Homogeneity studies: aims?

Cosmology

25 years of DATA
SNIa, CMB, BAO

ΛCDM
validated
parameters
at %

But: Strong hypothesis:
Homogeneity at large scales

Is the Universe Homogeneous?
if so, at which scales?
How to improve our understanding?

Homogeneity studies: aims?

Outline:

- **Methodology**
- **Results DR12**
- **Forecasts**
- **Voids?**
- **Limitations**

Methodology in a Nutshell

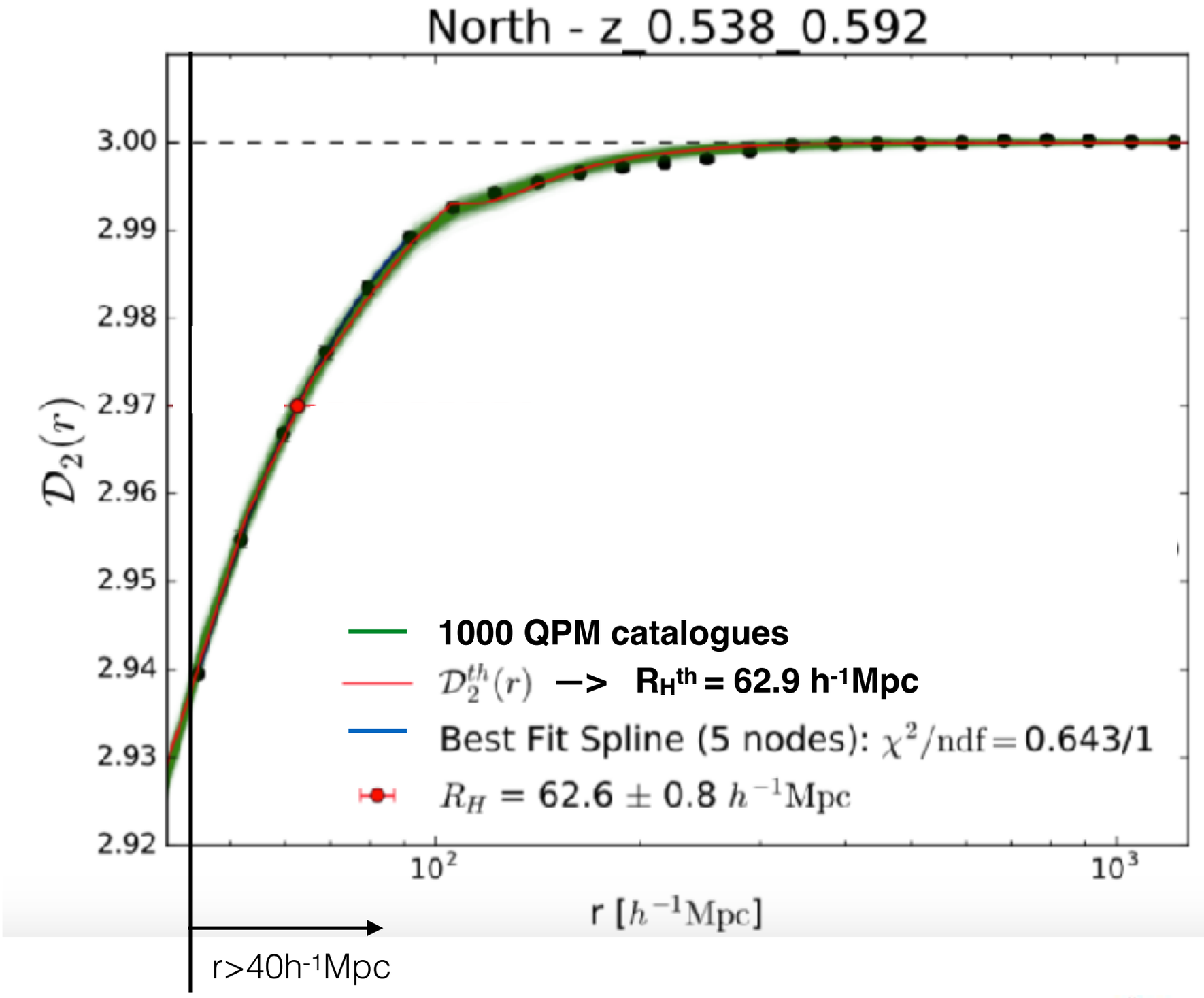
- Take objects z,RA,DEC
- Create Randoms (Future: proper mask)
- CUTE soft -> DD,RR,DR (r), n_gal,n_ran
- Build 2pt Correlation Function ξ(r)
- Build Fractal Correlation Dimension

$$\mathcal{D}_2(r) = 3 + \frac{d\ln}{d\ln r}\left(1 + \frac{3}{r^3}\int_0^r s^2\xi(s)ds\right)$$

