PICO

Summary from the Oslo group

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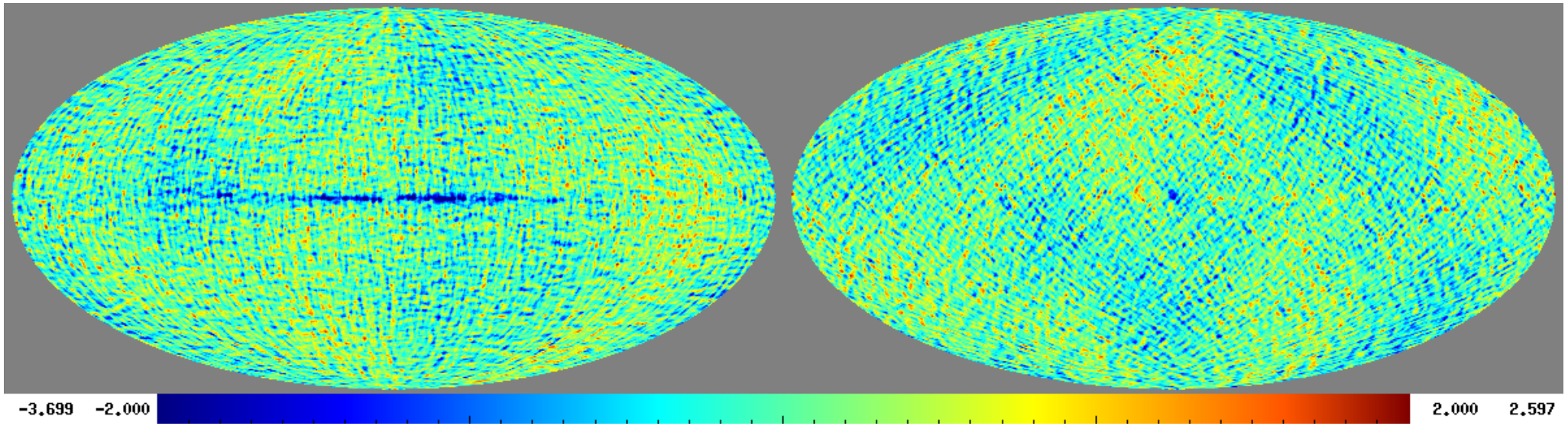
3 component separation analysis

- **Analysis 1**: Component separation using Commander 2 with full resolution and NSIDE 512
  - Worked on sky model 90.00, but not on the more realistic models
- **Analysis 2**: Commander 1 on sky model 90.92, nside 256 and fwhm of 60 arcmin
- **Analysis 3**: Commander 1 on Nside=16, fwhm of 10 degrees with brute-force likelihood tensor-to-scalar ratio estimation
  - Self made simulations

