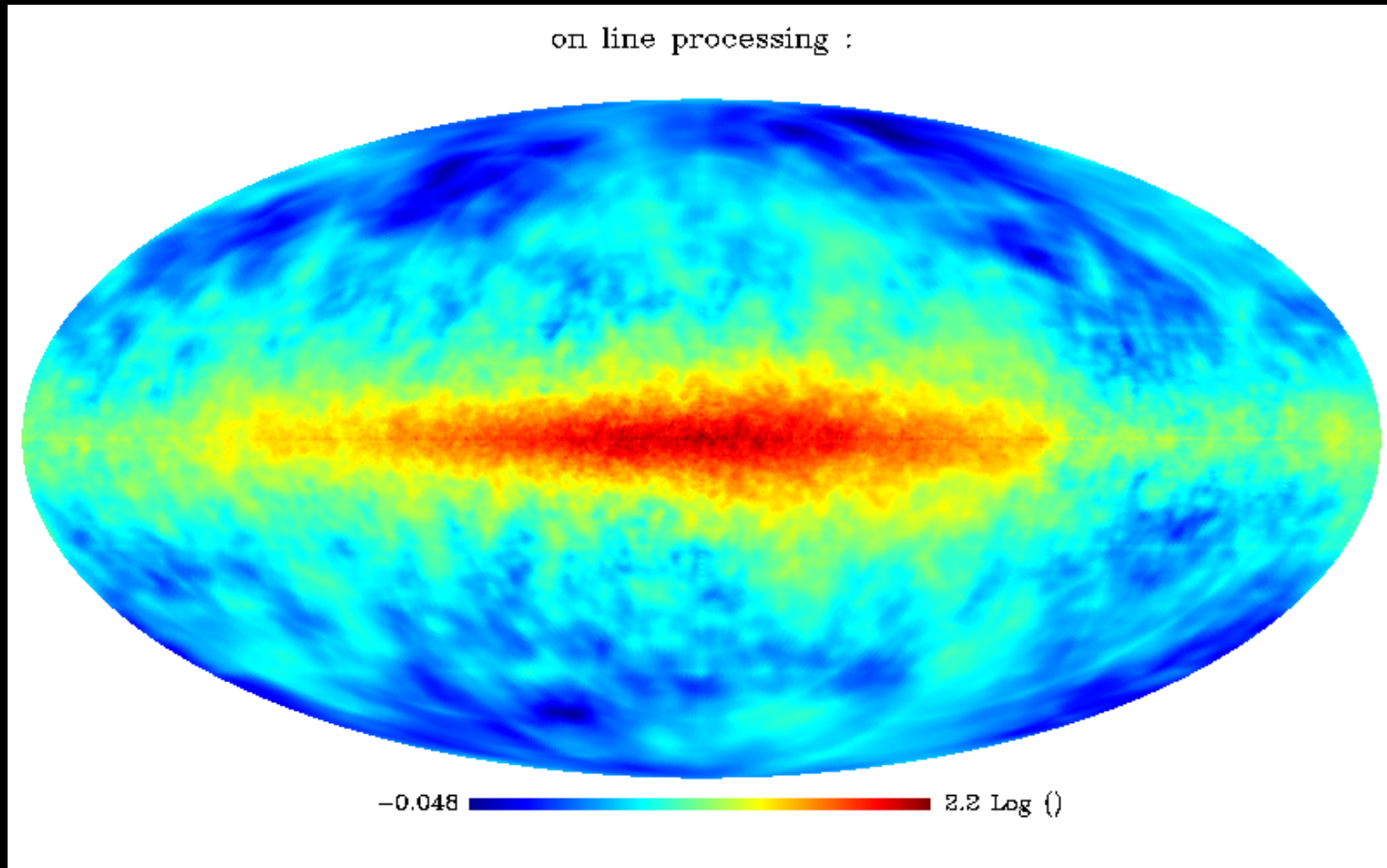