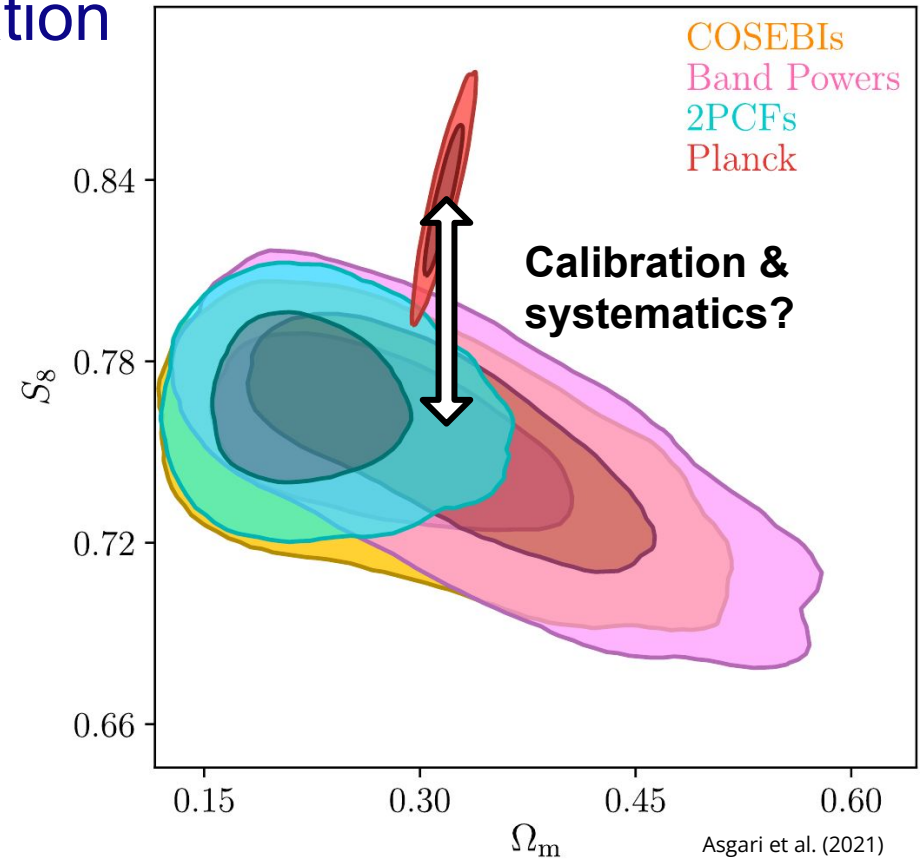
# KiDS-1000: Cosmic shear with enhanced redshift calibration

Jan Luca van den Busch

with Angus Wright,
Hendrik Hildebrandt,
et al.

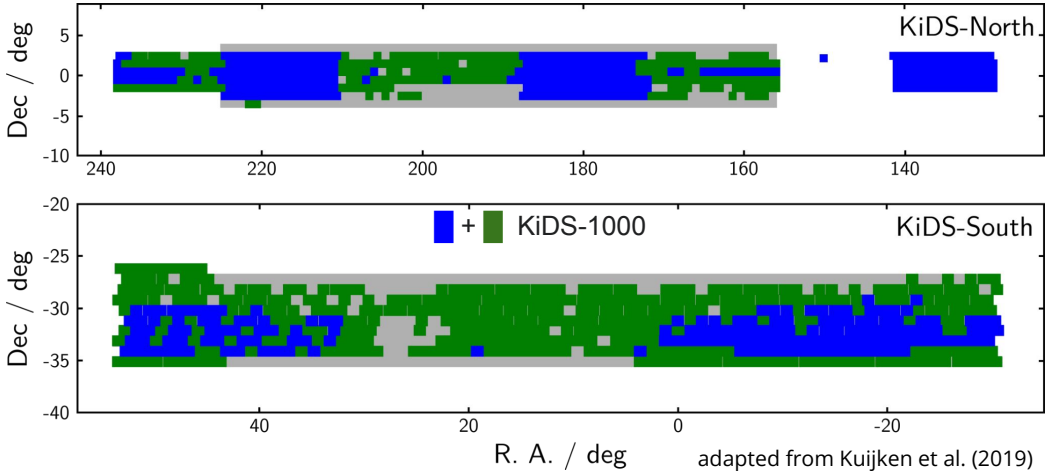
arXiv:2204.02396
(A&A, in press)

# Motivation


COSEBIs
Band Powers
2PCFs
Planck
Calibration & systematics?
0.84
0.78
0.72
0.66
$S_8$
0.15
0.30
0.45
0.60
$\Omega_m$
Asgari et al. (2021)

