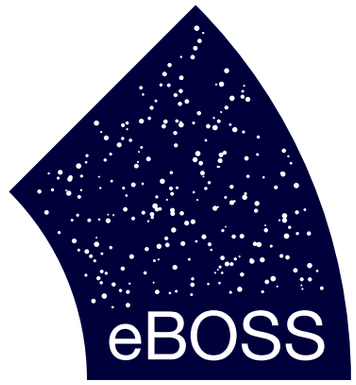

QSO Mock Challenge
Blind Analysis

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Scaling the Cosmology

- Method of Mead & Peacock 2014 to rescale OuterRim cosmology
- First part of method: scale position/mass/z to match σ(M) in new cosmology
- Scale comoving positions by factor s $\quad L' = sL$
- Since $M = \frac{4}{3}\pi R^3 \bar{\rho}$, scale masses by $\quad M' = s_{\rm m} M; \quad s_{\rm m} \equiv s^3 \frac{\Omega'_{\rm m}}{\Omega_{\rm m}}$
- Need to find scaling factor s, and redshift, z, of original simulation snapshot
- Minimize $\quad \delta^2_{\rm rms}(s, z \mid z') = \frac{1}{\ln(R'_2/R'_1)} \int_{R'_1}^{R'_2} \frac{{\rm d}R}{R} \left[1 - \frac{\sigma(R/s, z)}{\sigma'(R, z')}\right]^2$

Scaling the Cosmology

- Second part of method: displace halo positions/velocities
- Calculate displacement field, ***f***, from overdensity of haloes
- Change in ***f*** due to different cosmology

$$\delta \boldsymbol{f}_{k'} = \left[\sqrt{\frac{\Delta'^2_{\rm lin}(k', z')}{\Delta^2_{\rm lin}(sk', z)}} - 1 \right] \boldsymbol{f}_{k'}$$

- Adjust positions by $\boldsymbol{x}' = \boldsymbol{x} + \delta \boldsymbol{f}$
- To get right mass-dependent bias, multiply displacement by b(M)
- Also apply scaling and displacements to halo velocities

$$\mathbf{v}' = s \frac{H' f'_g a'}{H f_g a} \mathbf{v} \qquad \delta \mathbf{v}_{k'} = a' H' f'_g \left[\sqrt{\frac{\Delta'^2_{\rm lin}(k', z')}{\Delta^2_{\rm lin}(sk', z)}} - 1 \right] \mathbf{f}_{k'}$$