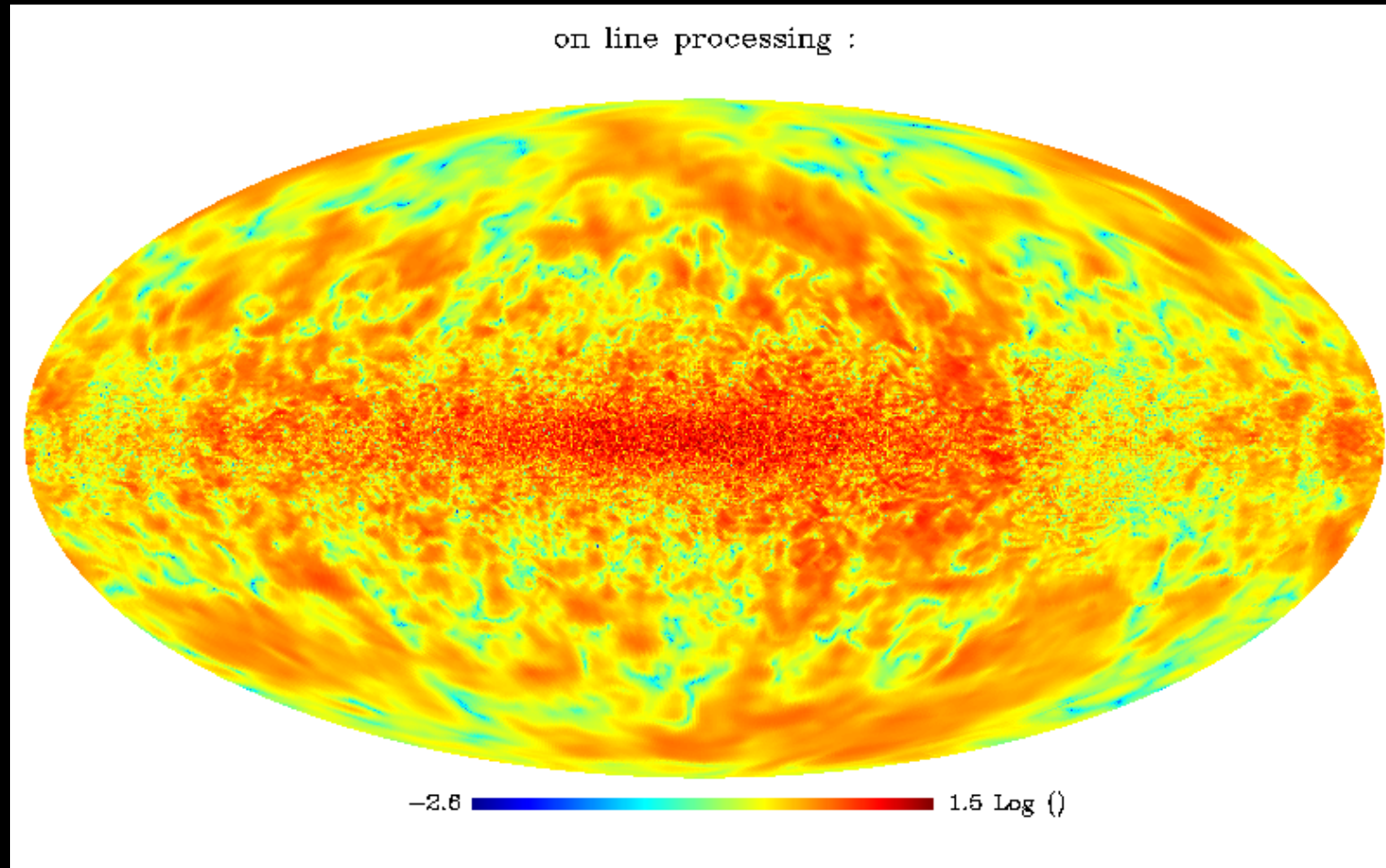# Other Probes of cosmology

