

Exploiting Lyman Break Galaxies for Cosmology with LSST



Vera C. Rubin Observatory

Francesco Petri (Imperial College London fp1414@ic.ac.uk)

Supervisors: Boris Leistedt & Daniel Mortlock

NAM 2023

Context: Cosmology & LSST

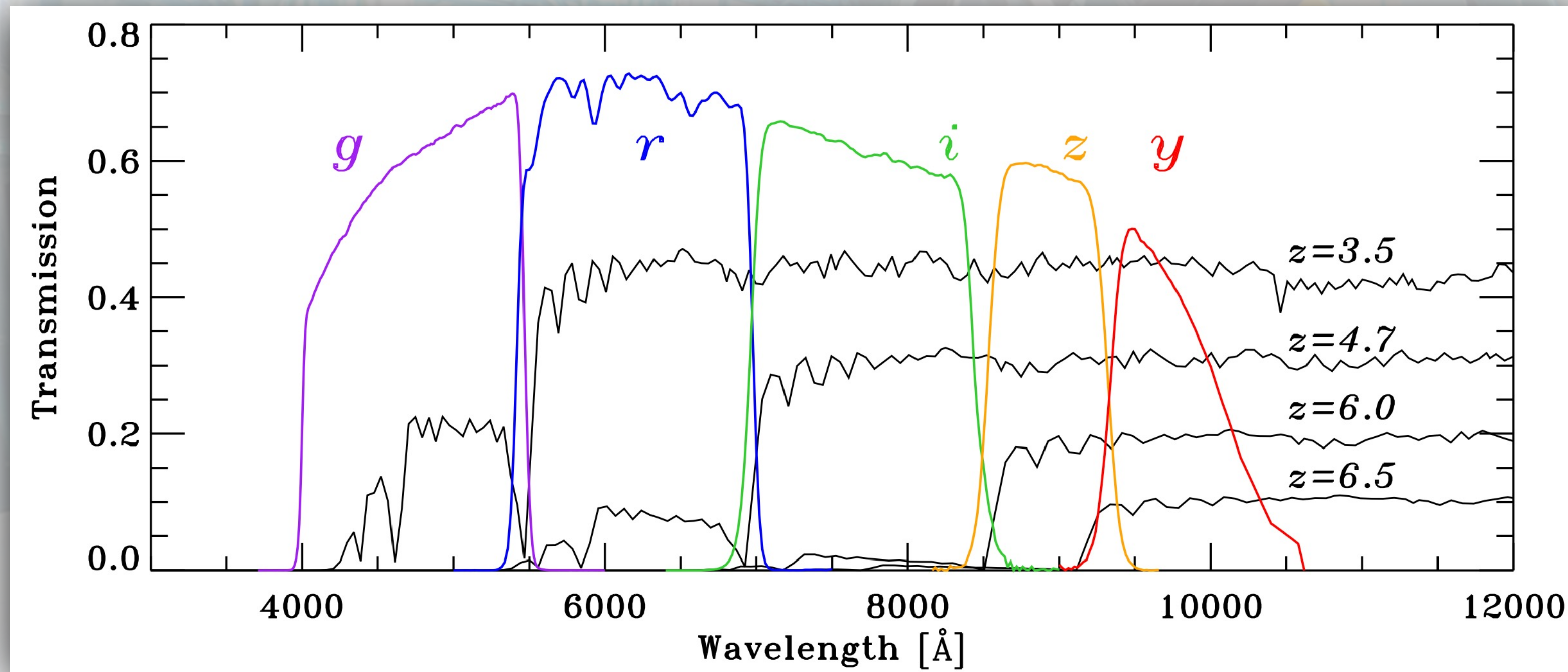
- **Standard cosmological model: Λ CDM**
- **Galaxy surveys probe dark energy dominated era up to $z \sim 2$**
- **LSST will have access to large numbers of fainter galaxies**
- **Use data beyond $z \sim 2$ for cosmology?**



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Lyman Break Galaxies (LBGs)

