

# CMB probe

ExGal working group running the fiducial CMB Probe design through various forecasting codes.

Calculations are being uploaded to the wiki (this is a summary)

Focused on: Point source and CIB measurements, Clusters, Lensing, Reionization

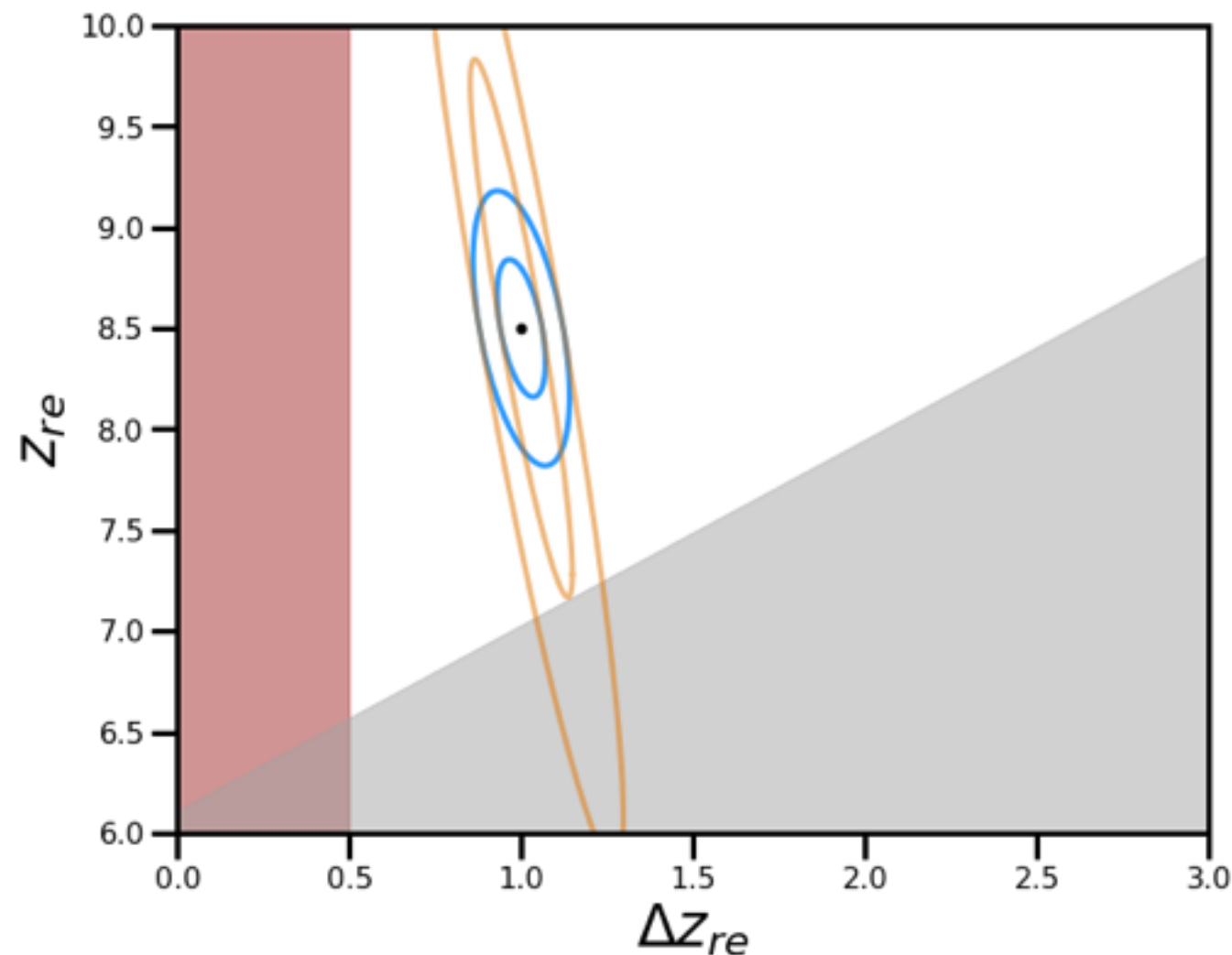
Thinking about 2 questions higher frequencies and resolution (in the context of S4 + other CMB exp)

The strongest case right now for both higher frequencies and resolutions is for the Point source and CIB science

Currently, Clusters and Reionization constraints improve over S4 etc from the low  $\ell$  pol Probe measurements. The \*Major\* caveat here is we need sims to address the other science cases. News on that front Mathieu and Jacques are running the CORE sky sims and observing in the nominal CMB probe bands.

