Preliminary Rejection of Gaussian Models for the Global 21-cm with EDGES High-Band *(ongoing work)*

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Description

Here I show preliminary constraints on the absorption trough modeled as a Gaussian in redshift, i.e.:

$$T_b(z) = T_{21} \exp\left[-\frac{4(z - z_r)^2 \log(2)}{(\Delta z)^2}\right]. \quad (1)$$

The foregrounds are modeled with a 5-term EDGES polynomial.
The average spectrum was produced with data between 2015-207 and 2016-90.
The nominal calibration consists, among others, of:

1. Antenna S11 measured on 2015-212 for days before 2015-237, and measured on 2015-262 for days after 2015-237.
2. Spectrally flat, 0.5%, ground loss.
3. Nominal beam model from FEKO GF, using a plus-shaped ground plane.
4. Correction for receiver temperature.

Preliminary Measured Sky Brightness Temperature and Residuals

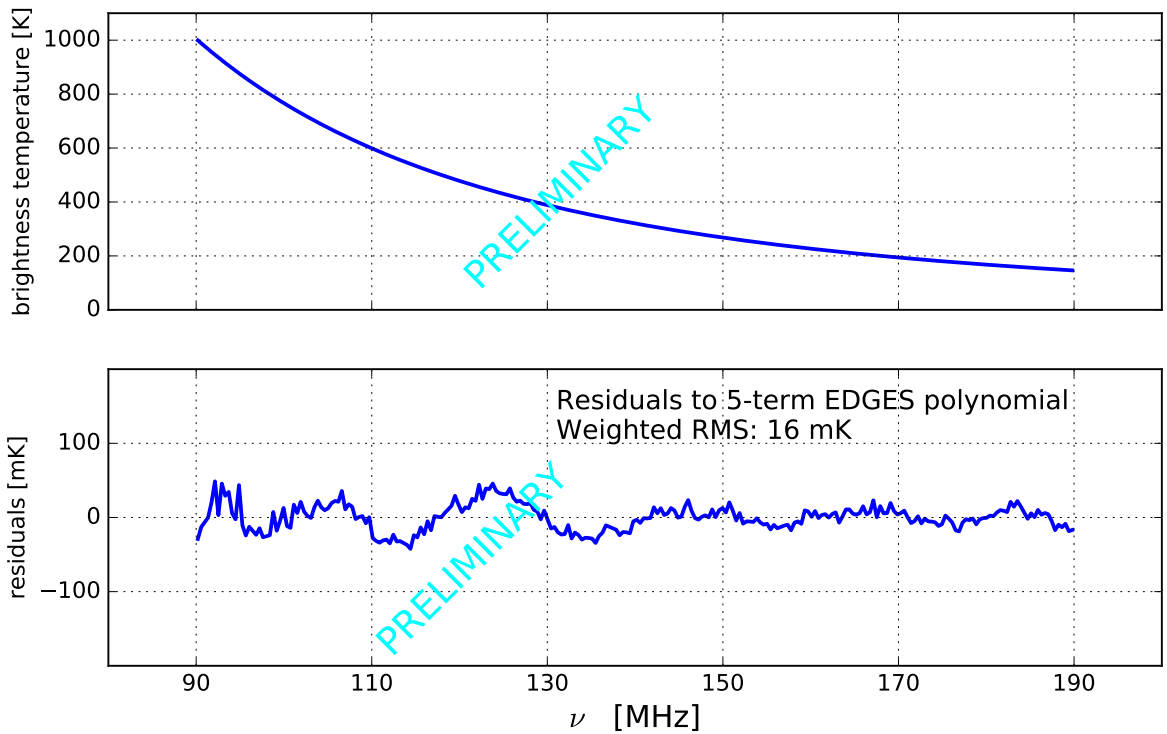

Figure: (1): TOP: Measured sky brightness temperature. BOTTOM: Residuals after fitting and removing a 5-term EDGES polynomial from data in top panel. These residuals have a weighted RMS of 16 mK. This average spectrum is an improvement to the one presented in Report 78 (`http://loco.lab.asu.edu/loco-memos/edges_reports/report_20161123.pdf`).

