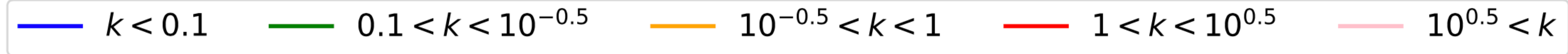


Evaluating baryonic effects in HSC Y3 cosmic shear data with a dark matter-only model

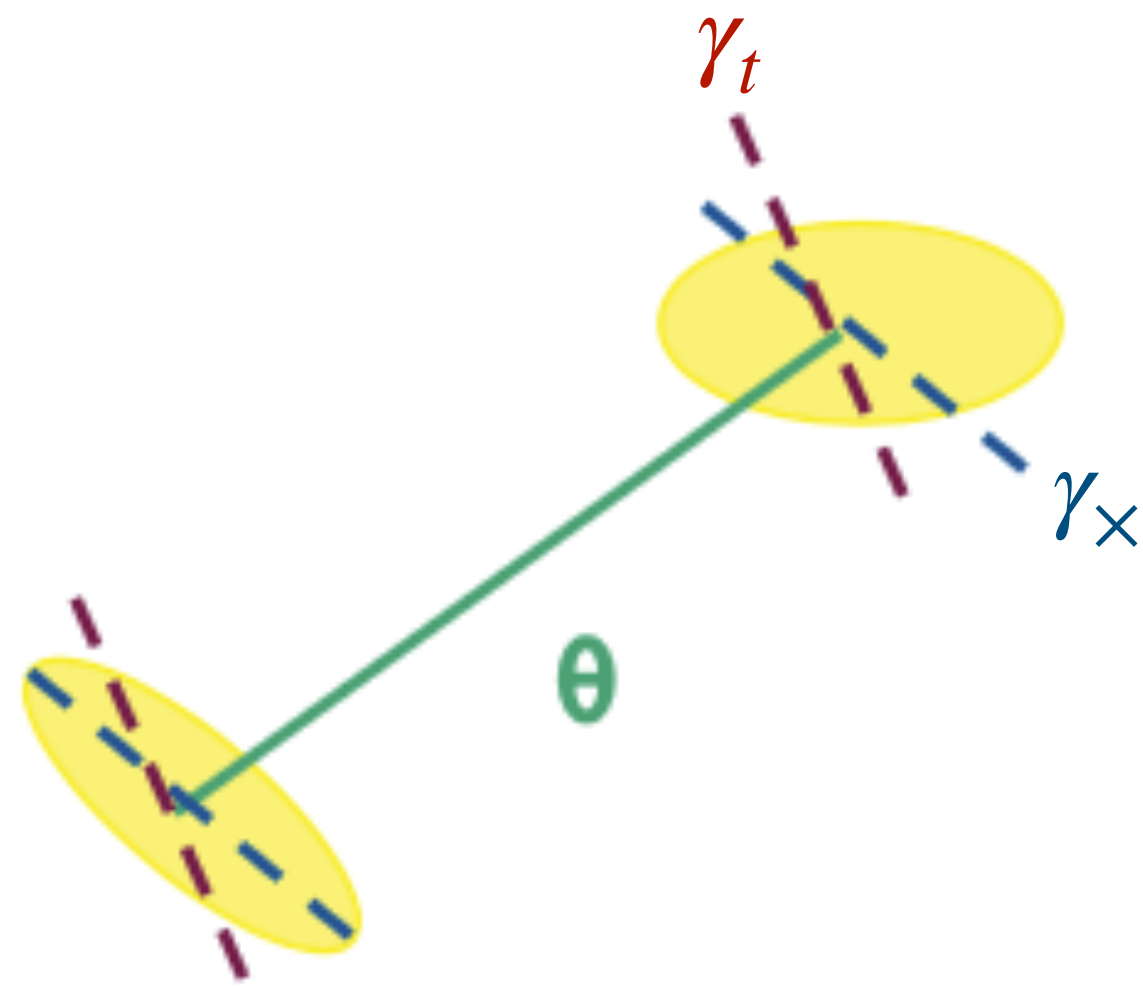
Ryo Terasawa (Kavli IPMU), Masahiro Takada (Kavli IPMU),
and HSC collaboration

