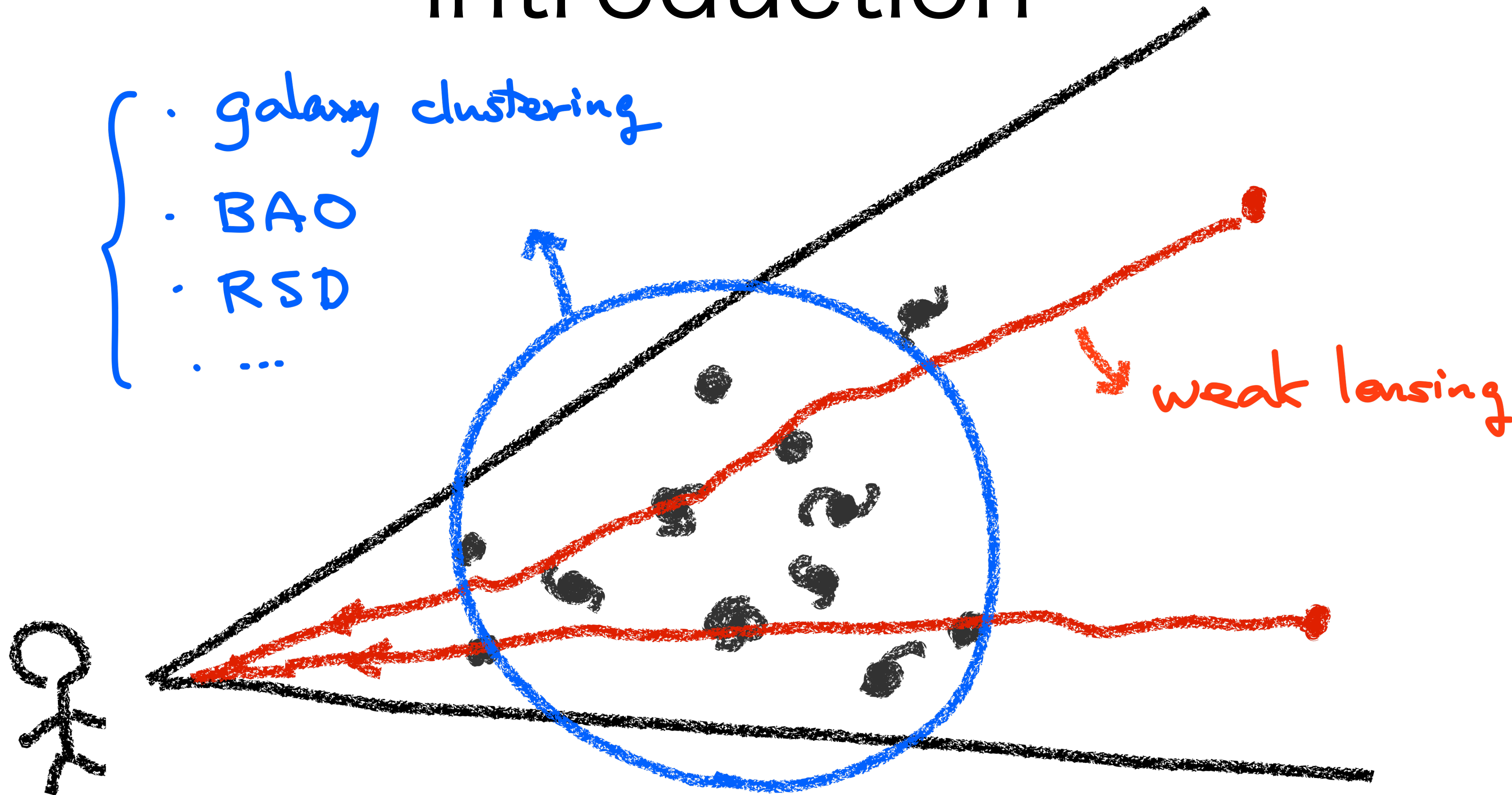


# HSC-PFS cross-correlation simulated by the `lognormal_lens` code

Issha Kayo (Tokyo Univ. of Tech.)  
with Ryu Makiya and Eiichiro Komatsu

# introduction

- galaxy clustering
- BAO
- RSD
- ...



# merits of lognormal codes

- very fast
  - a minute for a map
- “answer” is known  
→ useful for systematics validation
- window function (survey geometry)
- opening angle
- integration depth
- easy to use (I, believe)

## lognormal\_lens

### lognormal\_galaxies

- by Makiya-san+
- matter density
- galaxy
- used in B03

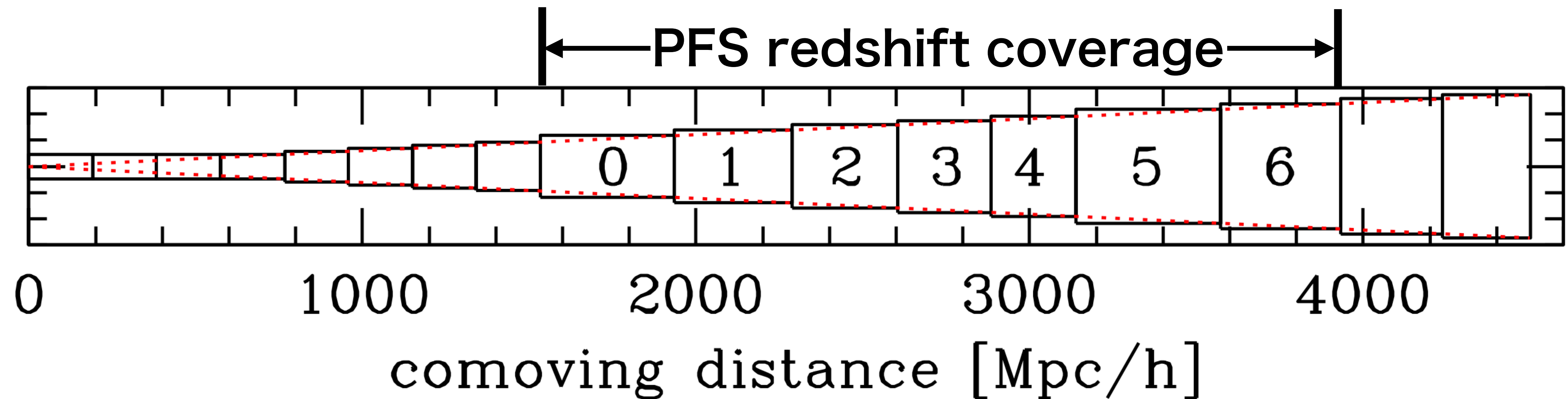
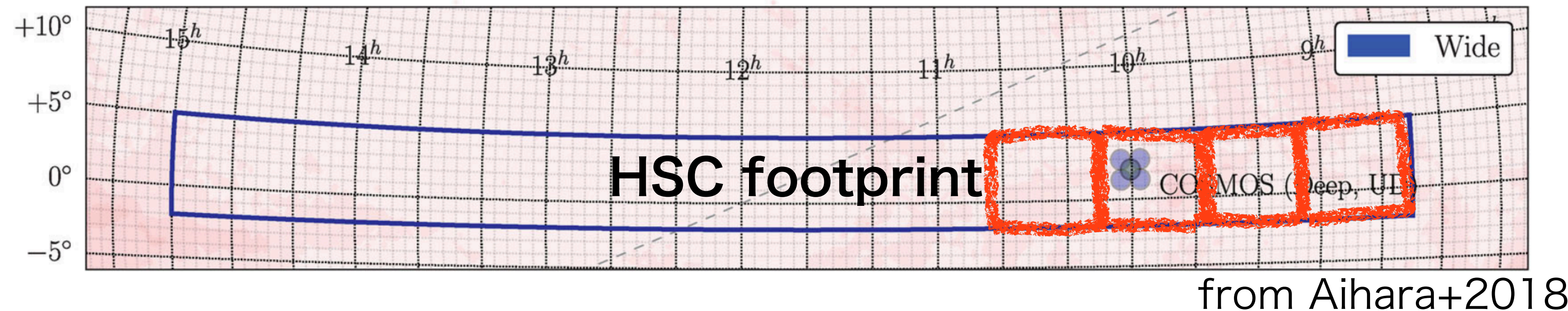
### RAYTRIX

