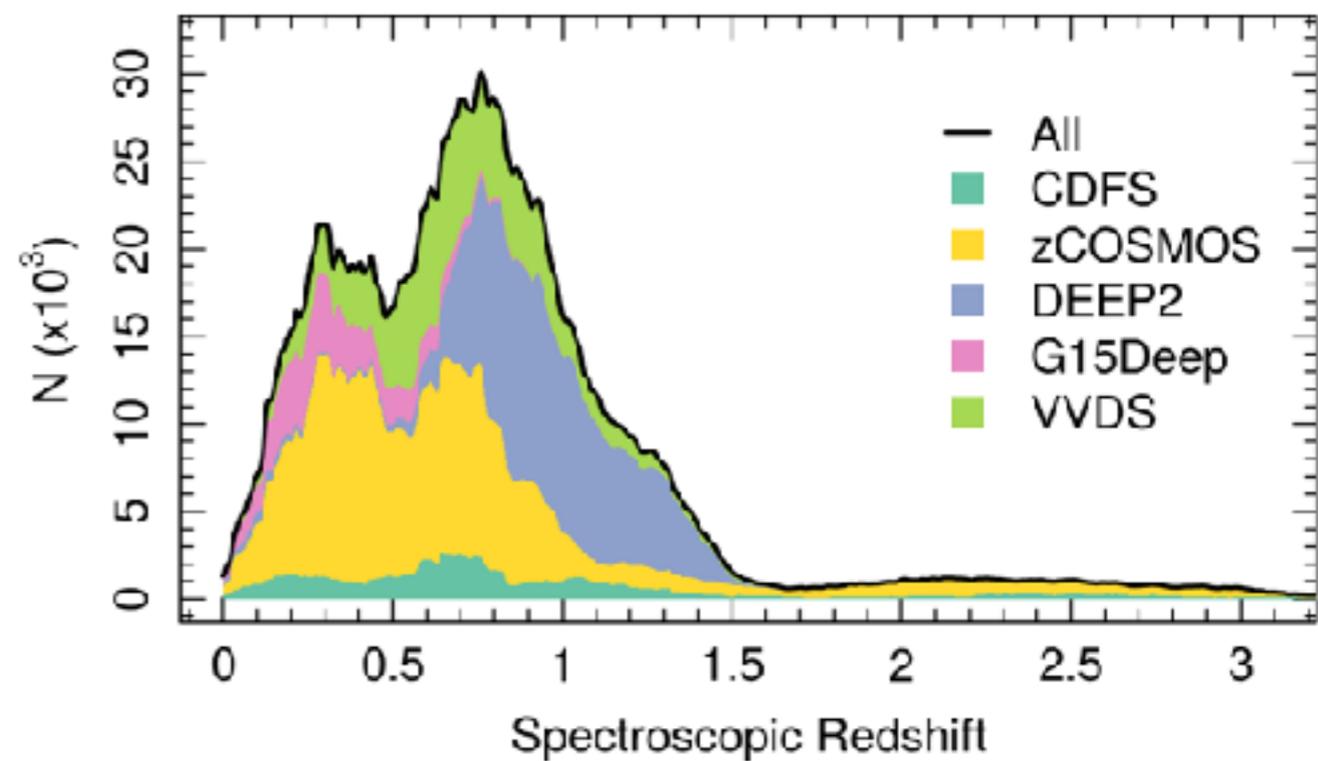
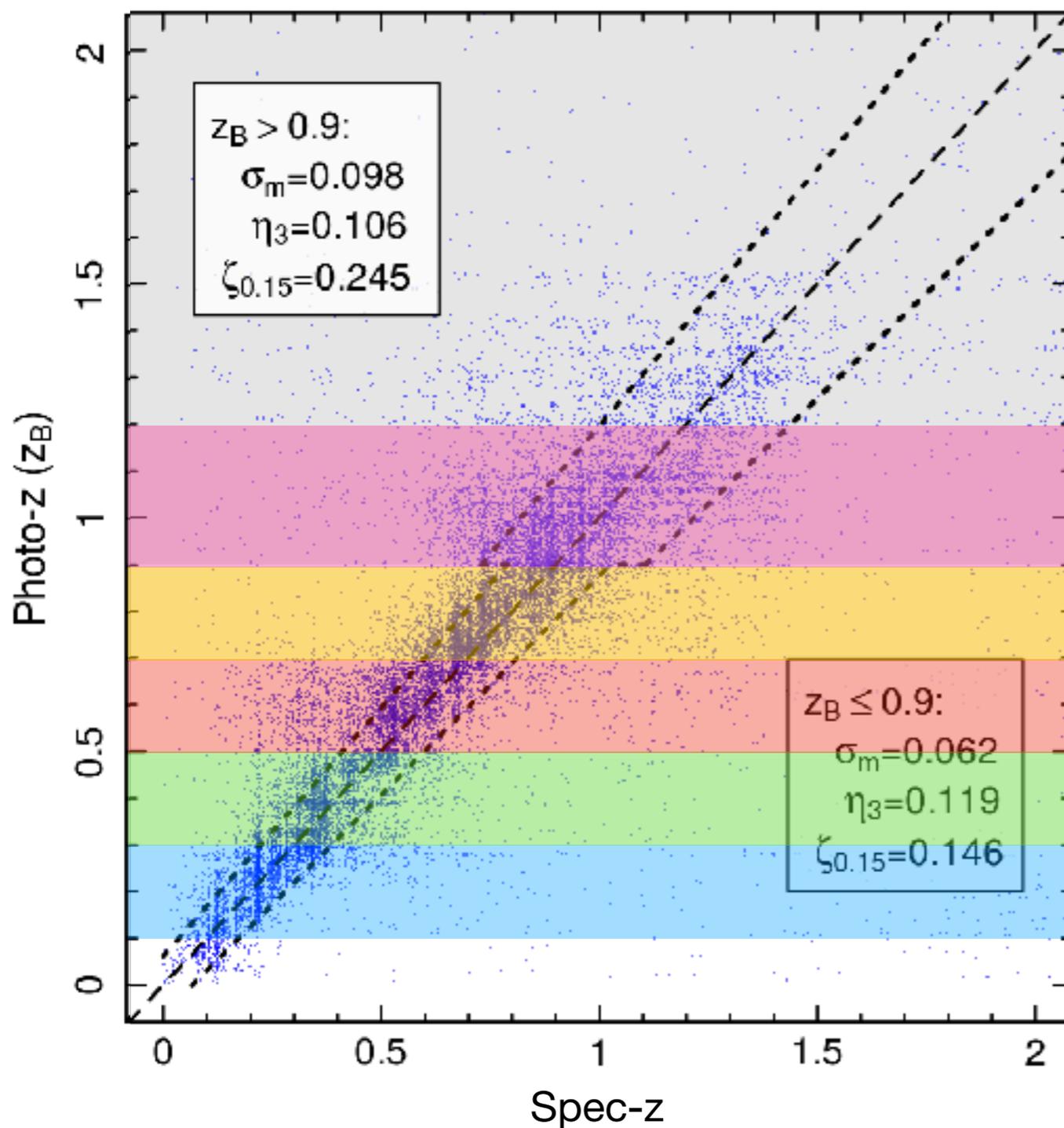