# Kilo-Degree Survey

- Optical imaging @ VLT Survey Telescope
- Infrared counterpart: VIKING survey @ VISTA
- KiDS-1000: 1000 deg², r $\lesssim$ 26 mag, 0.1 < $z_{phot}$ ≤ 1.2




adapted from Kuijken et al. (2019)

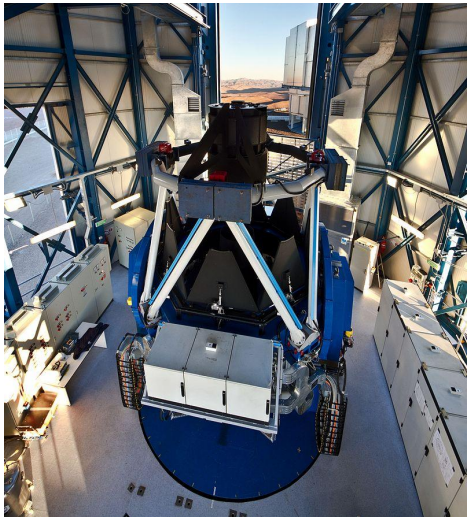
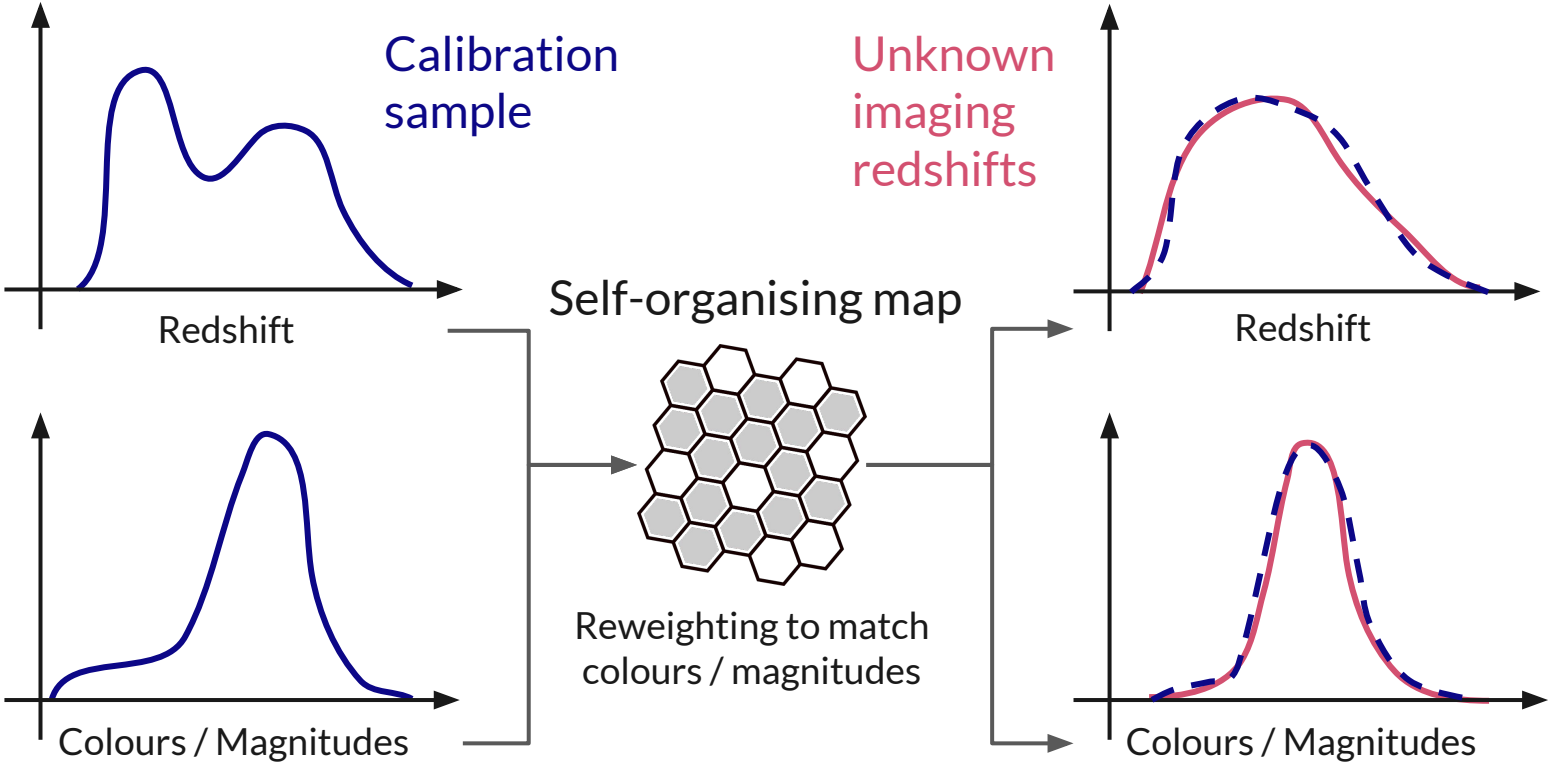