- by Hamana-san
- ray-tracing
- used in B02

a project of D01



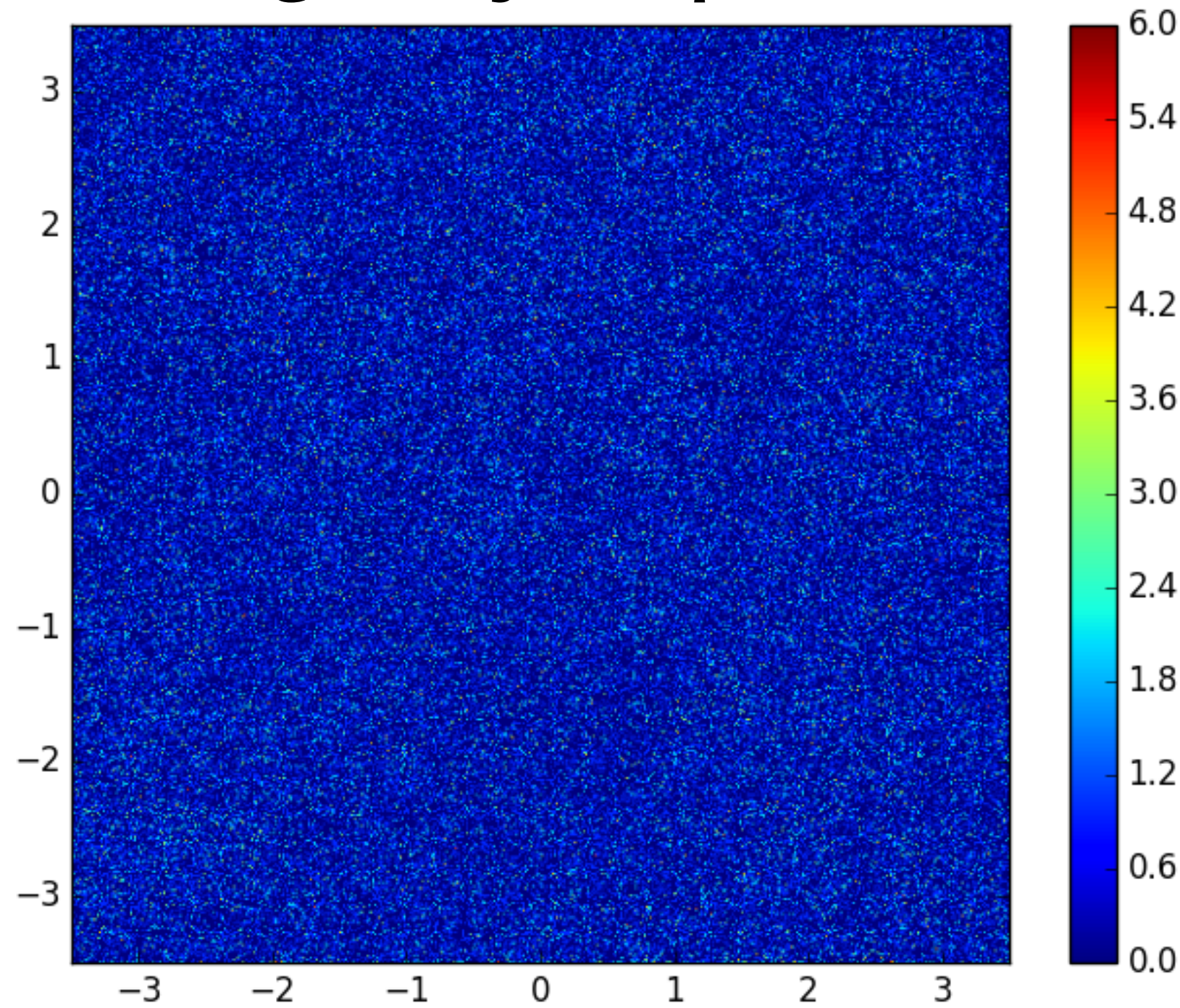
# ray-tracing geometry