# Reionization

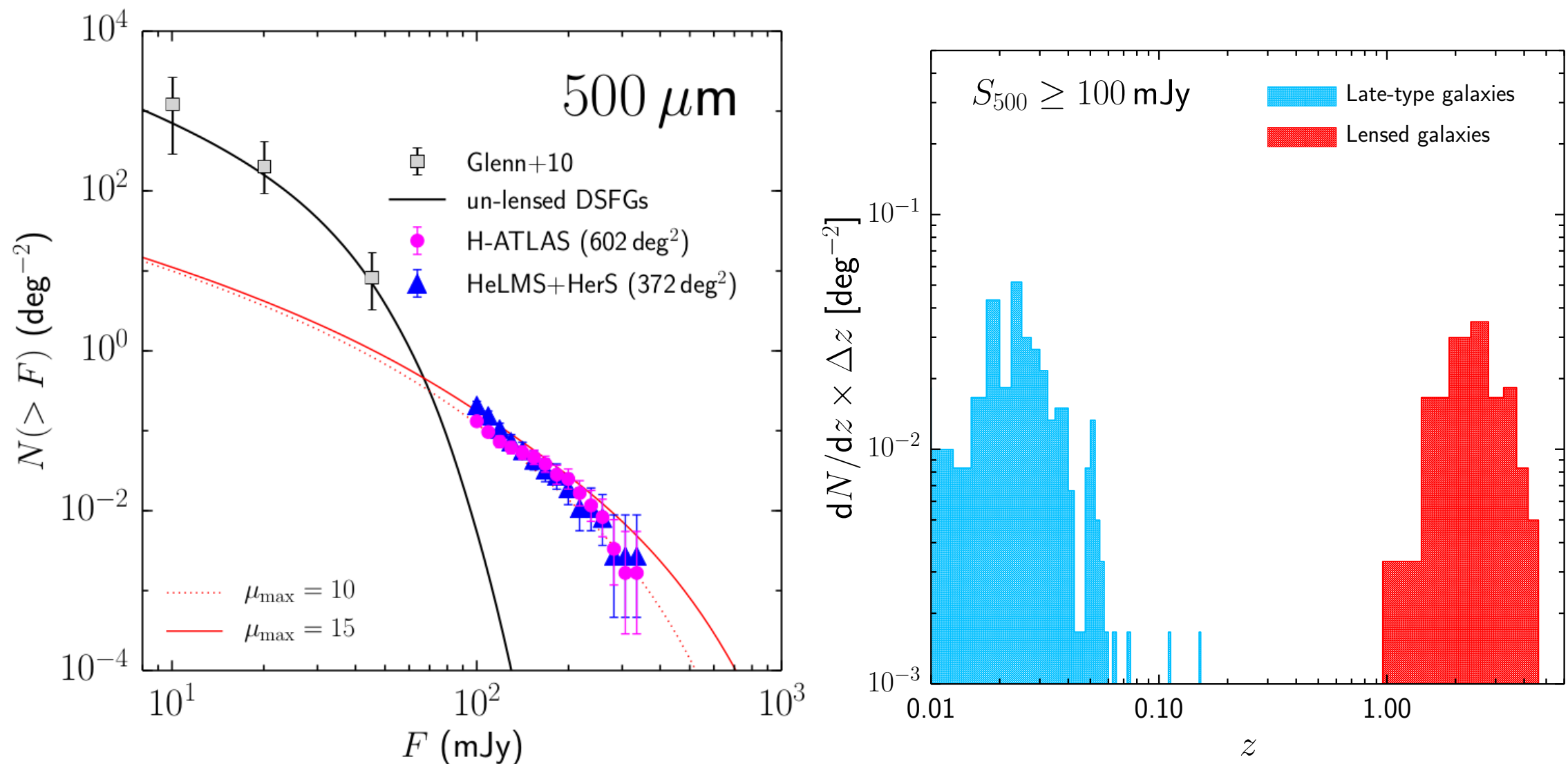
We know very little about Reionization. The CMB Probe will deliver CV tau measurements, what does that mean for Reionization models?