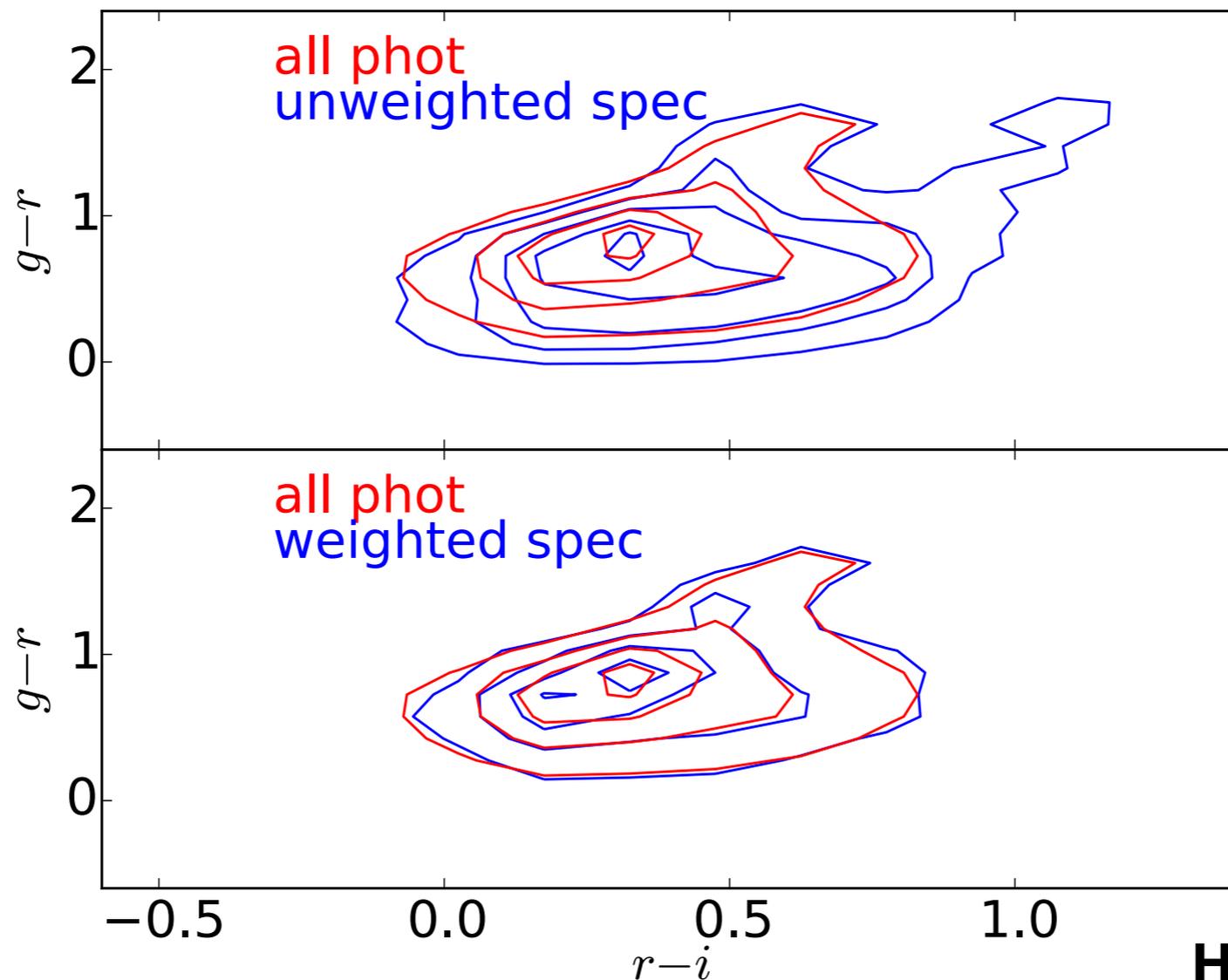


Photometric redshifts



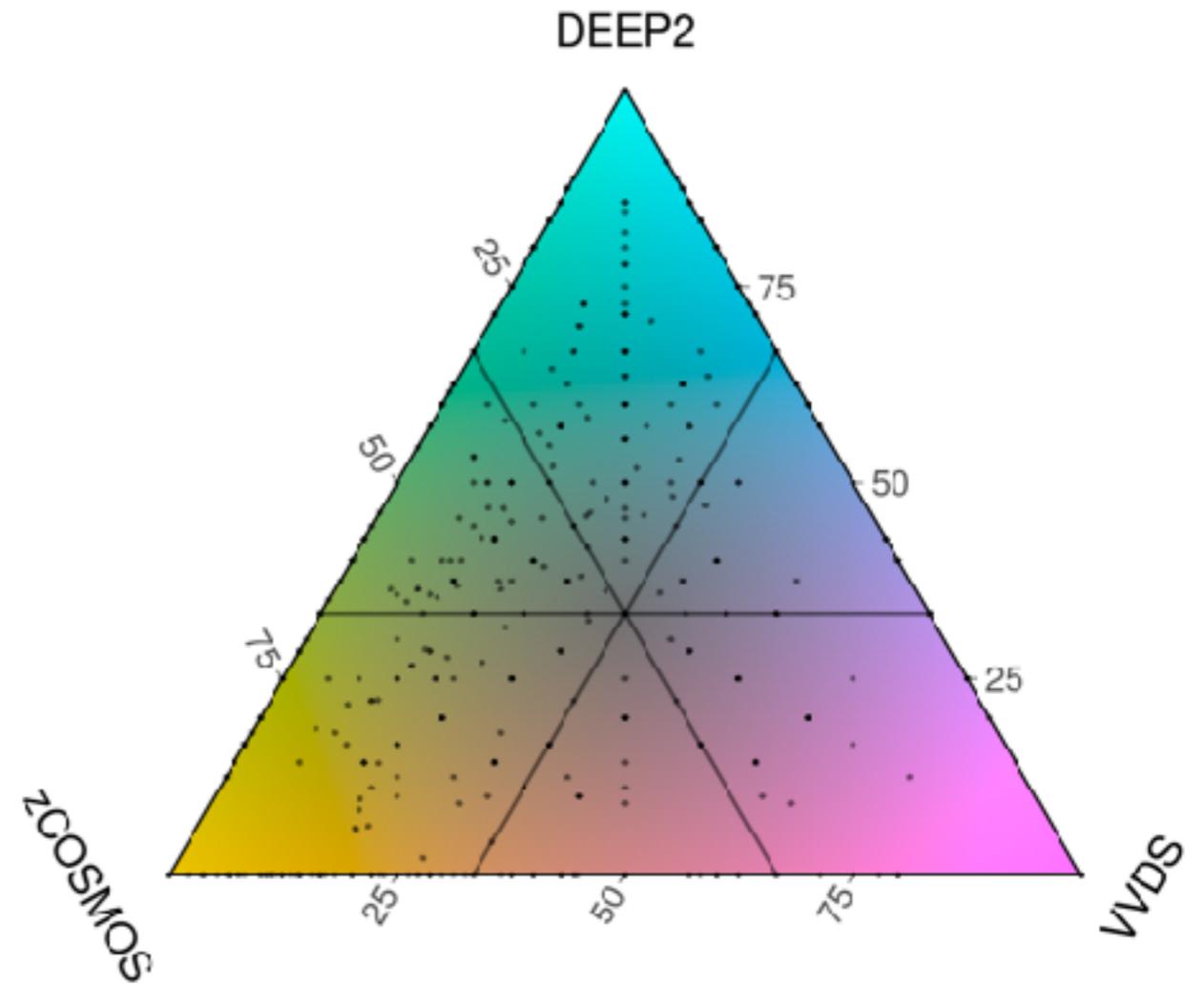
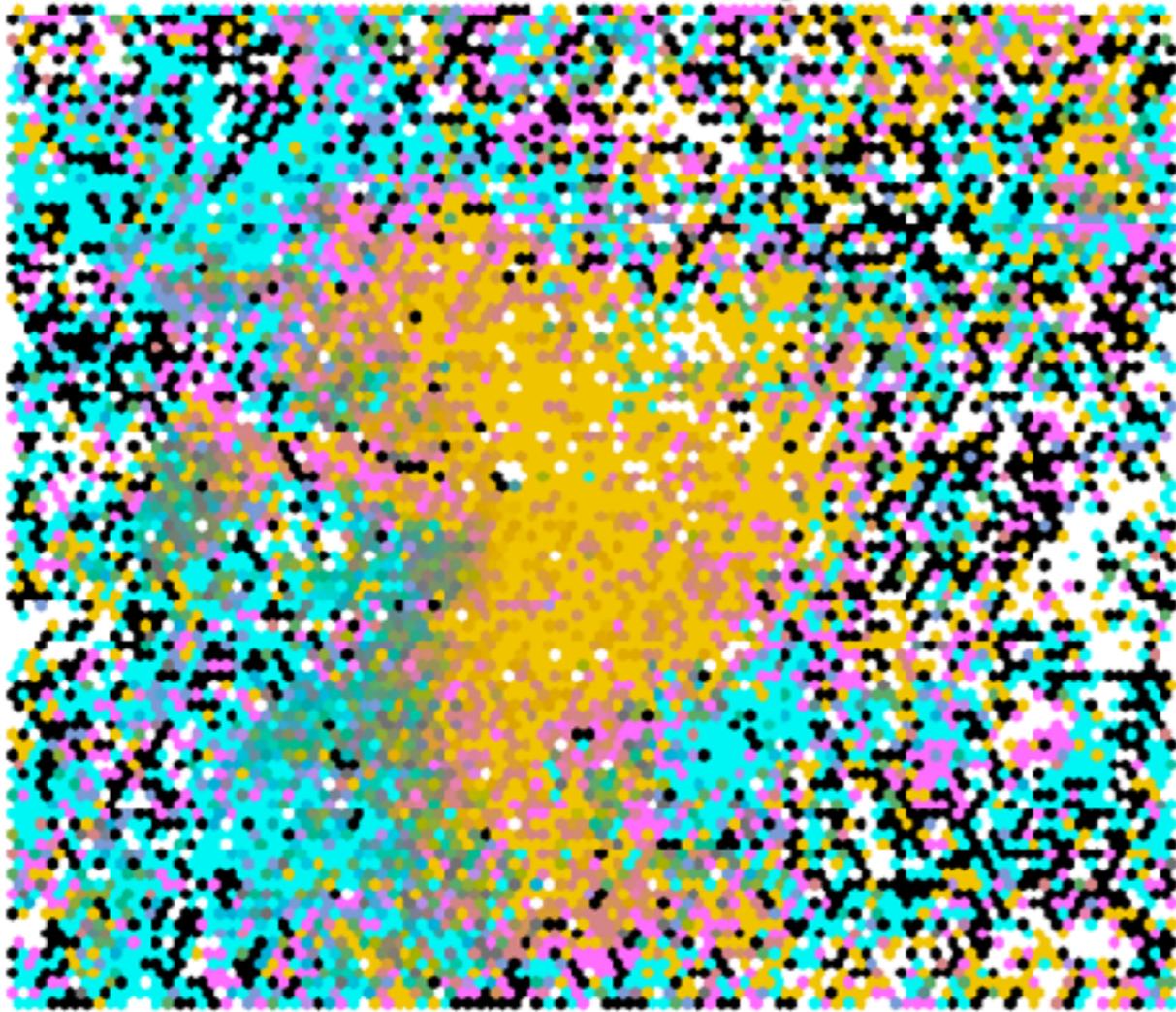
Redshift calibration