@ The 32nd Texas Symposium on Relativistic Astrophysics, 2023/12/14

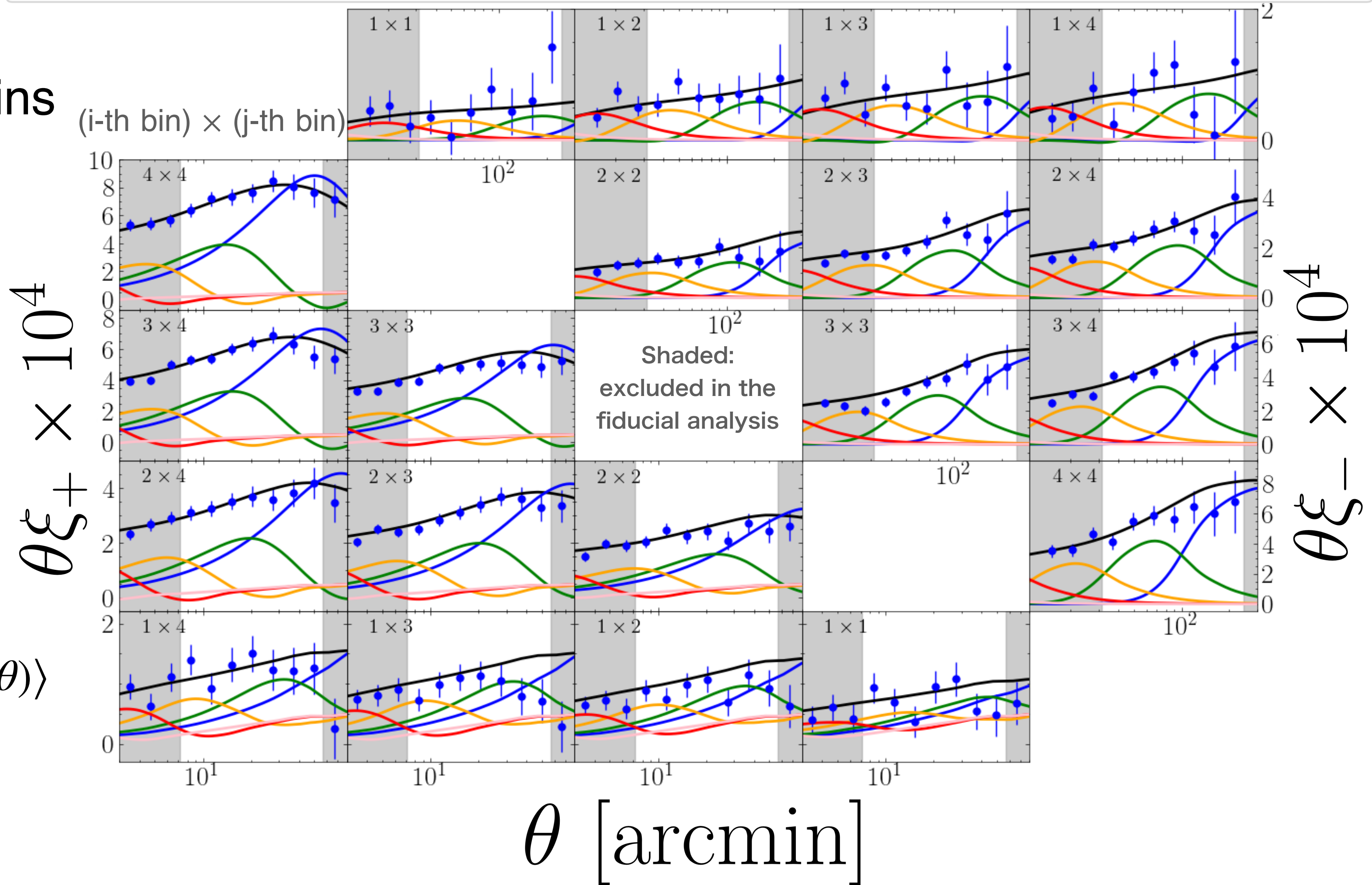
Cosmic Shear 2 Point Correlation Functions