AdvACT-like kSZ constraints with a CV tau constraint from CMB Probe in the mean reionization redshift and duration of reionization plane. The blue 1 & 2 sigma contours show show the what the addition of the Probe constraints provide compared to the Planck (orange contours).

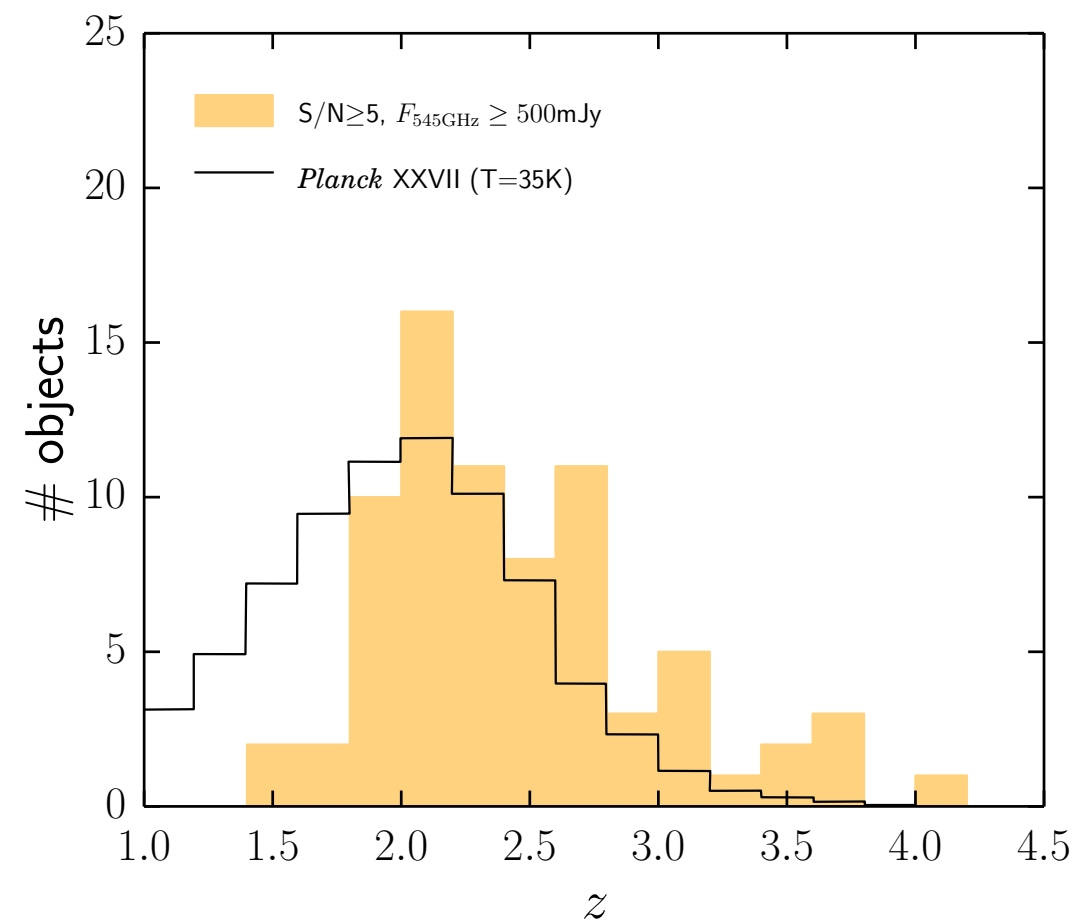