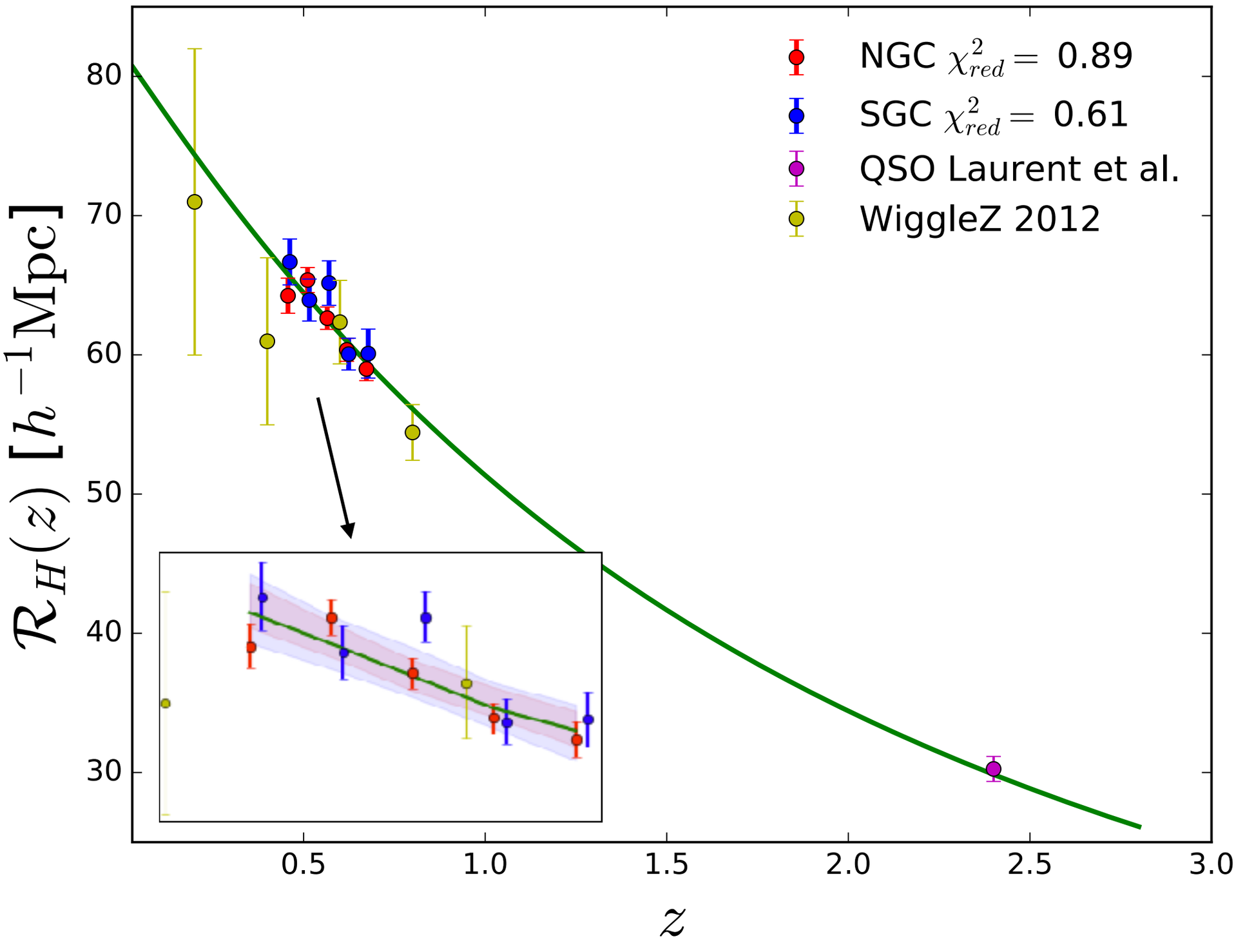
- Measure a characteristic scale of Homogeneity: D2(RH)=2.97

Euclid: Results CMASS DR12 galaxy sample SDSS

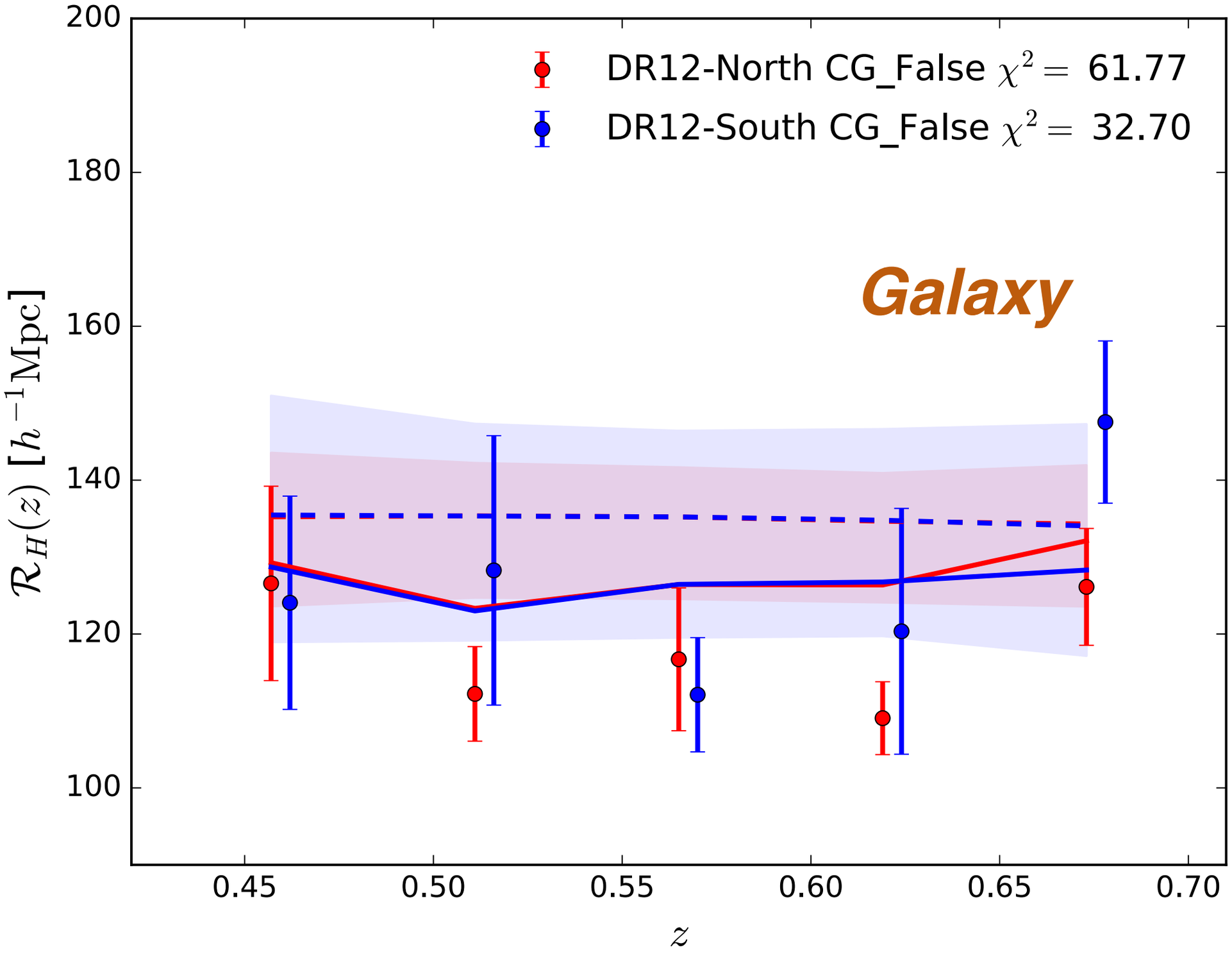
- $r_{min}=40h^{-1}Mpc$
- applied bias on N
- Compute D_2
- DR12 DATA
- 1000 QPM-ΛCDM
- ΛCDM PLANCK 2015