- 21 cm signal from neutral hydrogen

- Very challenging due to foregrounds.
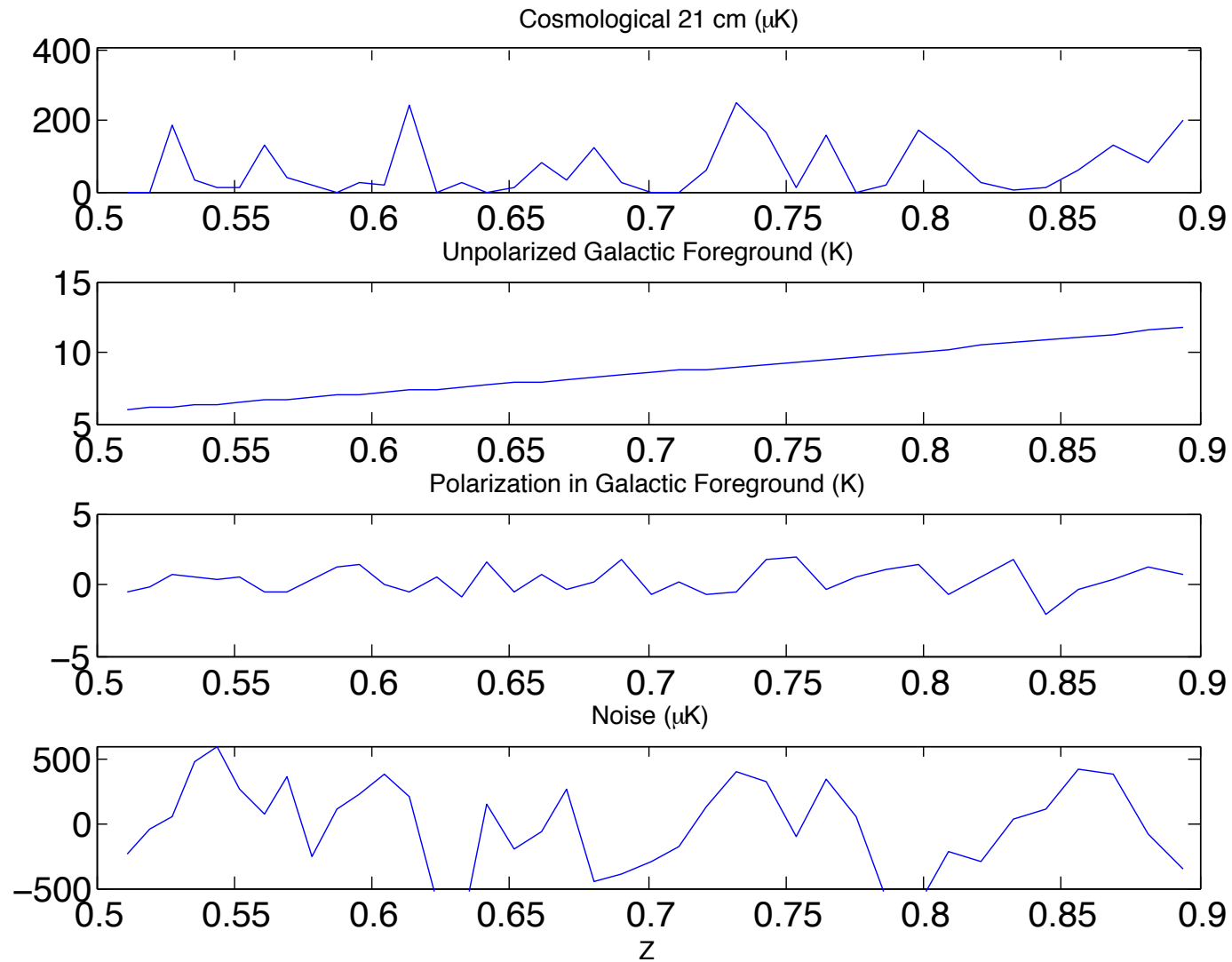
Synchrotron sky at 1GHz

on line processing :