Image Credit: ESO

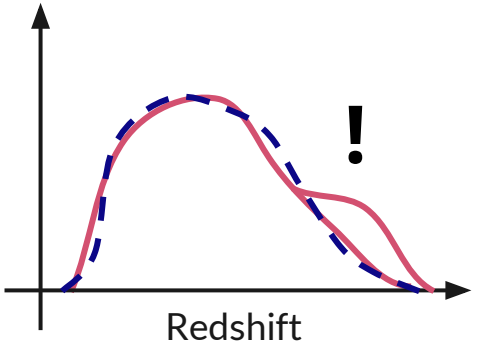
see also Wright et al. (2020a)

# SOM redshift calibration

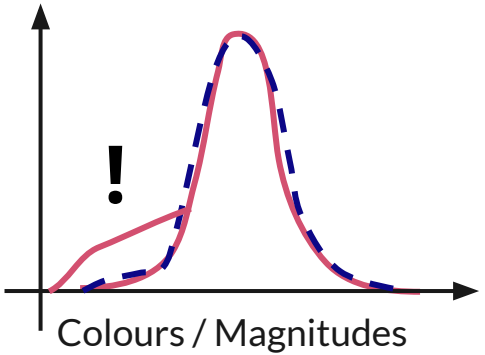


# SOM redshift calibration

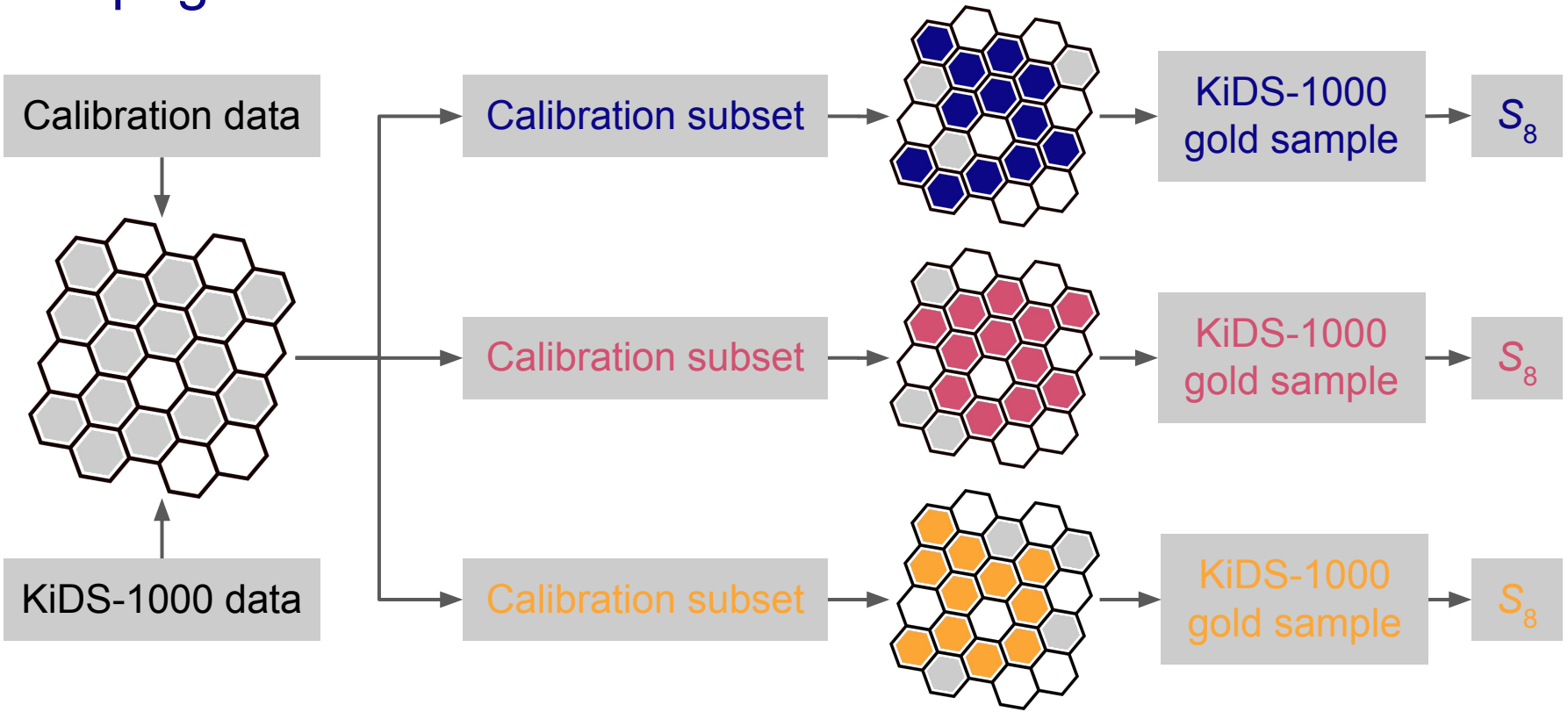
- Problem: cells with no calibration data
- Cannot estimate unknown redshifts