4 tomographic redshift bins

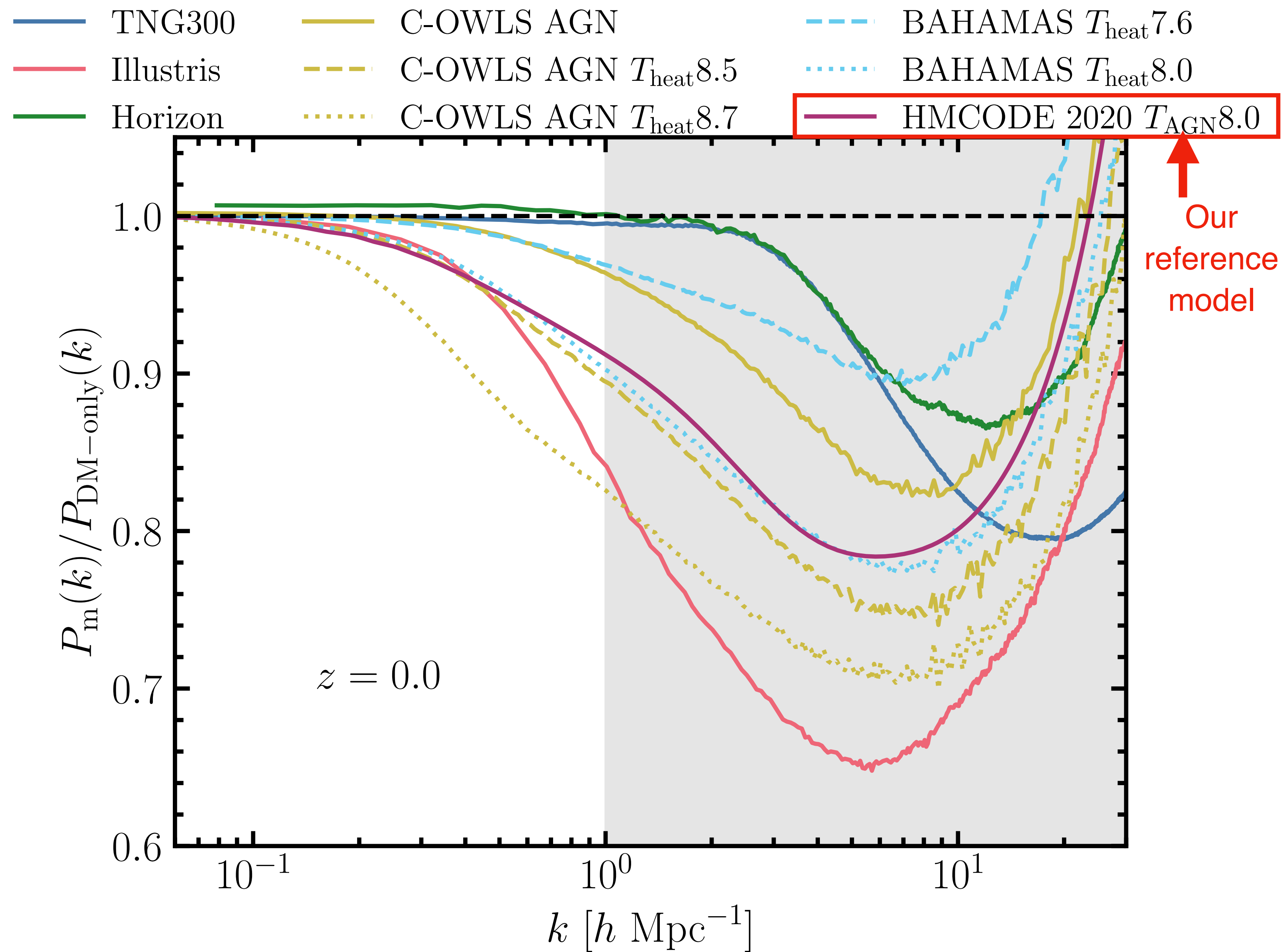


$$\xi_{\pm}(\theta) = \langle \gamma_t(\mathbf{0})\gamma_t(\theta) \rangle \pm \langle \gamma_x(\mathbf{0})\gamma_x(\theta) \rangle$$