- Re-weight spec-z surveys to be more representative.
- Magnitude space needs to be fully covered.
- Requires unique relation colour-redshift relation.
- Requires extremely reliable spec-z.



Self-organising map

Fiducial Training

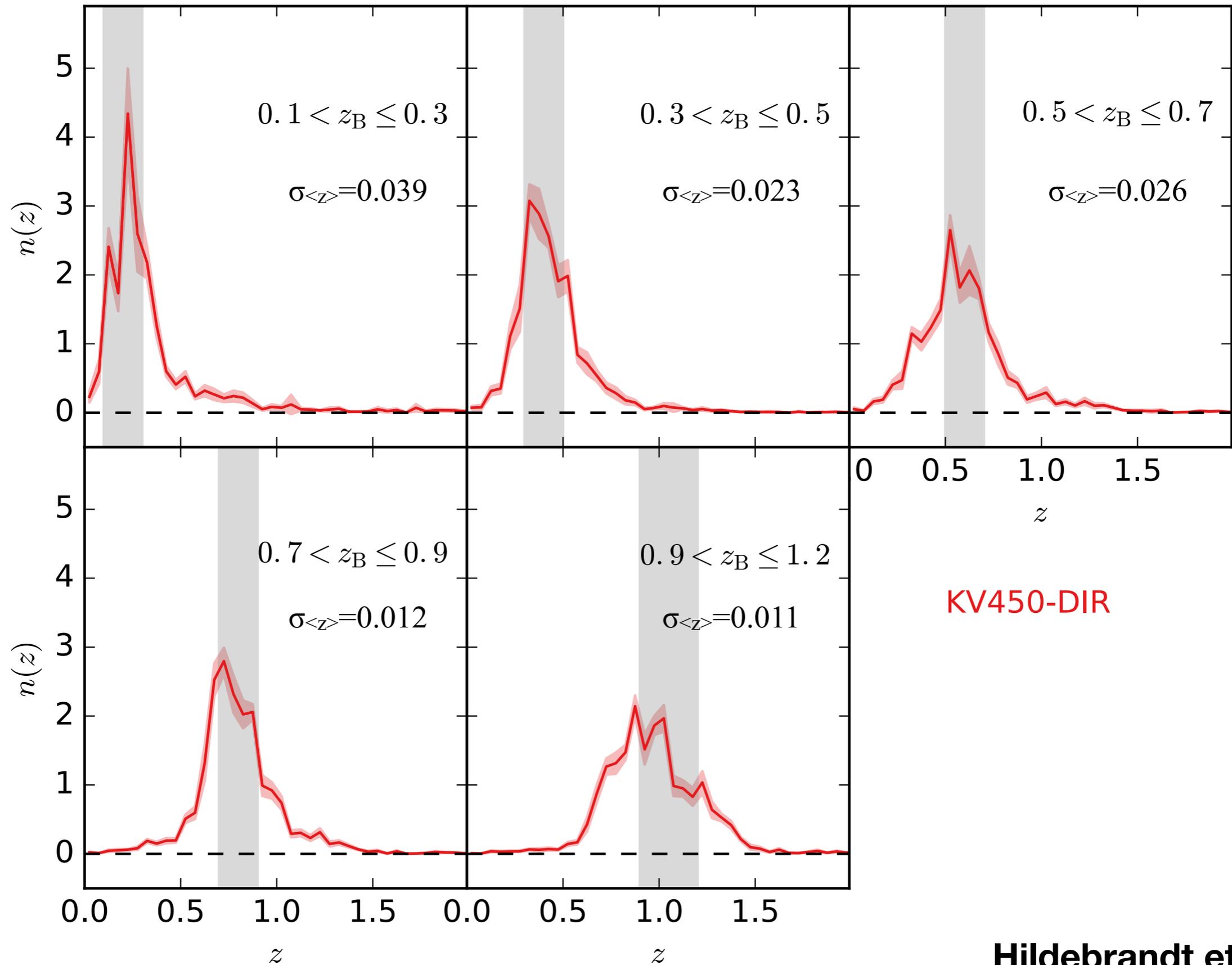


99.2% coverage of 9D mag space in KV450.

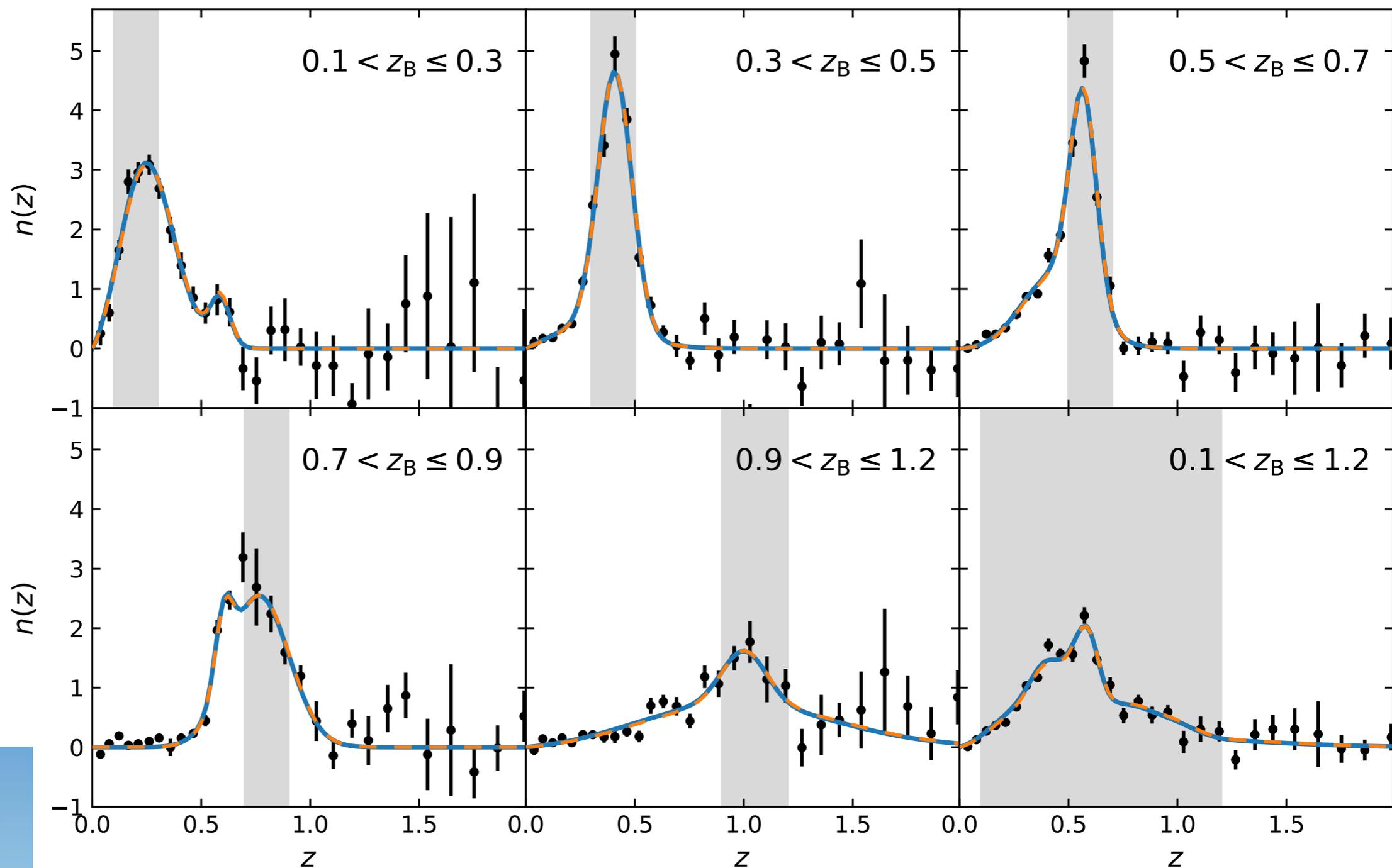


Wright et al. in prep.