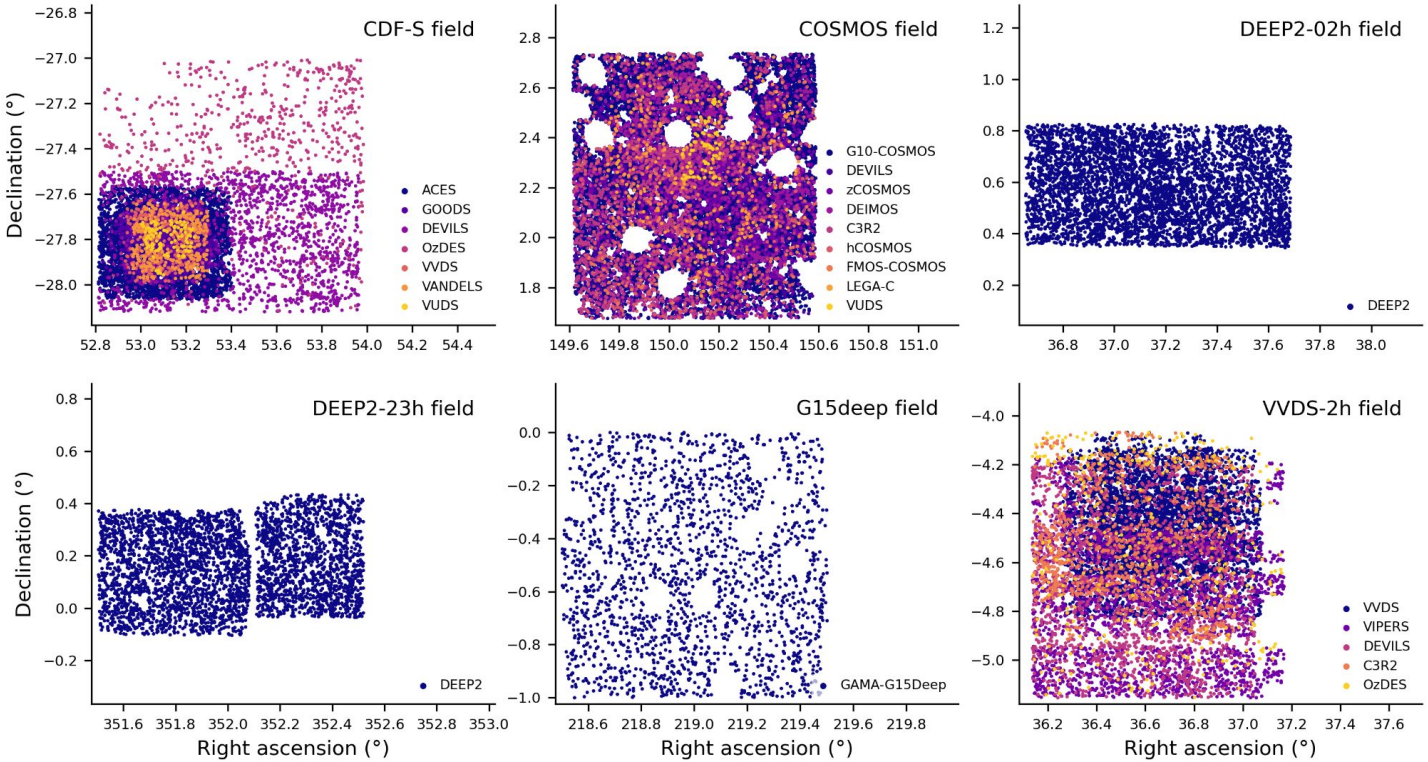

- “Gold sample” selection:
  sample size vs redshift bias



# Propagation of selection effects



# Spectroscopic redshifts



# Photometric redshifts

COSMOS2015:

- 30 filters (broad + intermediate bands)
- Significantly deeper than KiDS

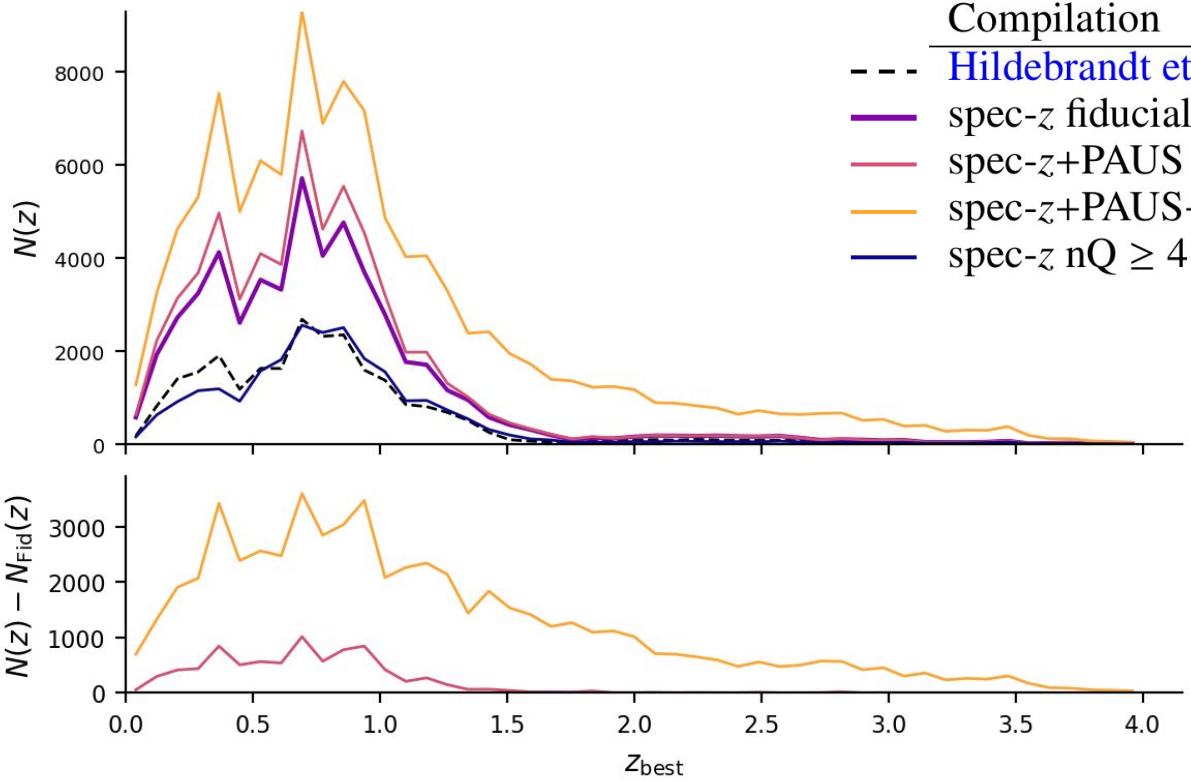
PAU survey:

- 26 COSMOS filters + 40 narrow bands
- Limited to $i_{AB} < 23$

Hierarchical order:

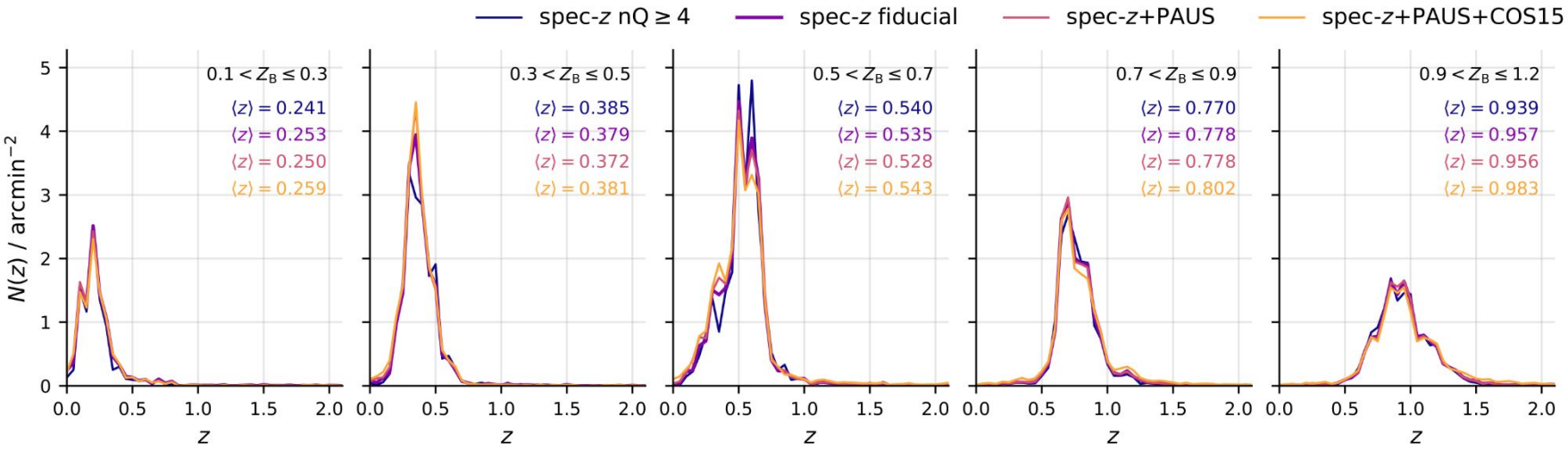
- spec-z > PAUS > COSMOS2015

# Calibration data

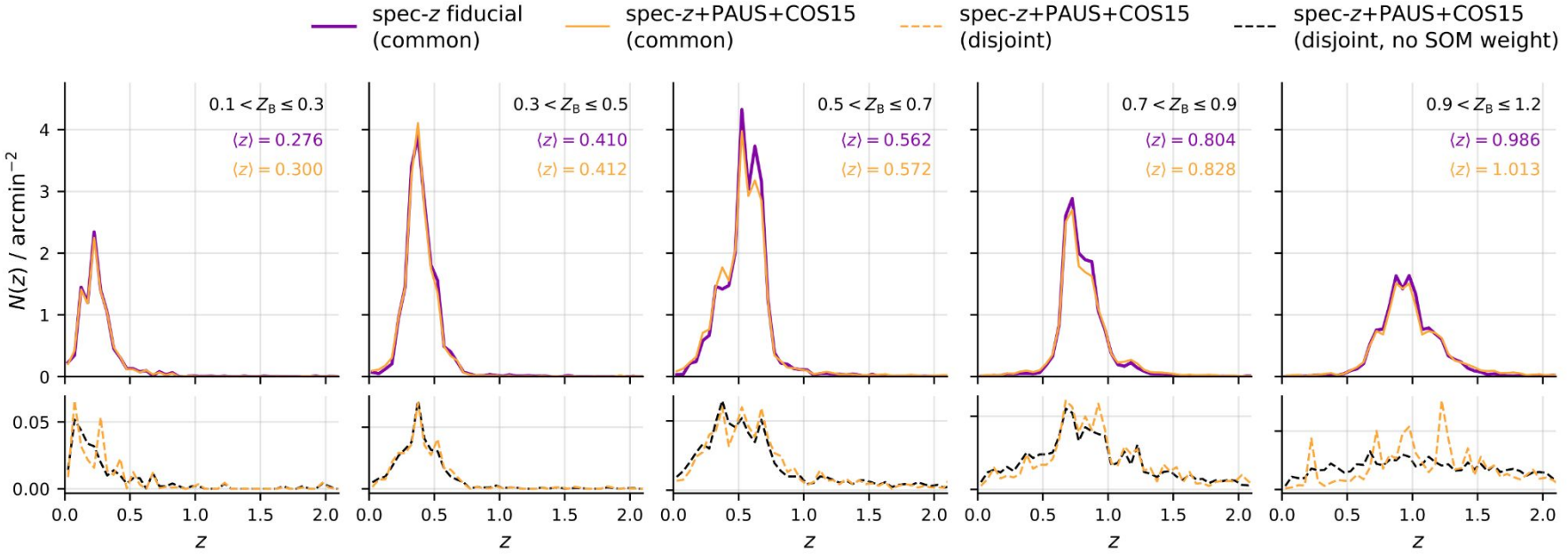



| Compilation | Count | $\langle z \rangle$ |
|---|---|---|
| Hildebrandt et al. (2021) | 25 373 | 0.796 |
| spec-$z$ fiducial | 52 911 | 0.788 |
| spec-$z$+PAUS | 61 163 | 0.776 |
| spec-$z$+PAUS+COS15 | 112 400 | 1.002 |
| spec-$z$ nQ $\geq 4$ | 24 117 | 0.832 |