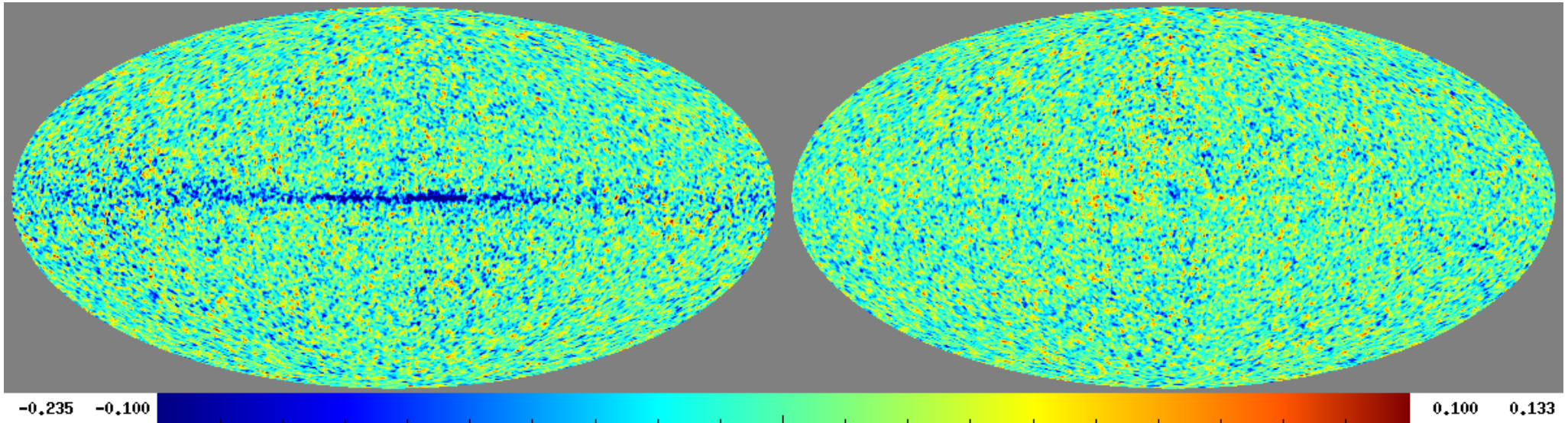
Commander 1 – analysis setup 1

- Tried different sky models, main focus on 90.92
- All maps smoothed to 60 arcmin and nside 256
- Optimized 8 parameters per pixel
  - CMB (A_{cmb})
  - Two independent dust models (A_{dust}, T_{dust} for each, as well as β for dust2)
  - Synchrotron model ($\mathrm{A}_{sync}, \beta_{synch}$)
  - CMB masked, 79% sky coverage
- In addition, β for the first dust component is fitted uniformly on the sky
- Power spectrum was derived with anafast cross-spectra between ds1 and ds2, after inpainting the mask with a constrain realization to minimize E-to-B coupling