Redshift distributions

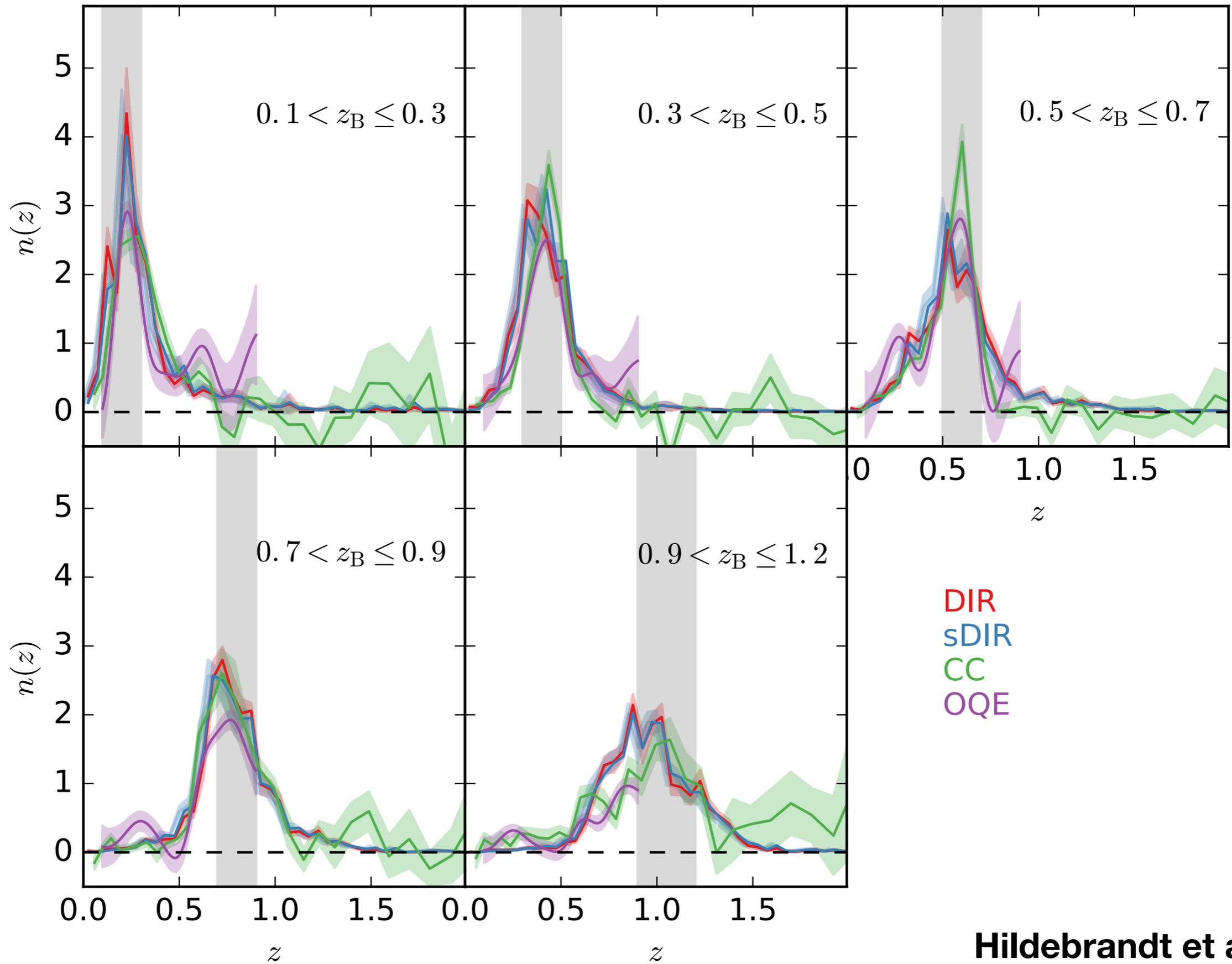


KV450 clustering-z



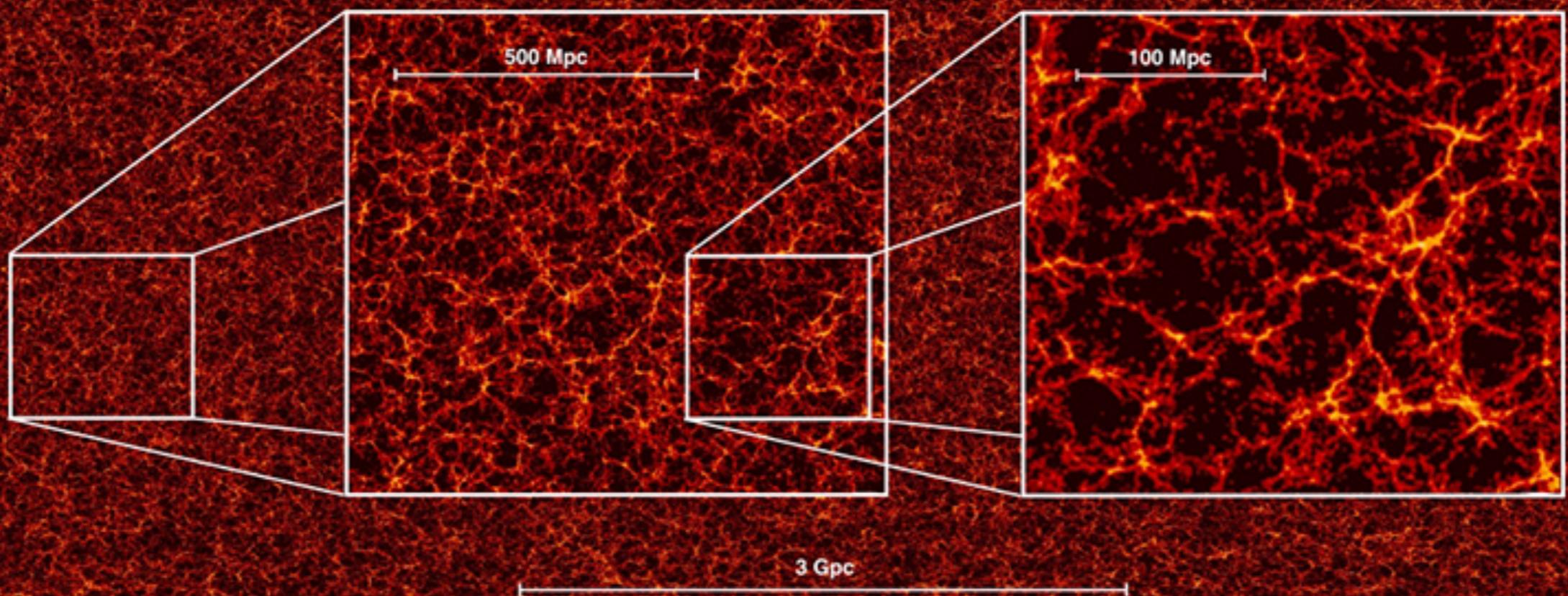
van den Busch et al. in prep.
Hildebrandt et al. (2018)

KV450 $n(z)$



Testing KiDS-VIKING photo-z on MICE

MICE Grand Challenge: an all-sky lightcone Nbody simulation using 4000^3 particles and 4096 processors