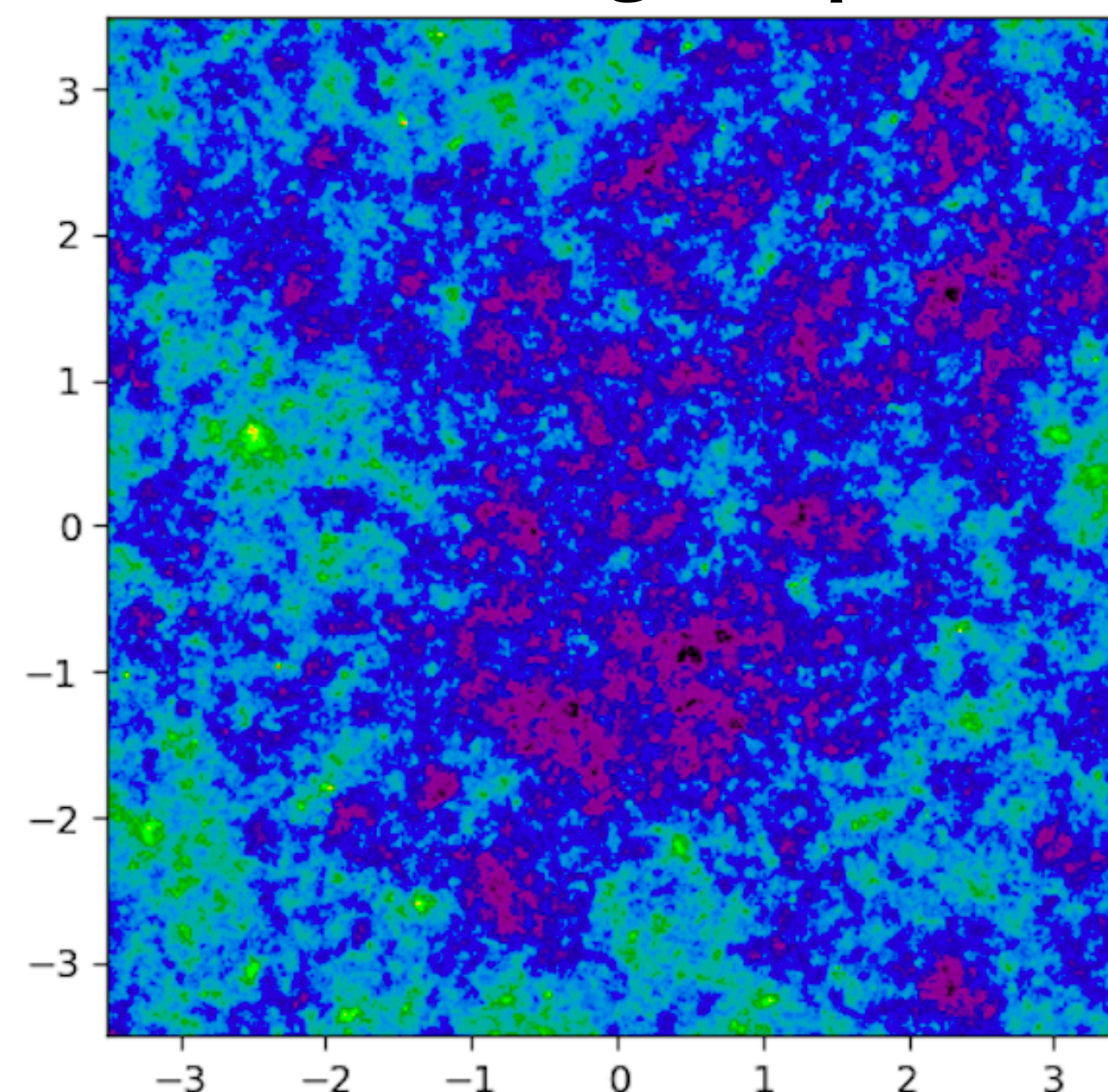


# resulting maps

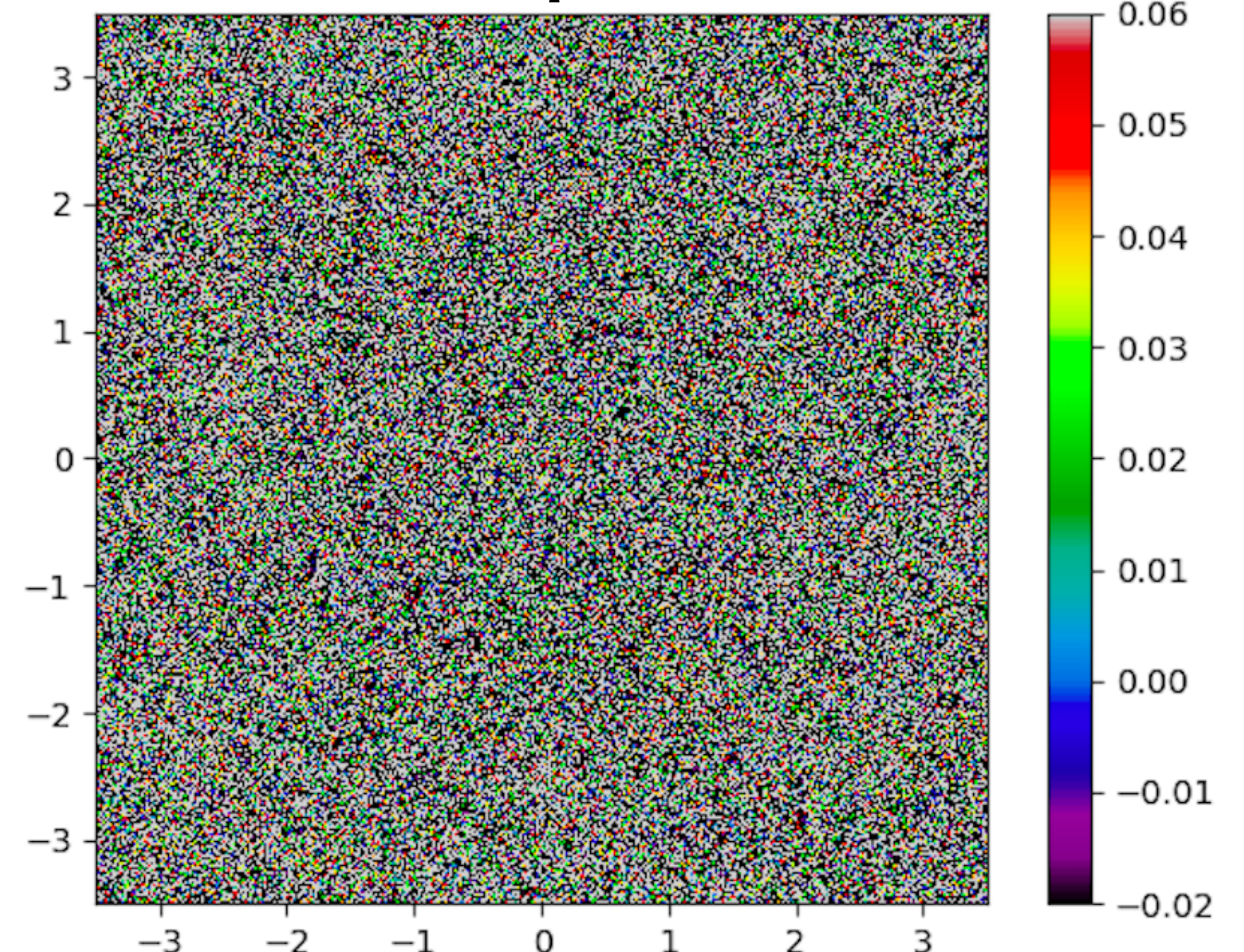
galaxy map



lensing map