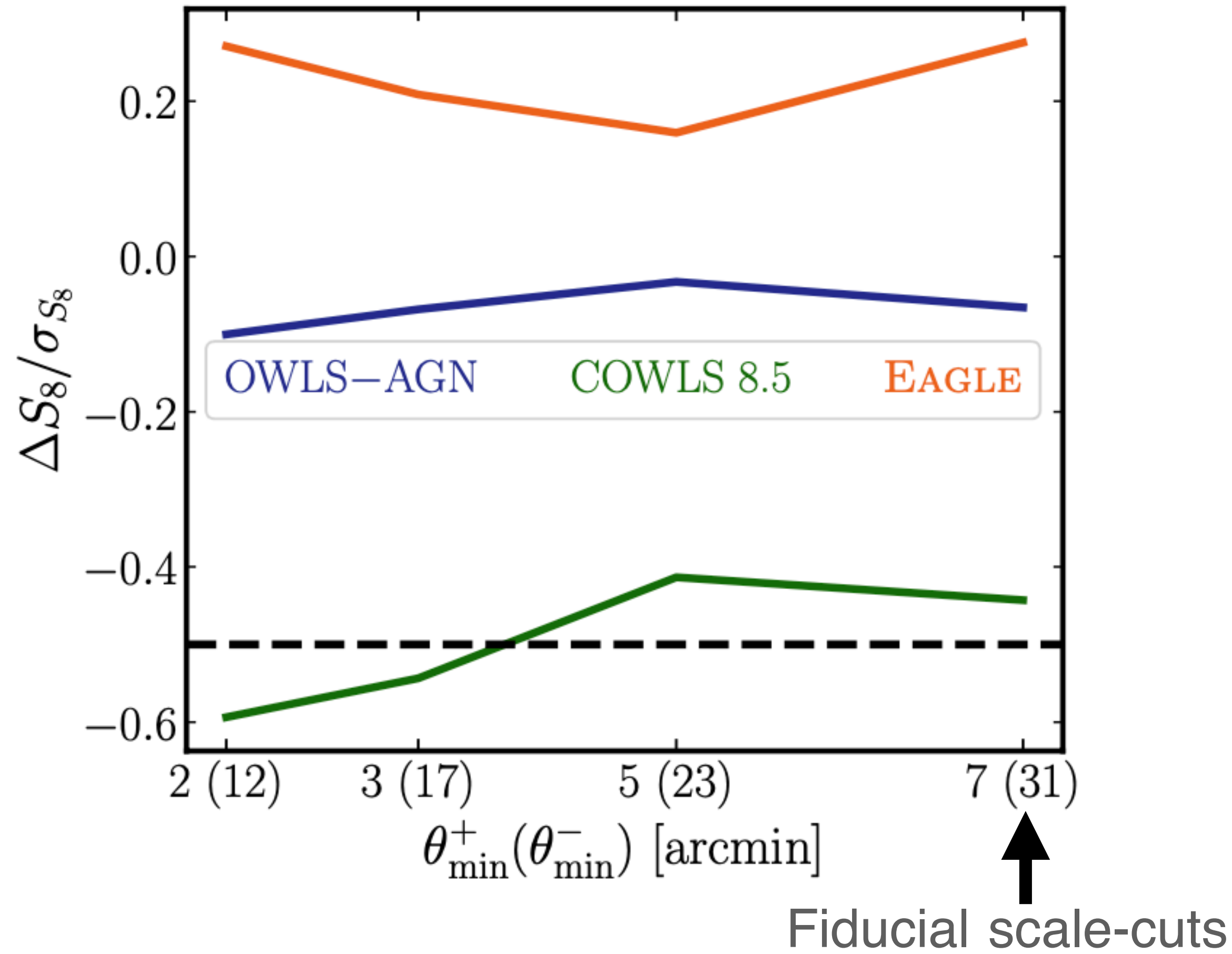


Baryonic effects

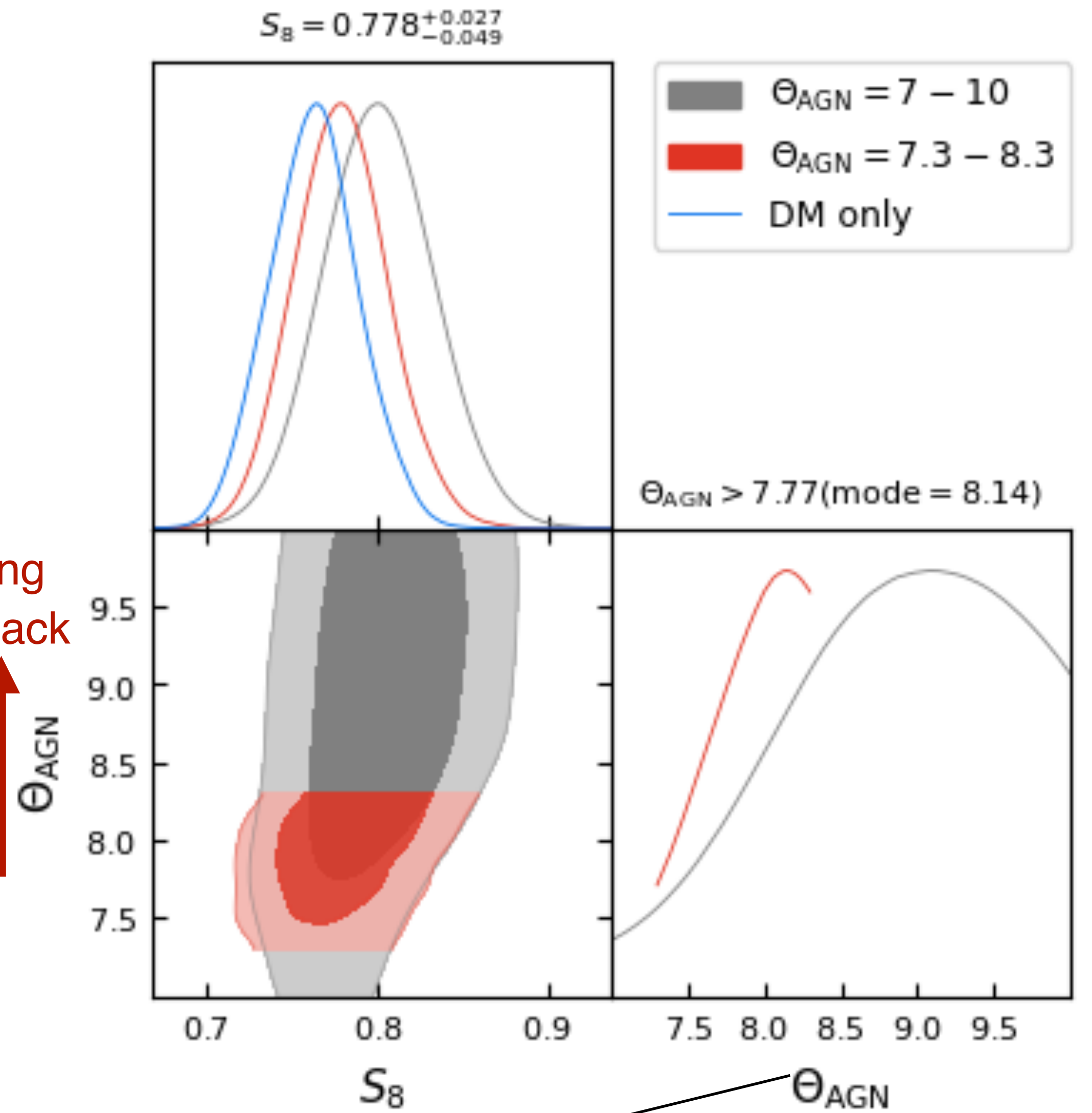
- Baryonic effects (e.g. AGN/SN feedback) suppress the matter clustering
- Baryonic feedback model based on the hydro sims:
 - HMcode (Mead+16,20)
 - PCA (e.g. Xu+23)
 - Baryon Correction Model (BCM; e.g. Arico+20,23)