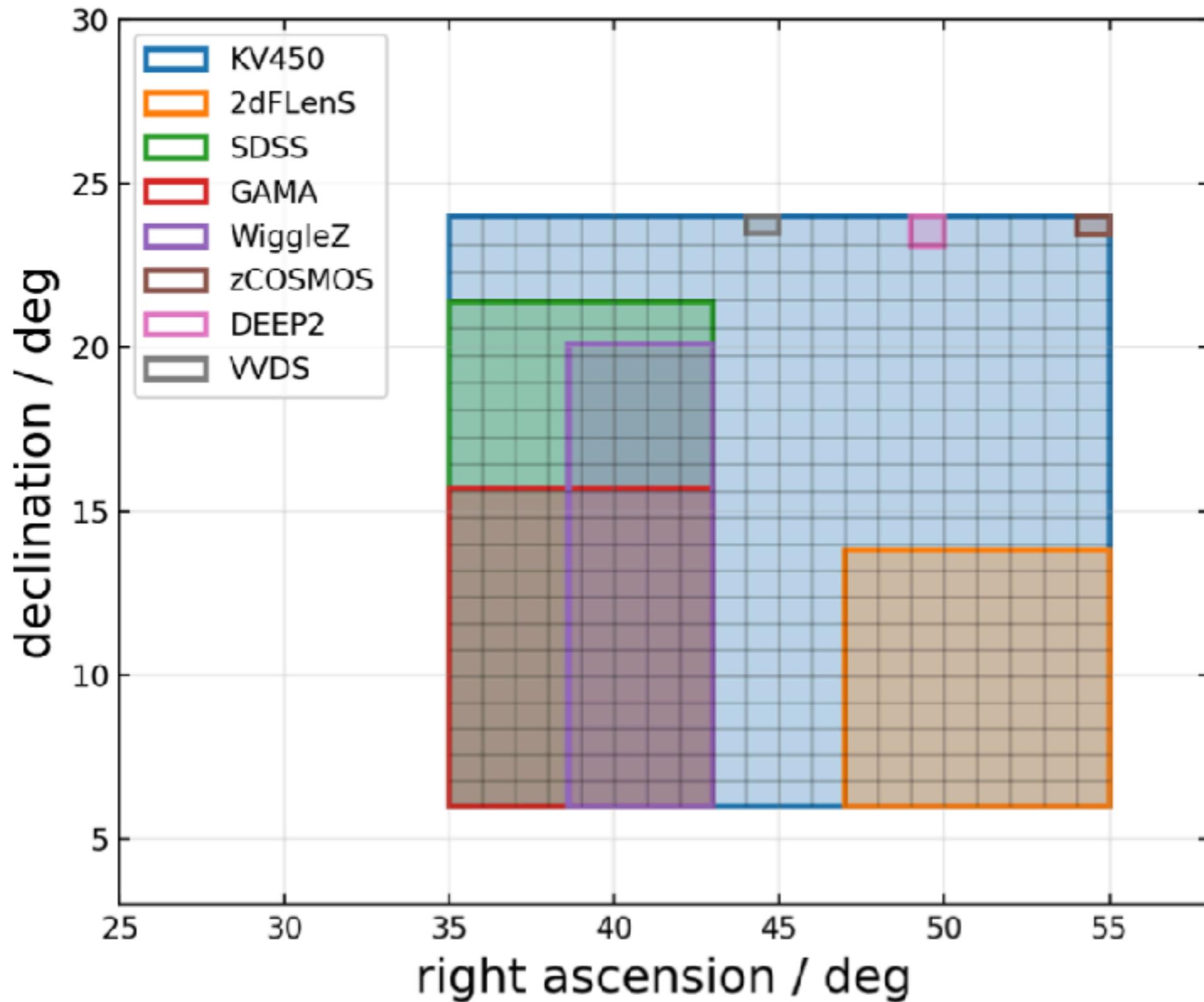


Cosmological Simulations © Marenostrum Supercomputer

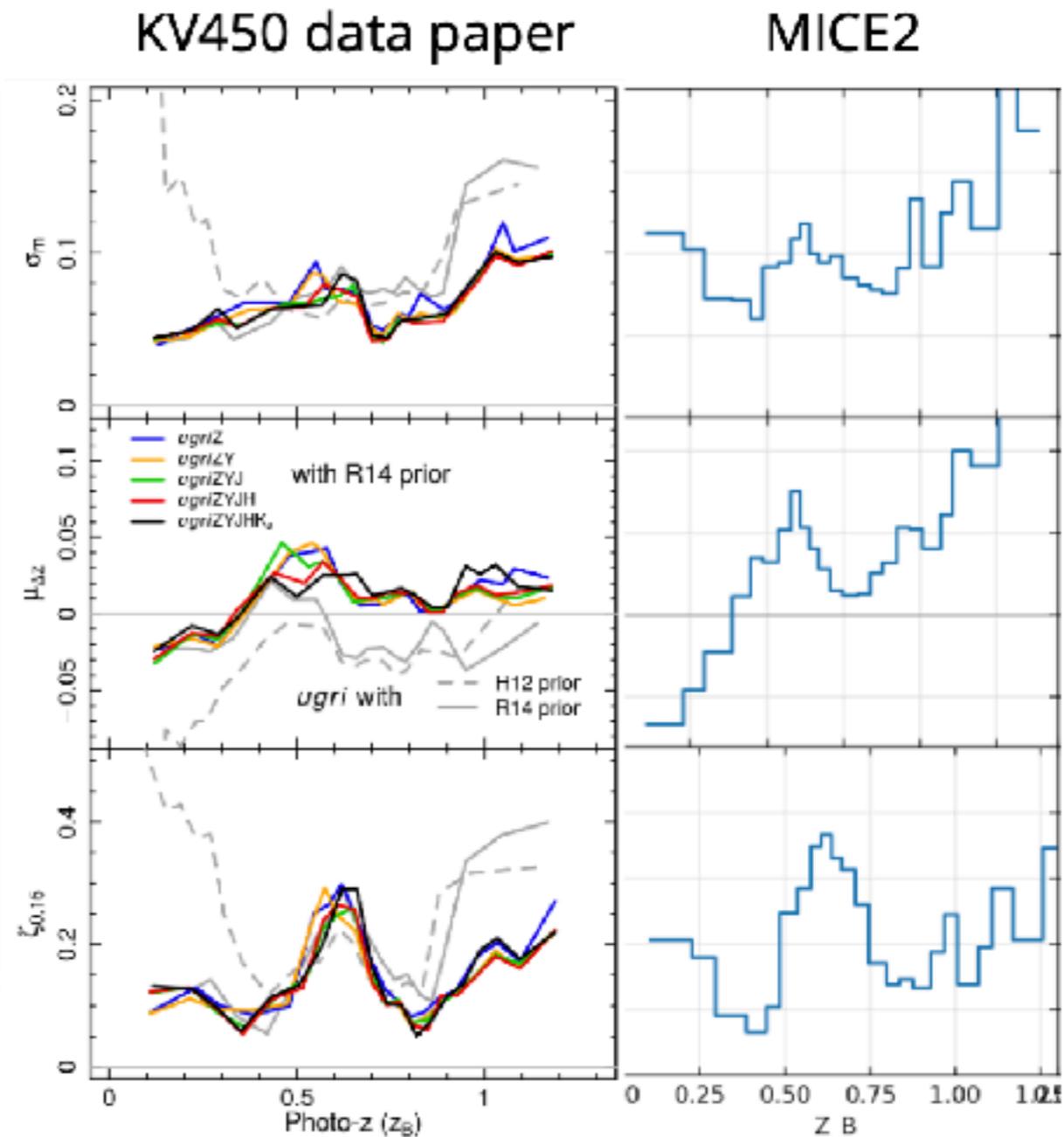
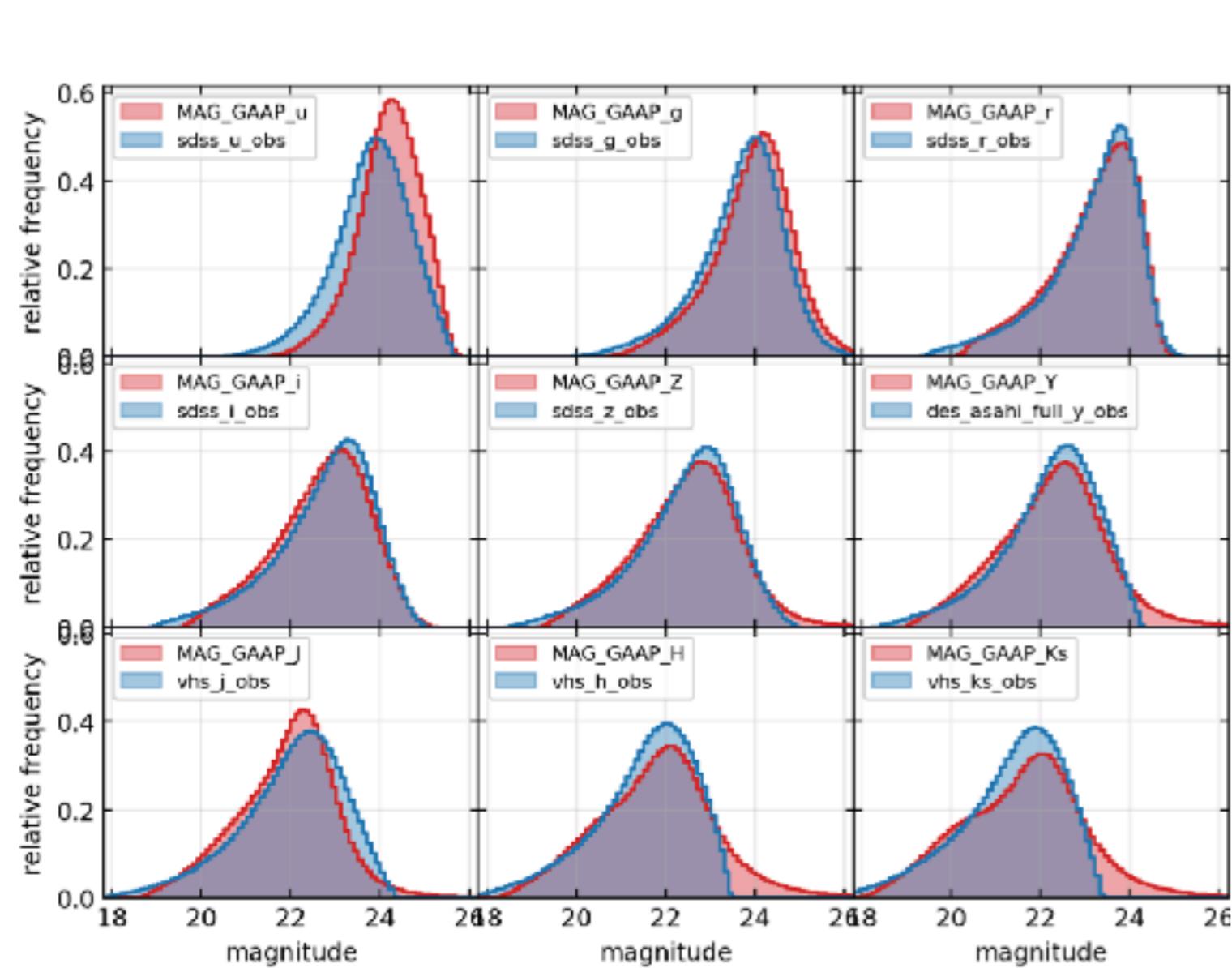
MICE