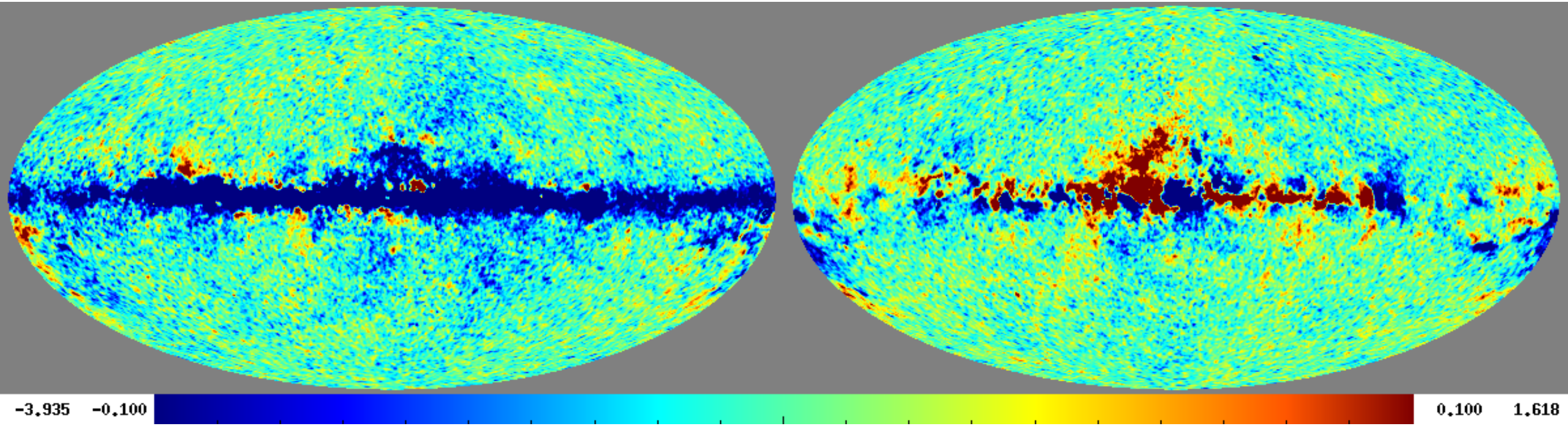
Reconstructed component maps: CMB ds1



Difference ds1 - ds2



Difference CMB from Commander - input CMB

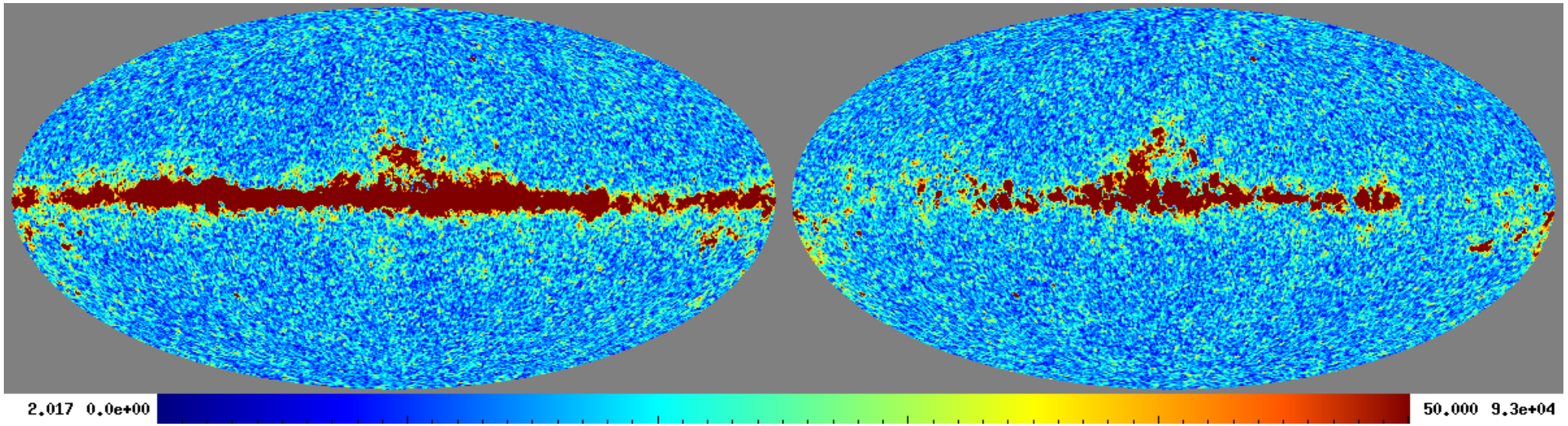


Color scale = +/- 0.1 μK