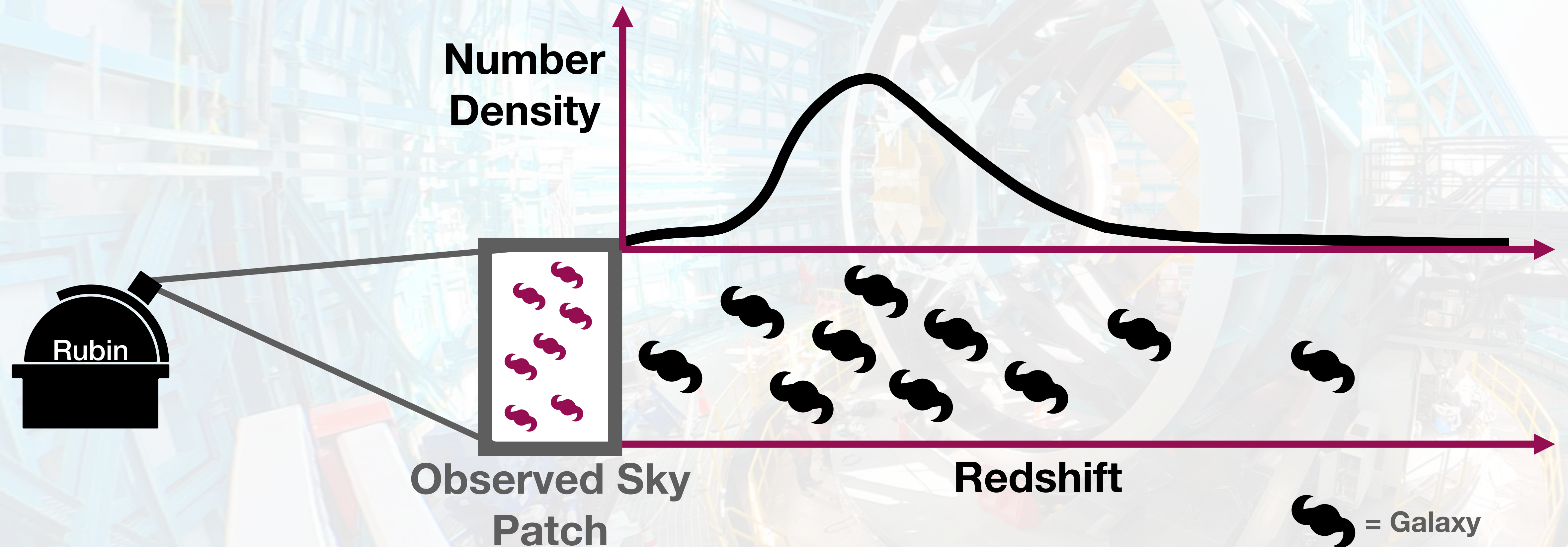
- Young, actively star forming galaxies at $z \gtrsim 2$
- About 4,000,000 LBG candidates observed by Subaru Hyper Suprime-Cam
- High numbers expected between $3 \lesssim z \lesssim 5$ for LSST (Wilson & White 2019)
- Probe the universe before dark energy dominated era