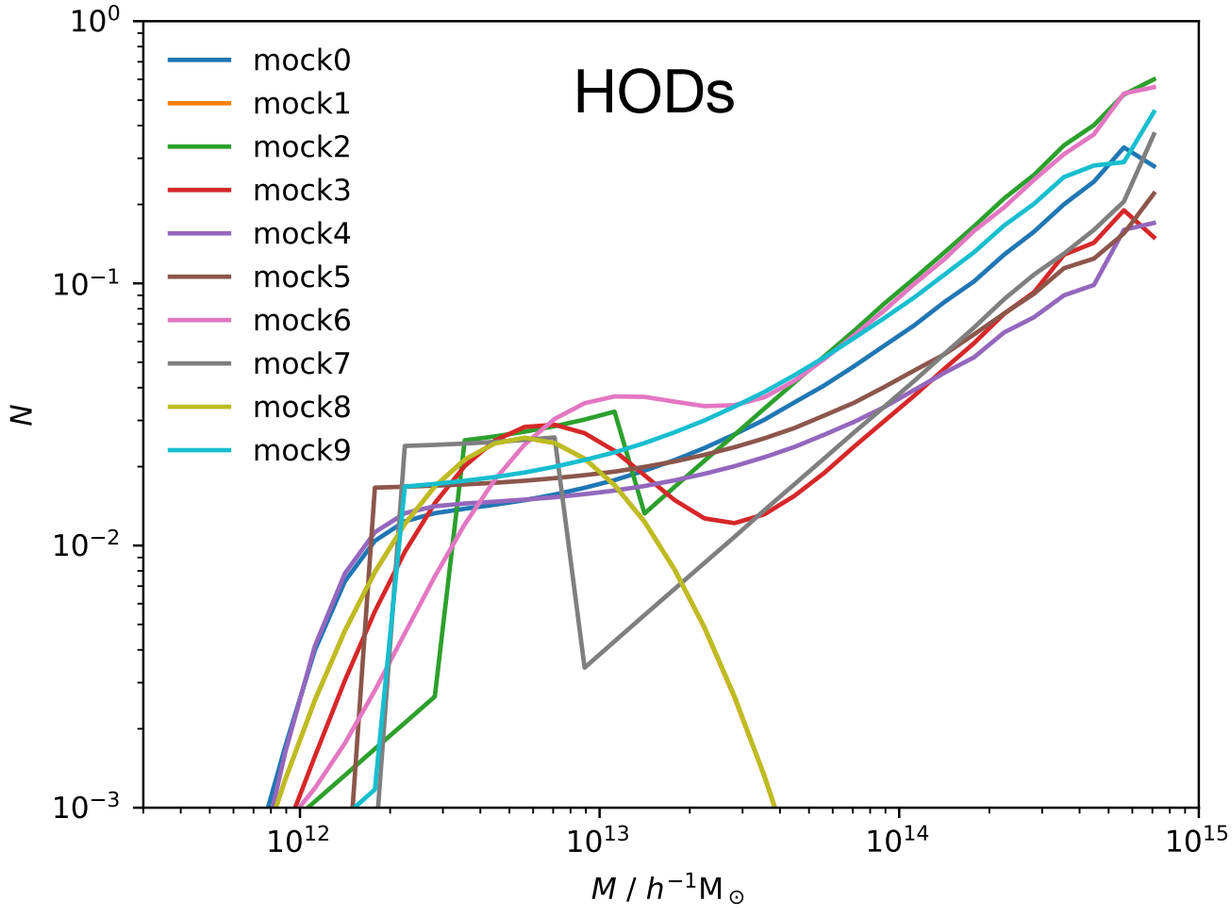
Blind Mocks

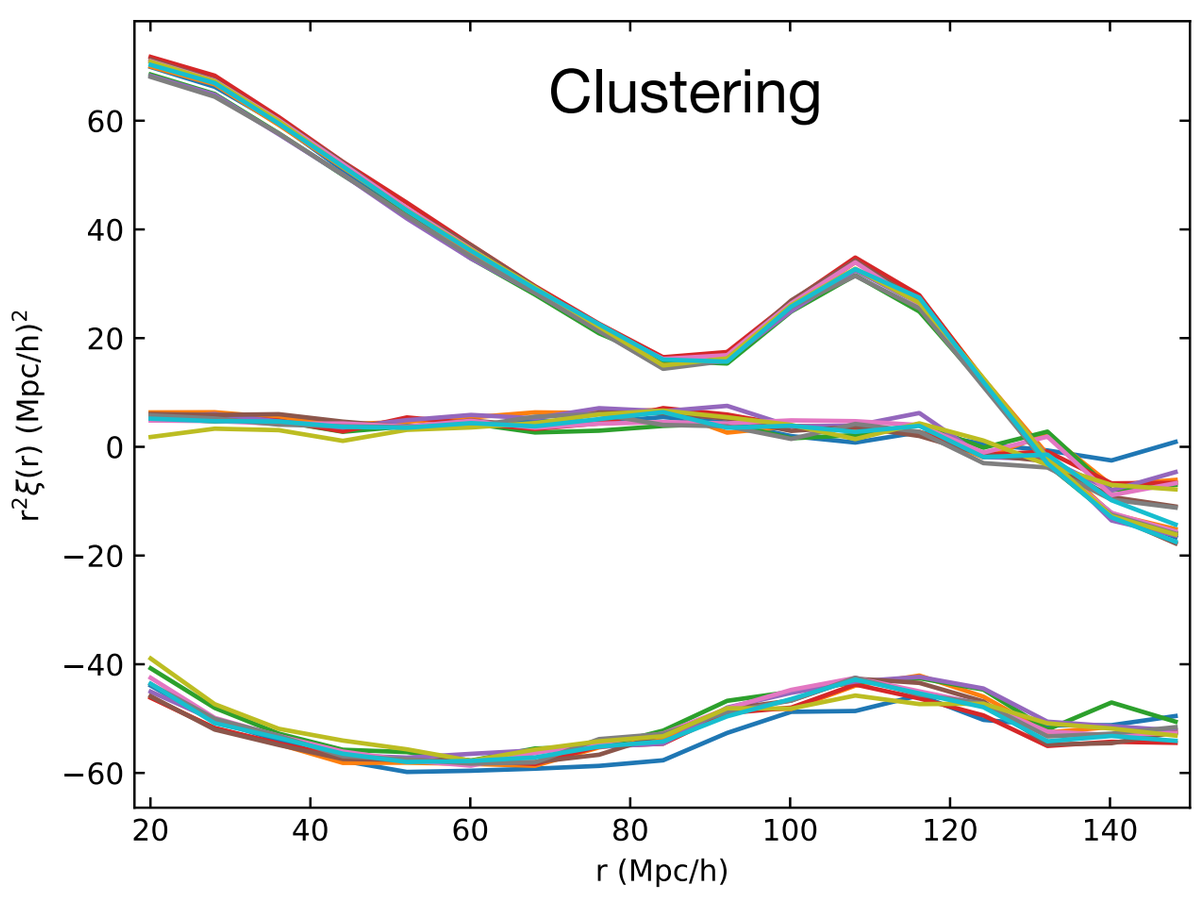
- Mead & Peacock method used to rescale OuterRim snapshots either side of z=1.433 to new cosmologies at z=1.433
- Modify $\Omega_{\rm b}$, $\Omega_{\rm cdm}$, h and σ_8 from OuterRim values by generating random numbers from Gaussian distribution
- Find n_s needed for z to match snapshot z when rescaling
- Populate with HODs from non-blind mock challenge
- Blind mocks do not have redshift smearing
- In some mocks, additional velocity scaling