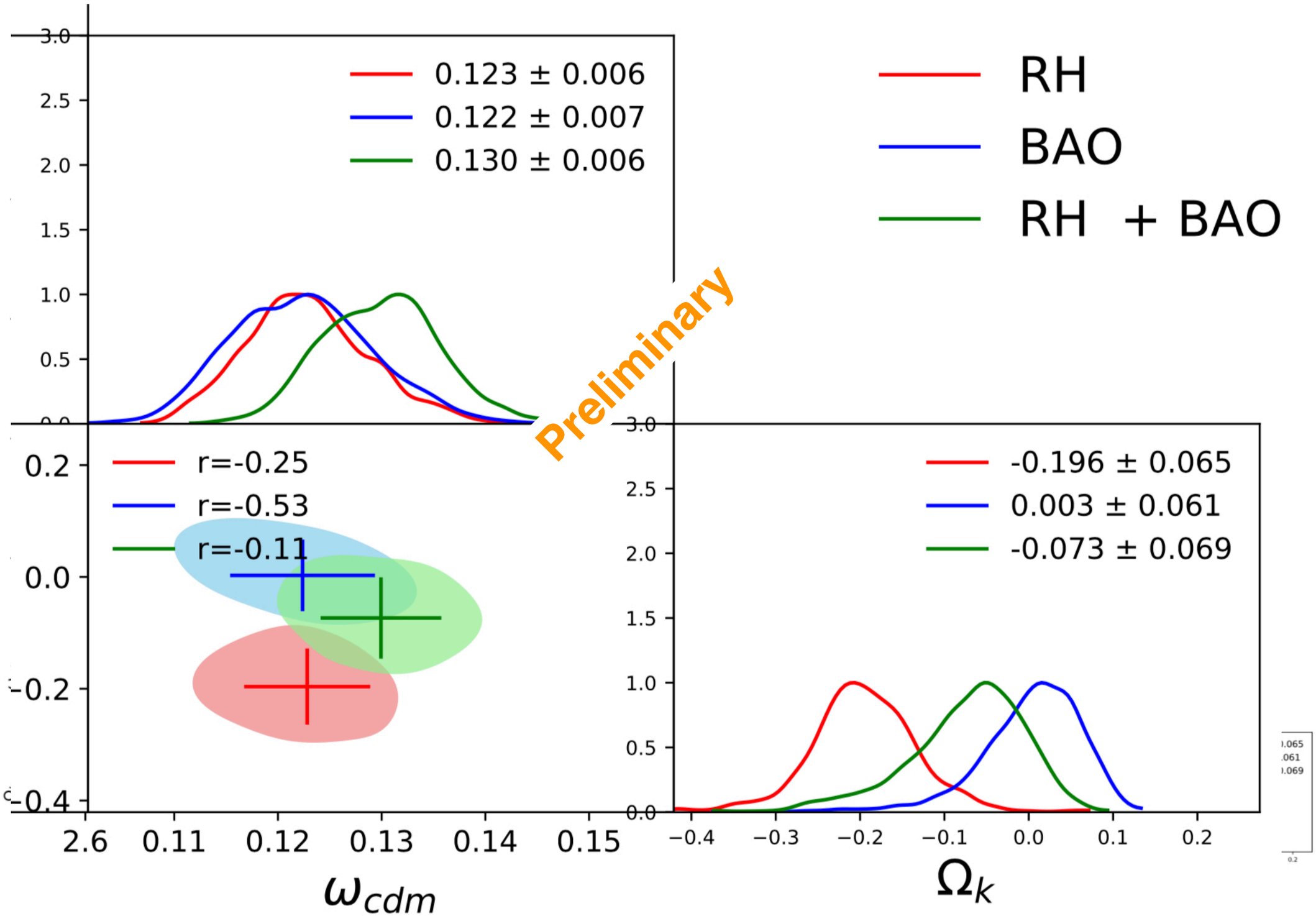
Redshift Evolution of Homogeneity



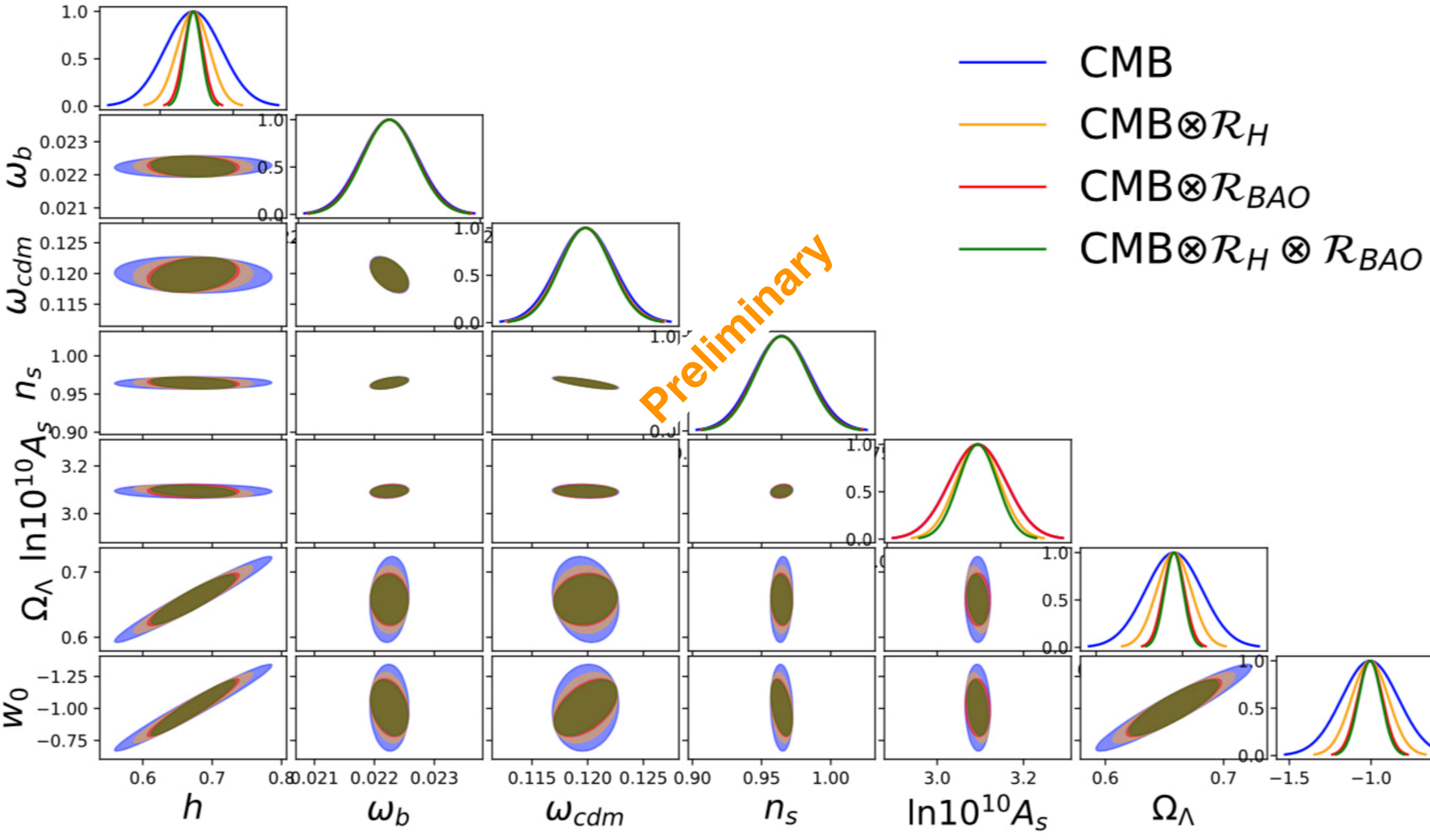
Euclid: Better Unbiased Estimate of RH(z)