Ono et al. 2018

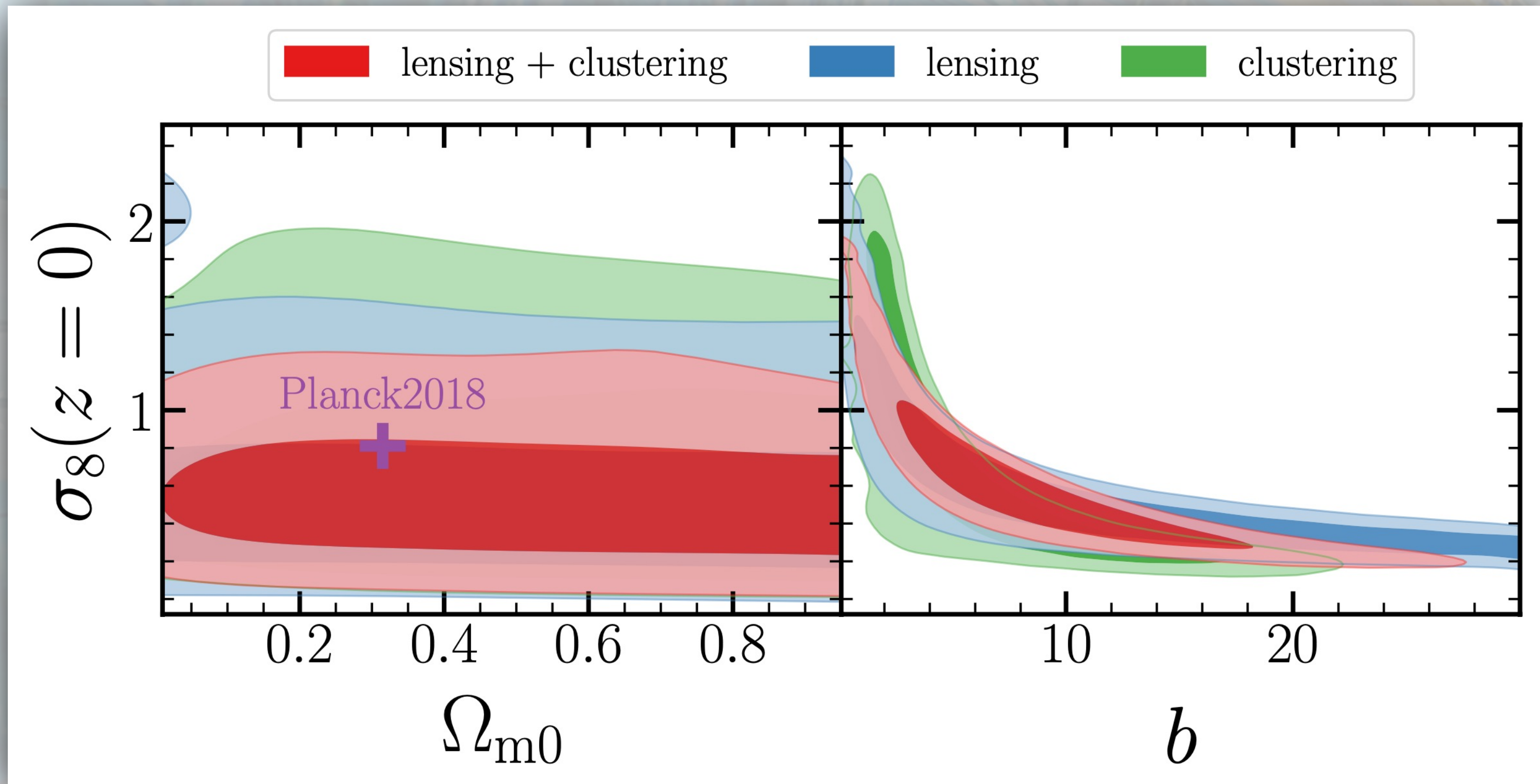
Redshift Distribution $N(z)$

- Required for photometric galaxy surveys
- Typically determined with use of spectroscopy
- Representative spectroscopy of LBGs will likely be unattainable for LSST

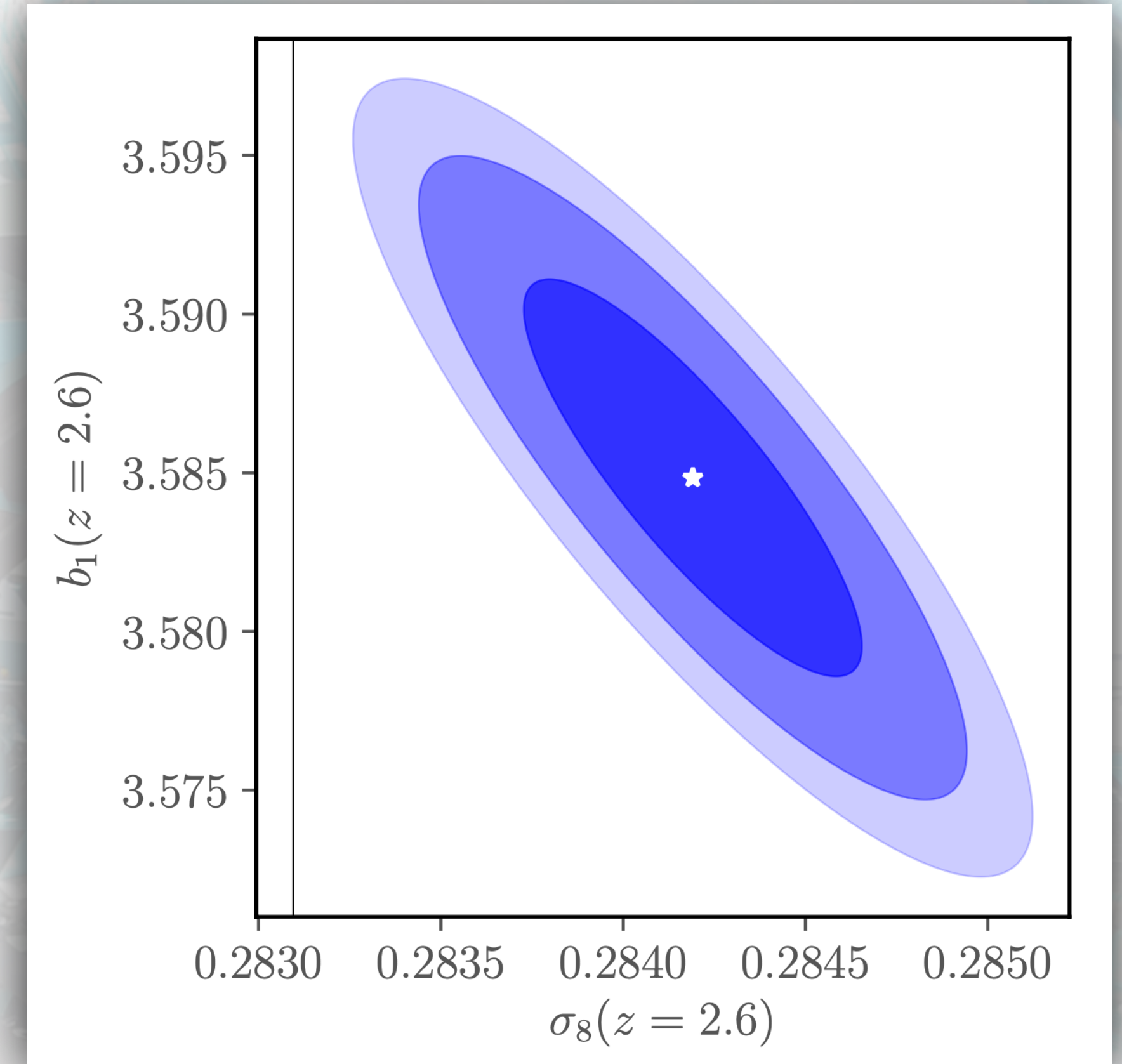


LBG Cosmological Inference

- **LBG clustering x CMB weak lensing**



Constraints from HSC (LSST Precursor)
(Miyatake et al. 2022)