# New redshift distributions

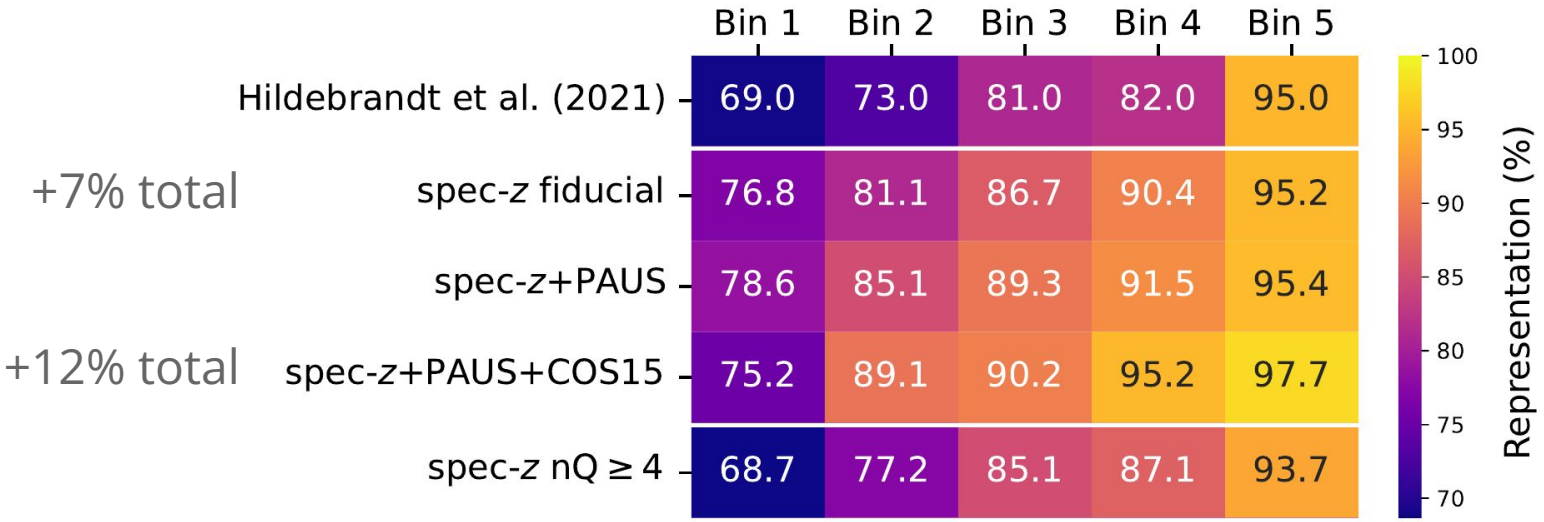


# New redshift distributions




⇒ Need simulations to calibrate

# KiDS-1000 gold samples

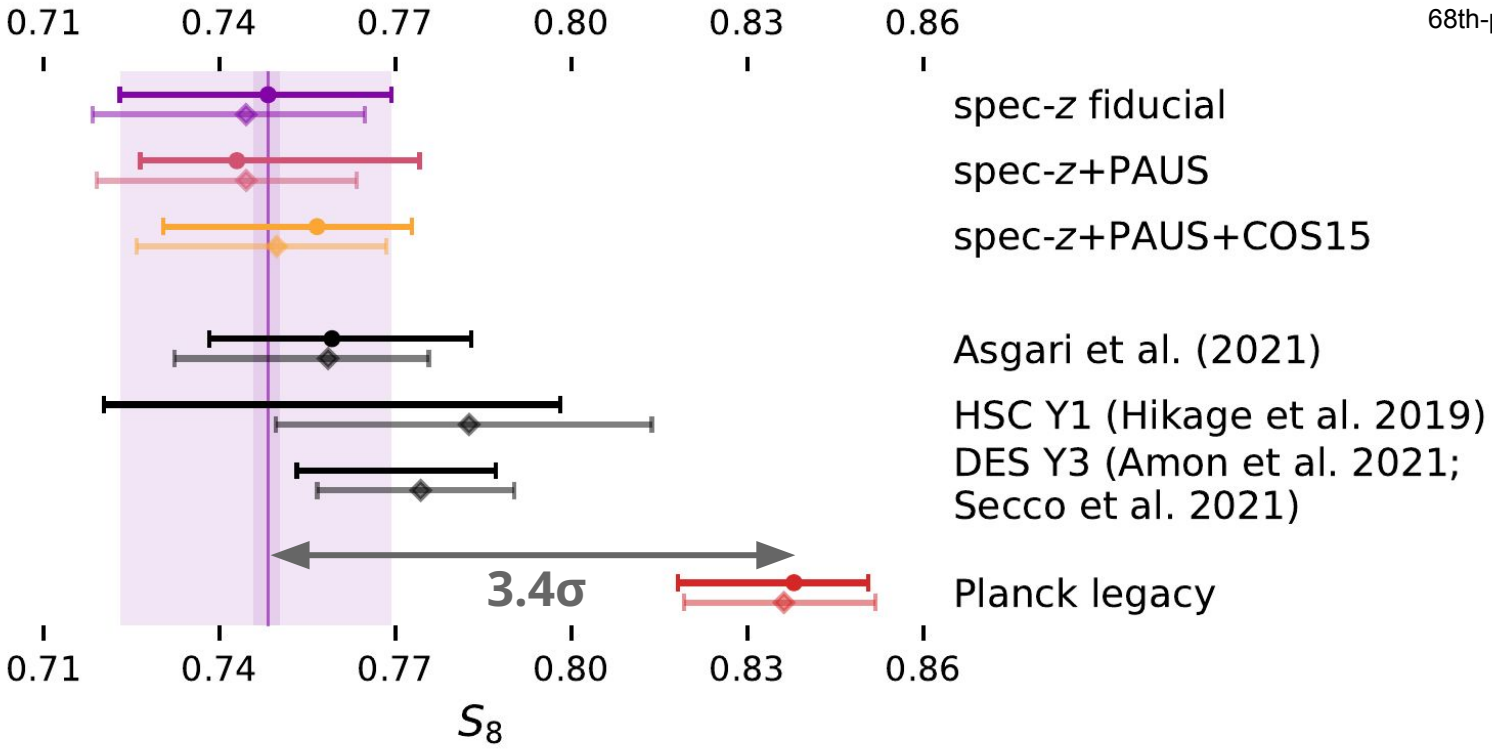


# Cosmic shear analysis

KiDS cosmology pipeline (KCAP):