- Python implementation of Mead & Peacock method on GitHub https://github.com/amjsmith/rescale-cosmology

HOD models

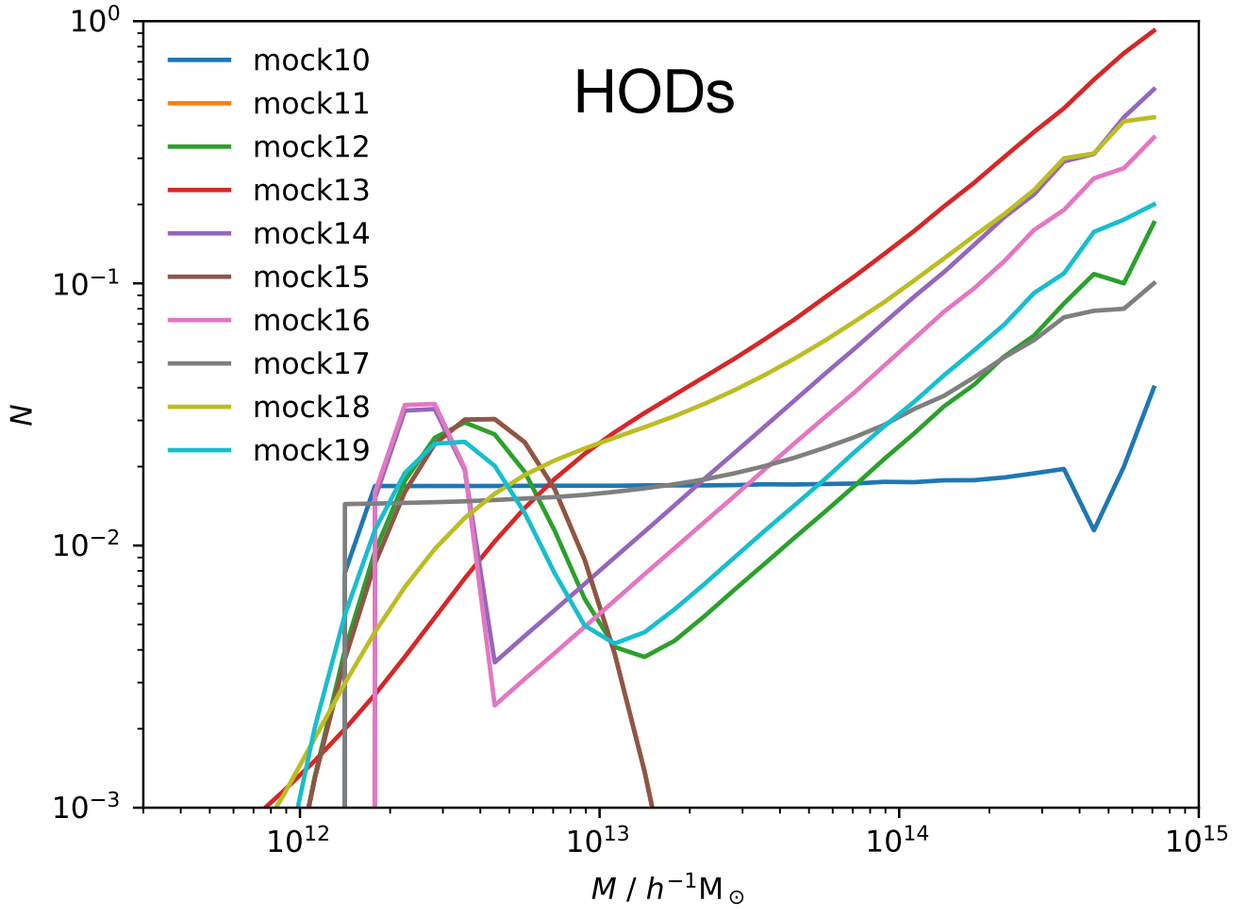
	mock0	mock1	mock2	mock3	mock4	mock5	mock6	mock7	mock8	mock9
HOD	Smooth step + PL	Gaussian	Top hat + PL	Gaussian + PL	Smooth step + PL	Sharp step + PL	Gaussian + PL	Top hat + PL	Gaussian	Sharp step + PL
Satellite positions	Particles	NFW	NFW	Particles	NFW	NFW	NFW	Particles	NFW	NFW
Satellite %	19 %	7 %	60 %	21 %	8 %	17 %	56 %	24 %	100 %	42 %