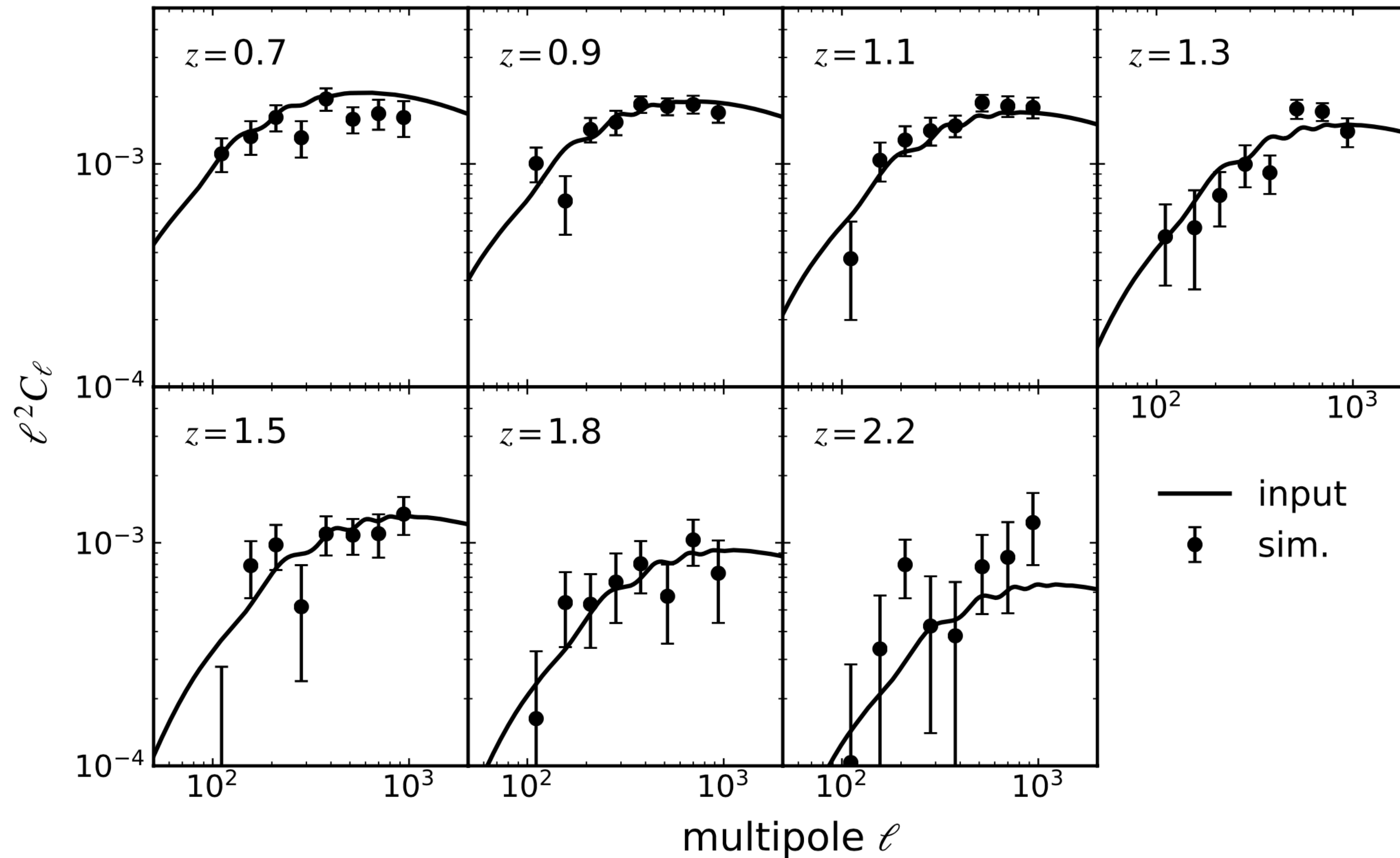
with shape noise



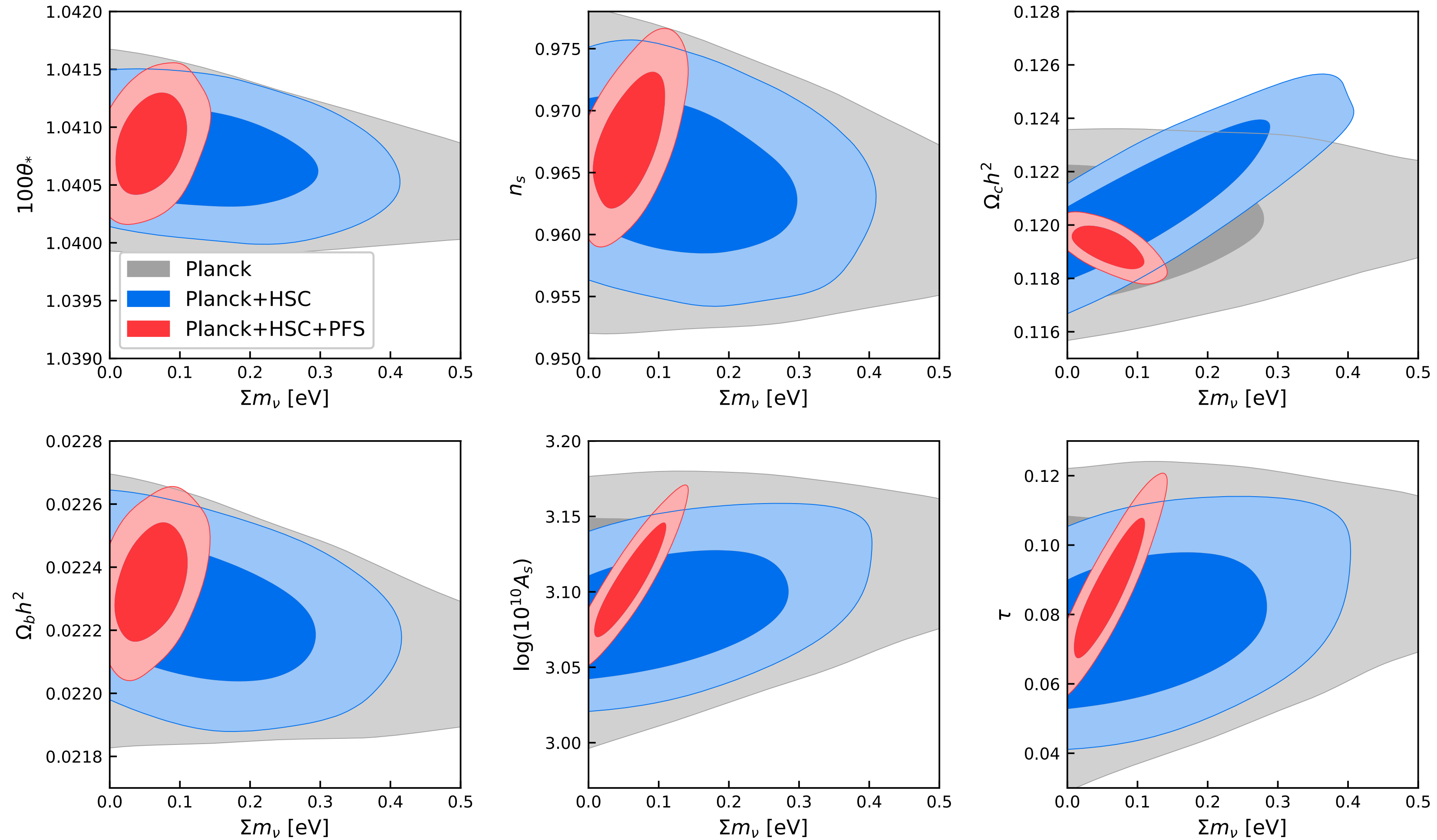


# cross power spectrum

