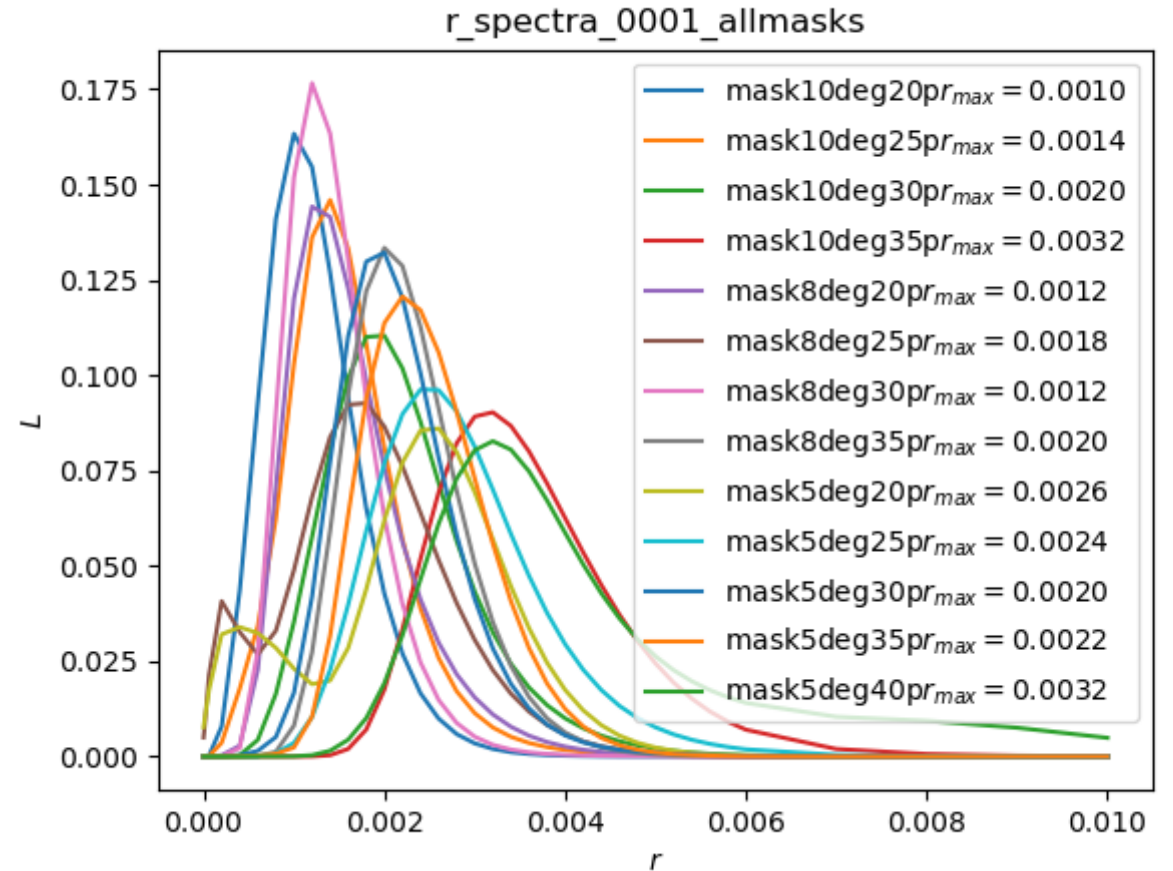


Pico

Commander updates 18.02.2021
Ragnhild Aurlien and the Oslo group

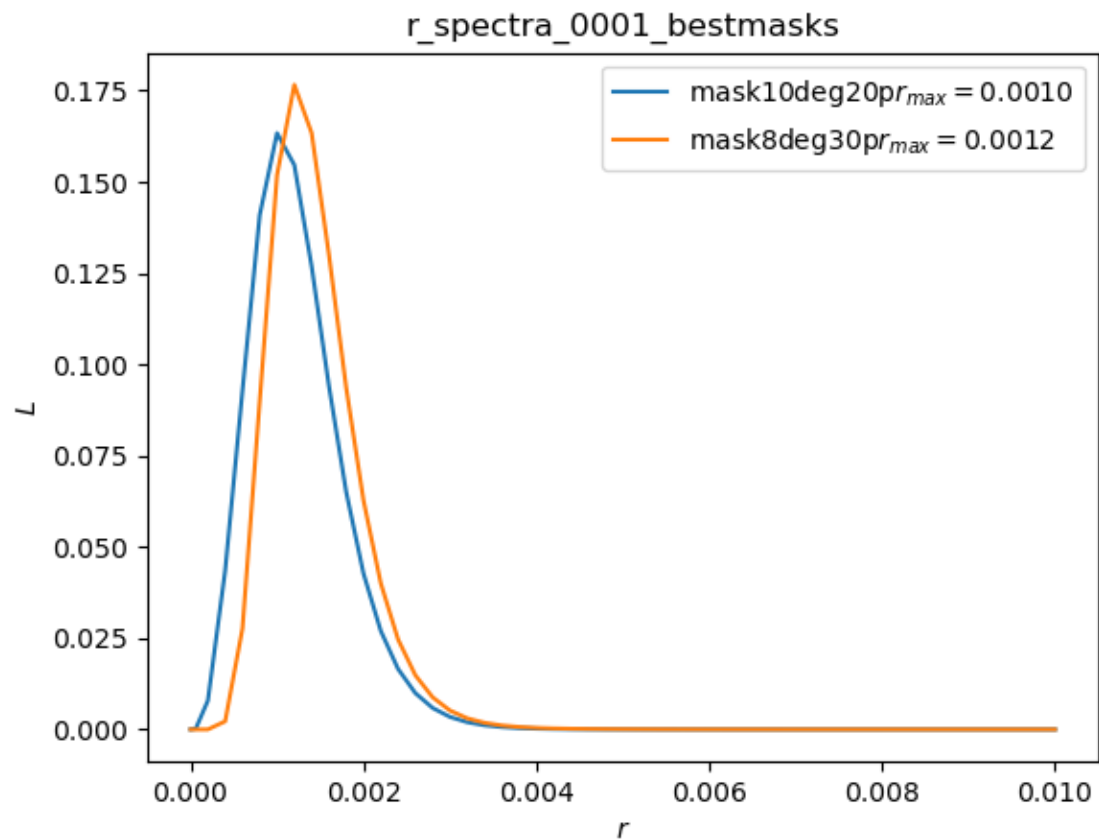
Trying to optimize mask

- Model 90.91
- Simulation 0001 with $r = 0$