~200 million galaxies over 5000 sq.deg and up to a redshift $z=1.4$
Not the same as the data but similarly complex as the data.

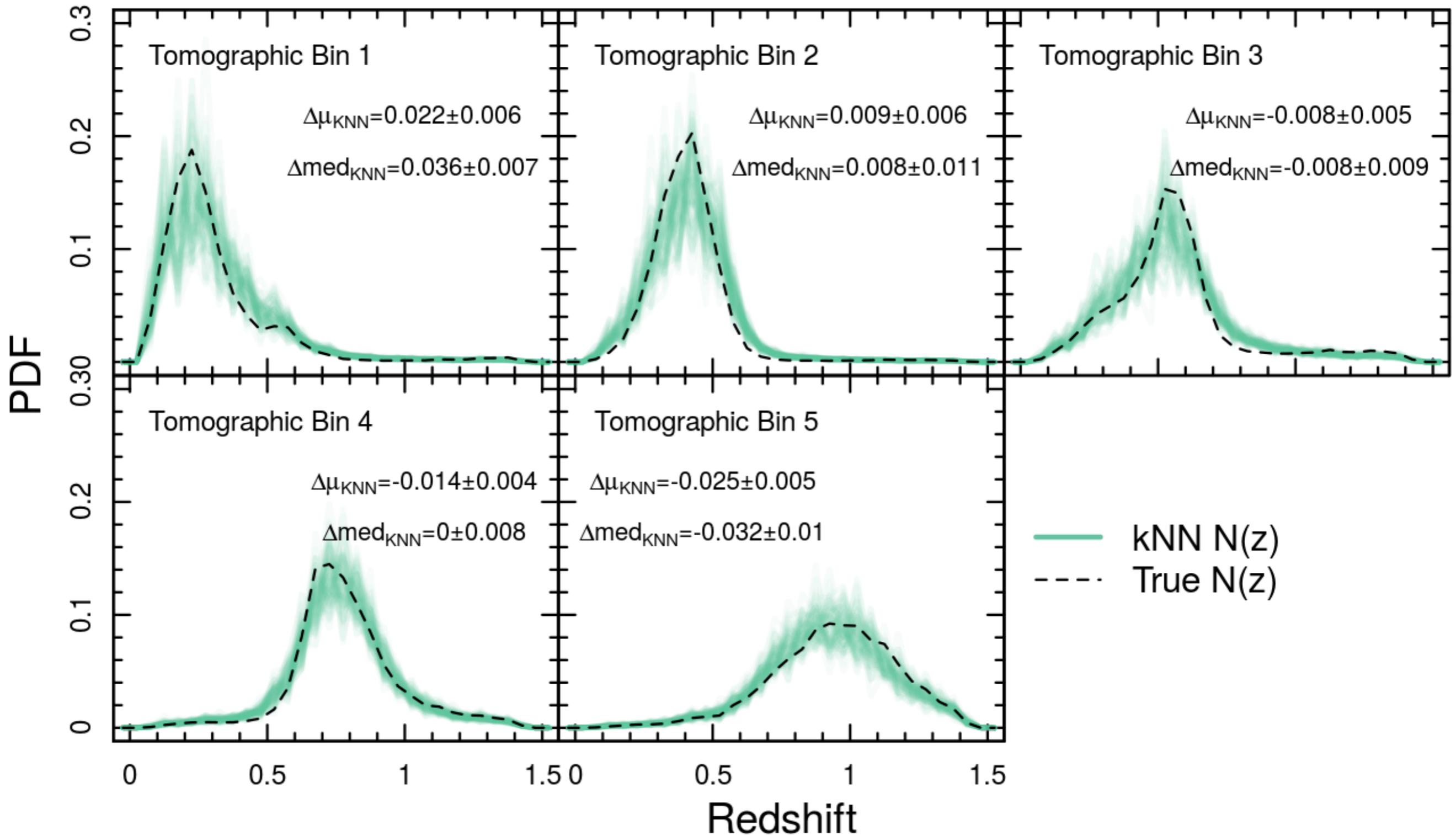
MICE2 - KV450 mocks



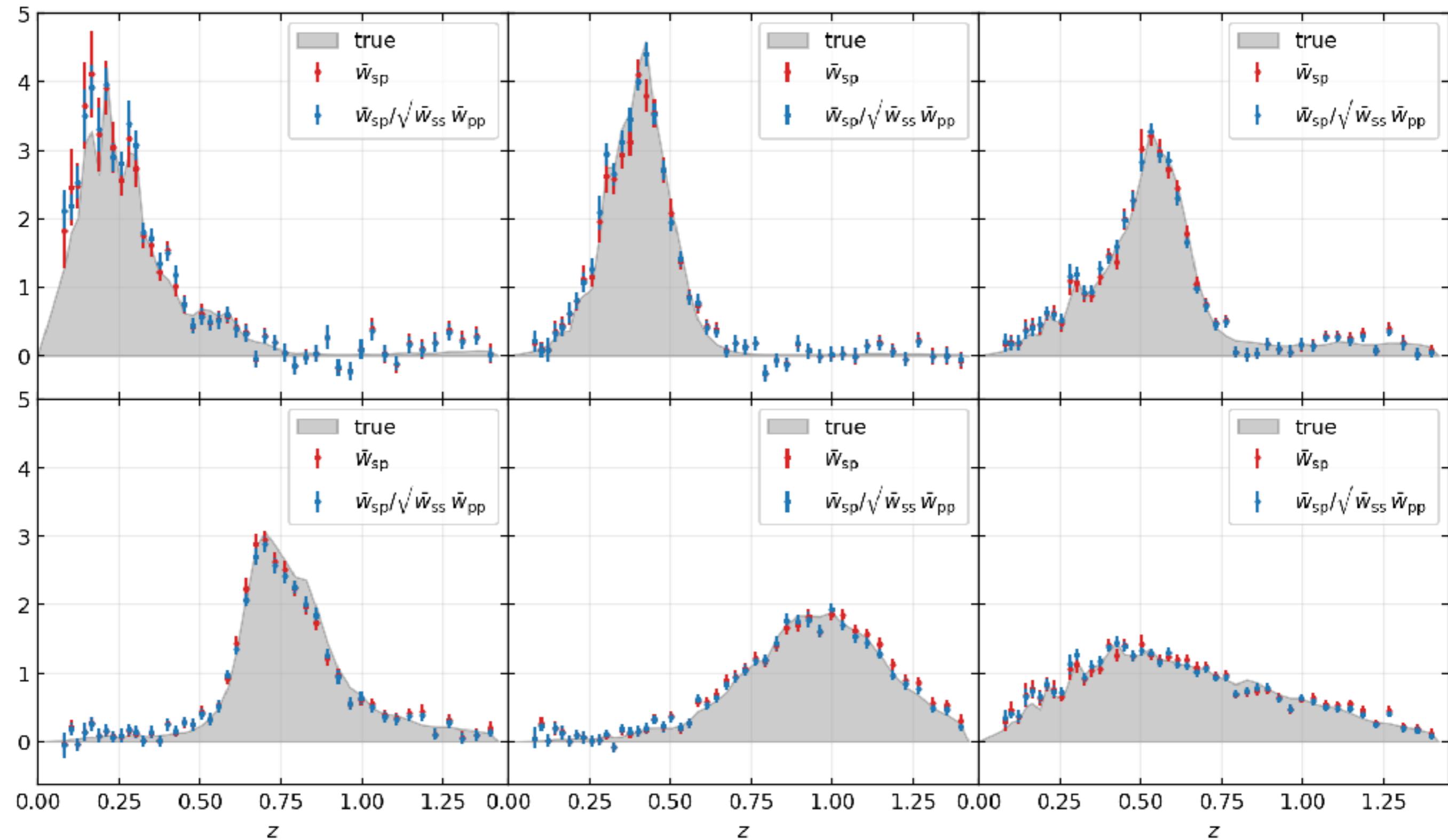
MICE2 - KV450 mocks



Tests on MICE2



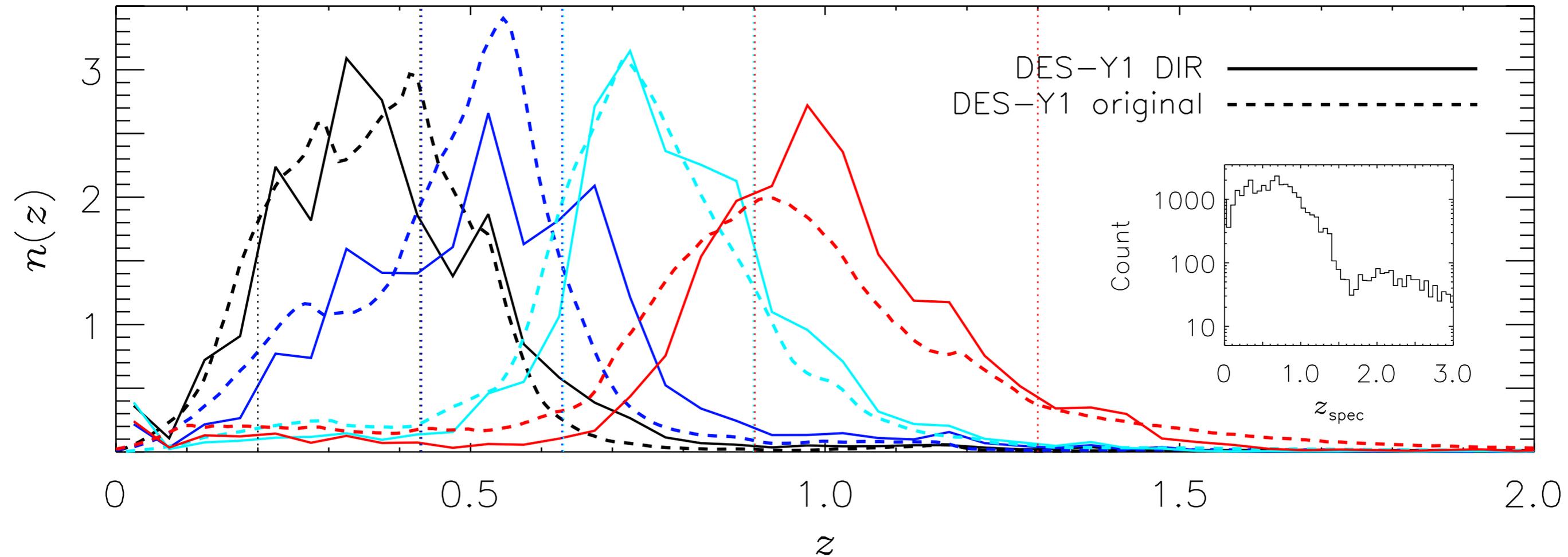
MICE2 - Clustering-z



Ideal spectroscopic sample

van den Busch et al. in prep.