## PFS galaxy and HSC lensing

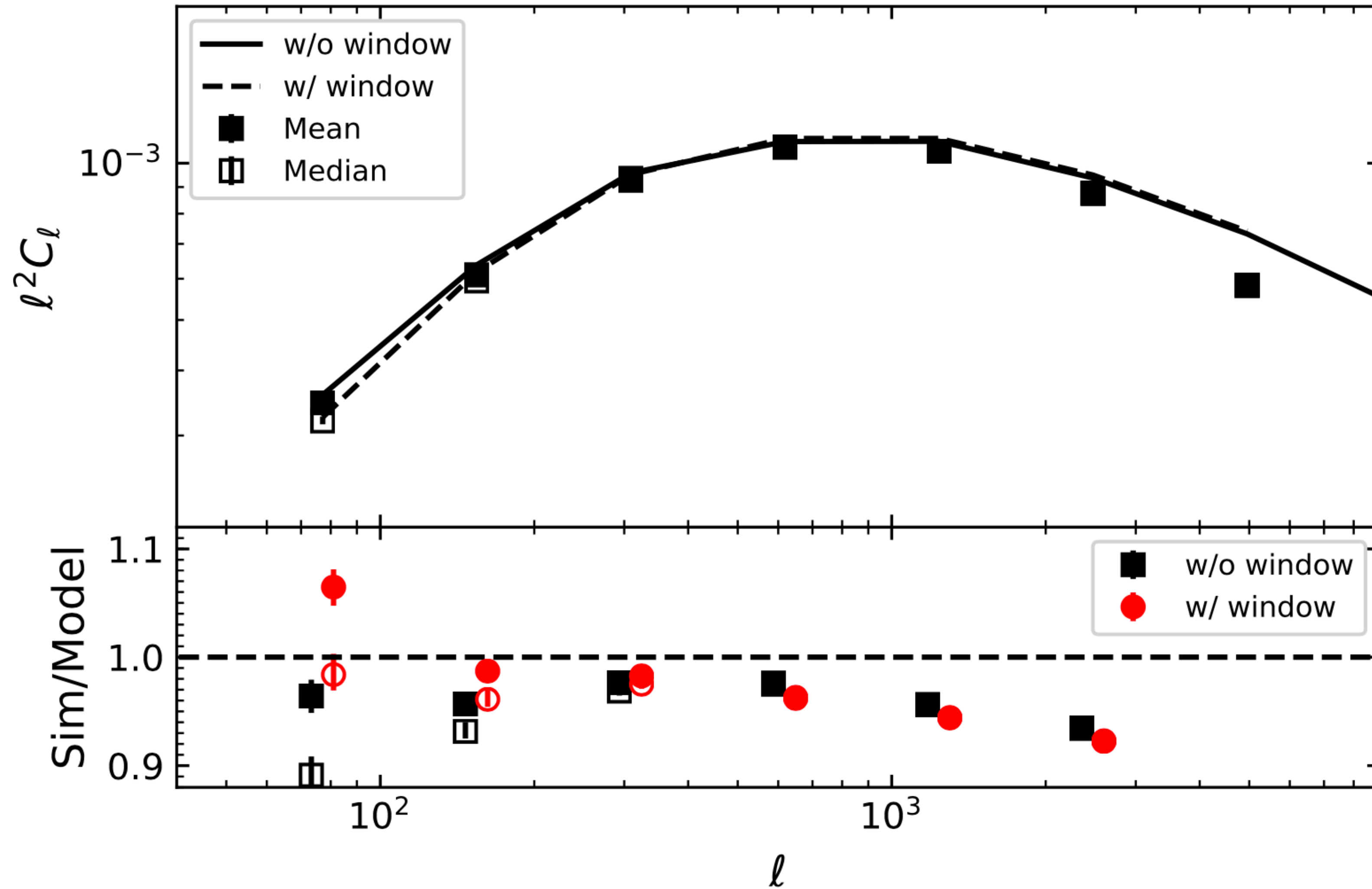


# constraints on cosmological parameters