Gaussian Model for the Absorption Trough

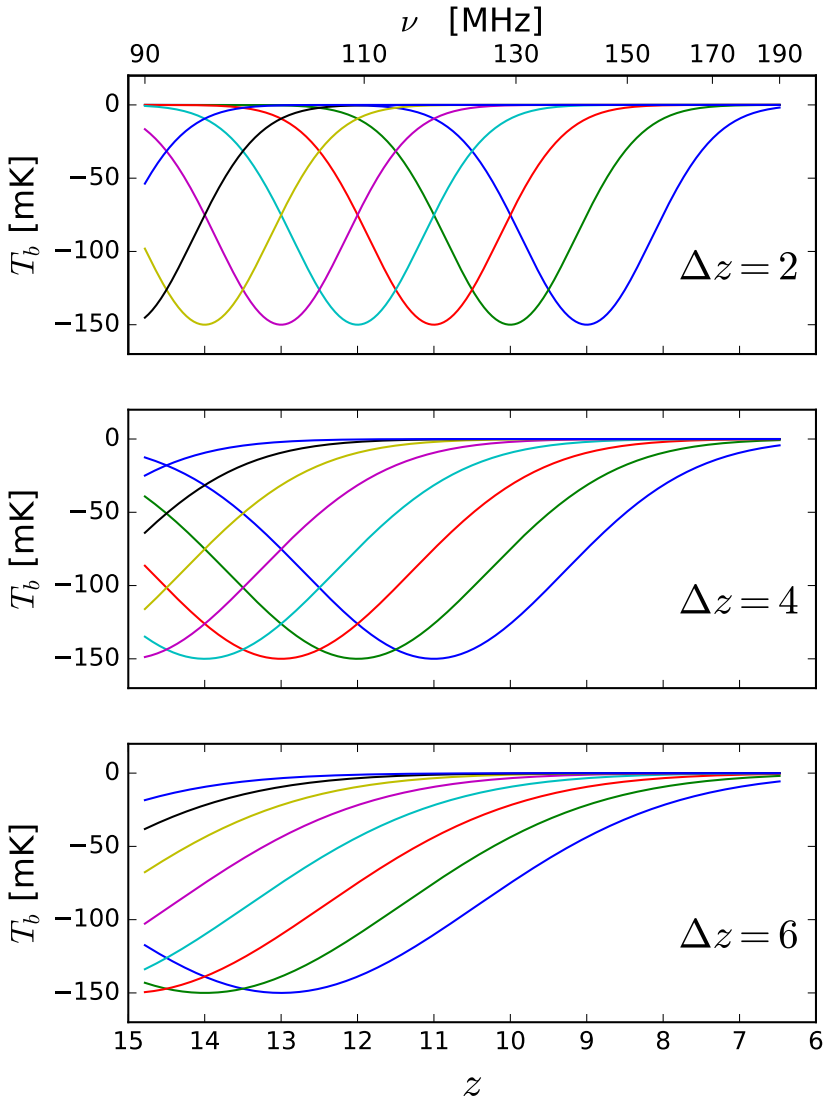

Figure: (2): Examples of the Gaussian model for the absorption trough. All of them have an amplitude of -150 mK. From top to bottom, the FWHM of the Gaussian (Δz) is 2, 4, and 6. The center of the Gaussian (z_r) is allowed to descend in redshift while the condition $T_b \approx 0$ at $z = 6$ is met.