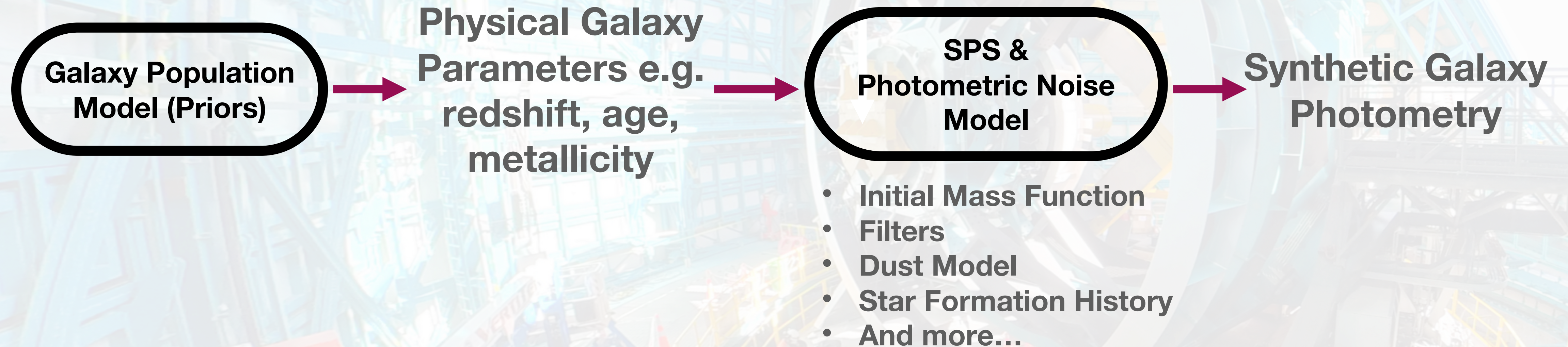


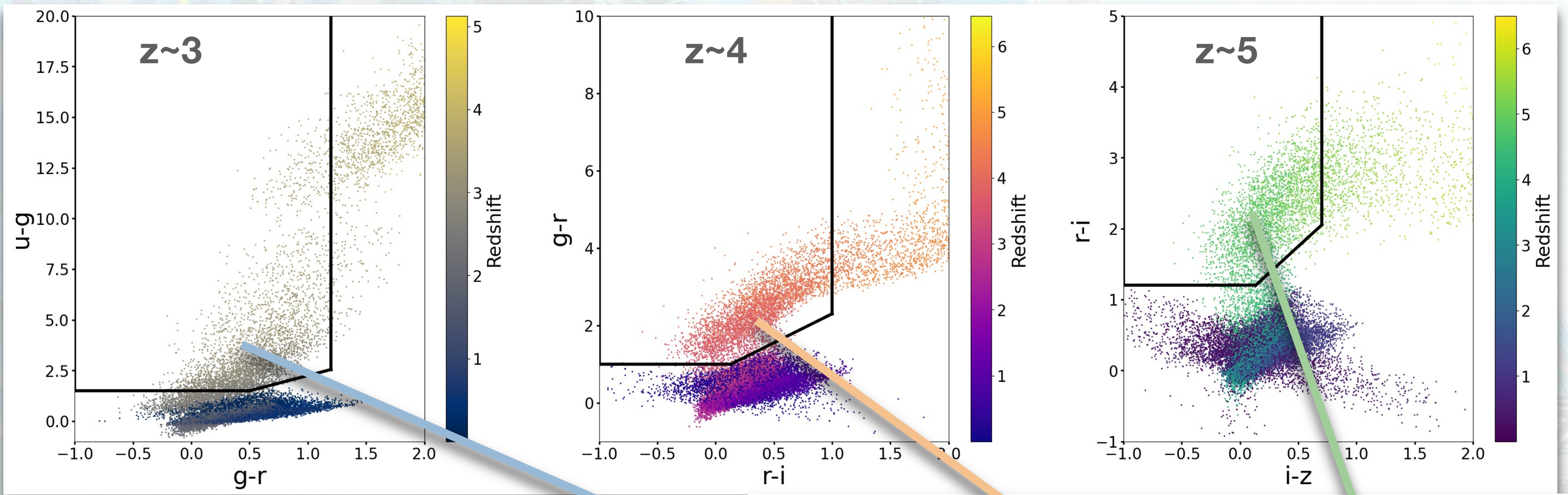
Forecast from Wilson & White 2019

σ_8 : matter density fluctuations
 Ω_{m0} : Present day matter energy density
 b : linear galaxy bias parameter