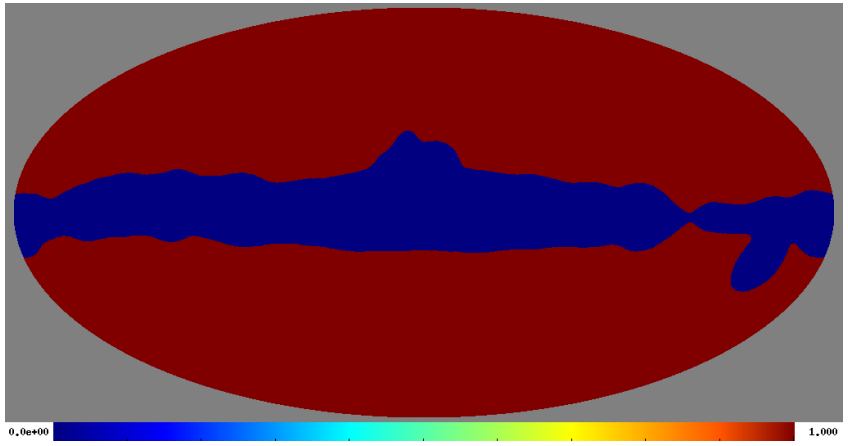
Synchrotron curvature fixed

Not fitted for AME

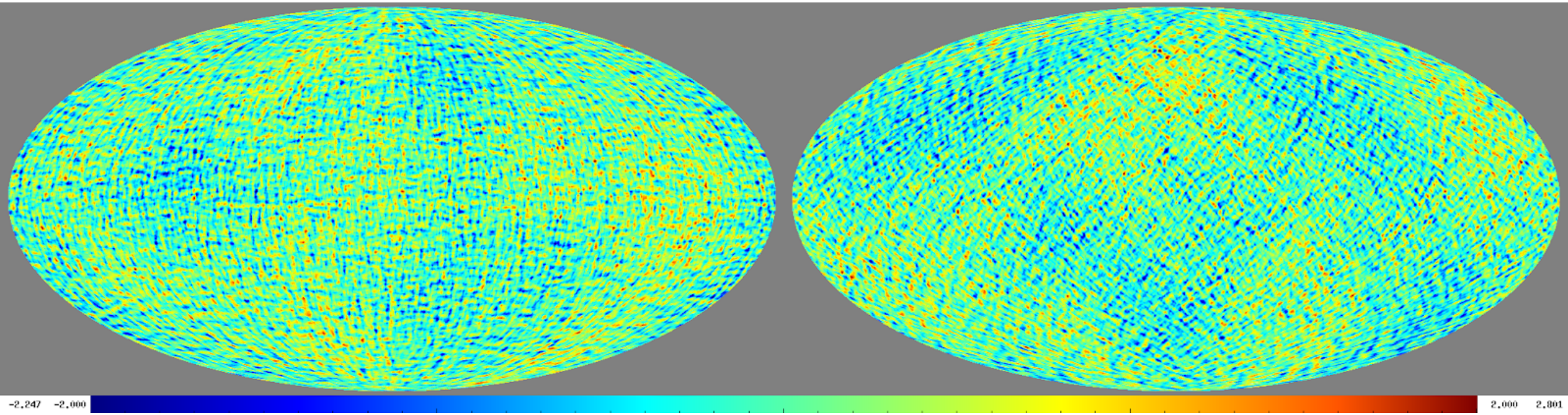
Total chi-square map



Mask made from chi-square