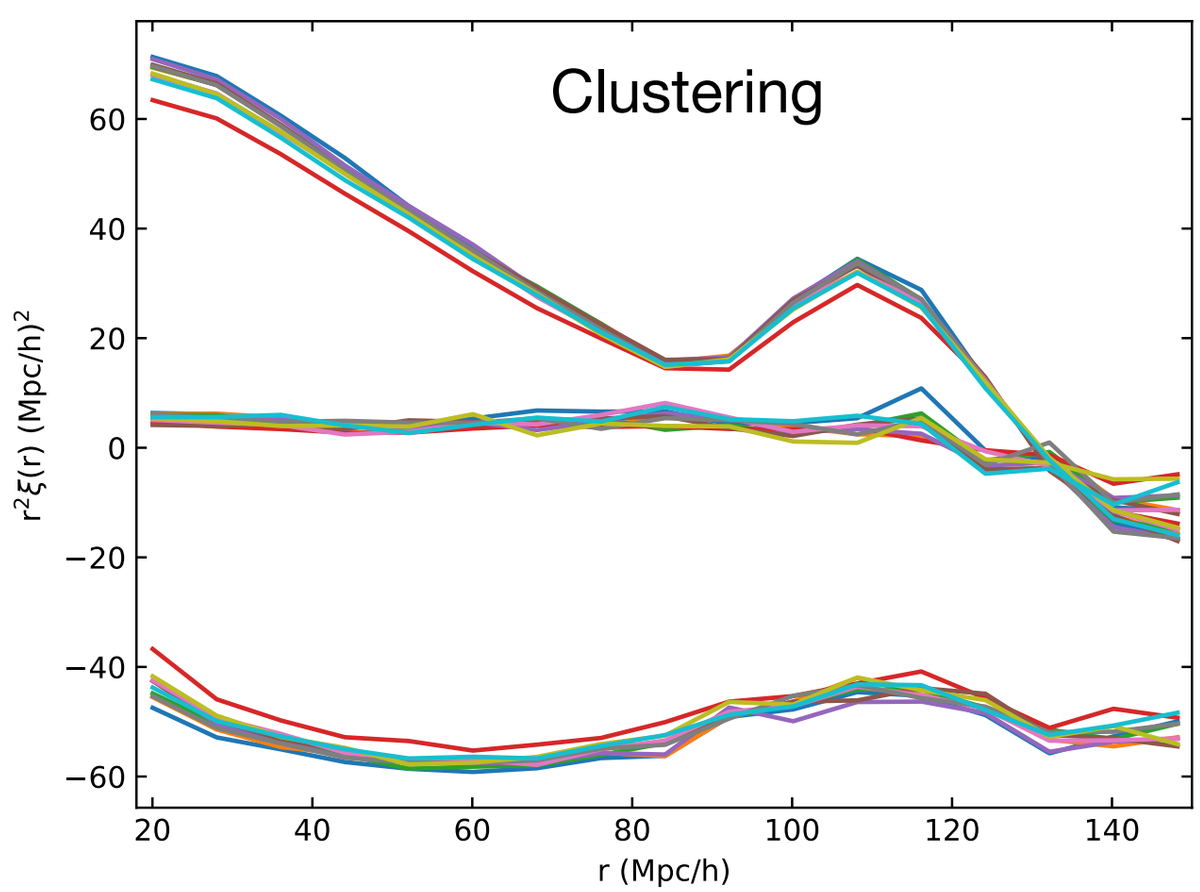




HOD models

	mock10	mock11	mock12	mock13	Mock14	mock15	mock16	mock17	mock18	Mock19
HOD	Sharp step + PL	Gaussian	Gaussian + PL	Smooth step + PL	Top hat + PL	Gaussian	Top hat + PL	Sharp step + PL	Smooth step + PL	Gaussian + PL
Satellite positions	Particles	NFW	NFW	NFW	Particles	Particles	NFW	NFW	NFW	Particles
Satellite %	0.2 %	10 %	5 %	73 %	17 %	50 %	12 %	4 %	36 %	7 %