Simulating LBG Redshift Distributions

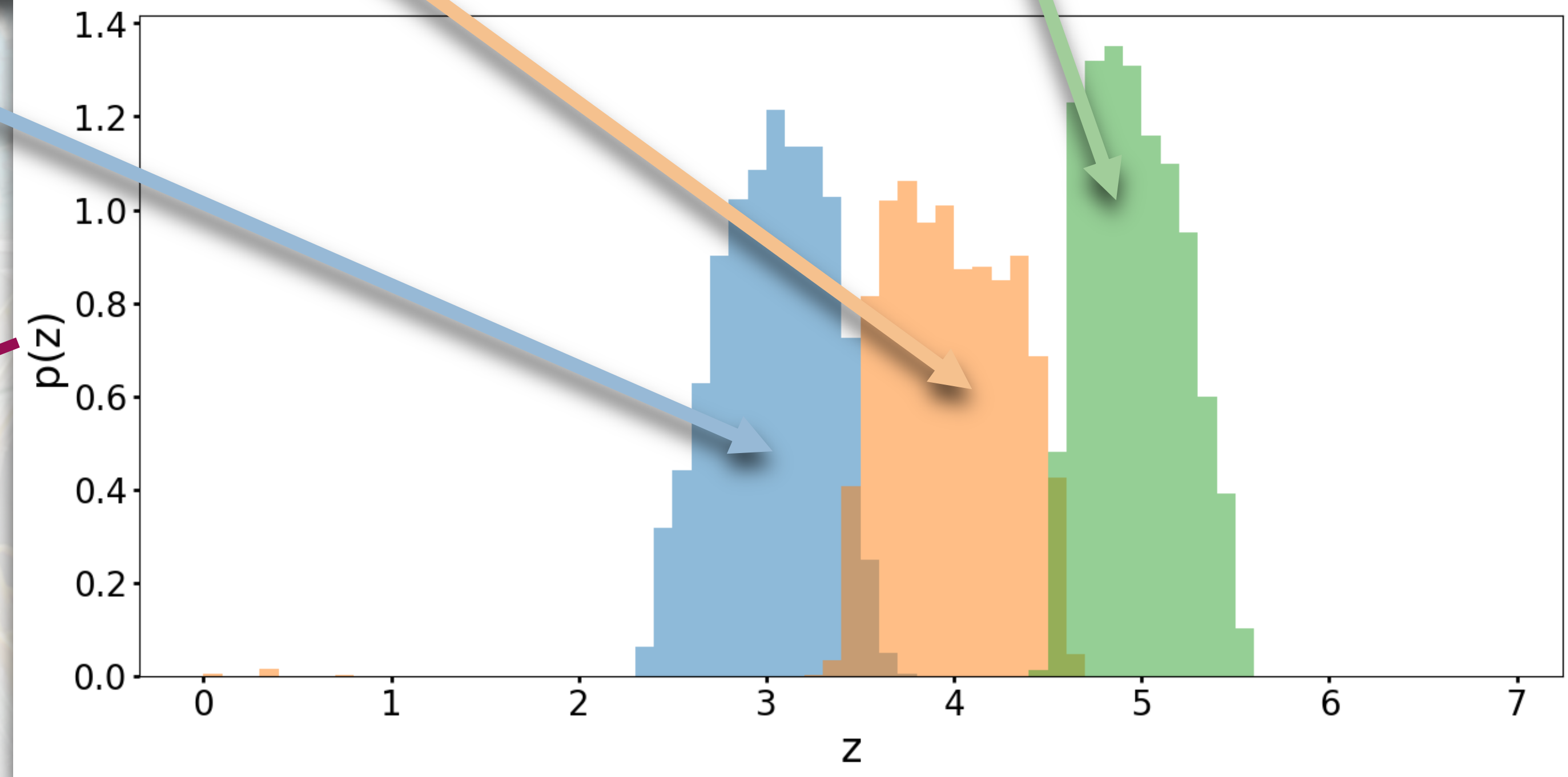
- Simulate LBG SEDs using Stellar Population Synthesis (SPS) to forward model $N(z)$ s
- Allows for a more 'continuous' model over using galaxy SED templates