Masked and in-painted CMB map



Color scale = +/- 2 μK

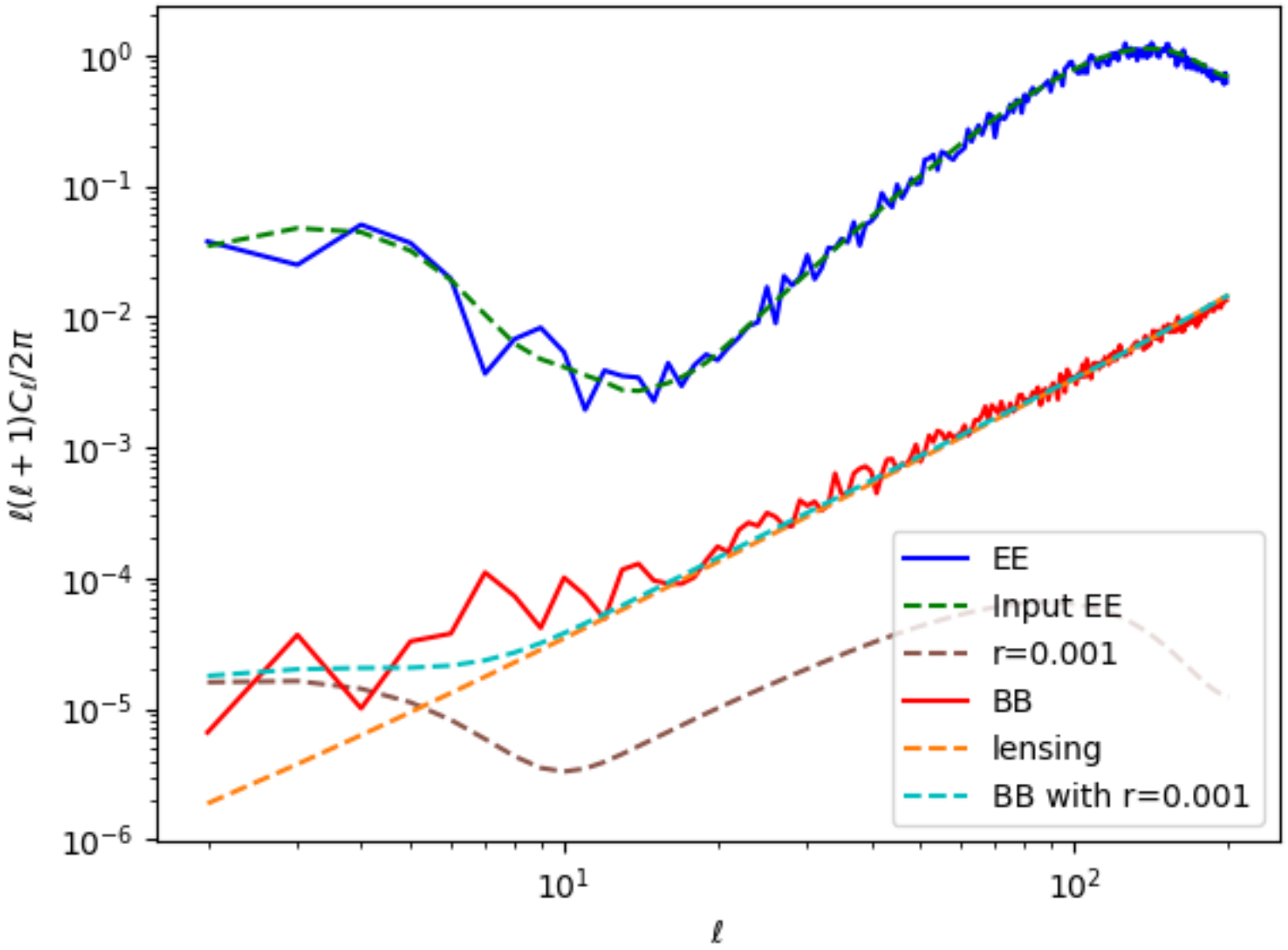
Synchrotron curvature fixed at input

Power spectra

Cross spectrum of masked and in-painted ds1 and ds2 CMB maps.