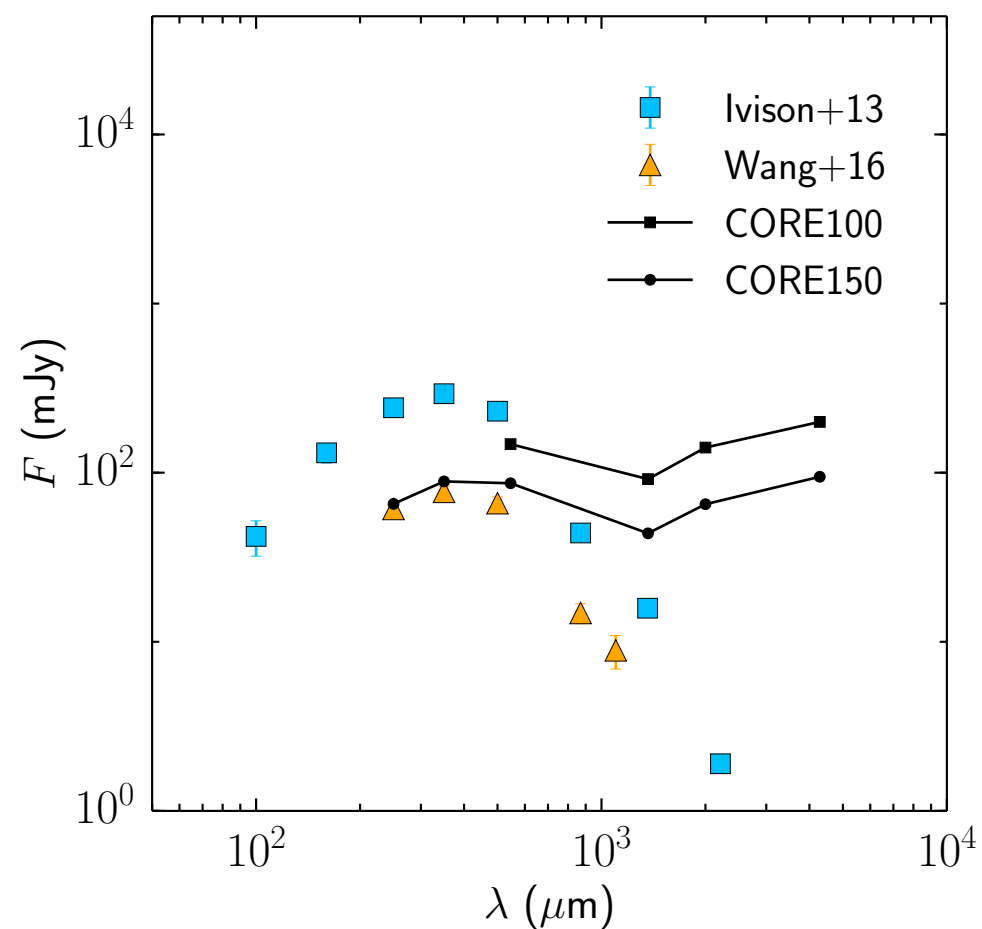
# Point sources

Strong lenses - the brightest high frequency sources in the Probe will be nearby galaxies and strongly lensing systems, roughly 0.3 per square degree -> thousands for an all sky survey, emission is not contaminated by lens galaxy.