S_8 and baryonic feedback



Strong feedback



Feedback strength is not well constrained

Robust evaluation of baryonic effects with DM-only model

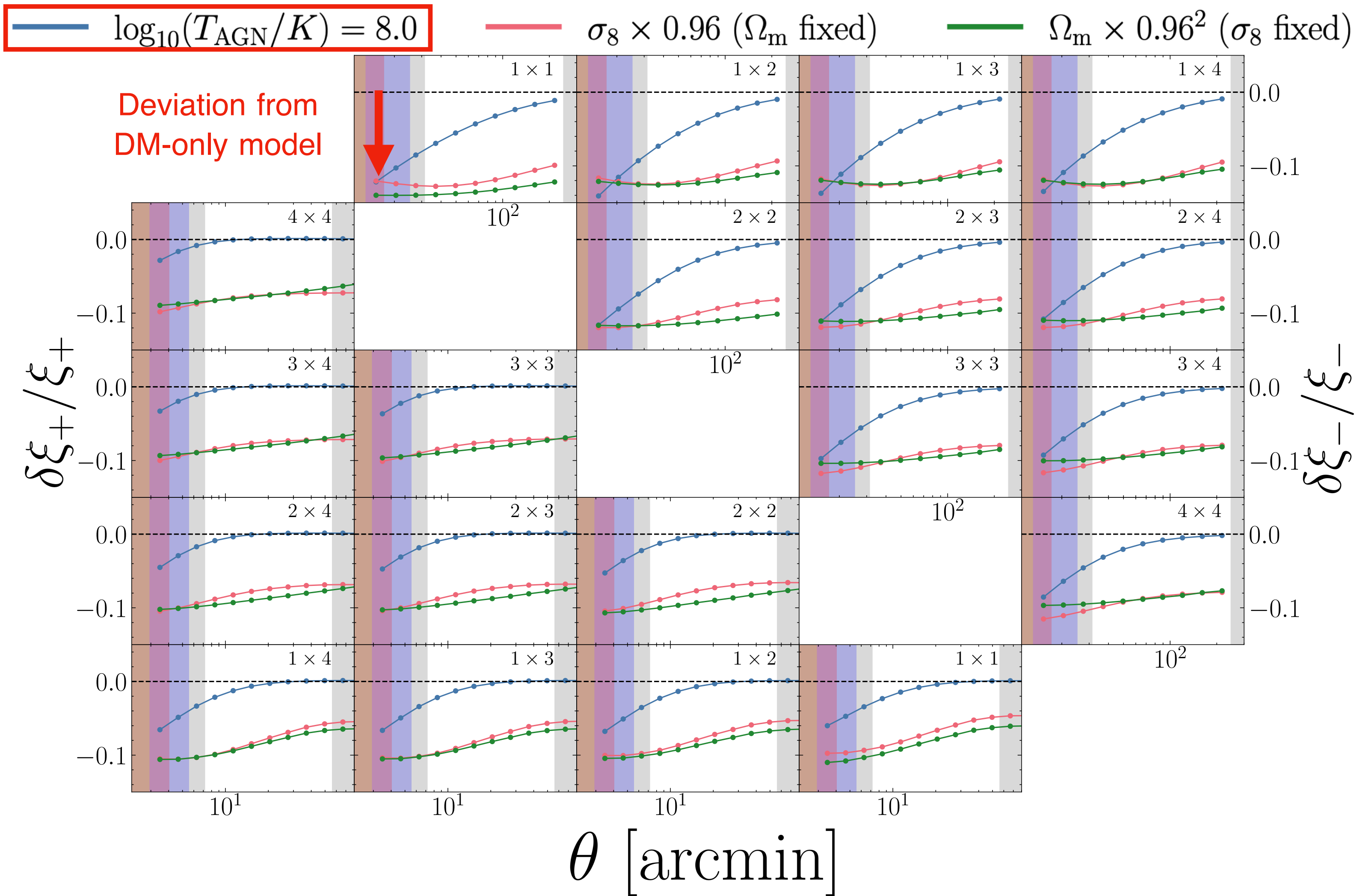
fiducial cut ($\theta_{\min}^+ = 7'.1$) L1cut ($\theta_{\min}^+ = 5'.3$) L2cut ($\theta_{\min}^+ = 4'.0$) L3cut ($\theta_{\min}^+ = 2'.9$)

- Try to fit the data with N-body based DM-only model for $P_m(k)$ (Dark Quest 2 Emulator)

- If the DM-only model ... fails to fit the data -> Strong baryonic feedback (or WDM, axion, etc)

can fit the data -> Data is consistent with DM-only (or modest feedback) model

- DM-only model is accurate. On the other hand, the model including baryonic effect suffers from the modeling uncertainty.