90.92 model, 0000 realization with r=0.001

Red (BB) and blue (EE) curve from reconstructed CMB map



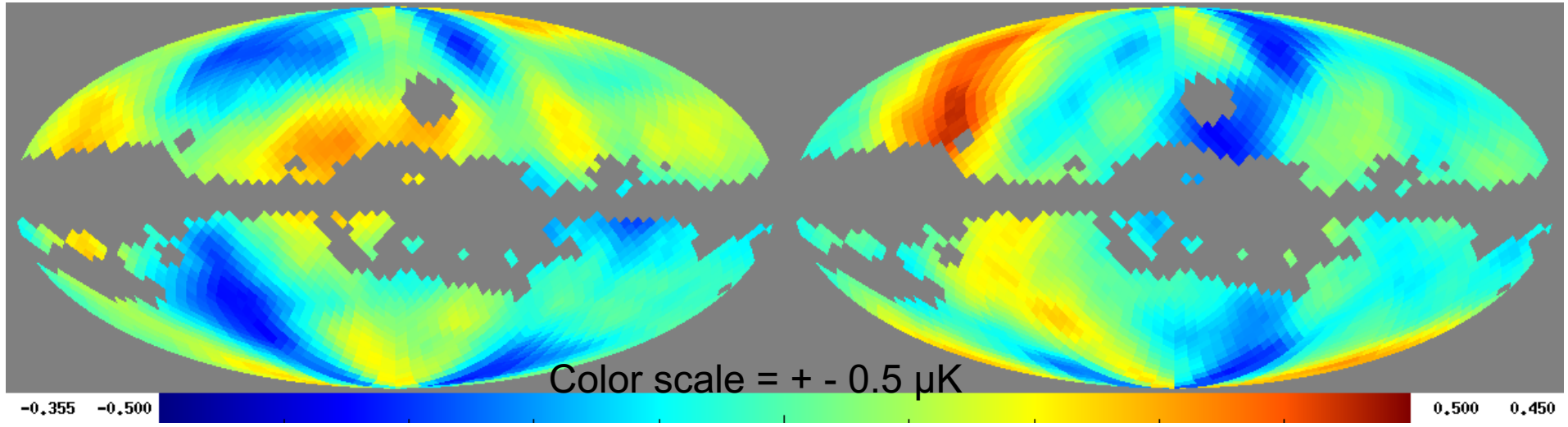
Analysis setup 2

Component separation performed with Commander1 at a common resolution of 10 deg FWHM and Nside=16

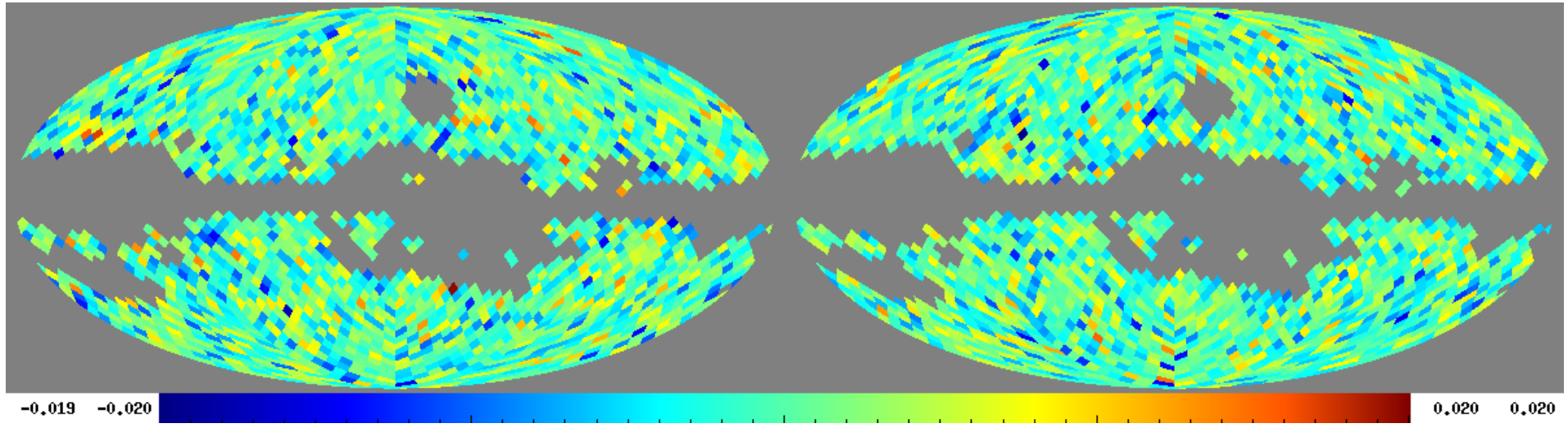
Foreground model from PySM, case with one bb dust plus synchrotron. Spatial variable spectral parameters; co-added directly at Nside=16 to eliminate downgrading artefacts

- CMB r=0.01, tau=0.06, 4 different noise realisations
- Delta function band-pass, white noise from Pico sensitivity
- Fitted 6 parameters per pixel
  - CMB (A_cmb),
  - One bb dust model, (A_dust, β_dust, T_dust)
  - Synchrotron power law model (A_synch, β_synch) (no curvature)
  - Analysis mask, 73% sky coverage
- Compute r from brute-force map-based likelihood using $2 \leq l \leq 12$