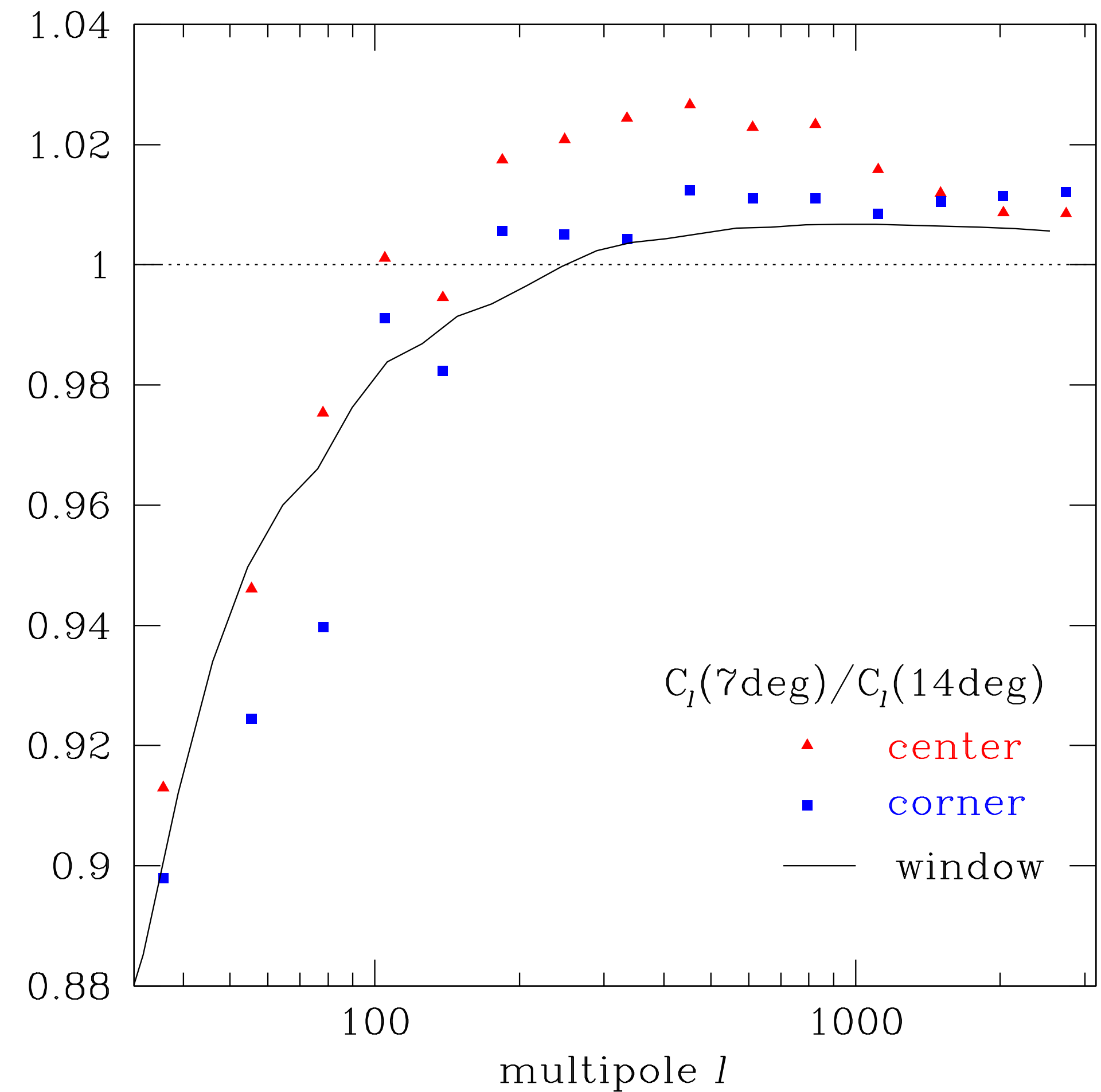
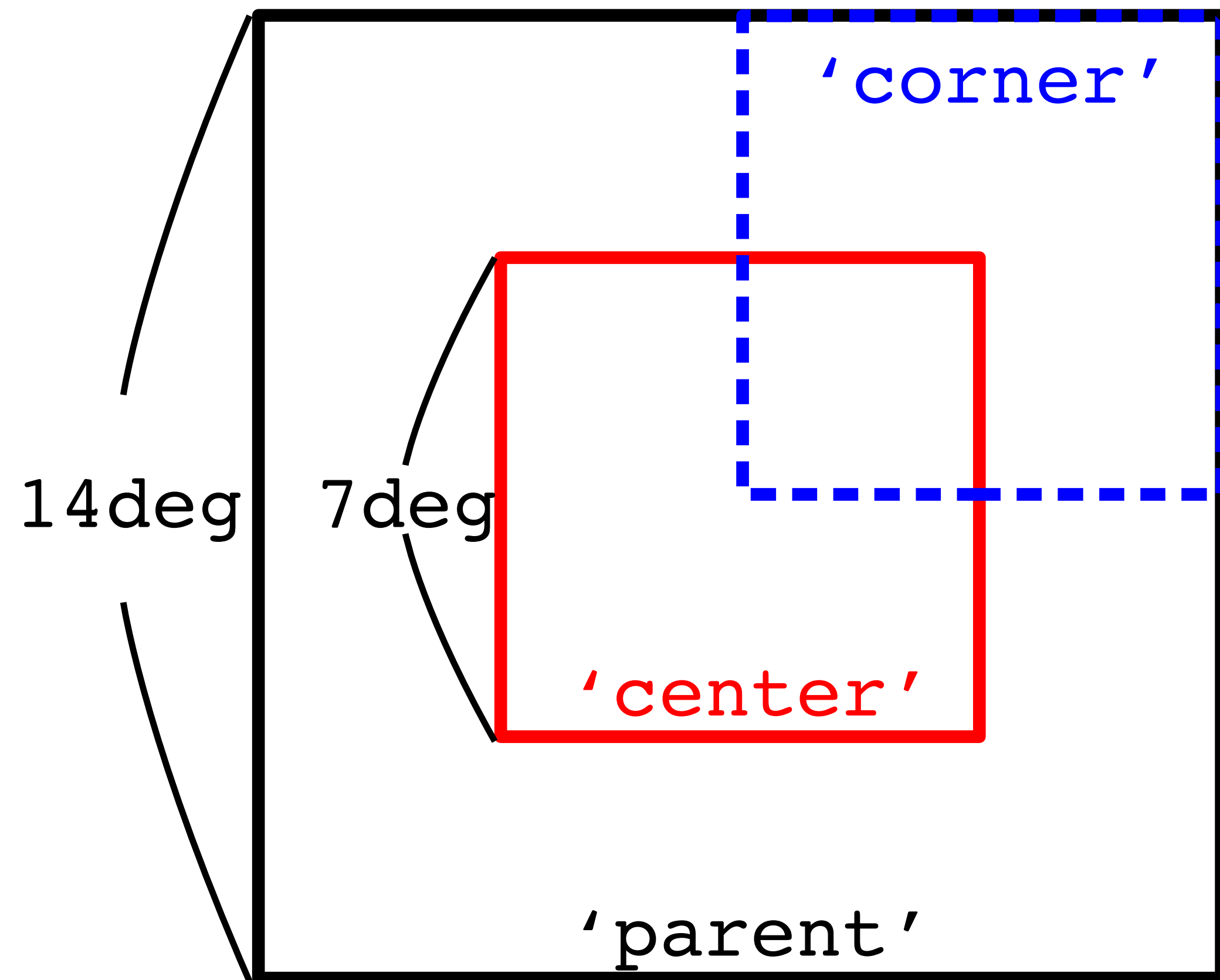
knowledge is imported into the PFS cosmology proposal