- Masked between 20% and 50% of the sky, smoothed with three different beams
- Infilling in the masked area
 - The runs with the biggest masks does not converge

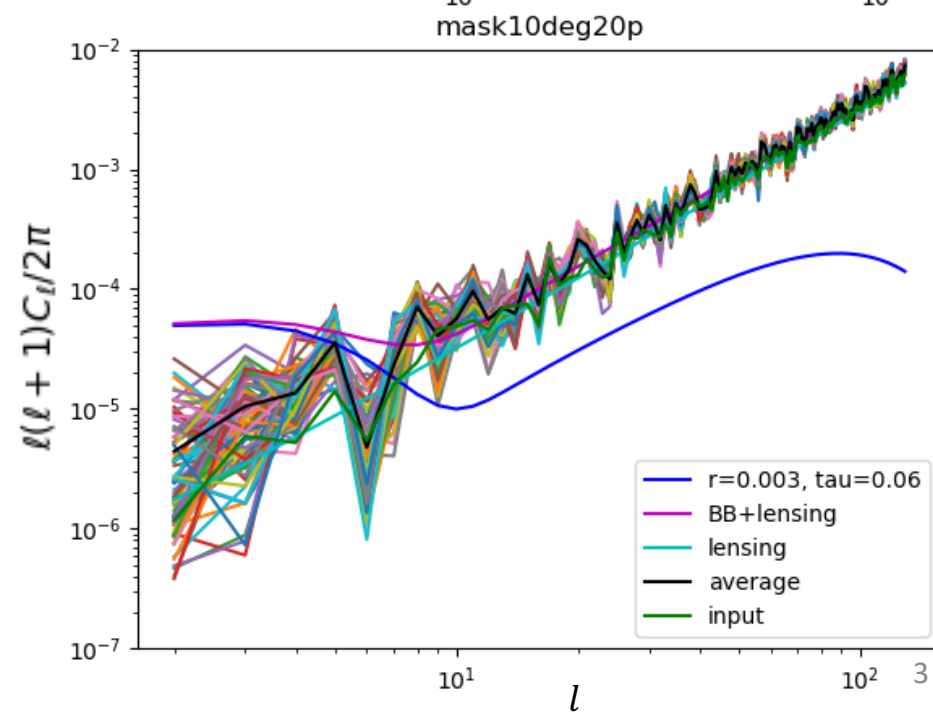
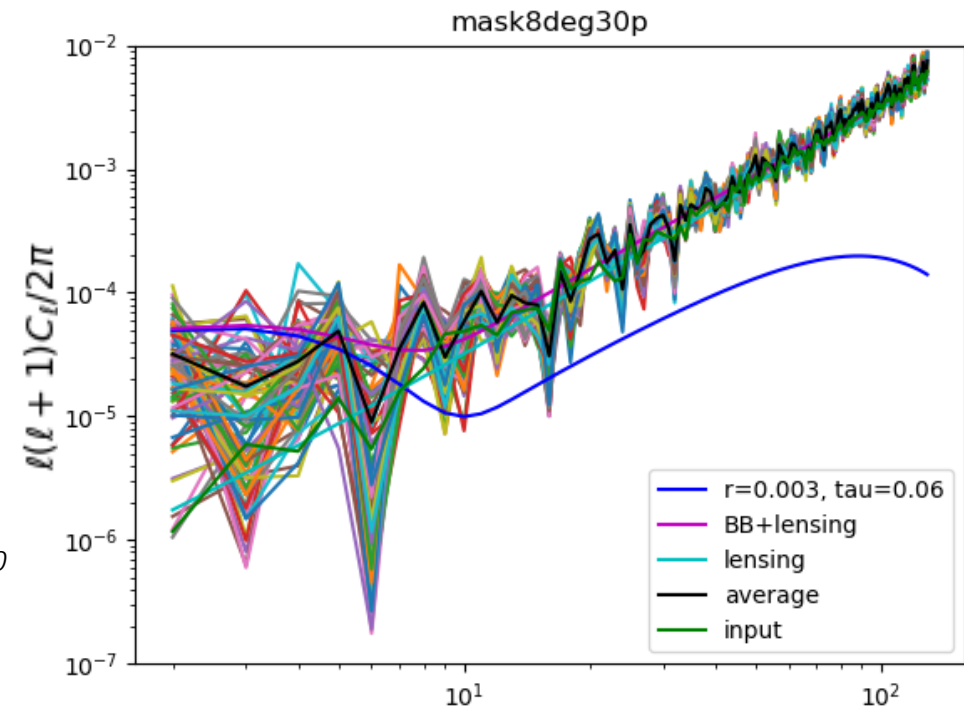