Nominal Rejections

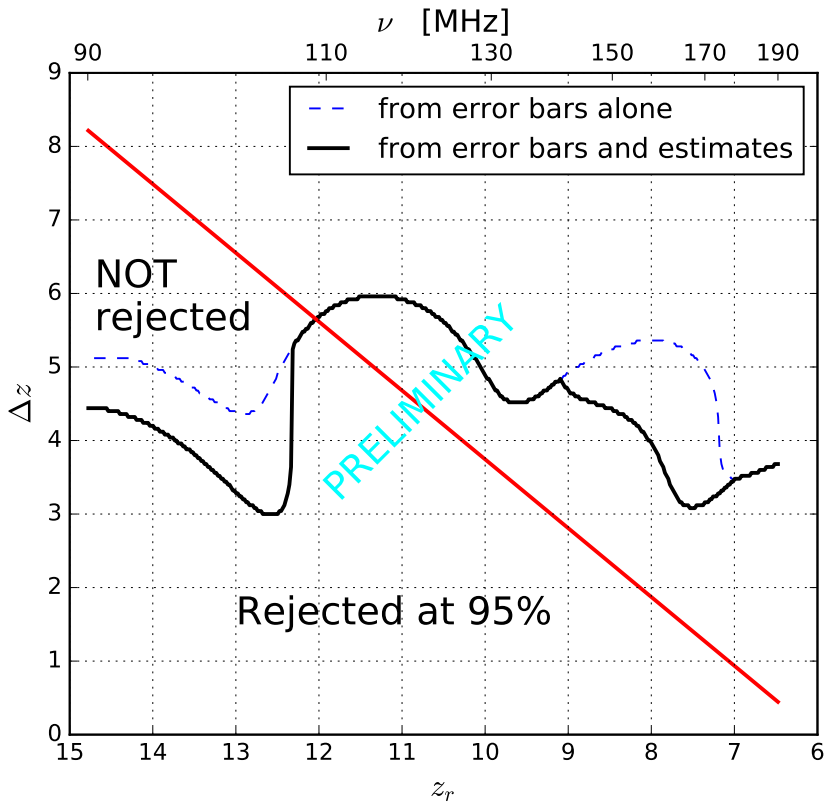

Figure: (3): Models rejected at 95% confidence, with a trough amplitude of -150 mK, are those below the black line and the red line, on the lower left corner. The red line represents the requirement of $T_b \approx 0$ at $z = 6$. Across redshift, and below the red line, the EDGES measurement enables to rule out Gaussians with an amplitude of -150 mK with FWHM of at least $\Delta z \approx 3$.

Nominal Rejections, including Uncertainties

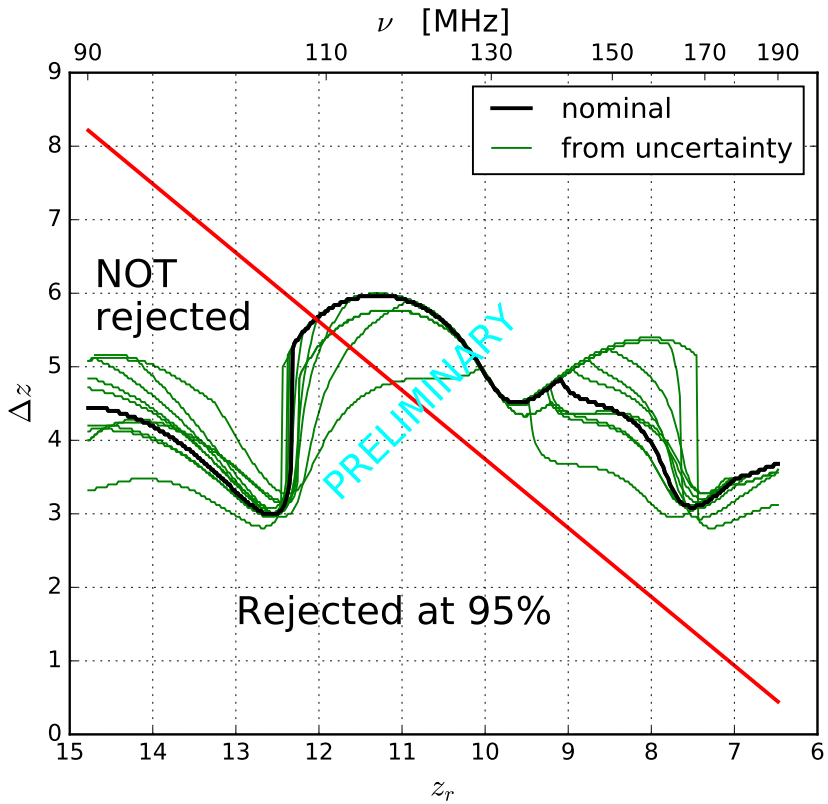

Figure: (4): Same as Figure 3 but including additional realizations in green that account for calibration uncertainty. This uncertainty does not impact the lower bound of $\Delta z \approx 3$ for a -150-mK Gaussian.