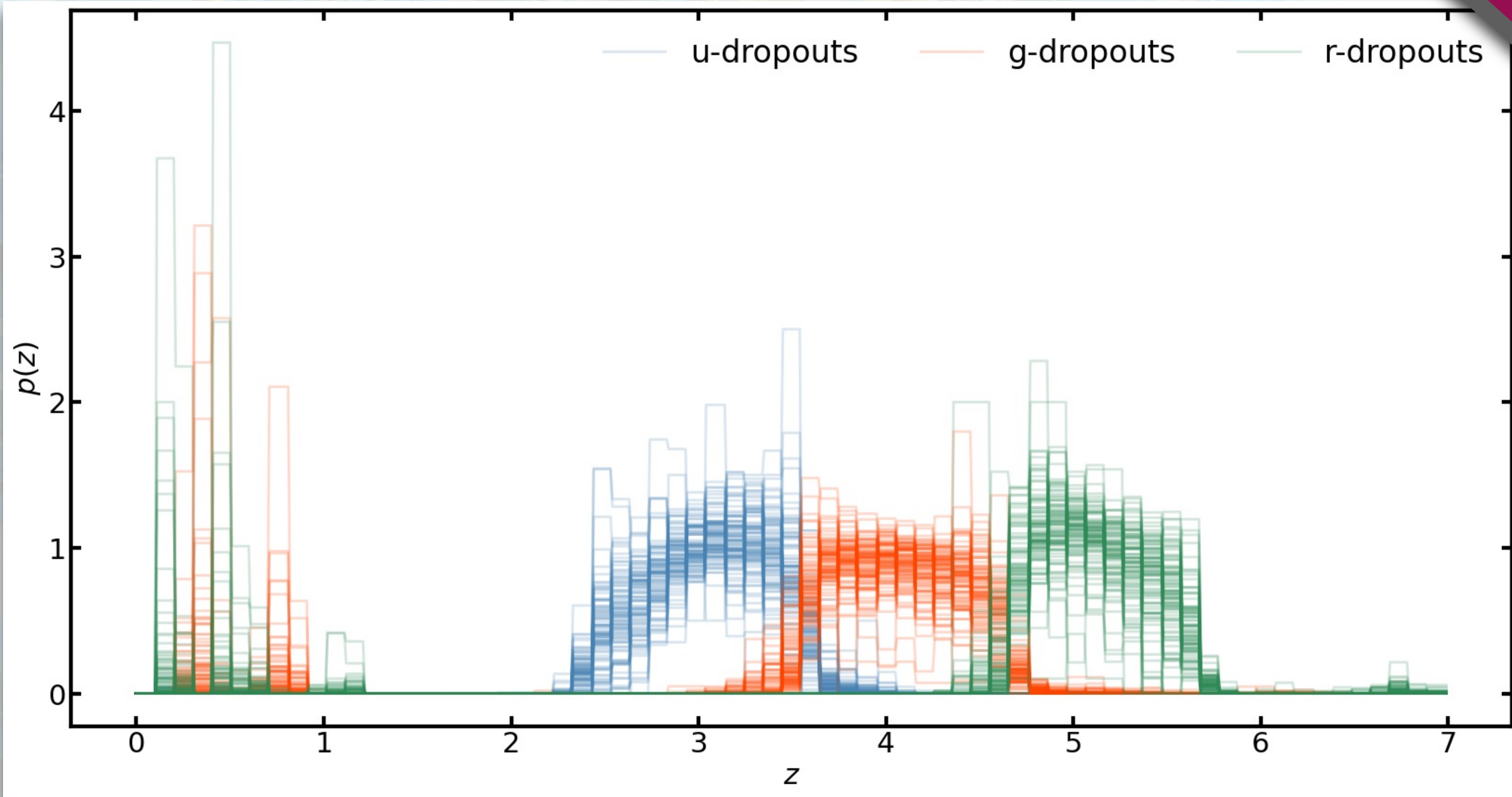
Simulating $N(z)$

$p(z | \text{SPSModel, SelectionCuts, PopulationModel, Filters, PhotometricNoiseModel})$