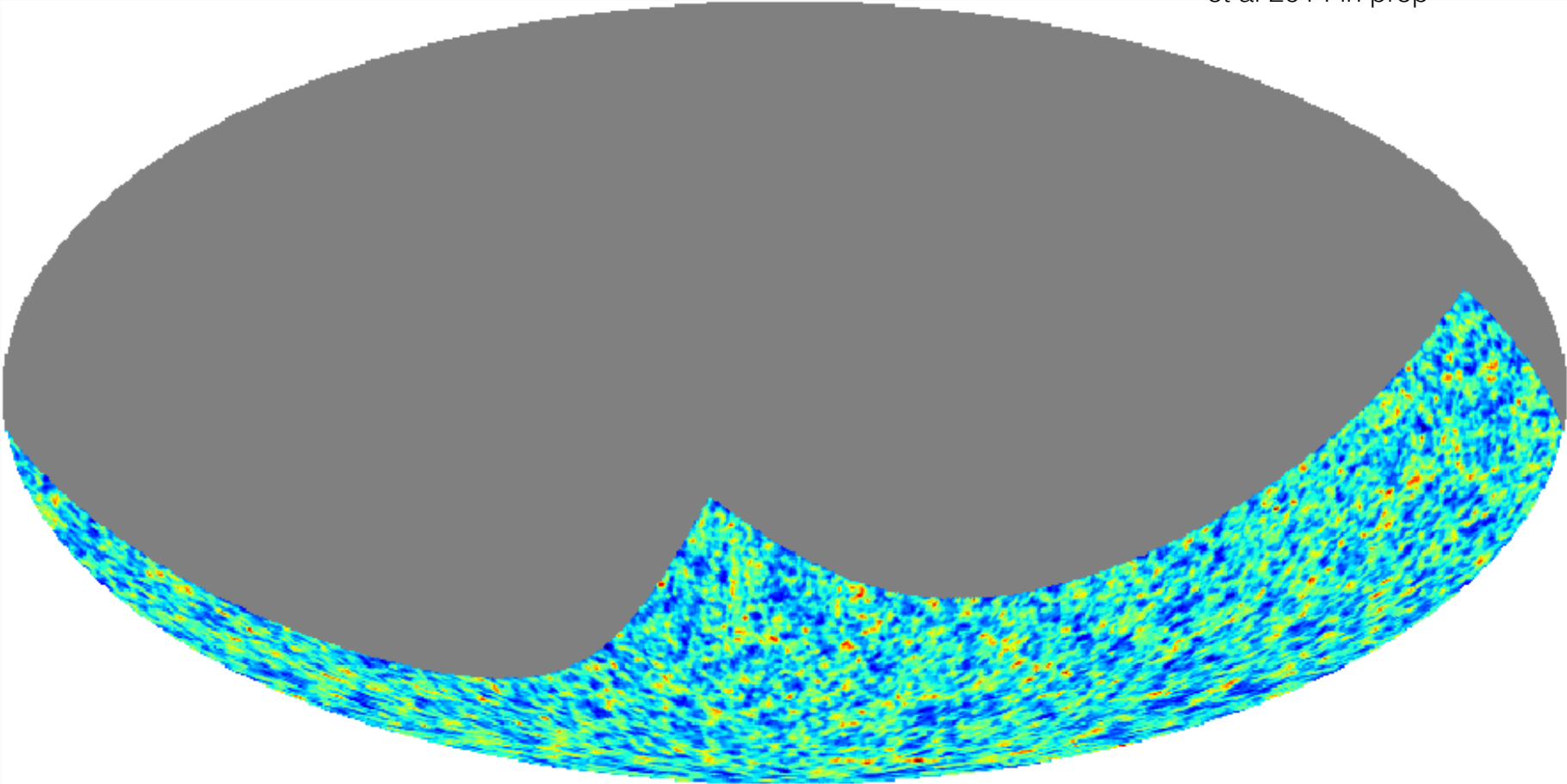−0.048 ⬛ 2.2 Log ()

Polarized Sync sky at 1GHz

on line processing :

−2.6   1.5 Log ()

Line of sight brightness in units of temperature (corresponding frequency=1420 MHz/(1+z)

Cosmological 21 cm (μK)

Unpolarized Galactic Foreground (K)

Polarization in Galactic Foreground (K)

Noise (μK)