# Point sources

Evolution of Galaxy Clusters (Proto-clusters) at high redshift - Identifying proto-clusters from there submm galaxies at  $z > 2$ , these would be objects where the ICM hasn't formed yet. Planck's beam is too big



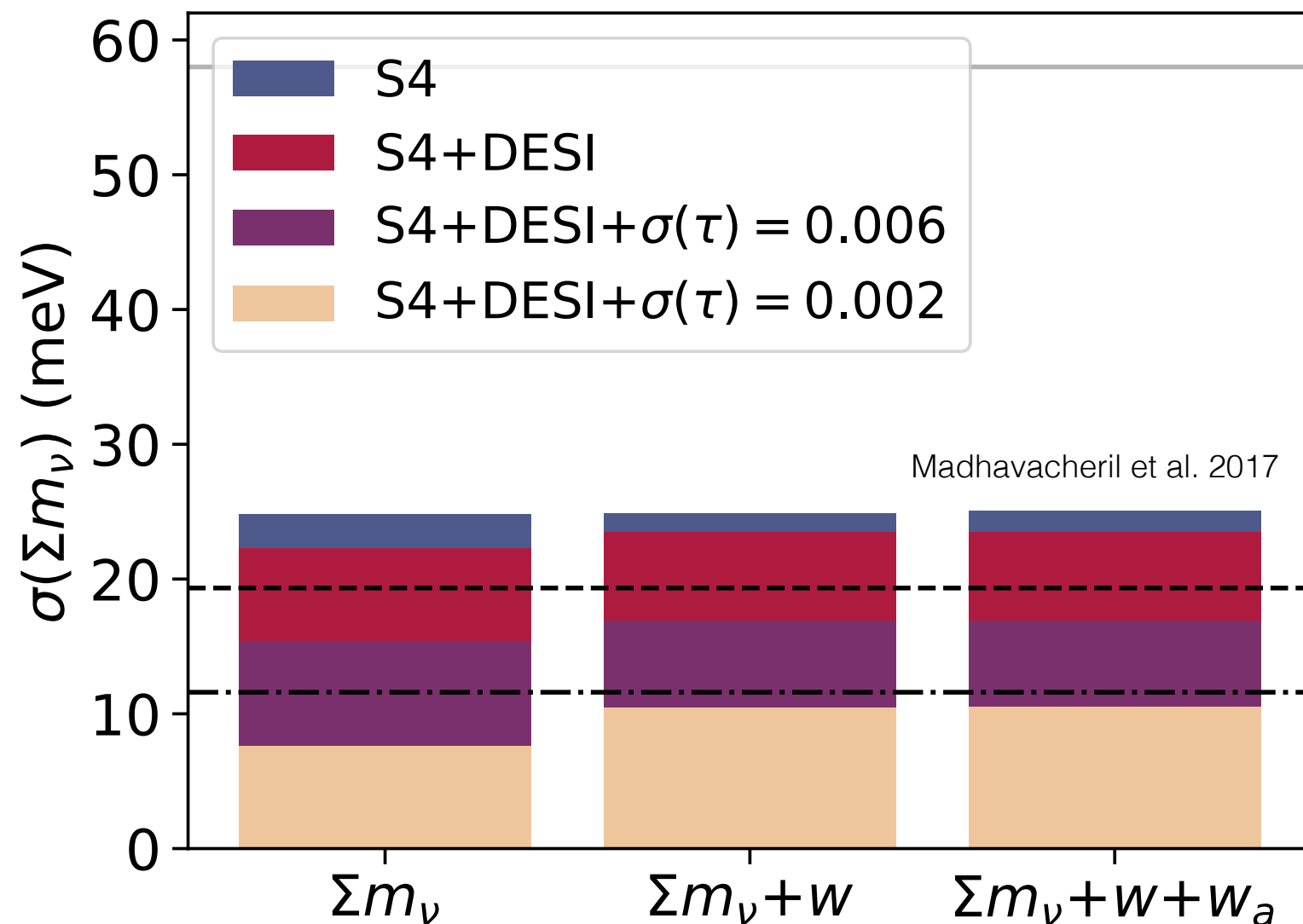
Additionally, polarized point sources contamination to primary CMB measurements from CORE (Remazeilles, et al. 2017, arXiv:1704.04501). Probe can directly measure polarization of these dusty sources

# Clusters

S4-max + Optical lensing calibration:  $\sim 25$  meV (Planck tau)