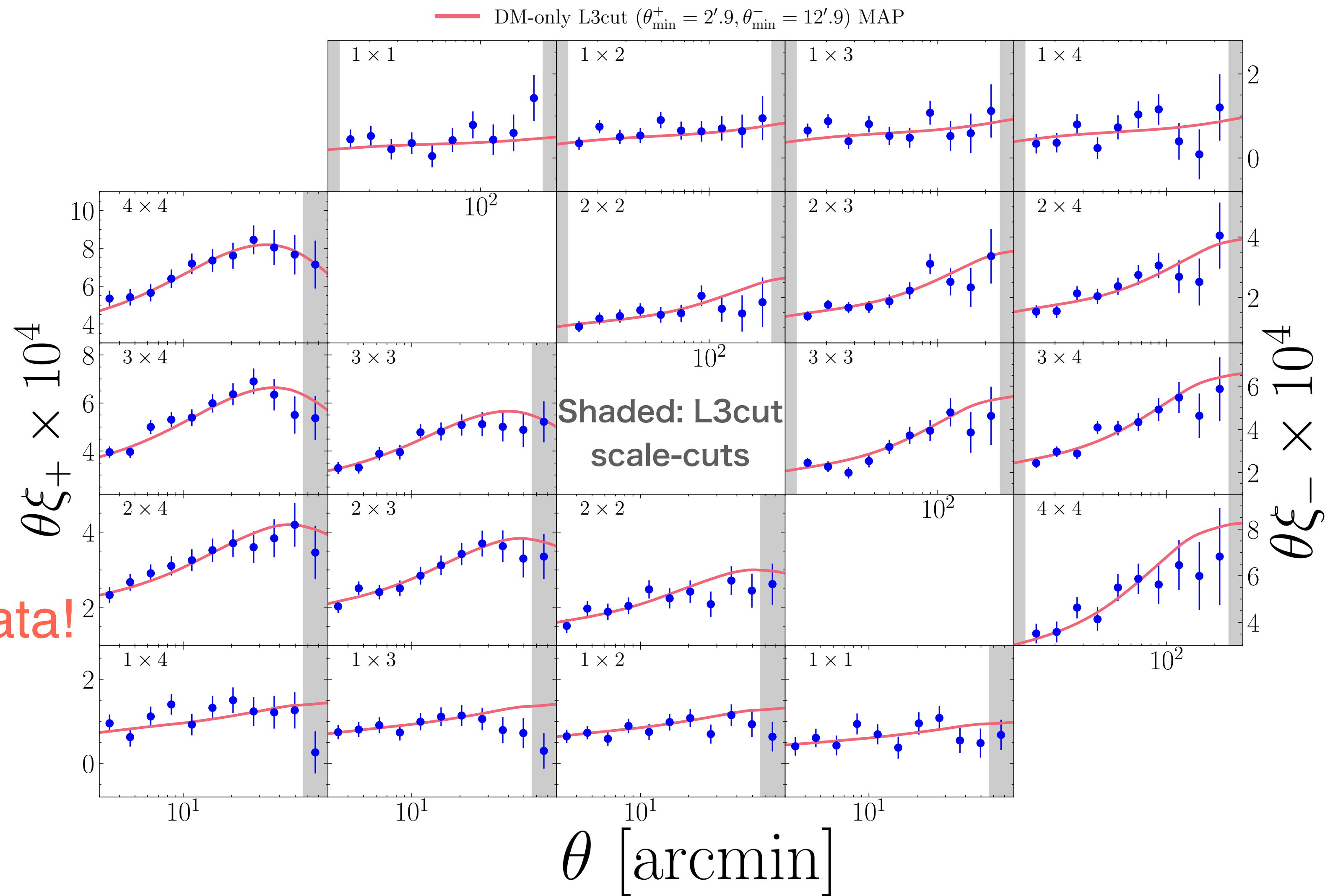


Goodness-of-fit

- p-value

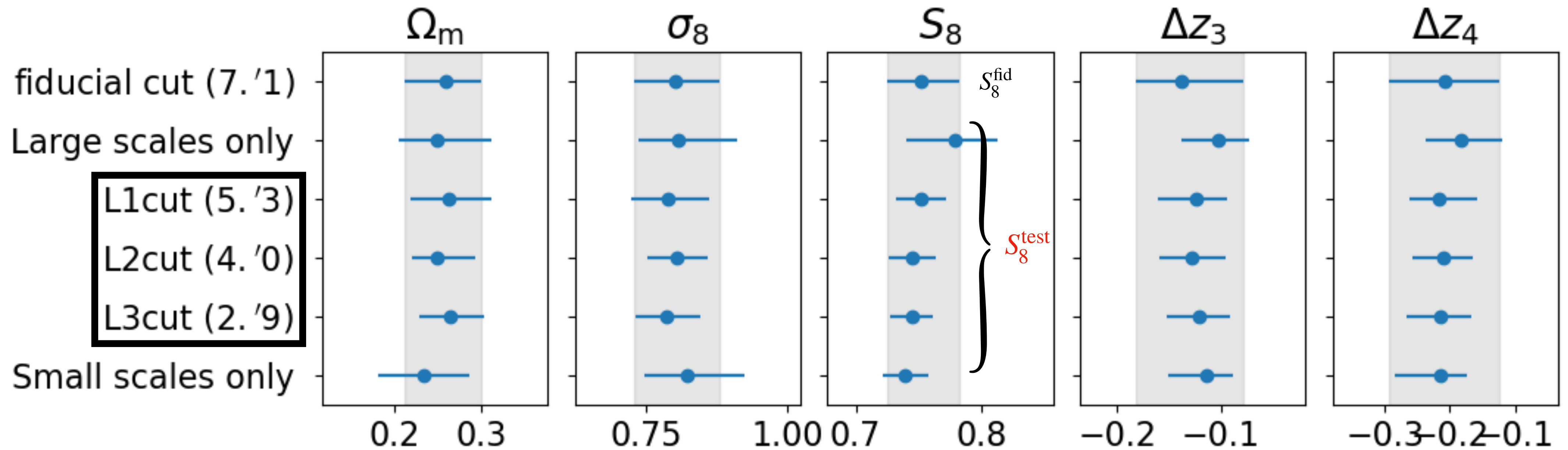
$p = 0.11$ for fiducial scale cuts
 $(\theta_{\min}^+ = 7'.1)$