z

Integrated HI signal from DES region from z=0.5-0.9

-52.6793 μK 86.5235 μK
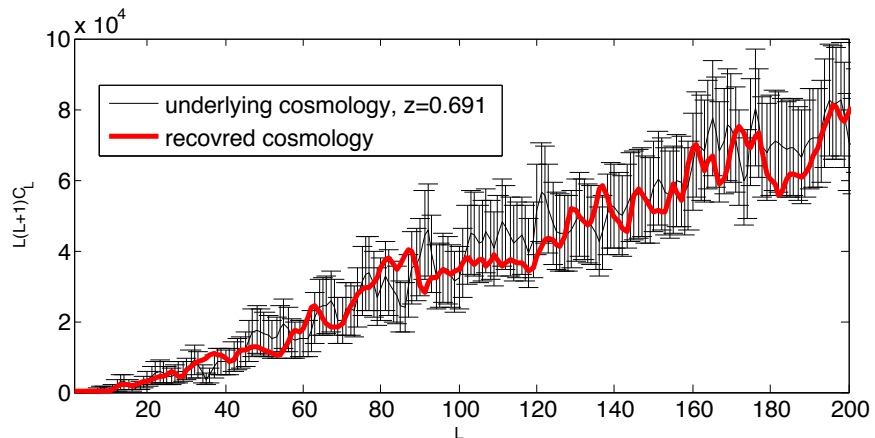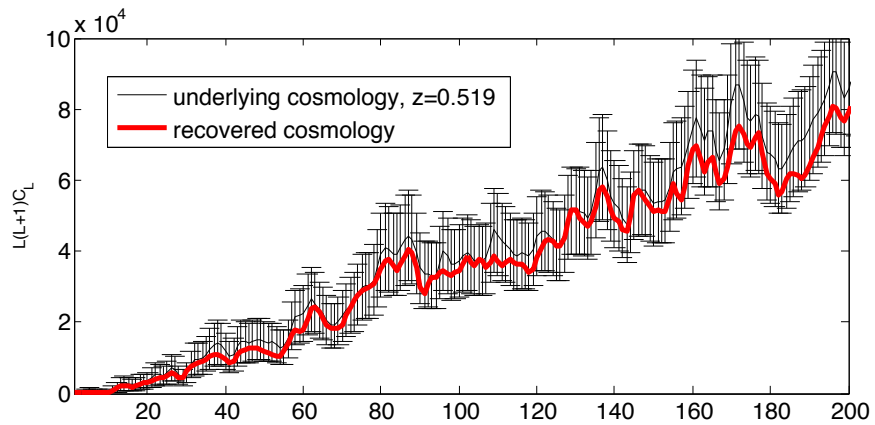
Angular power spectra for DES sky, z~0.5