Powerspectra and r for best masks

0001 with $r = 0$

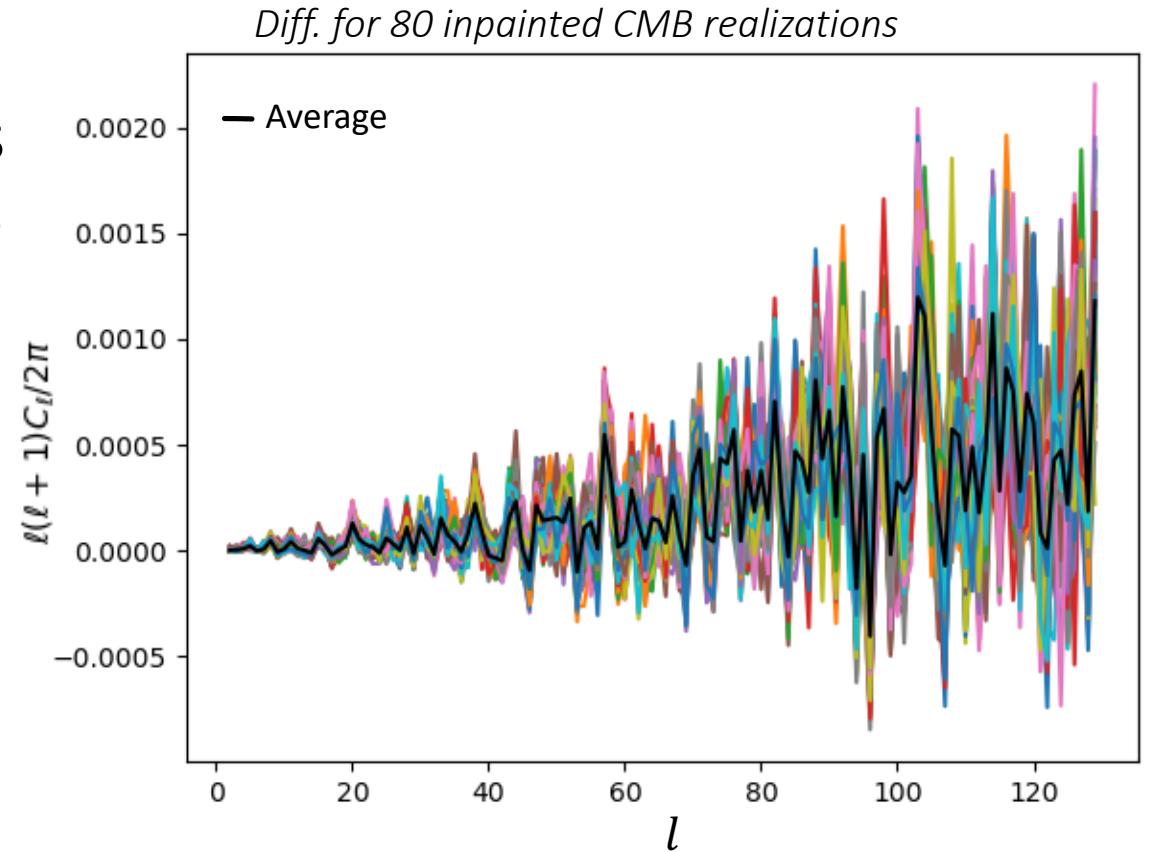
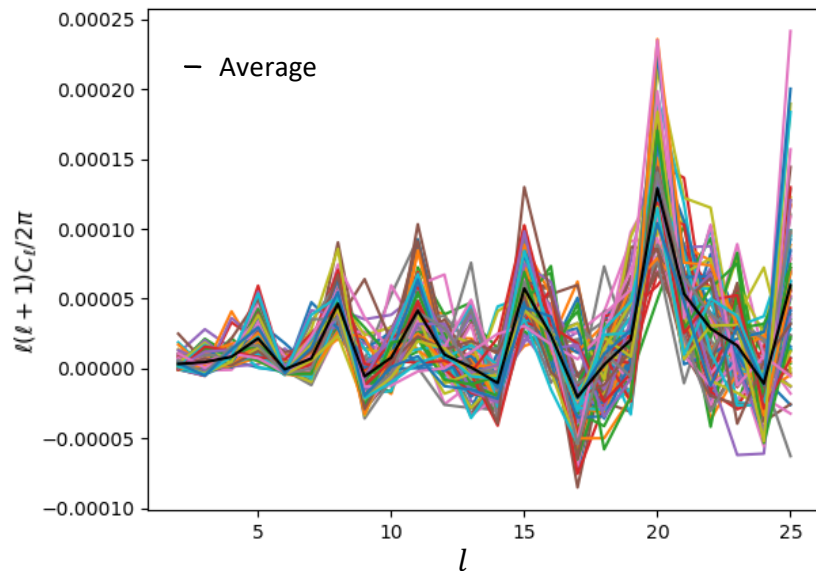