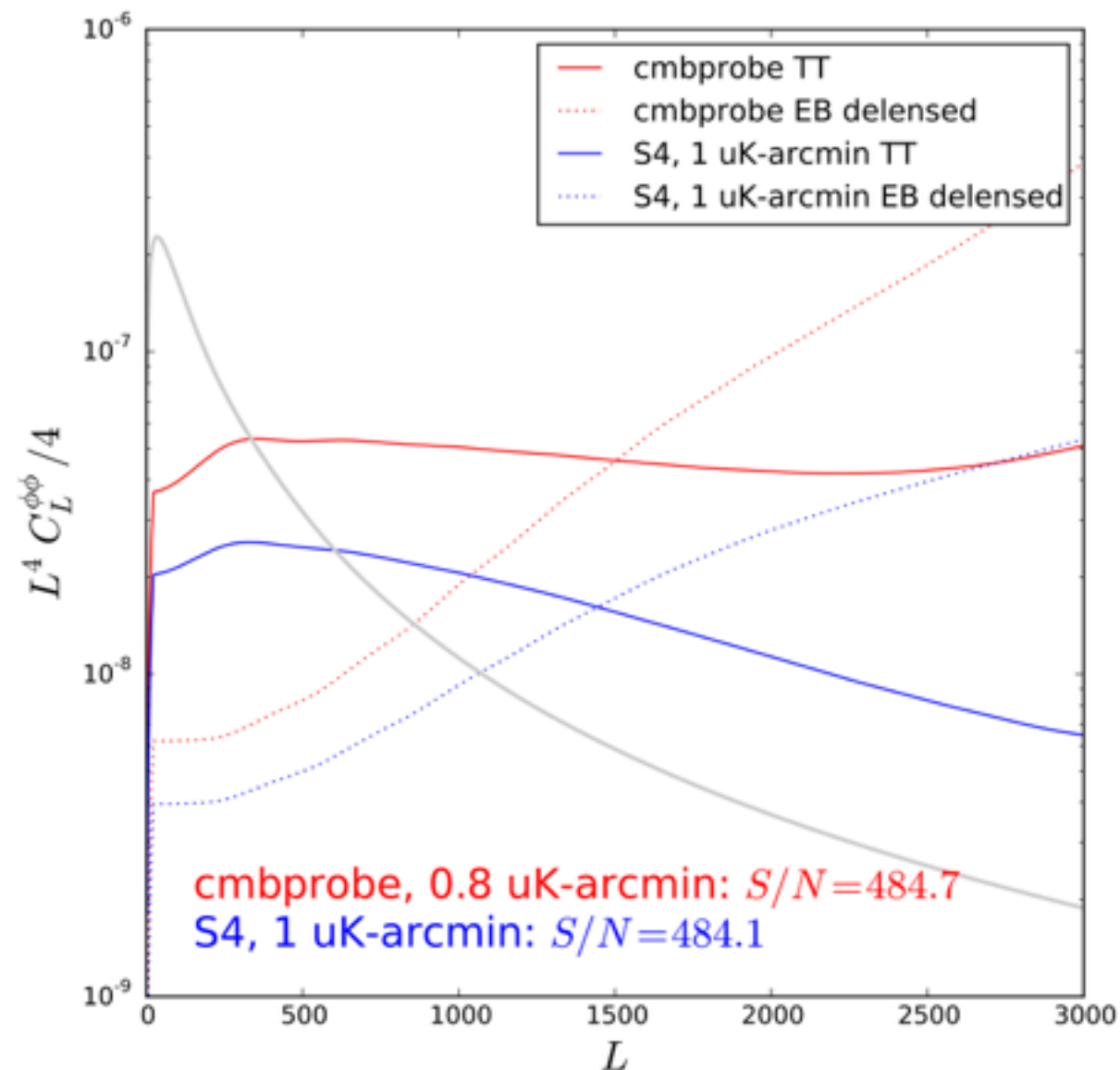
CMB Probe + Optical lensing calibration:  $\sim 20$  meV (CMB Probe tau)

S4-max + Optical lensing calibration:  $\sim 10$  meV (CMB Probe tau)