$p = 0.18$ for L3 cut $(\theta_{\min}^+ = 2'.9)$



The DM-only model can fit the data!

S_8 constraints



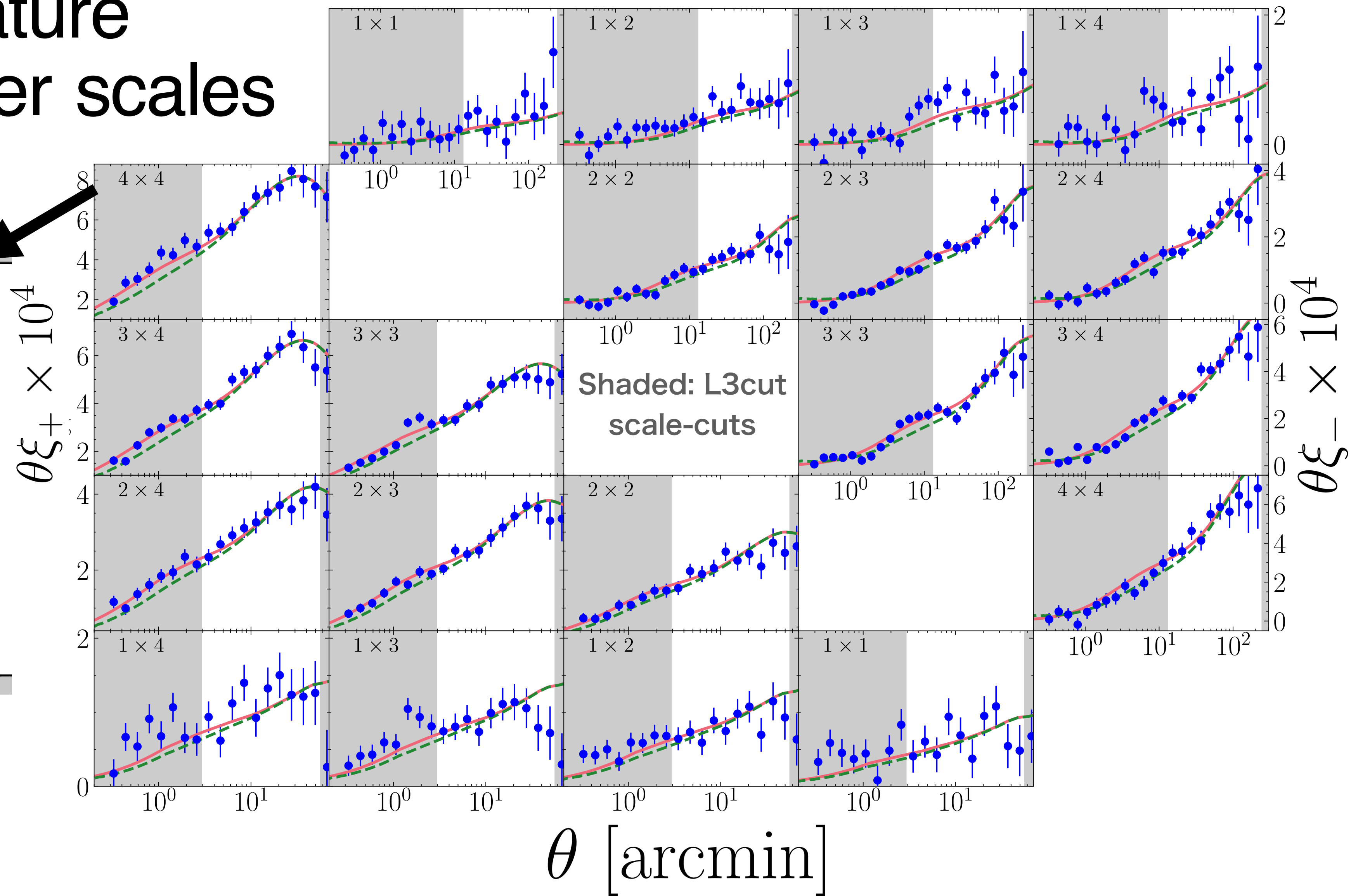
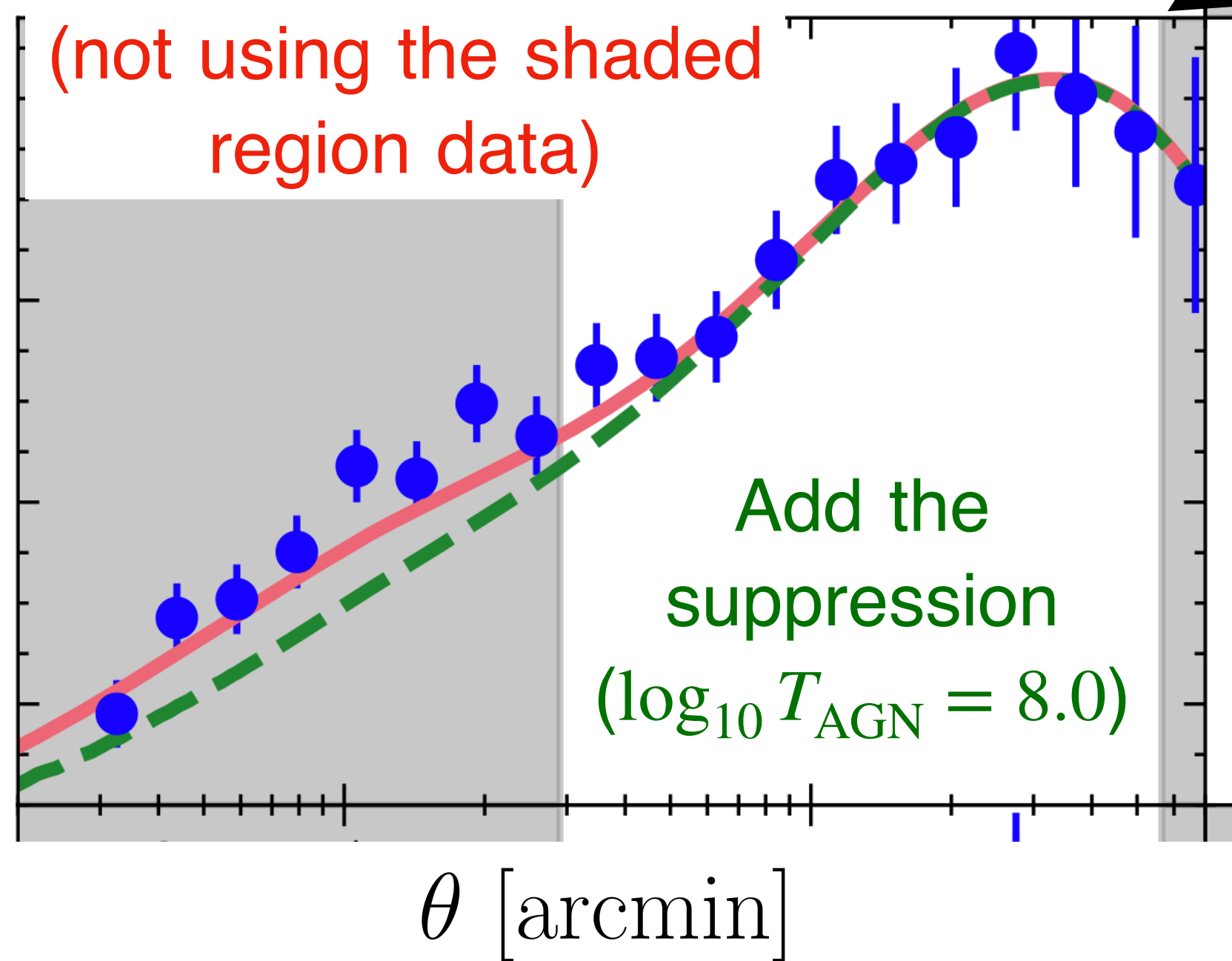
- Confirm that shifts of S_8 : $\Delta S_8 \equiv S_8^{\text{test}} - S_8^{\text{fid}}$ is statistically consistent with DM-only model using 50 noisy mock data vectors.

No suppression feature seen in even smaller scales

— DM-only L3cut MAP ($\chi^2 = 491.7$)

- - - + $\log_{10} T_{\text{AGN}} = 8.0$ ($\chi^2 = 511.8$)

Best-fit model to the L3 cut (not using the shaded region data)



Summary

Feel free to contact me via email (ryo.terasawa@ipmu.jp) for questions and discussion.

- Baryonic feedback suppress the cosmic shear signal and difficult to model precisely.
- We assessed whether the DM-only model can fit the HSC-Y3 cosmic shear data even down to very small angular scales that are sensitive to the baryonic suppression effects.
- The HSC-Y3 cosmic shear data does not show any clear signature of the baryonic effect; the DM-only model can explain the data down to very small scales (~ 0.3 arcmin).
- We conclude that the S8 result from the HSC-Y3 data is robust, not affected by the unknown baryonic effect; it confirms the S8 tension.