# comparison with “answer”



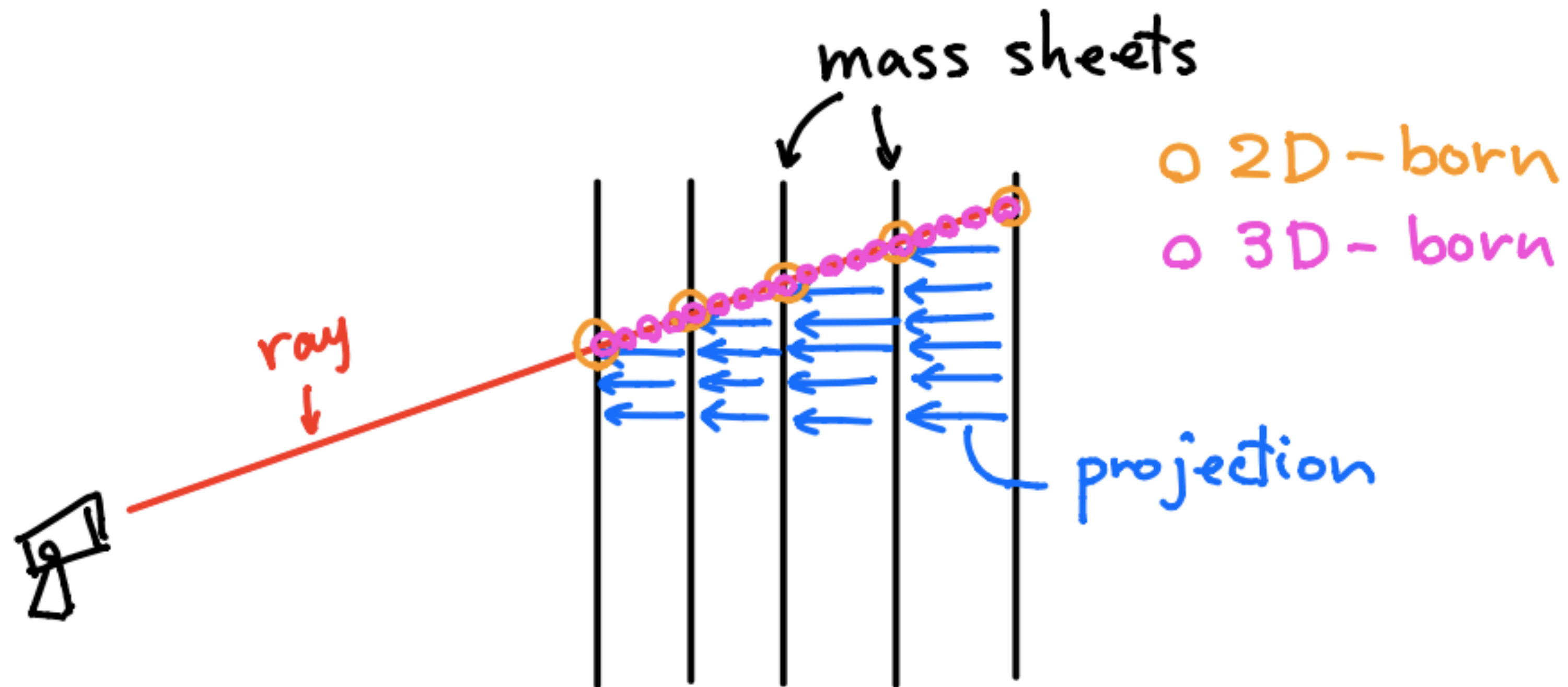


# center-corner test





# projection effect?



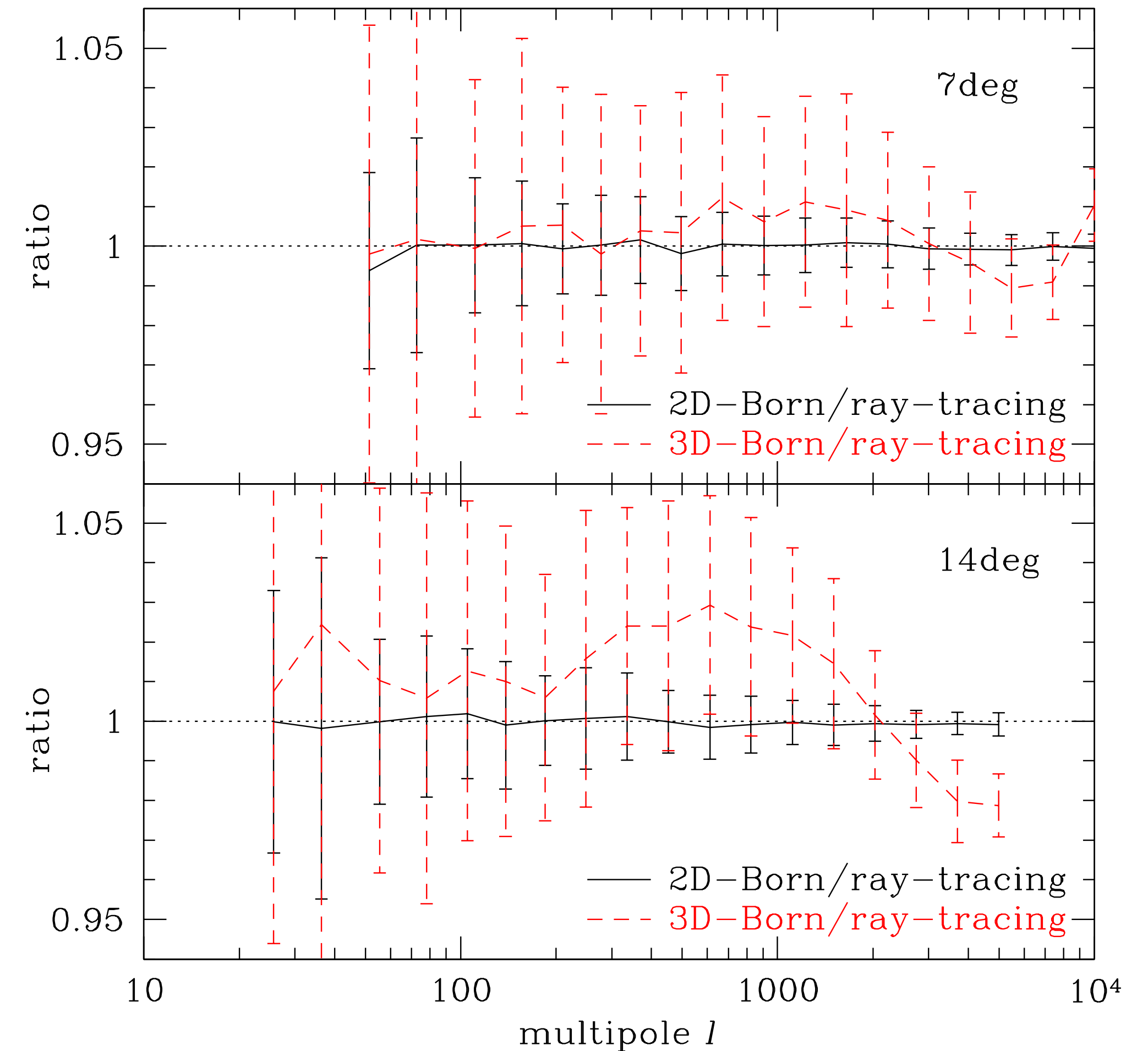
Expectation

- 2D-Born  $\sim$  ray-tracing [known in literature]
- 3D-Born  $>$  ray-tracing [new expectation]
- discrepancy would be larger for wider opening angle



# systematics!

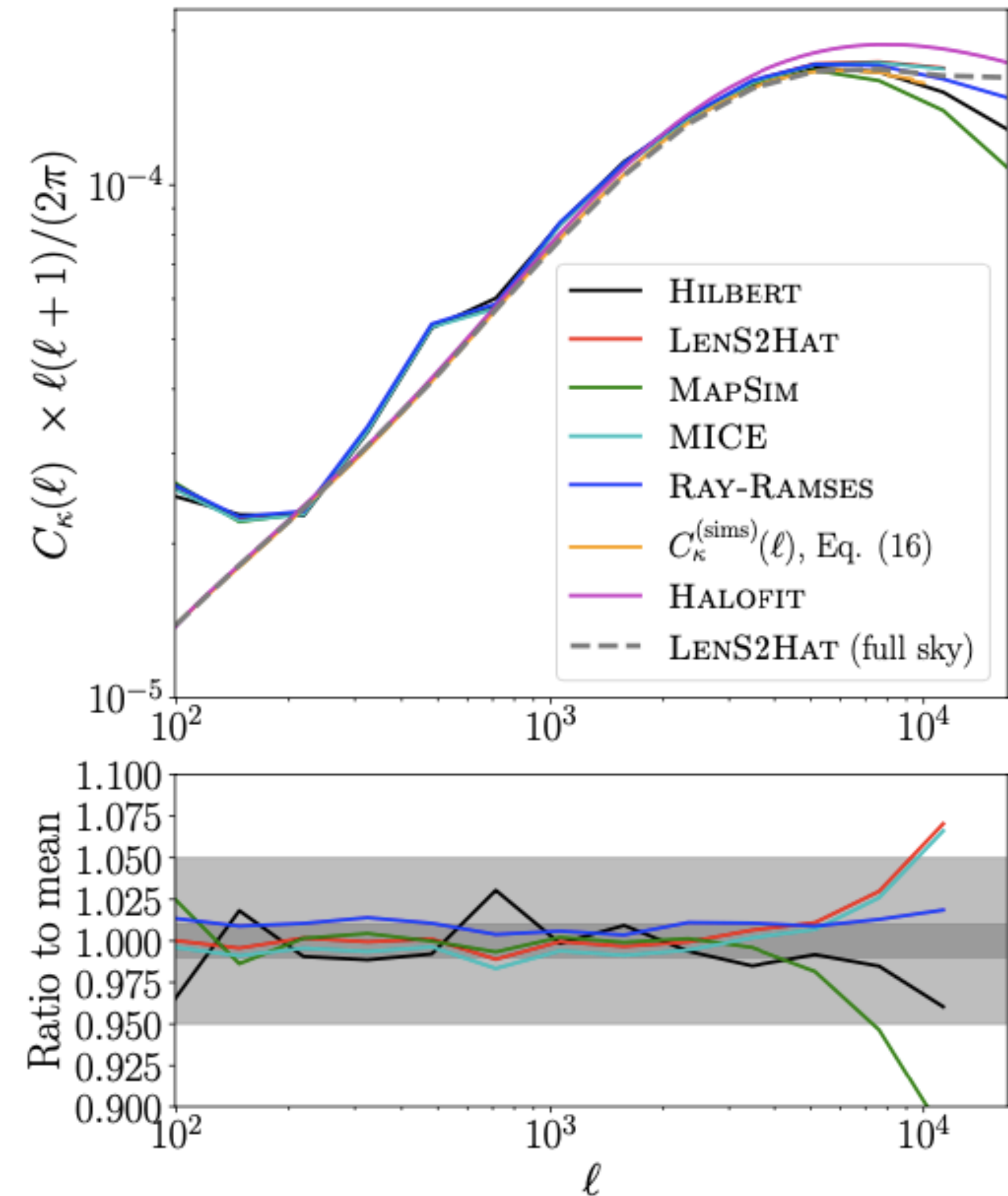
- ray-tracing and 2D-Born underestimate
- opening angle should be smaller than several degrees.
  - ~ 1% error
- we should move on to
  - spherical coordinate ray-tracing
  - GRayTrix developed by Hamana-san will be an obvious selection:)





# a code comparison project

- Hilbert et al. (2019; arXiv:1910.10625)
  - applied 5 independent codes onto the same N-body data
  - $10^\circ \times 10^\circ$  fields
  - scatter is below 2 %
- We may further tackle the systematics using our `lognormal_lens`





# summary

- `lognormal_lens` is ready
- code paper/bitbucket are (almost) ready
- limitation is also clearly shown
- a few percent systematics exists.
- Thank you for giving me time to concentrate on science