*Spectra for 80
inpainted
CMB
realizations*



Difference in powerspectrum

Subtracted powerspectrum of input CMB map used to create simulations from powerspectrum of output CMB from Commander



Commander1

- Needs same resolution and beam for all input frequency maps
- Smoothing simulated maps with white noise creates correlated noise
 - Good enough accuracy for temperature
- Same problem is faced when analysing real data

Commander2

- Frequency maps can have different resolution and beams
- Pixel size must be smaller than the beam
 - Limit lies between 2.5 and 3 pixels per beam FWHM
 - Pico simulations: nside 512 gives pixel size ~ 7 arcmin
 - Pico has beams between 38.4 and 1.1 arcmin
- Smaller beams than pixel size gives sub pixel effects

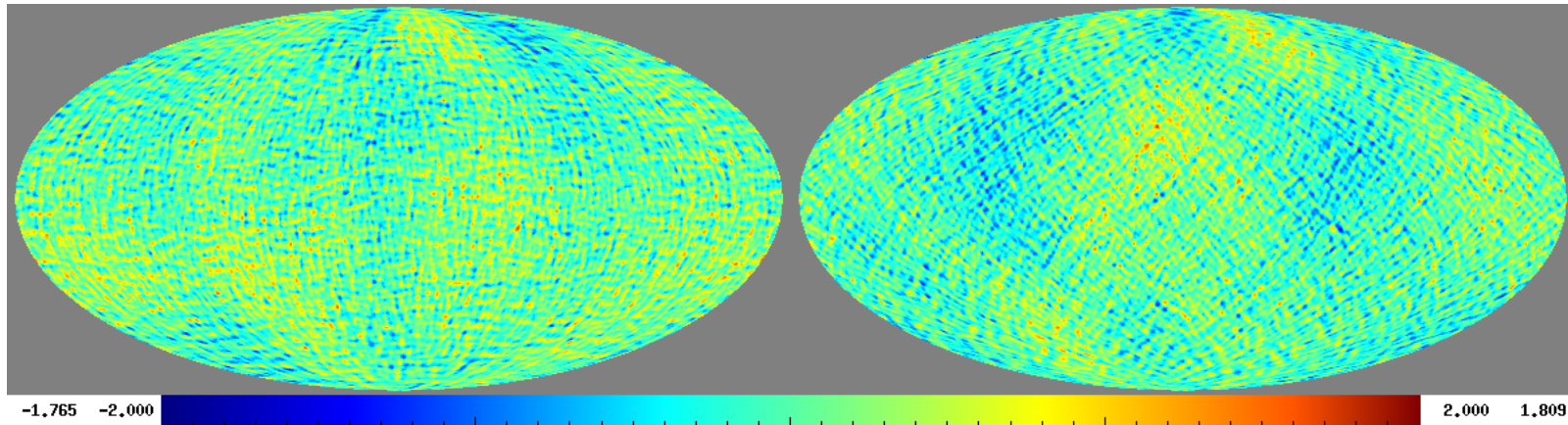
Simulations generated directly at nside 256

- All frequency maps are smoothed with a 1 degree beam and downgraded to nside 256 before white noise is added
- Foreground model PySM d1s1 (model 90.91)
- Same CMB maps as used for original simulations
- Run Commander1 with the same parameters as previously
- One set of simulation with $r = 0$

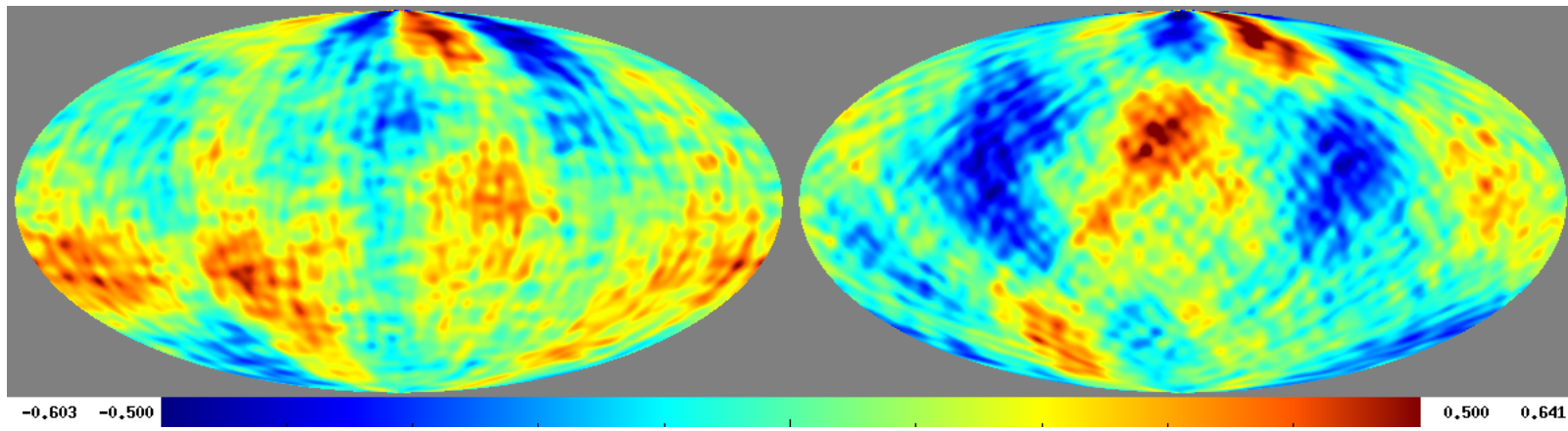
Resulting CMB map using Unnis simulations