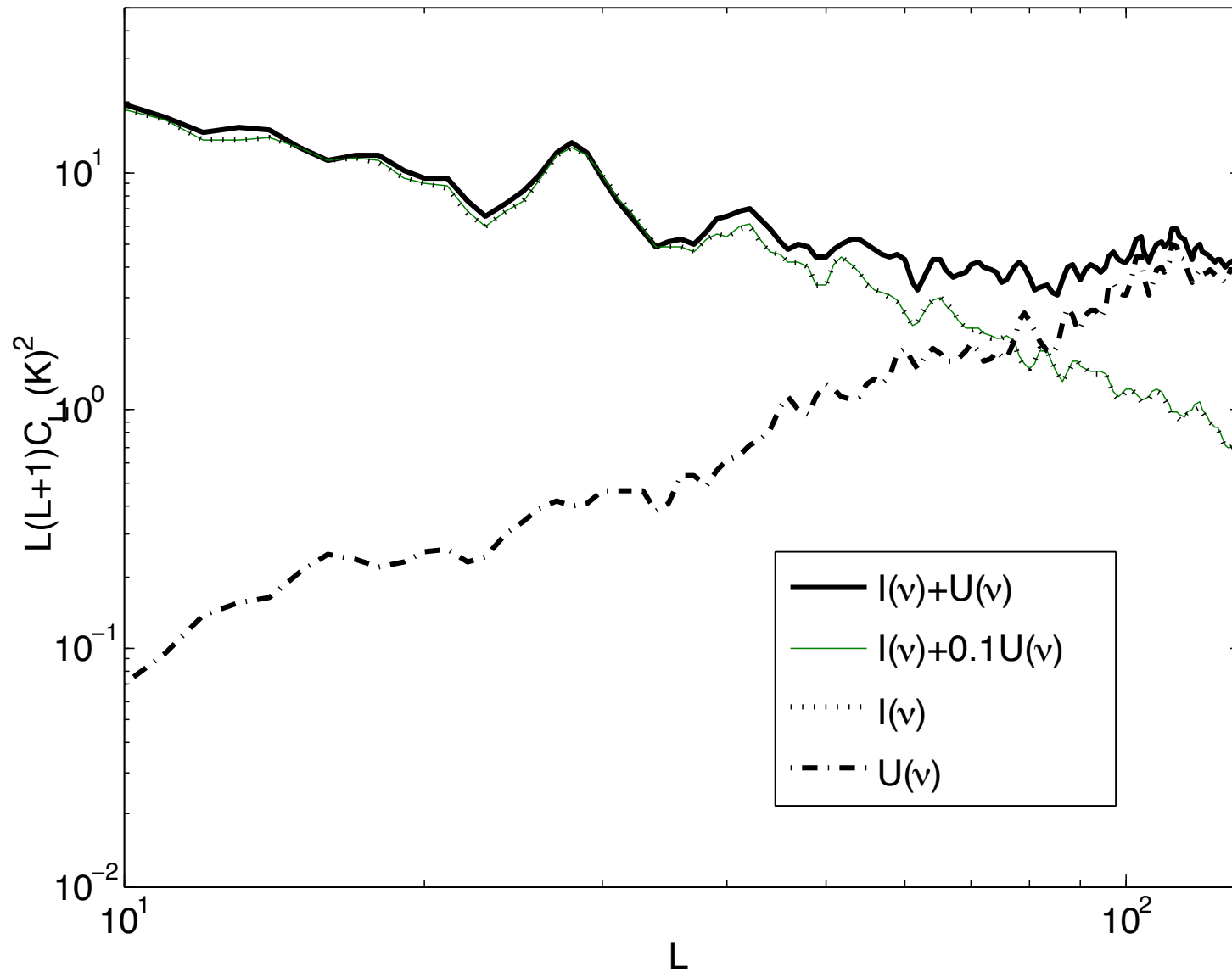
# Angular power spectra of Synchrotron at 1GHz
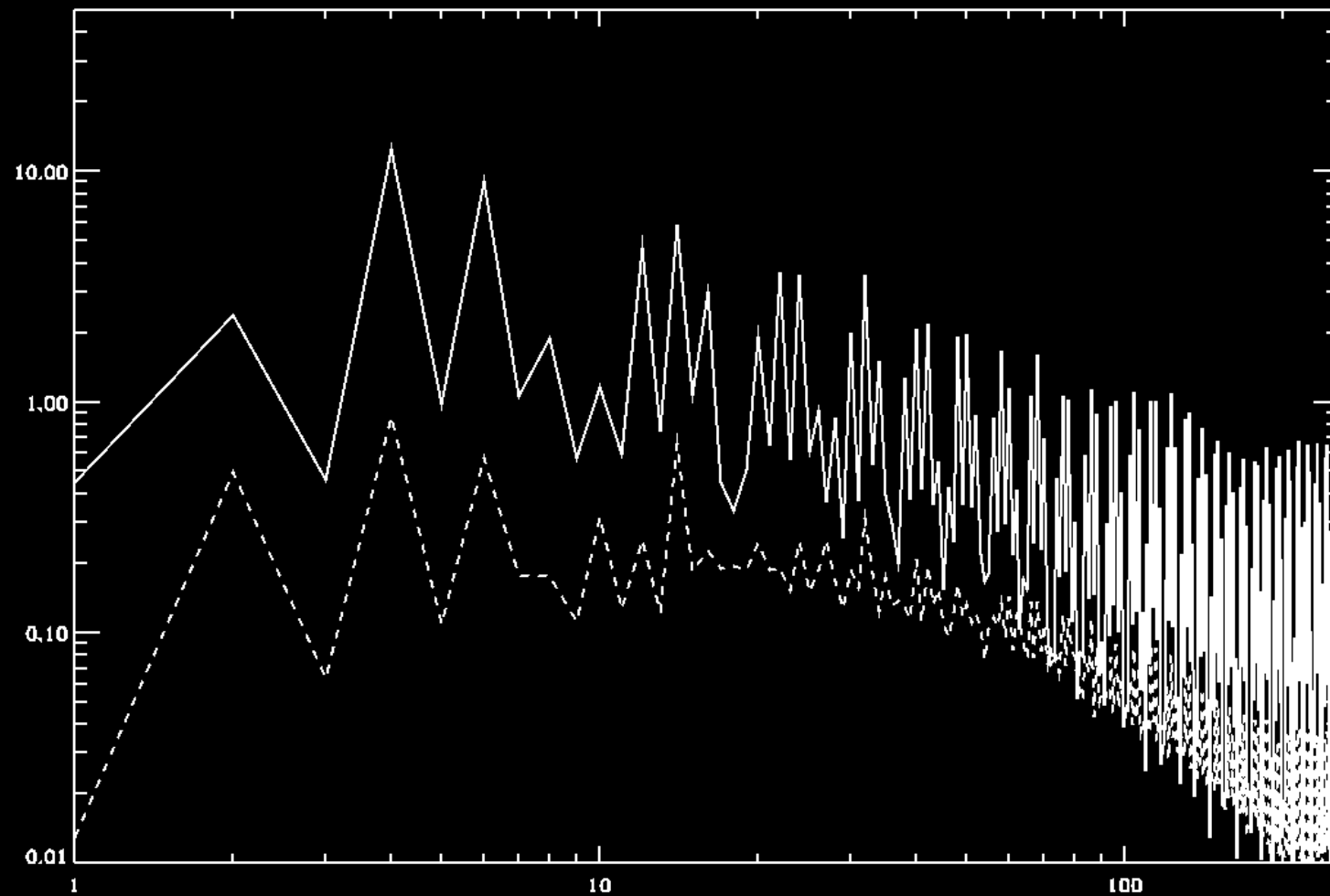
Recovered cosmology in presence unpolarized foreground and no leakage.