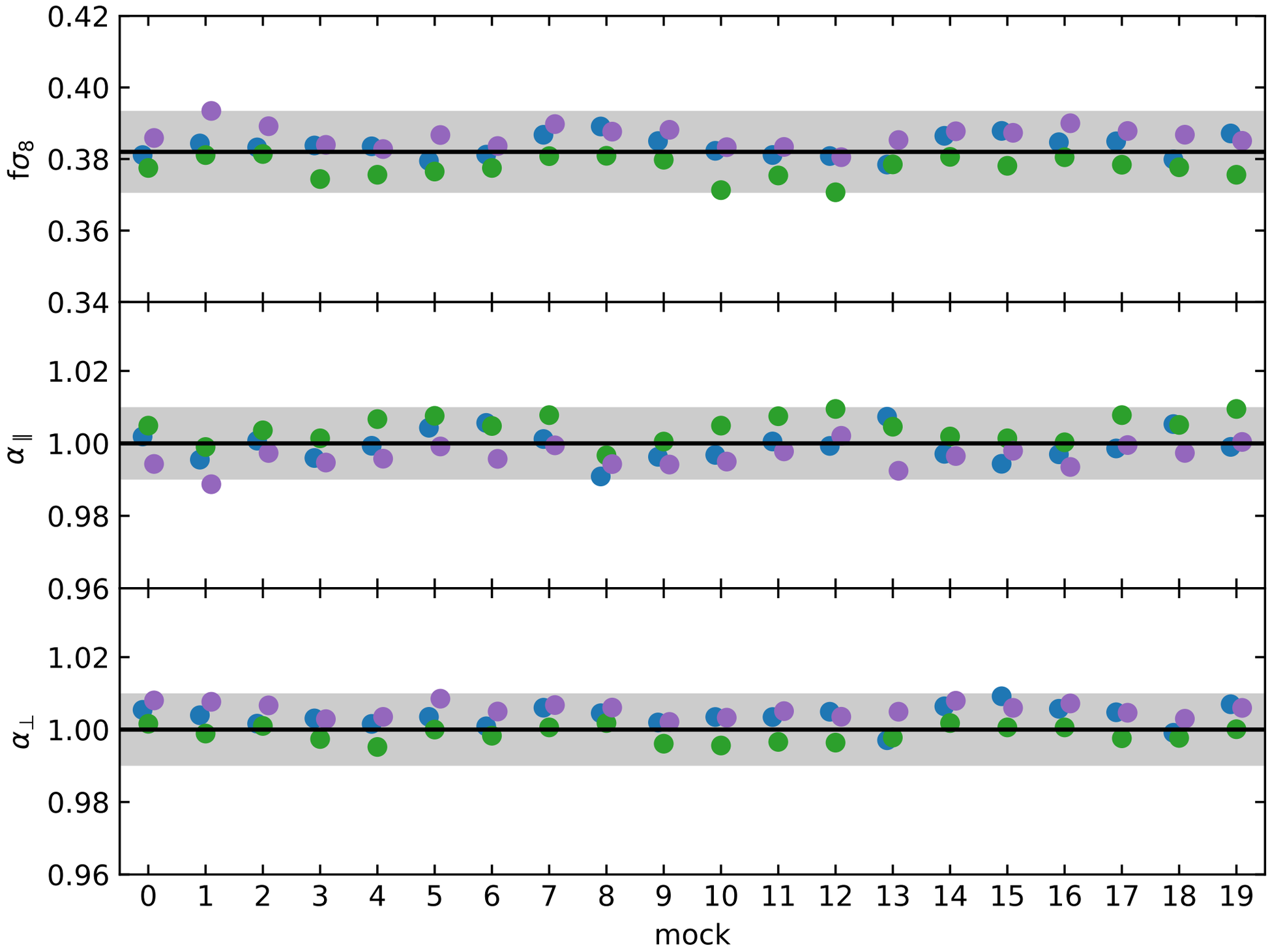




Non-blind Mocks

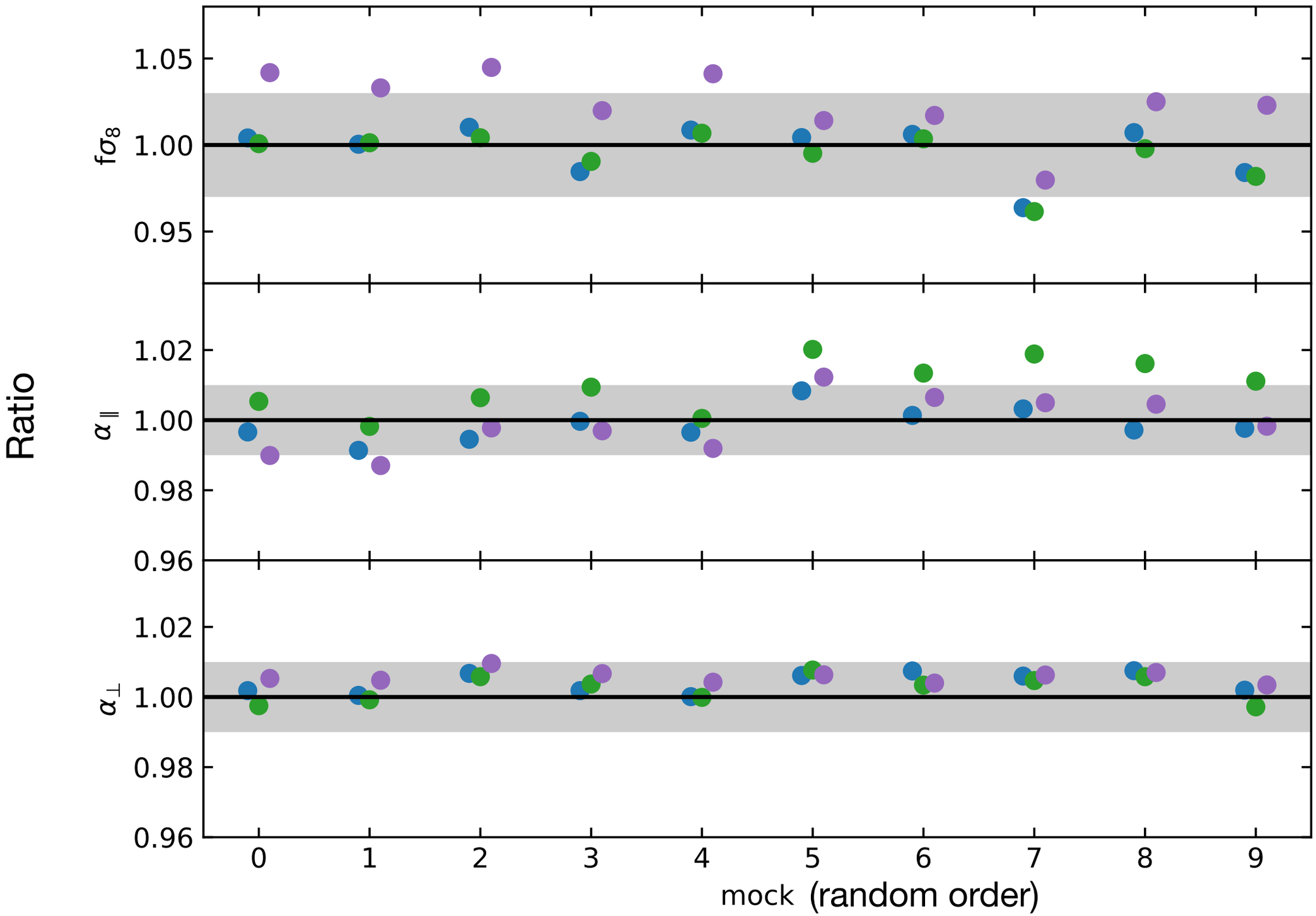
Richard
Jiamin
CLPT

- No redshift smearing



Blind Mocks (v1)

Richard
Jiamin
CLPT



Blind Mocks (v2)

Richard
Jiamin
CLPT
BAO