Q

U

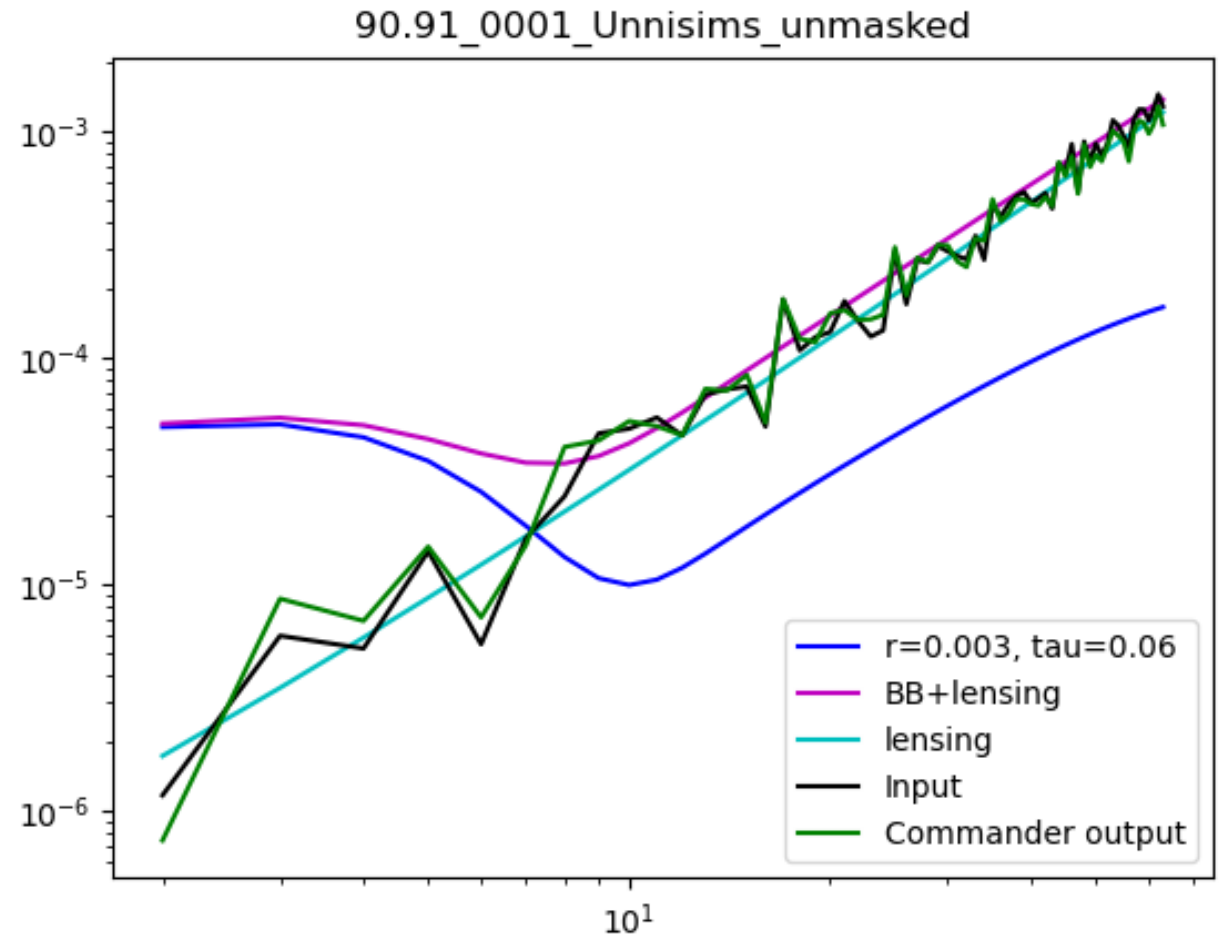


Smoothed to a
5 degree beam



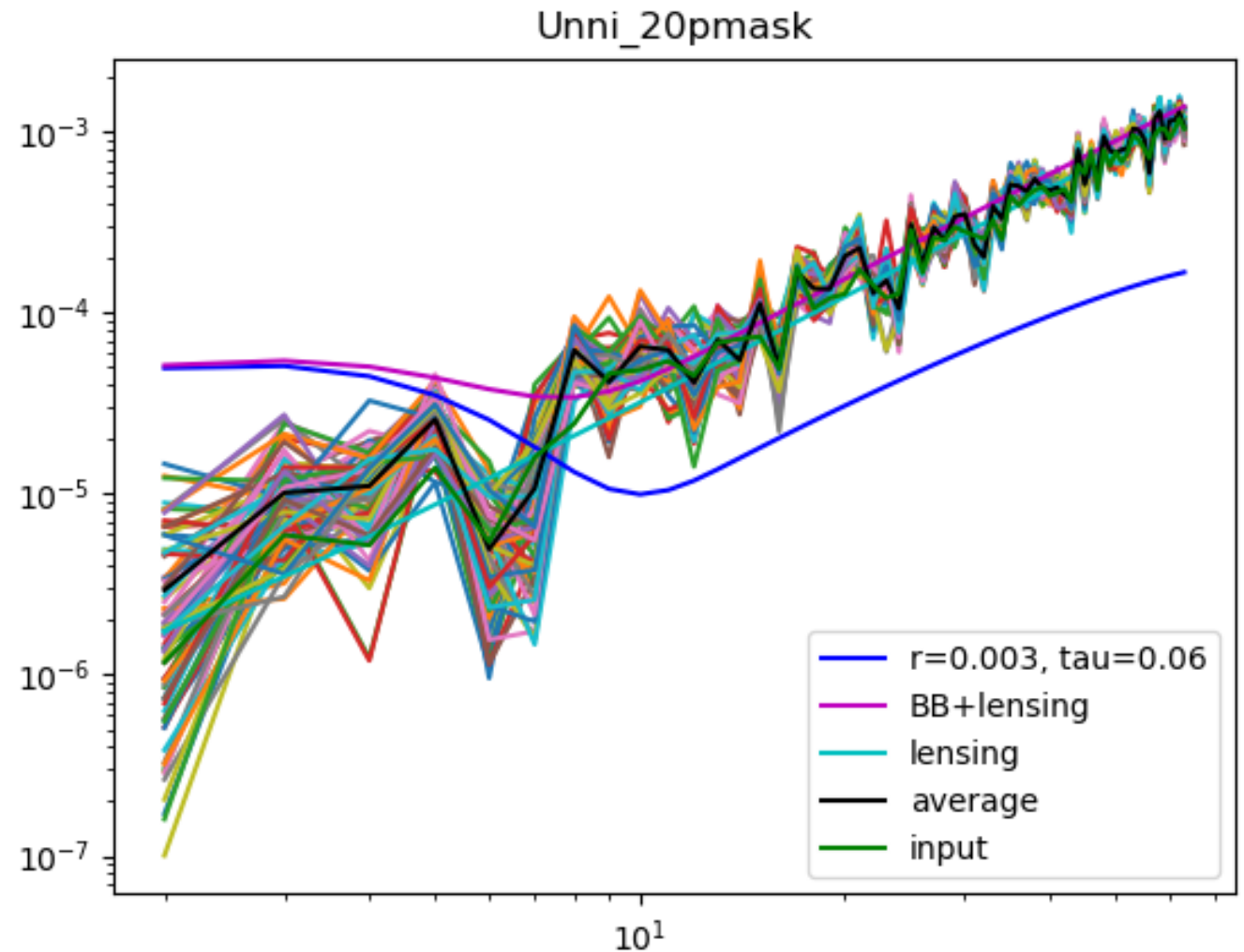
CMB powerspectrum

- Run with $r = 0$
- Power spectrum from both input and output CMB spectrum plotted
- Unmasked CMB maps