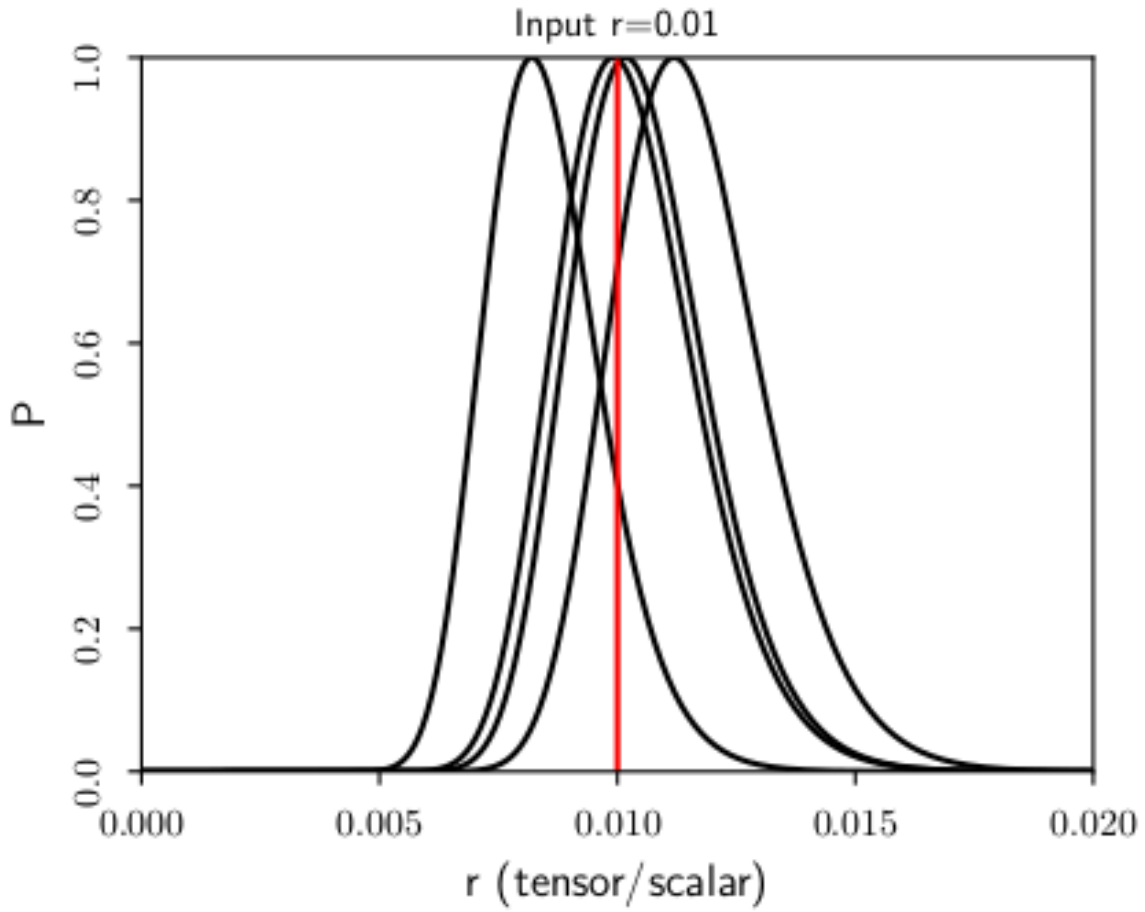
Output CMB



Difference input-output CMB



Estimation of r



- **r (average) = 0.00985**

4 noise realisations

- r1 = 0.0082 + 0.0013 - 0.0011
- r2= 0.0101 + 0.0015 - 0.0013
- r3= 0.0112 + 0.0017 - 0.0014
- r4=0.0099 + 0.0016 - 0.0013

Next steps

- Fit for synchrotron curvature, β for dust2 and AME
- Continue work with inpainting of CMB in the masked area to get power spectra
- Run for more simulations; both with $r = 0$ and $r \neq 0$