Angular power spectra of the 'original' or 'input' underlying cosmological signal in black dotted line, along with cos- mic variance and the 'recovered' underlying cosmological signal (in red solid line), after FastICA method was used. This angular power spectra was calculated at z=0.519 for the top subplot and z=0.691 for the bottom subplot. The number of independent components used in FastICA were 2, corresponding to primarily synchrotron and free-free emission components of the galactic foreground.

Recovery of cosmological signal using FastICA for cosmology+unpolarized foreground only
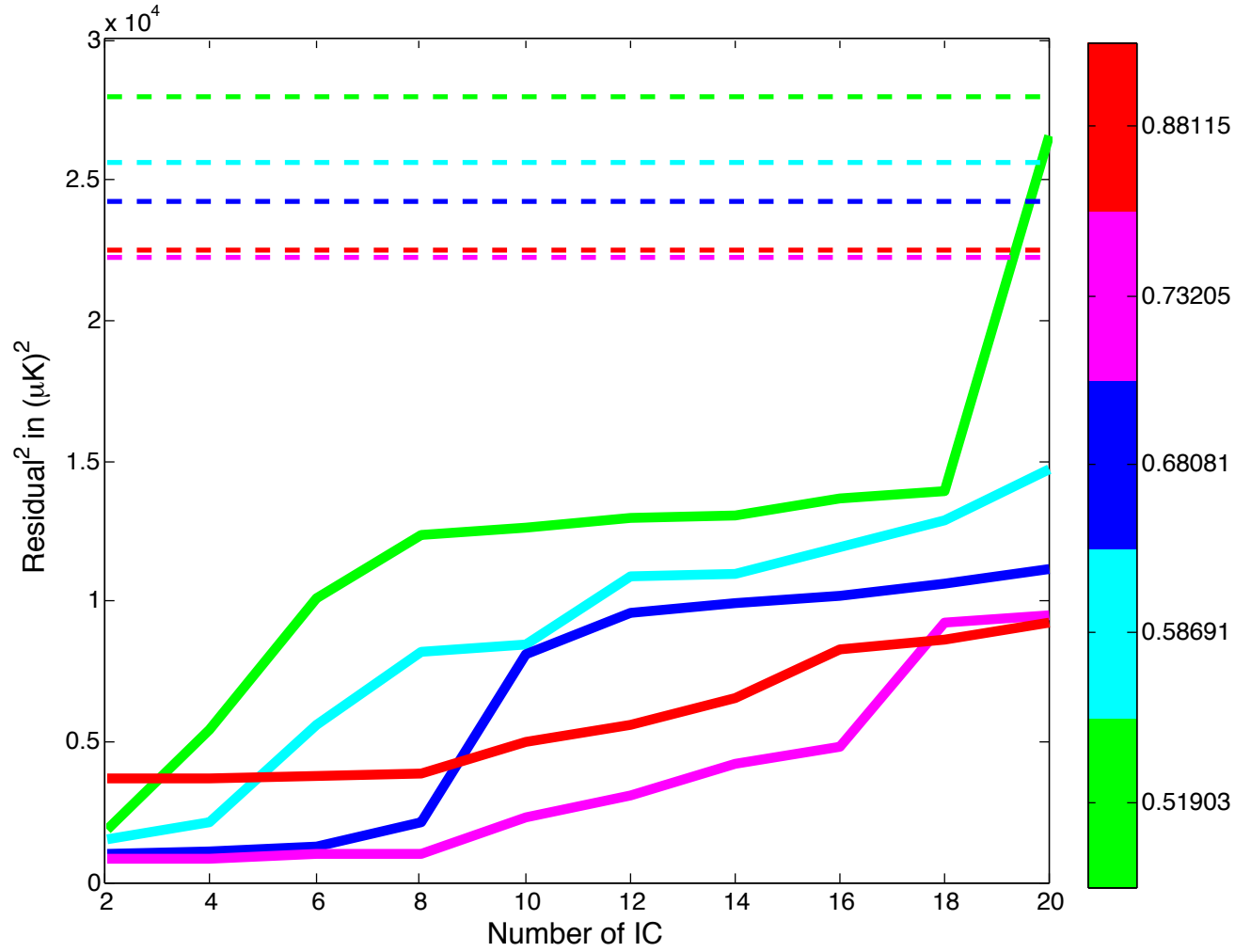
The residuals, r for different ICs at different redshifts. In this case no noise or polarization were taken into account. FastICA was applied to a signal created by simply adding CS and FG at each pixel. The values of redshifts for different colored lines are indicated on the vertical colorbar. The solid lines indicate the $(residual)^2$ in μK^2 and dashed lines show the same for $(residual)^2_c$