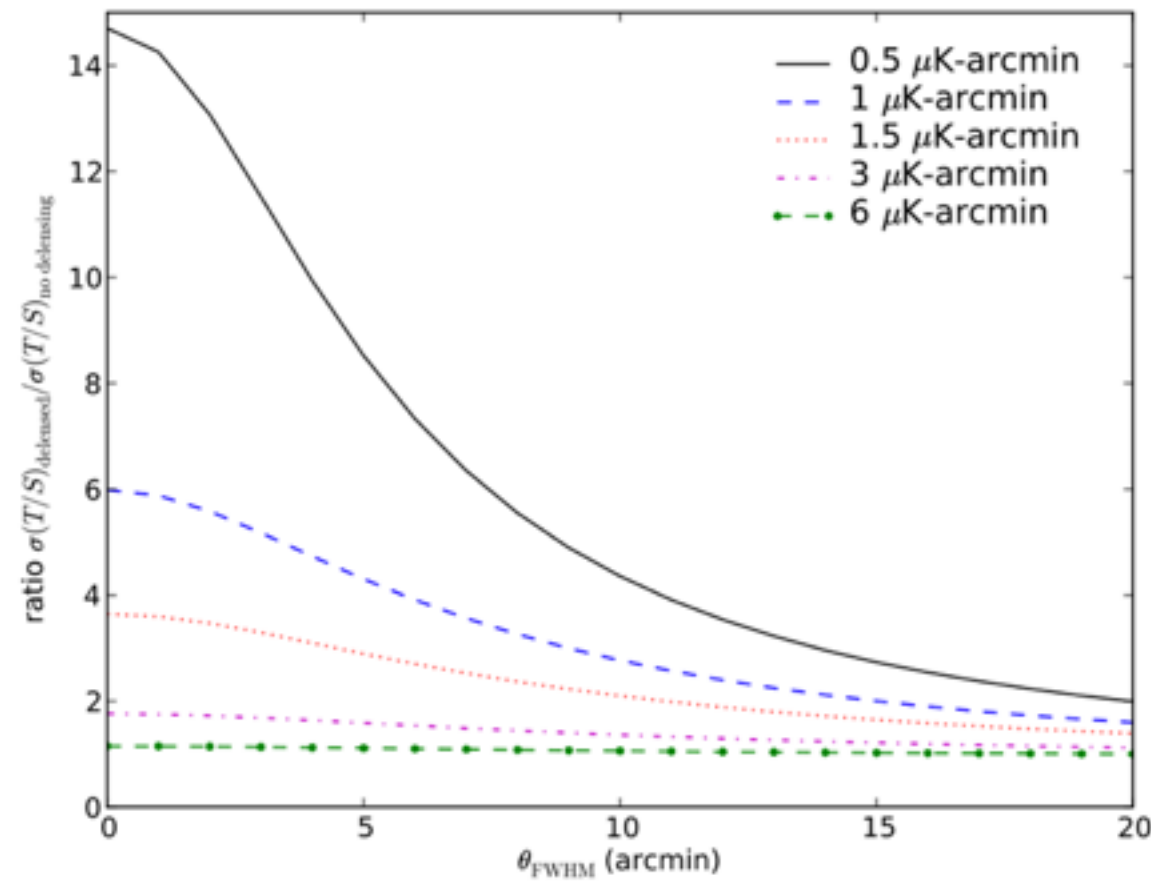
# Lensing

The noise curves for Probe are minimum-variance combination that does not include any foreground removal (this is the next step)



Note CMB-S4 and Probe have the same S/N (almost a factor of 2 > fsky).  $l_{\text{max}} = 5000$  for both TT and pol (normally 3000 for TT). The EB curves include iterative delensing for both experiments.

# De-lensing



**Figure 8:** Ratio of  $\sigma(T/S)$  with and without polarization delensing, forecasted using Eq. (12) for varying instrumental noise level and beam.

At the Probe noise levels De-lensing is a weak function of the beam size.

# CMB Halo lensing