Spectroscopic calibration of DES-Y1

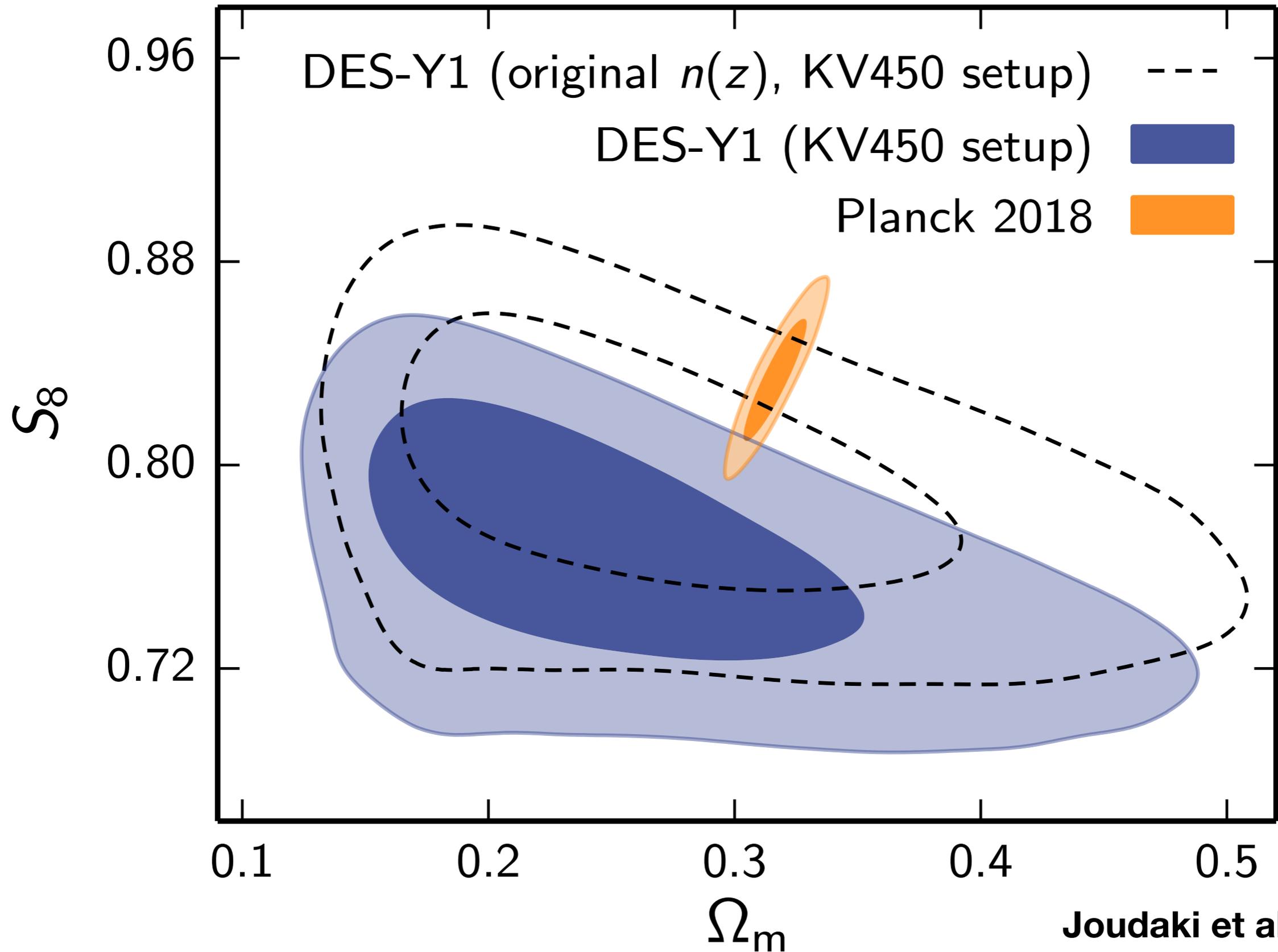


Joudaki et al. (2019), arXiv:1906.09262

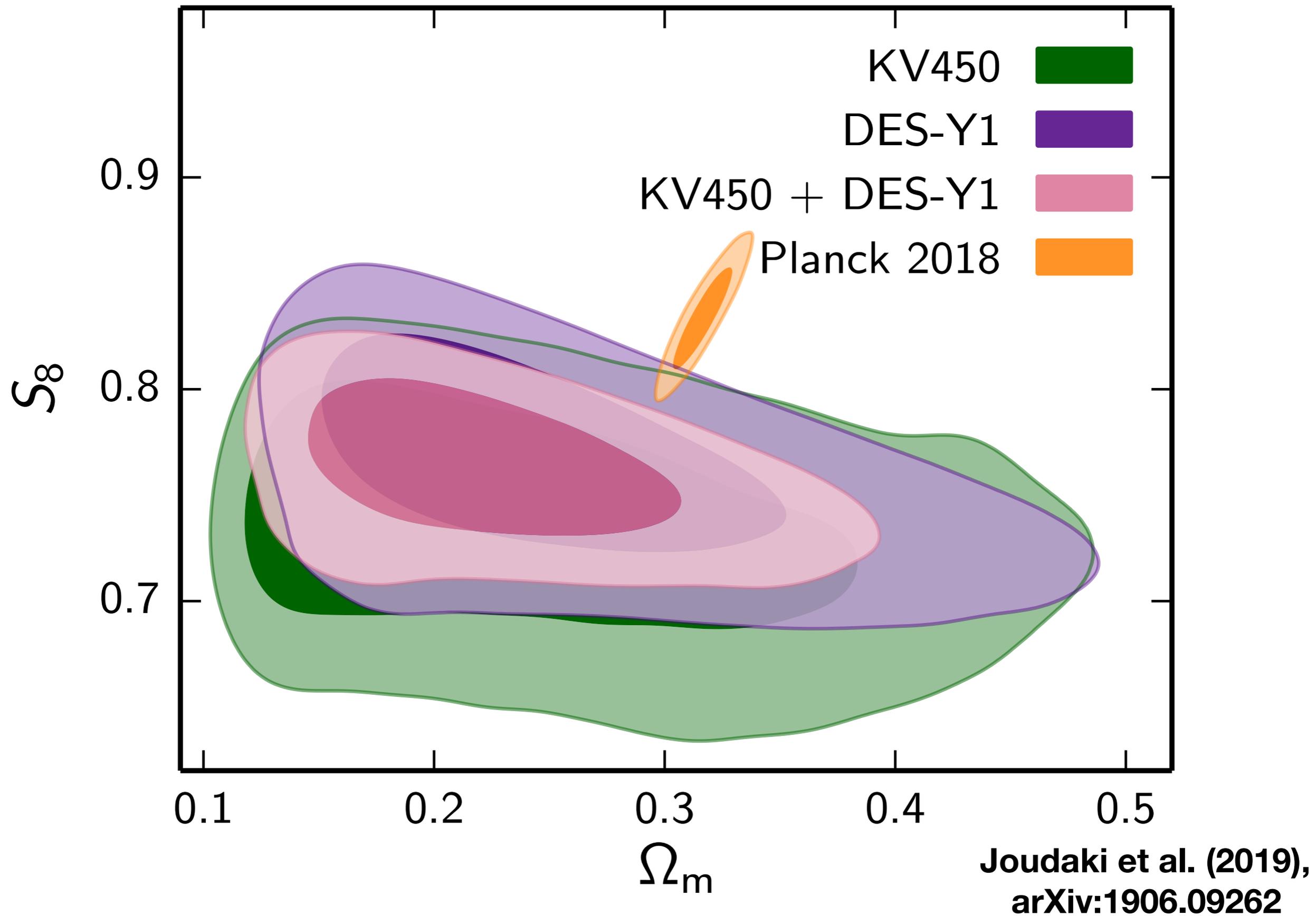
Caveat: Re-weighting done in 4D only.



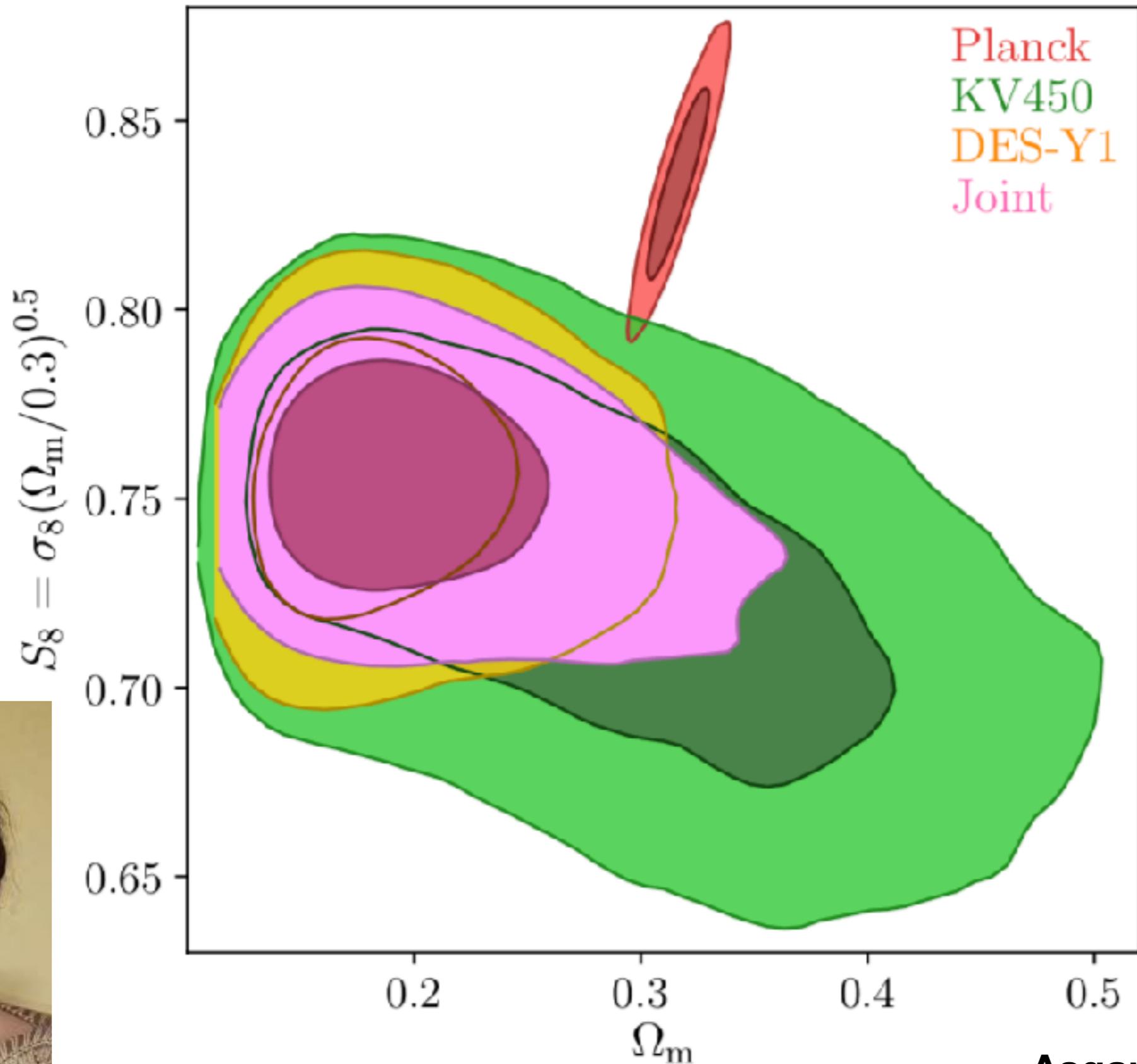
S_8 constraints



KV450 and DES-Y1 combined



Same with COSEBIs



**3.2 σ tension
between WL
and Planck**



Problems with the redshifts

- Calibration with photo-z (e.g. COSMOS-2015):
 - Outliers => underestimate $\langle z \rangle$
 - Bias => underestimate $\langle z \rangle$
- Calibration with spec-z:
 - Magnitude-space coverage => underestimate $\langle z \rangle$
 - Uniqueness of colour-redshift relation => underestimate $\langle z \rangle$
 - Wrong spec-z => $\langle z \rangle$ drawn to the mean of all spec-z
- Clustering redshifts:
 - Evolving galaxy bias
 - Magnification effects

Summary & Outlook

- Mild $\sim 2-3\sigma$ tension in S_8 between Planck and low- z WL measurements (KV450, DES-Y1 recalibrated).
- Systematics? **Redshift calibration?**
- Other LSS probes show similar discrepancies. Related to H_0 crisis? Serious problem for Λ CDM?
- Exciting times: KiDS+VIKING and DES finished; all 3 stage-III surveys analysing more data now.
- Prepare with today's data for Euclid/LSST.

Combined low- z probes