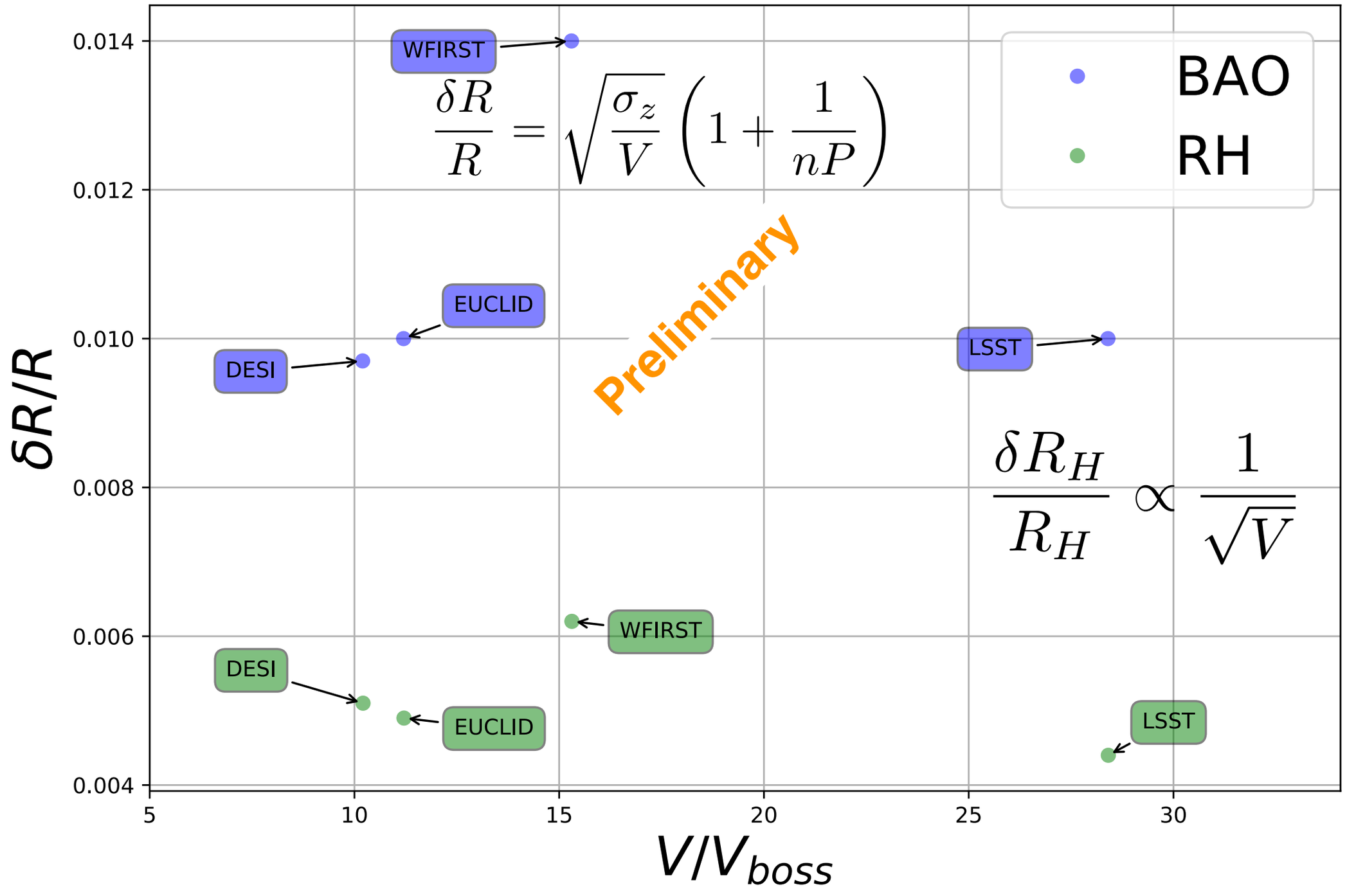
MCMC CMASS DR12 galaxy sample SDSS



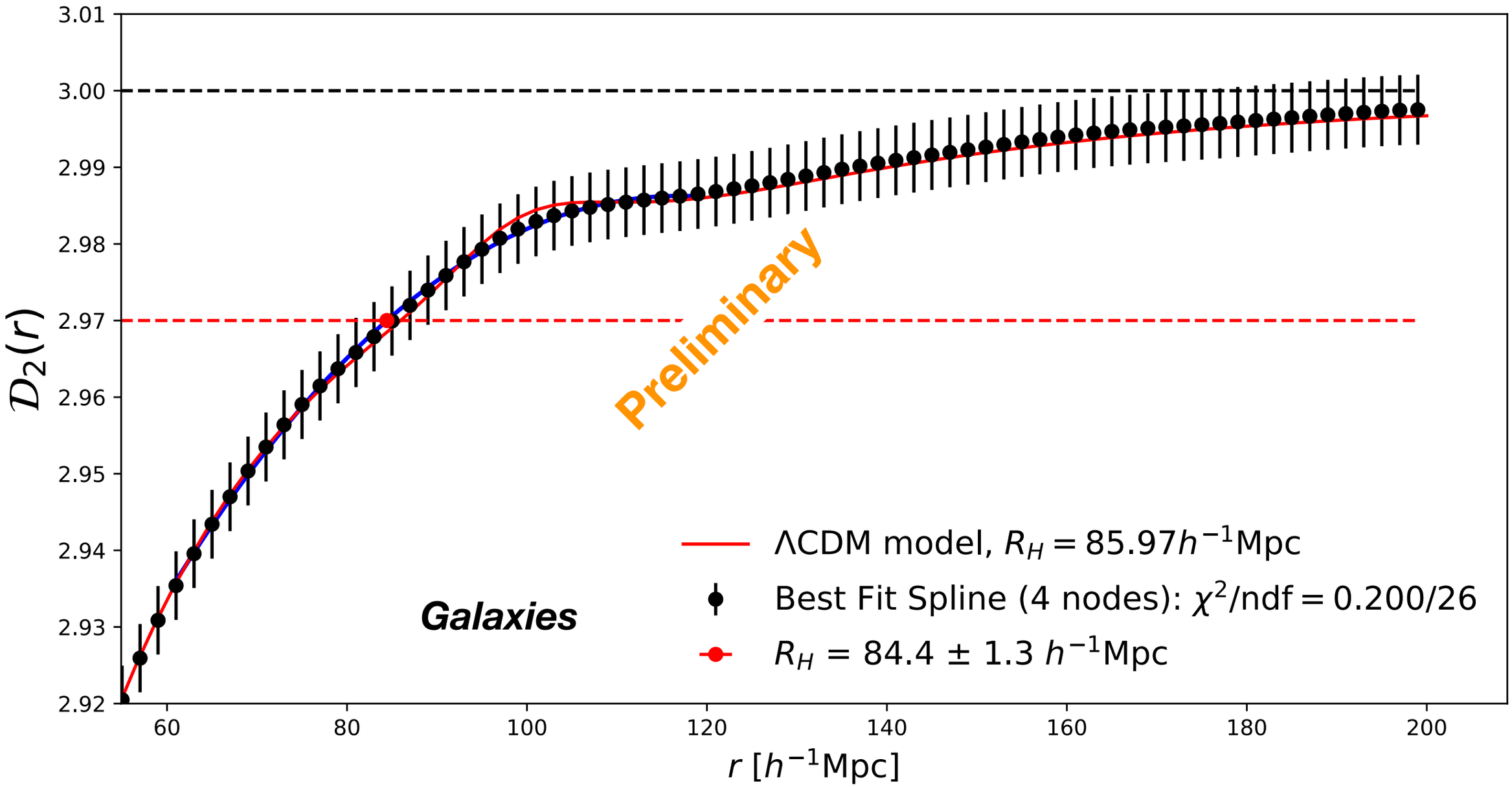