1. Calibrate the multiplicative shear bias
2. Measure the shear 2pt correlation functions
3. Transform to COSEBIs (first 5 modes)
4. Compute covariance matrix
5. Sample likelihood function and run minimiser

# Cosmological constraints




**Estimates:**
Best fit,
68th-percentile PJ-HPD

Max. of marginal distribution,
68th-percentile

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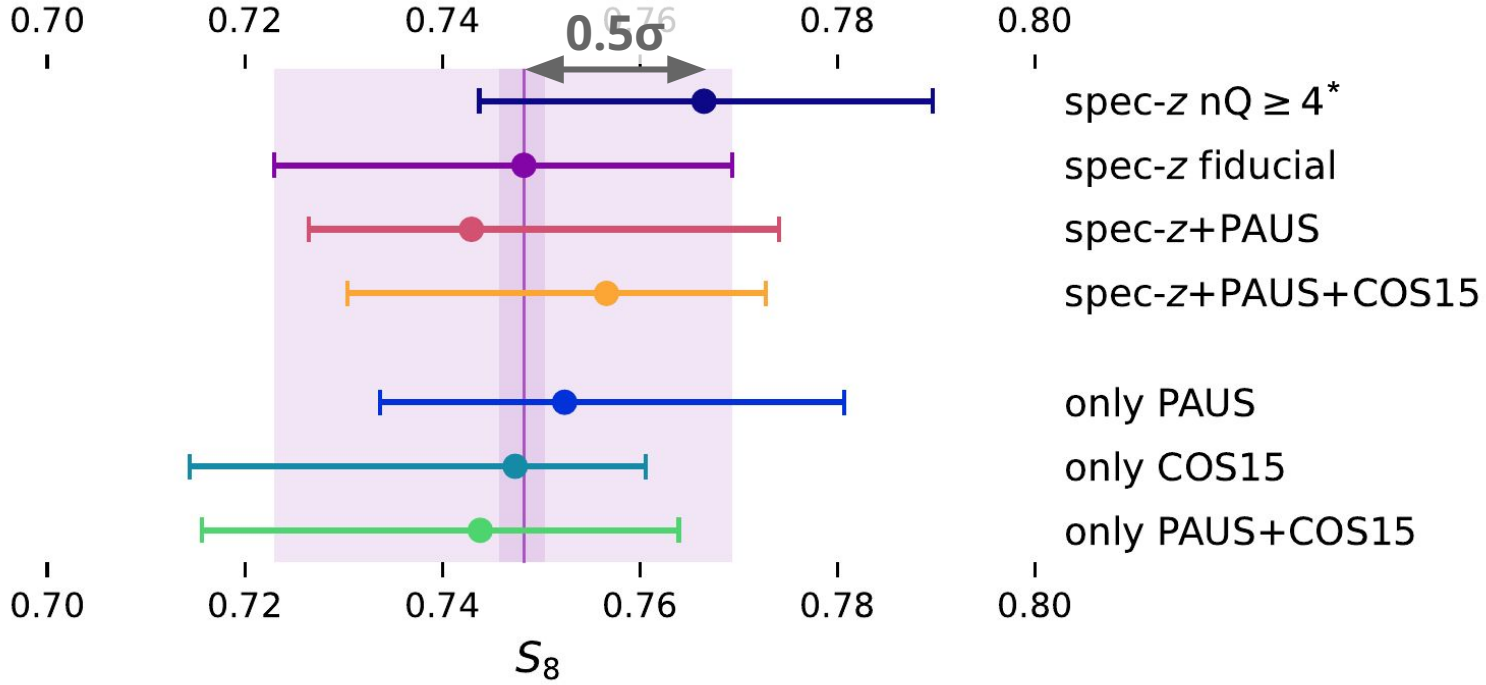
**Estimates:**
Best fit,
68th-percentile PJ-HPD




* see also Sect. 6.2.1

# Conclusions

- Precision photometric redshifts …
  - … improve completeness
  - … may reduce systematic biases
- Require simulations to calibrate systematic biases
- Different gold samples consistent in $S_8$ at < 0.5σ
- $S_8$ tension between KiDS-1000 and Planck confirmed at 3.4σ