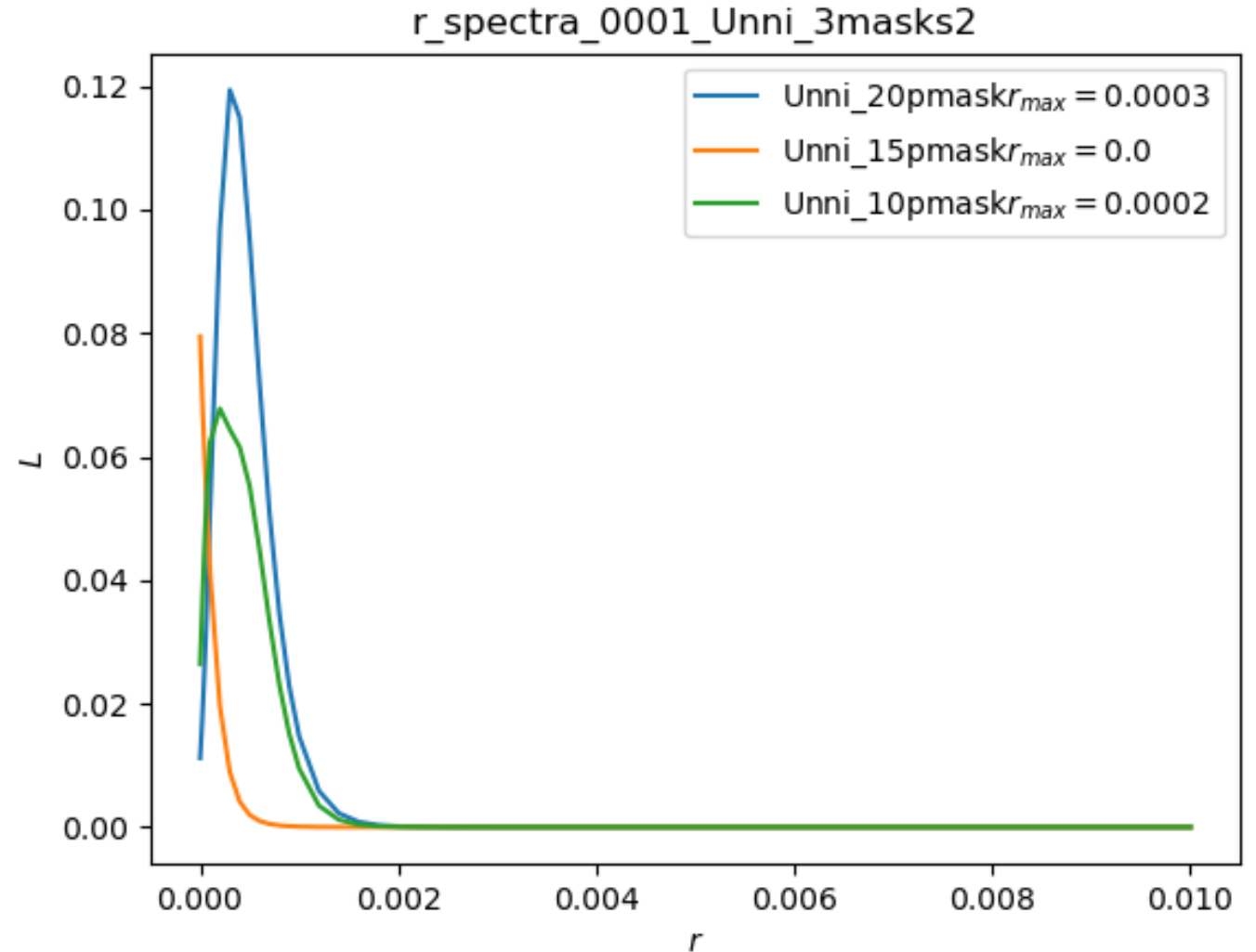
Powerspectrum from infilling

- CMB realization 0001 with $r = 0$
- CMB map from Commander masked with a 20% mask based on the dust amplitude map
- 80 different inpainted (Wiener filtering) realizations
- Average and input spectra also plotted