Fisherology: only CMASS Error



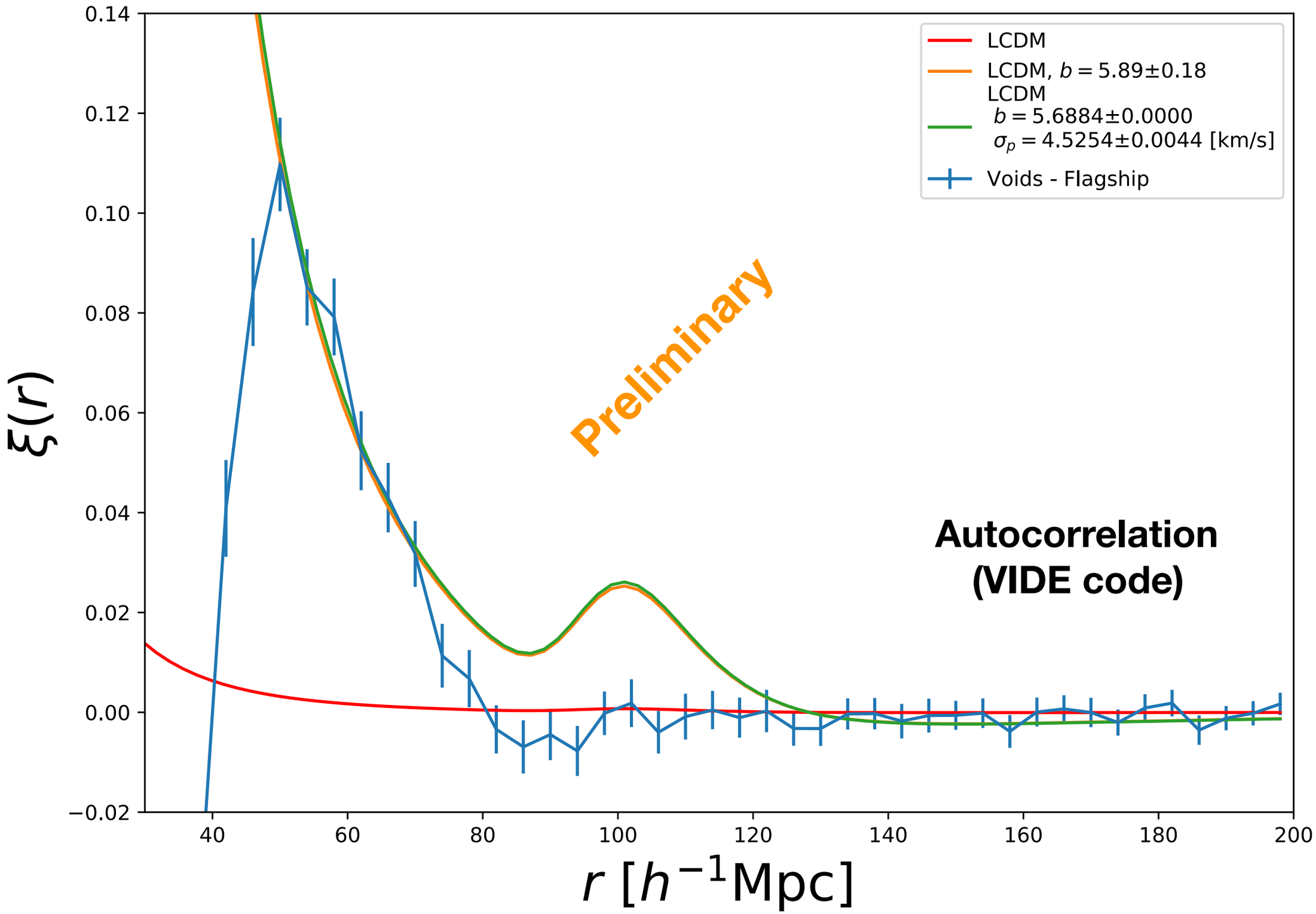
Sensitivity: Current and Future Surveys
Extrapolation from CMASS