Recovery of cosmological signal using FastICA for cosmology+unpolarized and polarized foreground only
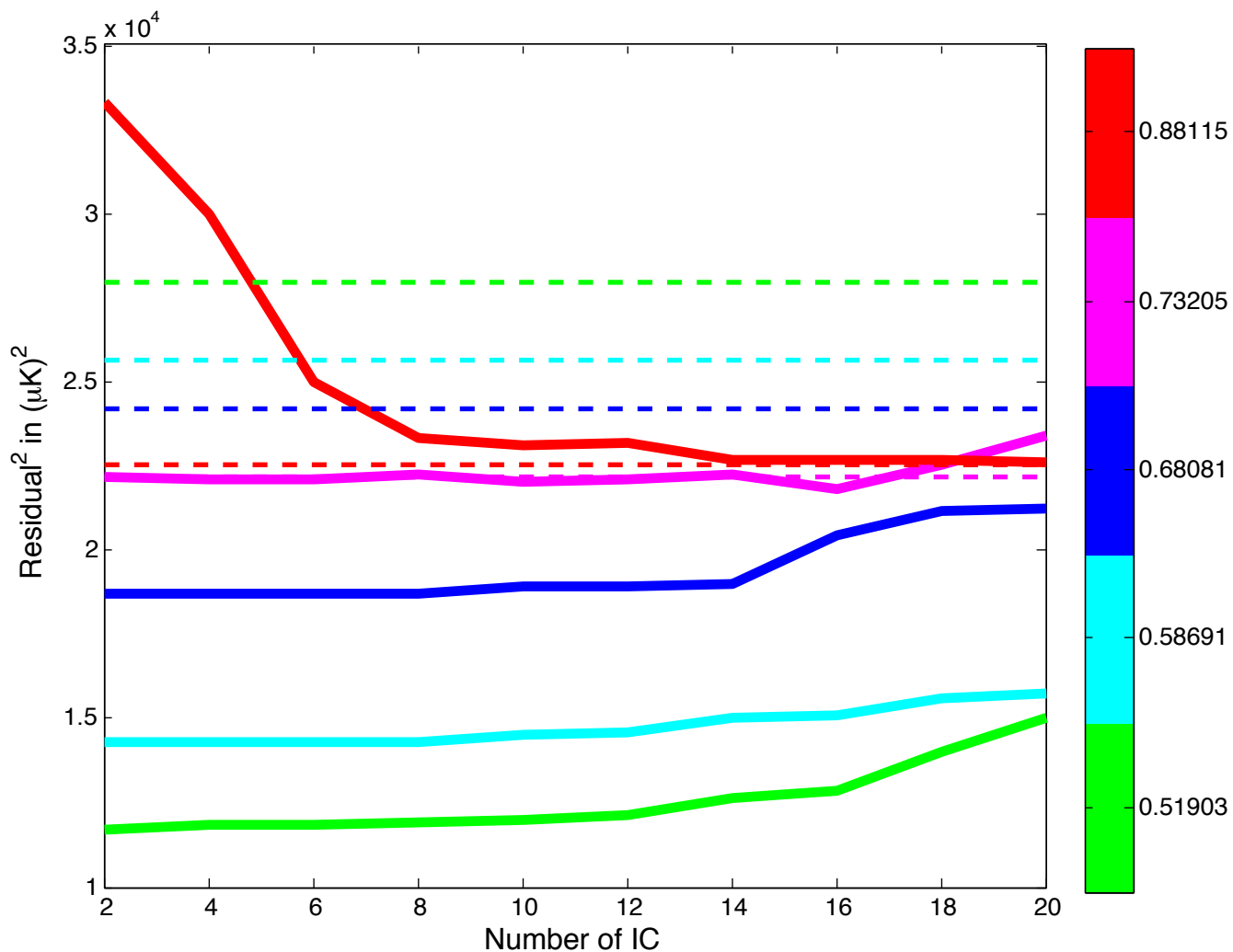
The residuals for different ICs at different redshifts. In this case no noise was taken into account. FastICA was applied to a signal created by simply adding CS, FG and POL at each pixel. The values of redshifts for different colored lines are indicated on the vertical colorbar. The solid lines indicate the $(residual)^2$ in μK^2 and dashed lines show the same for $(residual)^2_c$.

Conclusion

It is difficult to measure the underlying 21cm signal without assumption on the nature of the signal or a model of the foregrounds.