Nominal Rejections for Different Gaussian Amplitudes

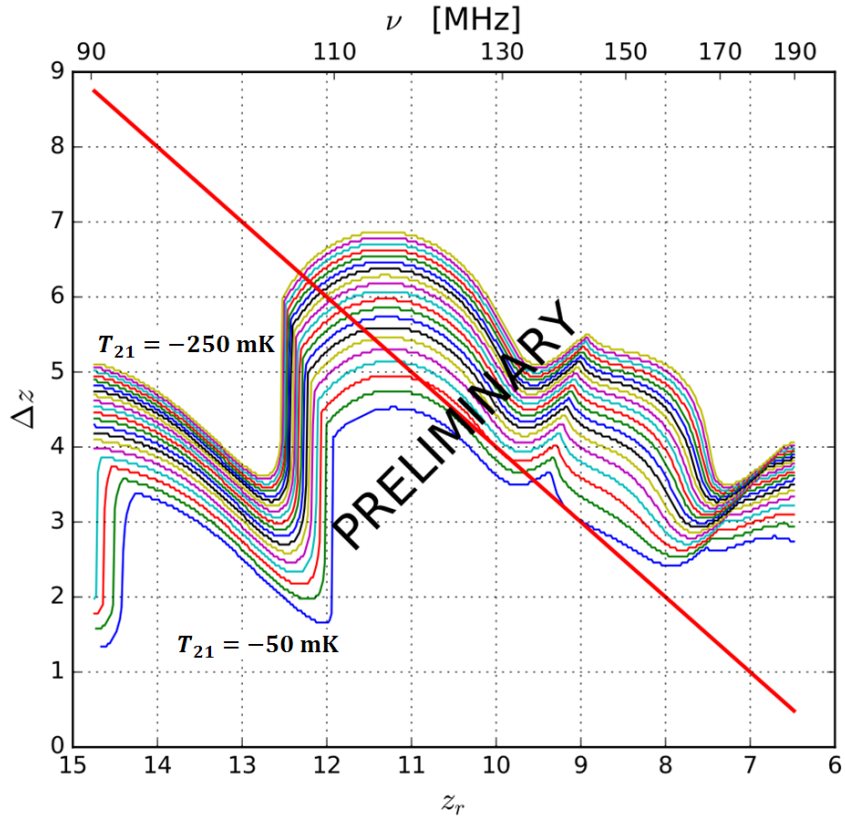

Figure: (5): Same as Figure 3 but for different Gaussian amplitudes.

Sample of Rejected / Non-Rejected Gaussian Models

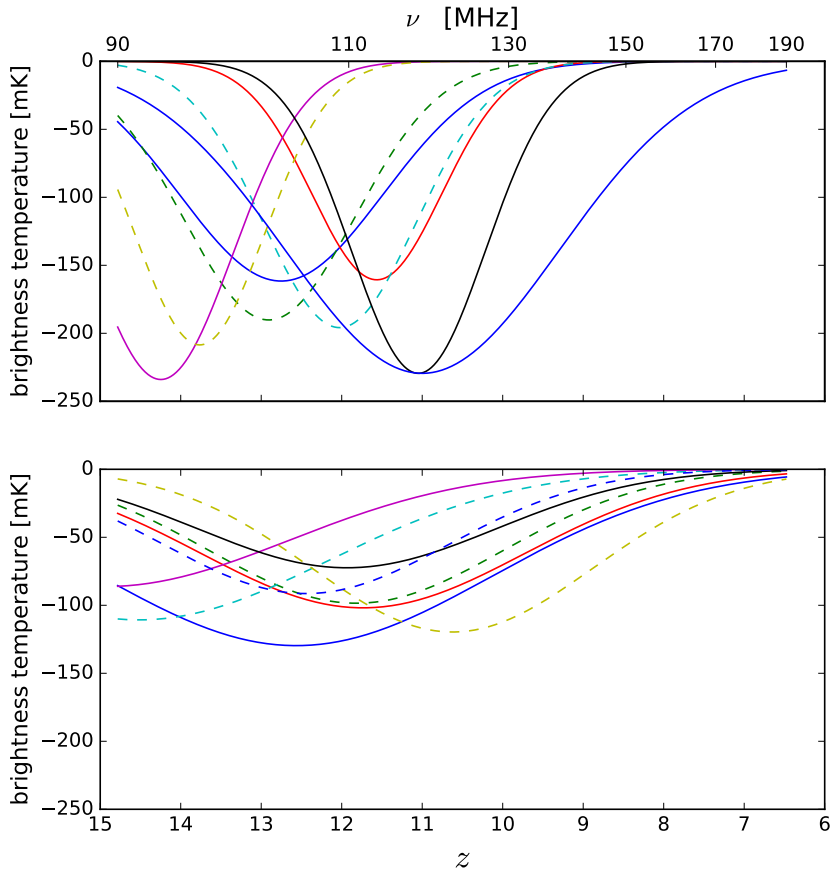

Figure: (6): TOP: Sample of rejected Gaussians. BOTTOM: Sample of non-rejected Gaussians.