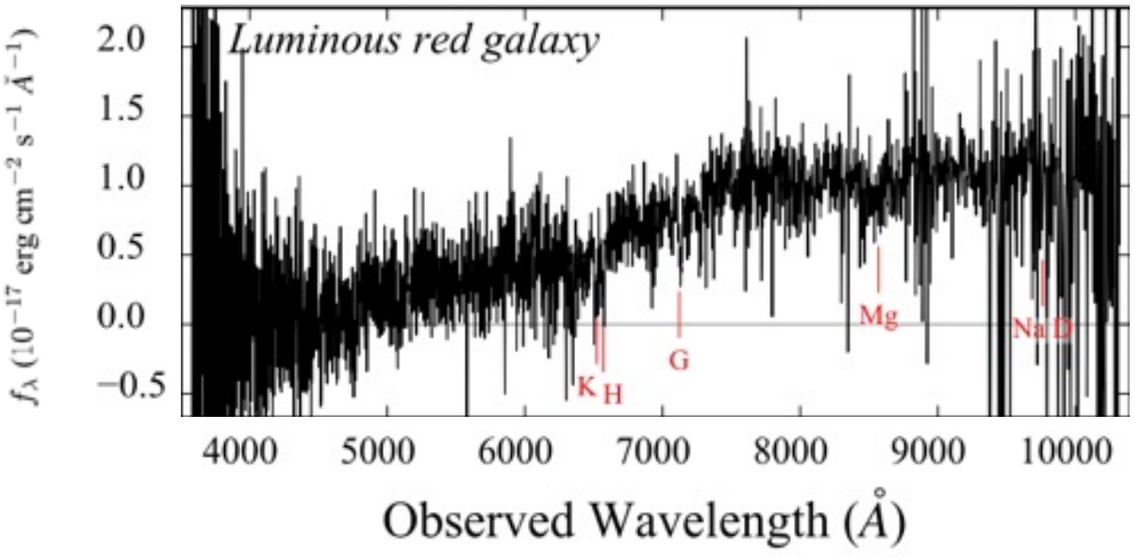
Euclid: RH from flagship

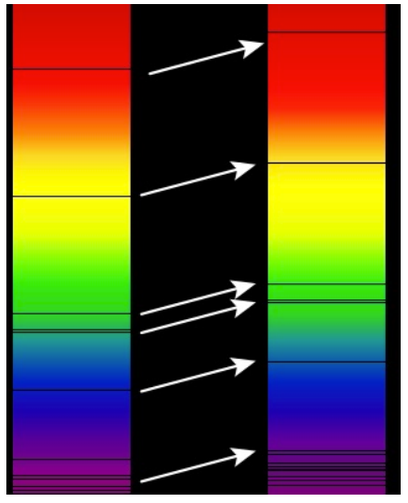


Euclid: Homogeneity from Voids?