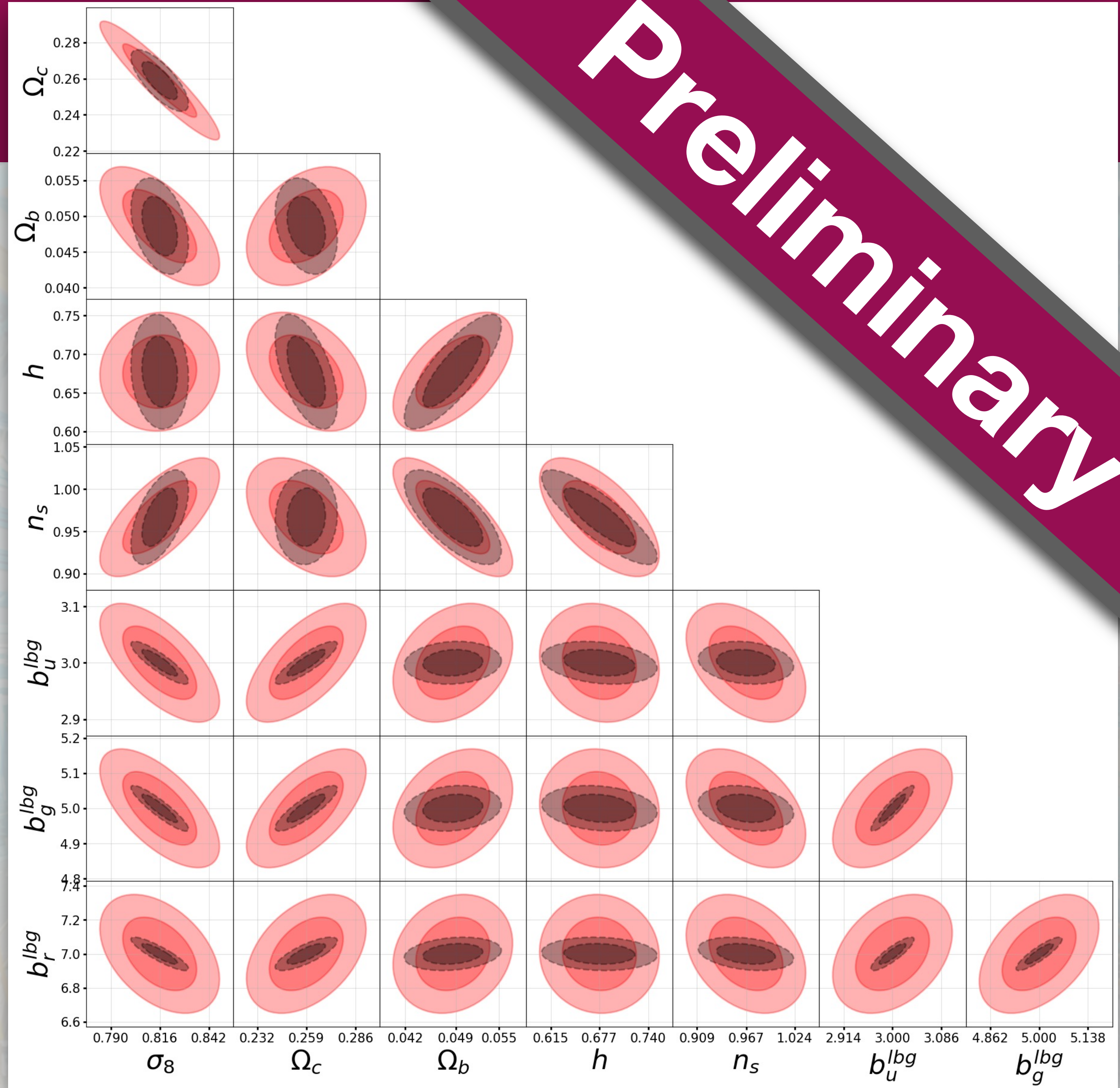
Uncertainty in $N(z)$

Preliminary



LSST Forecast

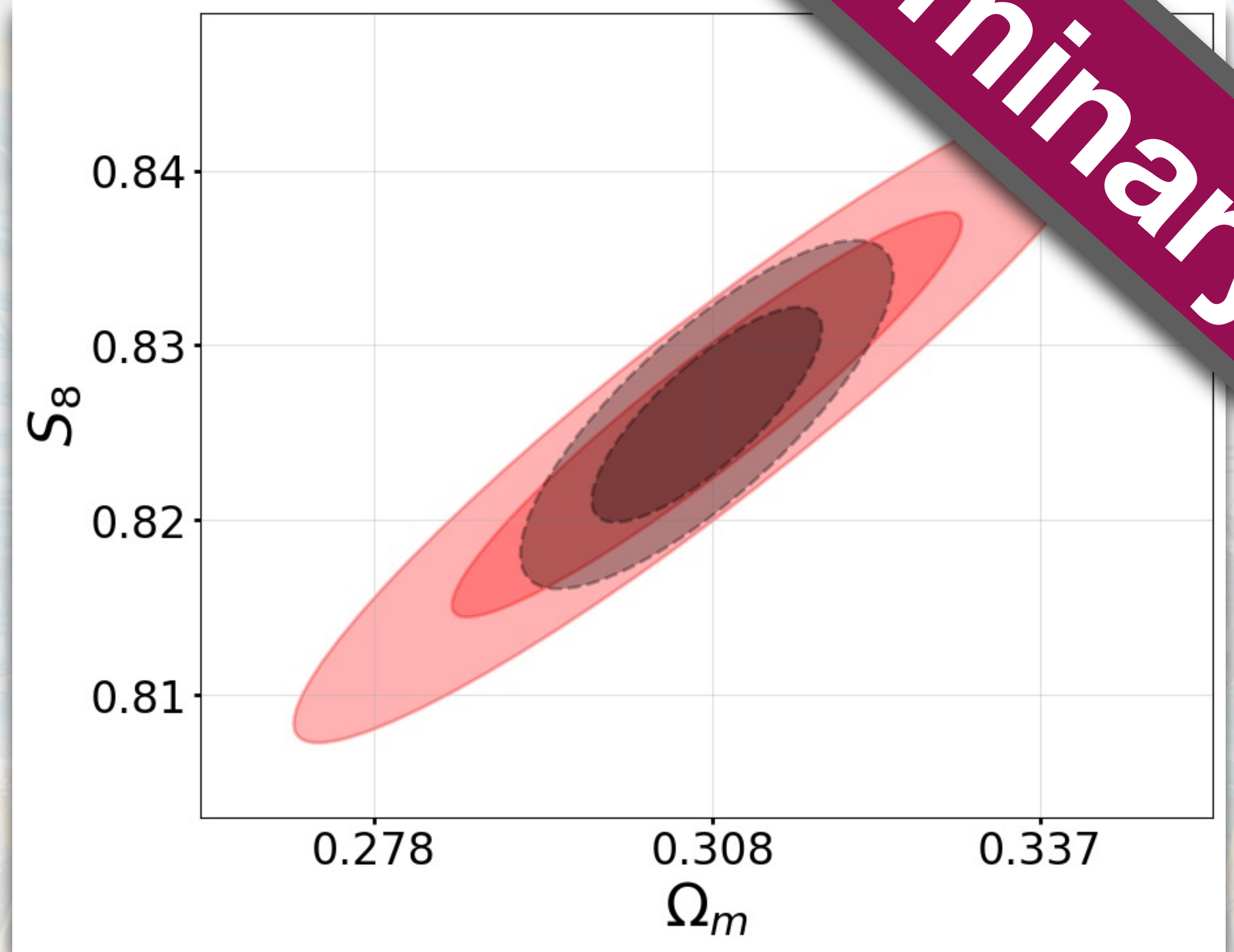
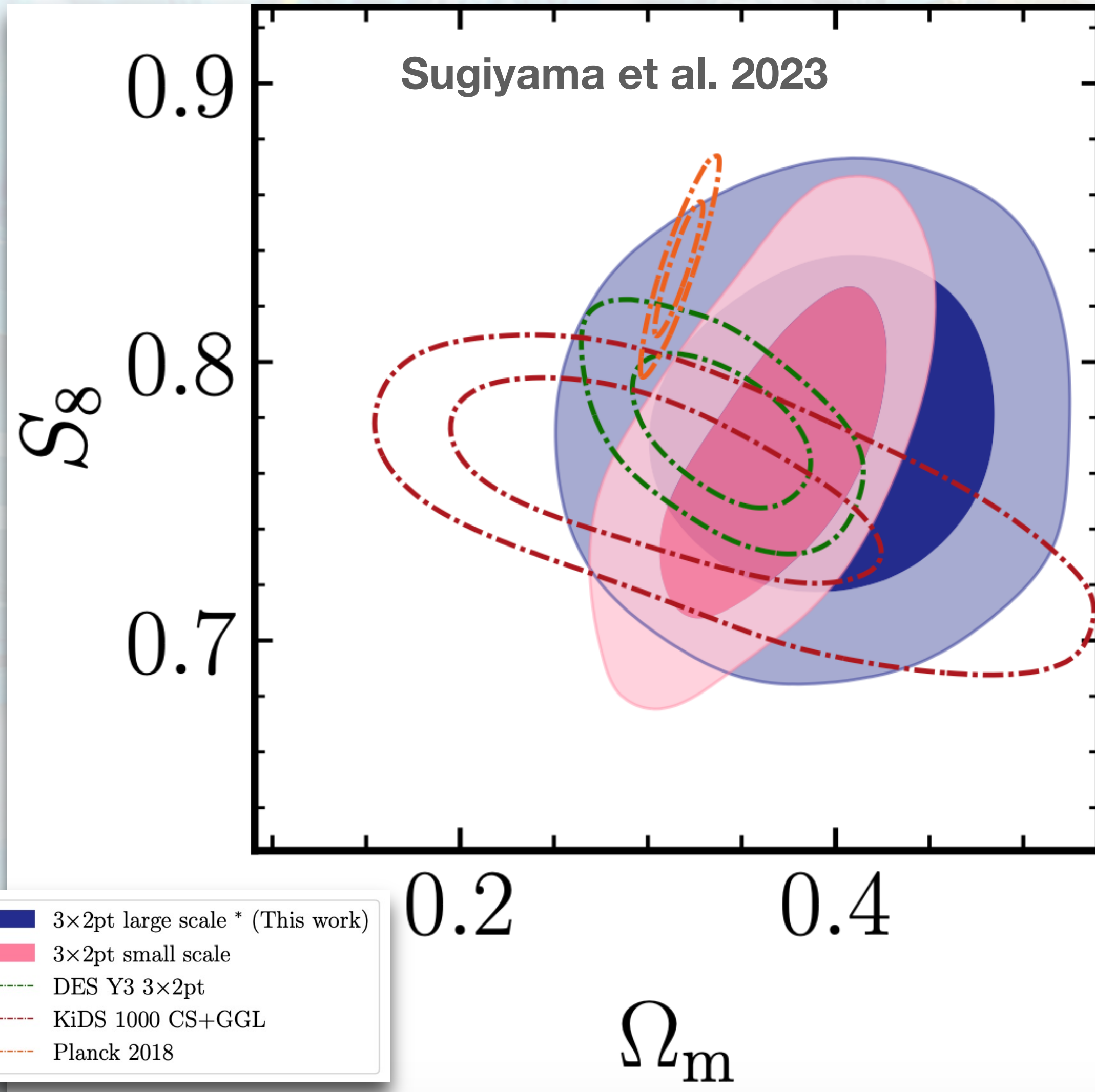
- Fisher Forecast (LSSTY10 type survey)
- Clustering x CMB Lensing
- Marginalisation performed analytically (Hadzhiyska et al. 2020)
- Dashed-black contours - fixed $N(z)$
- Solid-red contours - marginalised



Preliminary

LSST Forecast

Preliminary



Thanks!



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