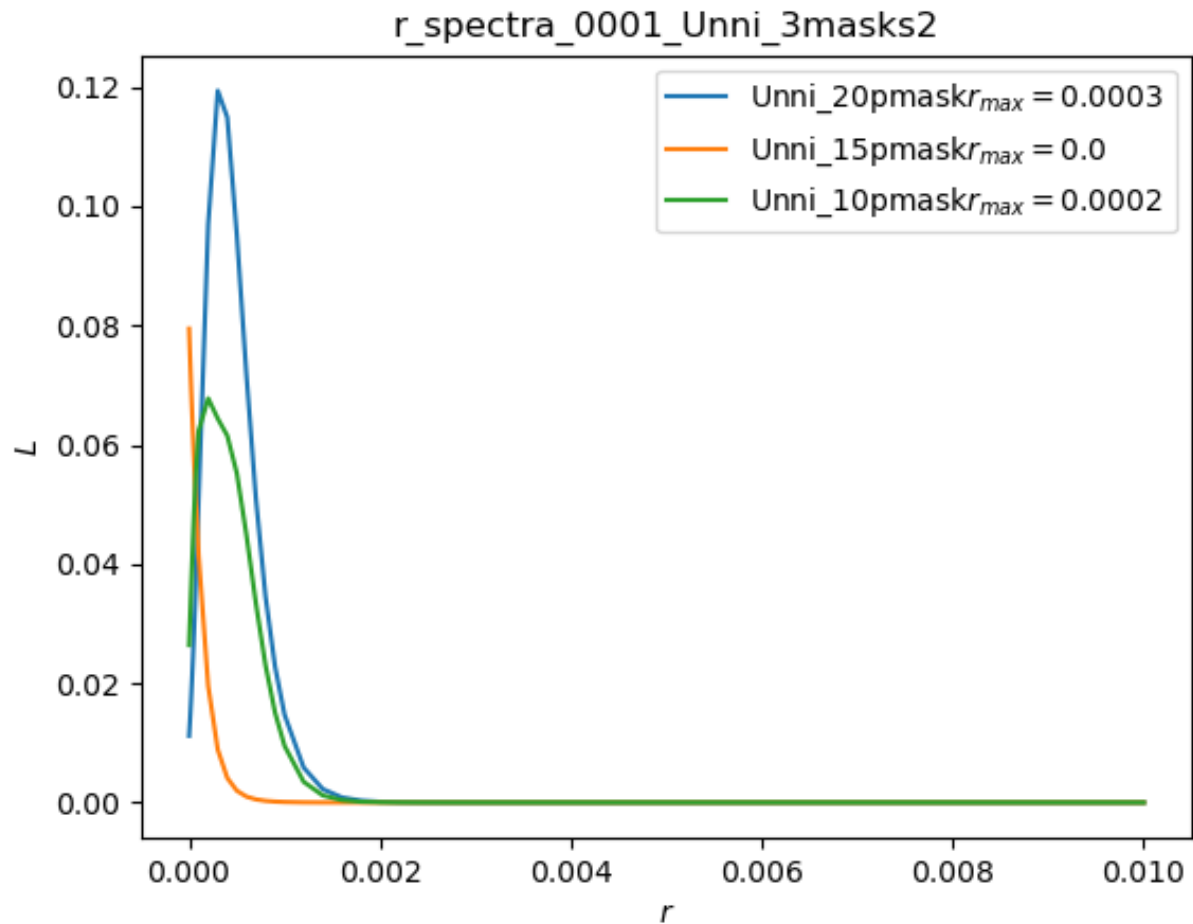
r-estimation

- Estimated using Blackwell Rao estimation based on the 80 inpainted CMB realizations
- Inpainting with three different masks
- Estimated based on l from 2 to 12

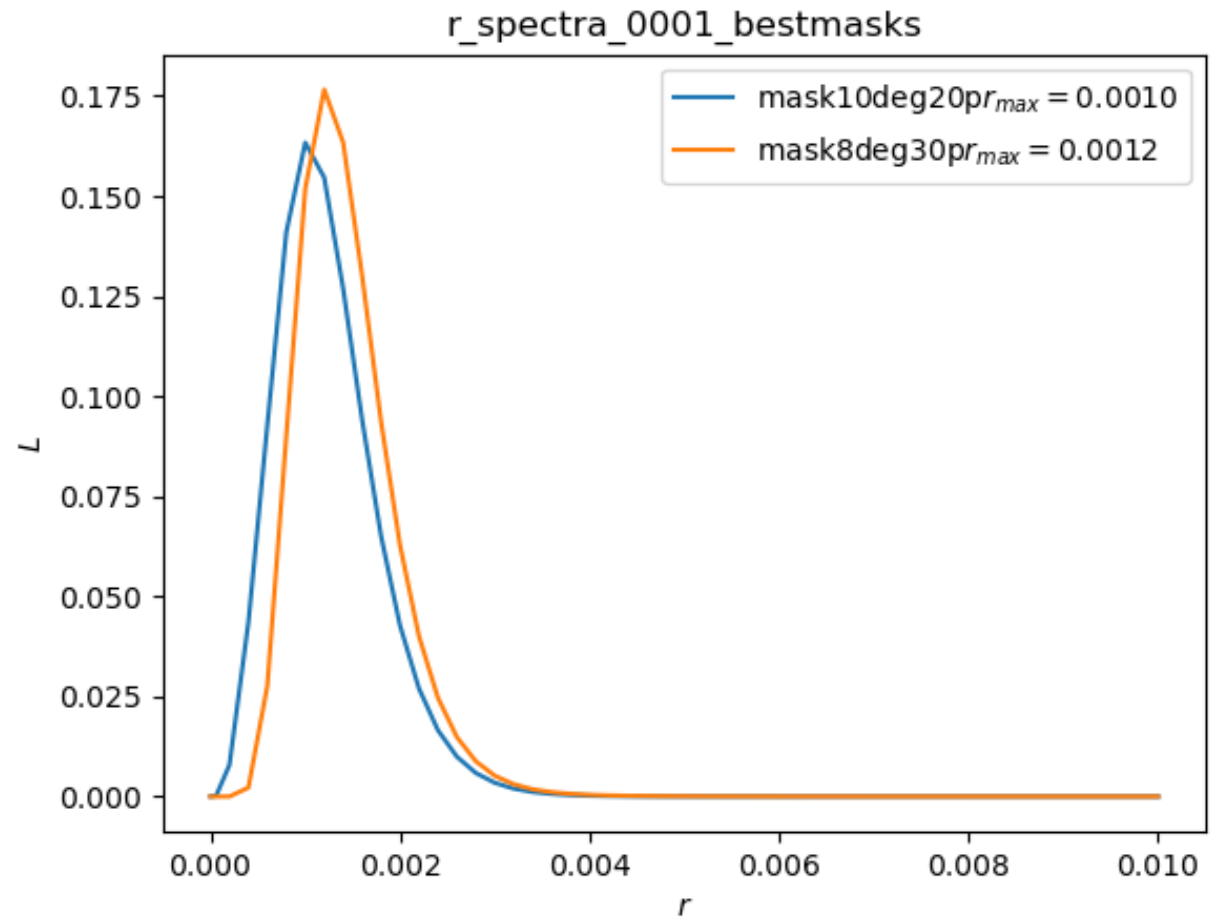


R-spectra for 0001 with $r = 0$

Unnis simulation



Original simulation



Suggested solutions

Commander1

- Simulations must be produced on the resolution they will be analysed in
- Simulations at nside 256 with beam between 42-60 arcmin

Commander2

- Need higher nside for frequency bands above 43 GHz
- or
- Beams for frequency bands above 36 GHz simulated with bigger beam
 - Between 23 and 25 arcmin