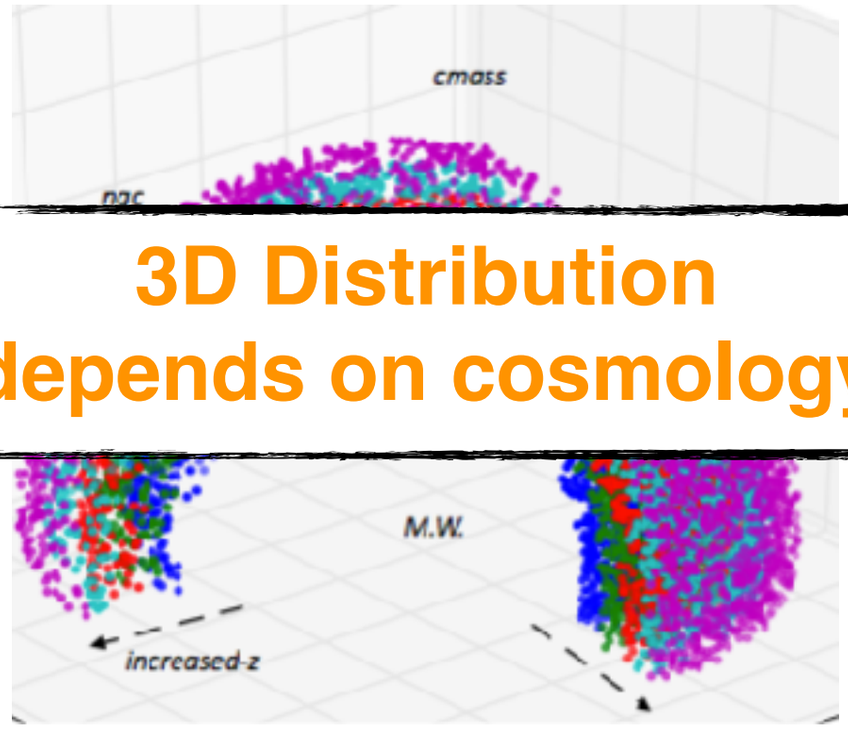


Limitation 1: ΛCDM-r(z), homogeneity assumption

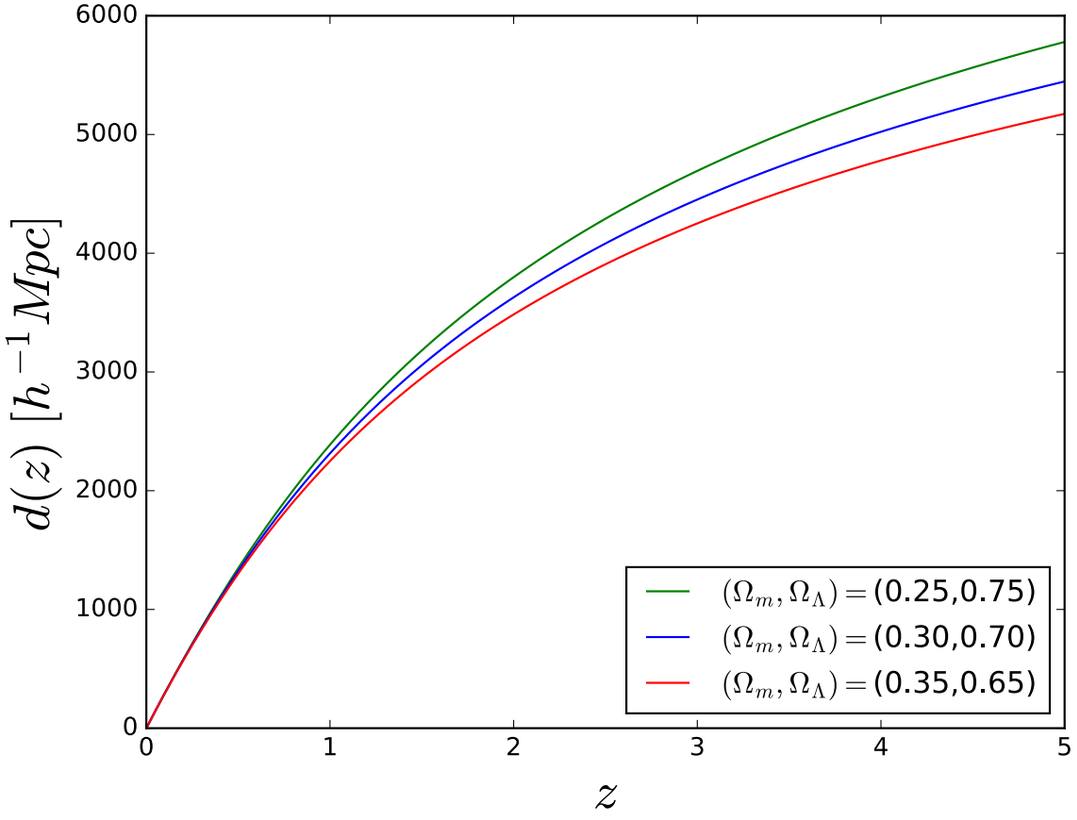




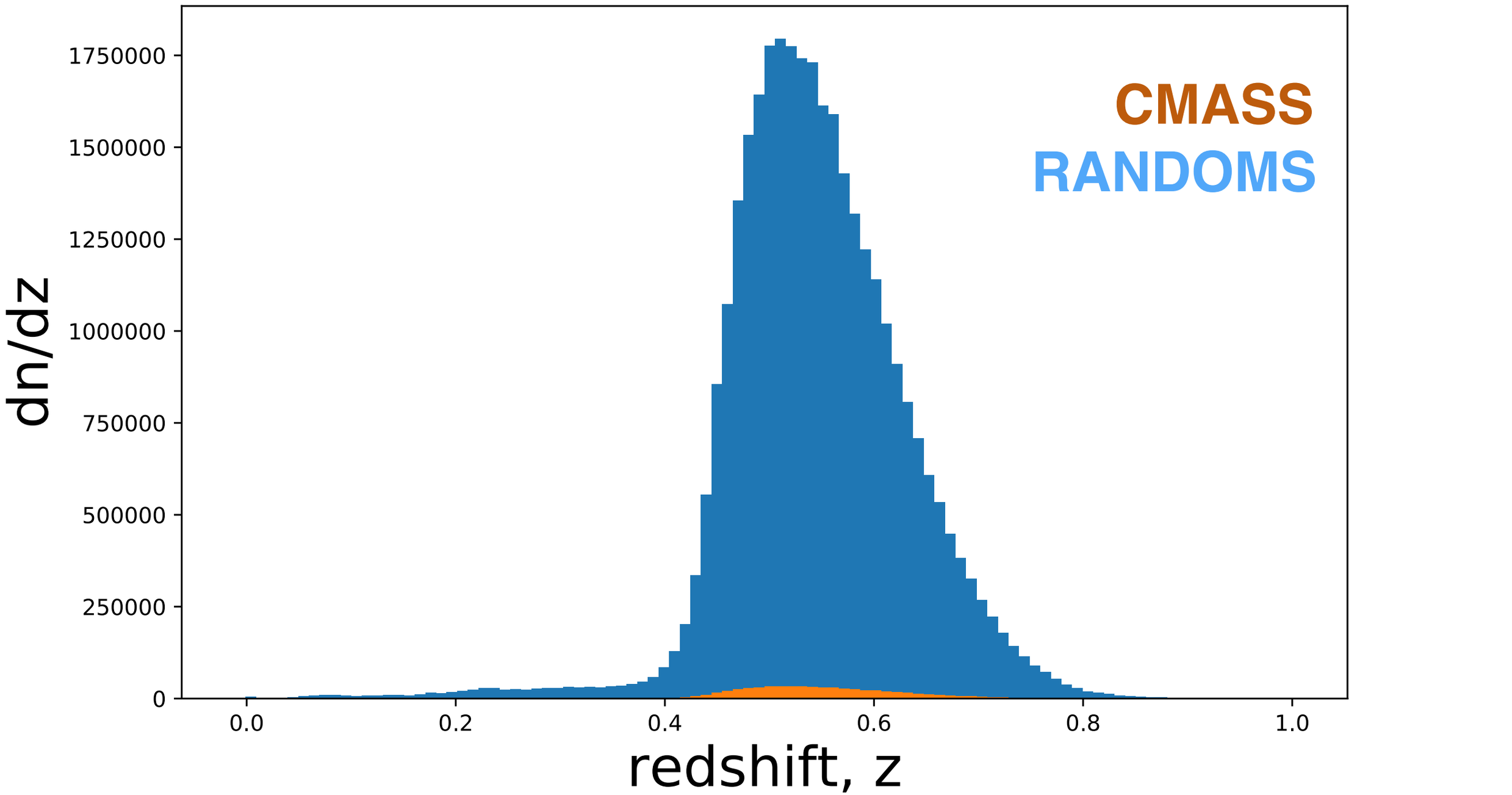
Redshift, z



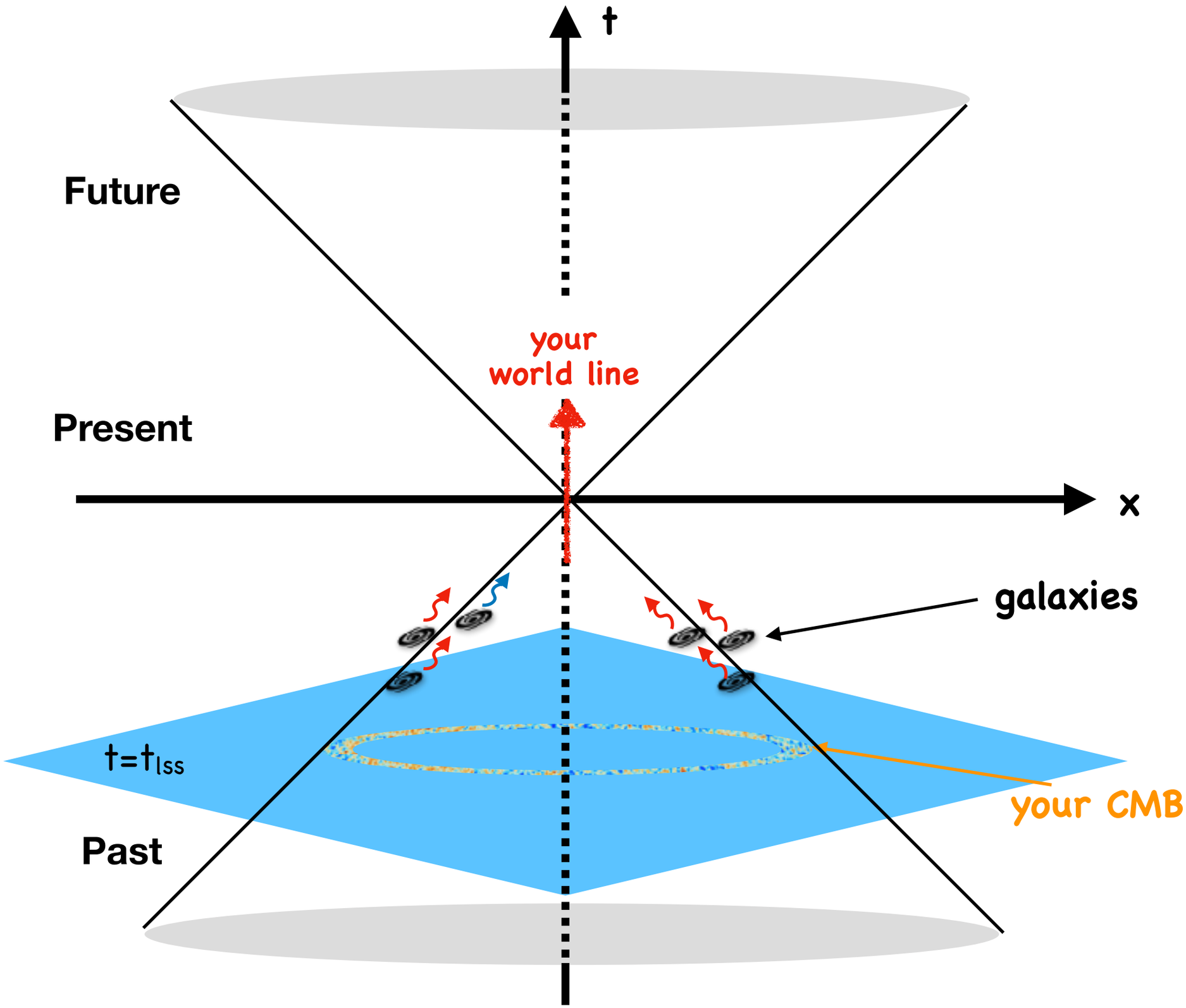
3D Distribution depends on cosmology



Limitation 2: Correction on redshift profile



Limitation 3: Observe only on past 3D lightcone



Conclusions

Main Advantages:

- Largest eff-V ever studied! (~3 $h^{-3}Gpc^3$)
- Precision ~1% (Wz ~ 5%)
- Complementary Standard Ruler
- Consistency Cosmological Principle Test (CP- Test)

Main Limitations on CP - Test:

- ΛCDM reconstruction, assumes homogeneity
- Observation only on the past lightcone
- Blind to ρ(z): Randoms for edge effects corrections