

Correction of EDGES Data using CST Beam

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Description

This report presents a preliminary beam correction of calibrated EDGES data described in a previous report:

http://loco.lab.asu.edu/memos/edges_reports/report_20140530.pdf.

The beam corresponds to that simulated by CST with a spatial resolution of $1^\circ \times 1^\circ$ in (AZ,EL) and a frequency resolution of 1 MHz.

This beam was convolved with a scaled Haslam map in the range 100-200 MHz in steps of 1 MHz. For the convolution, the antenna was placed at a latitude of -26.7 degrees, and rotated 7 degrees East of North to replicate the situation at Boolardy. The convolution was done in local coordinates with a spatial resolution of $1^\circ \times 1^\circ$. The resolution in LST is of 1 degree or 4 minutes (sidereal time). This means that there are 15 computations per LST hour. The spectra generated from this convolution are called *synthetic*.

In this report, a two-parameter power law was fitted to the measured and synthetic spectra in the range 110-180 MHz. Because of this, the results presented here are different from those in the previous report.

Description

The following plots present:

- ▶ Figure -1: Synthetic antenna temperature
- ▶ Figures 00-23: Comparison between residuals for measurements and synthetic temperature after removing independent two-parameter power laws.
- ▶ Figure 24: Simultaneous comparison for day 108, for all LST hours.
- ▶ Figure 25: Comparison between my results and Alan's for day 108.
- ▶ Figure 26: Comparison of best-fit parameters between measurements and synthetic temperature.

The main conclusions of this report are that (i) the feature at ~ 170 MHz due to the LNA box appears at a higher frequency (~ 175 MHz) in the synthetic results using the CST beam, and that (ii) the spectral index is significantly different between measured and synthetic antenna temperature for more than half of the sky, when the galactic signal has the lowest impact.

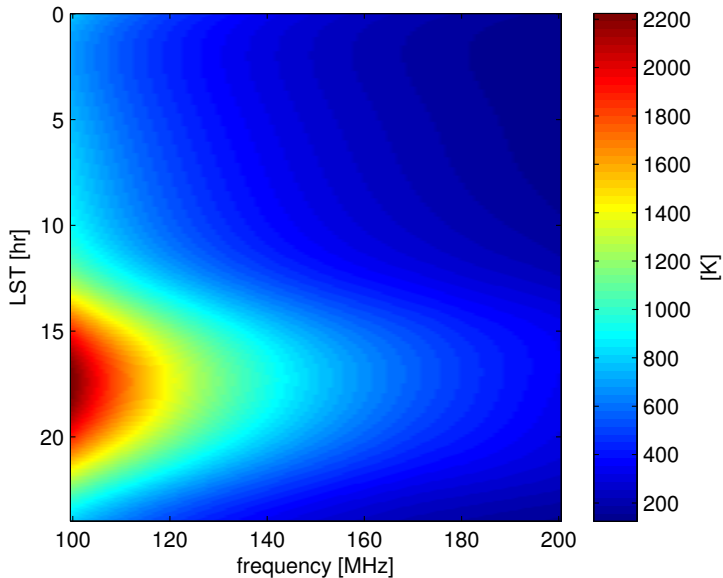


Figure : (-1): Synthetic antenna temperature from convolution of CST beam and scaled Haslam map.

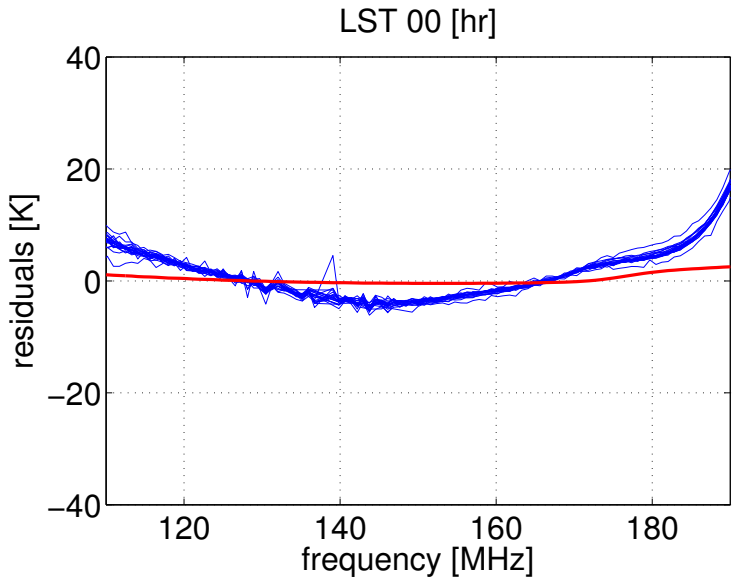


Figure : (0): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

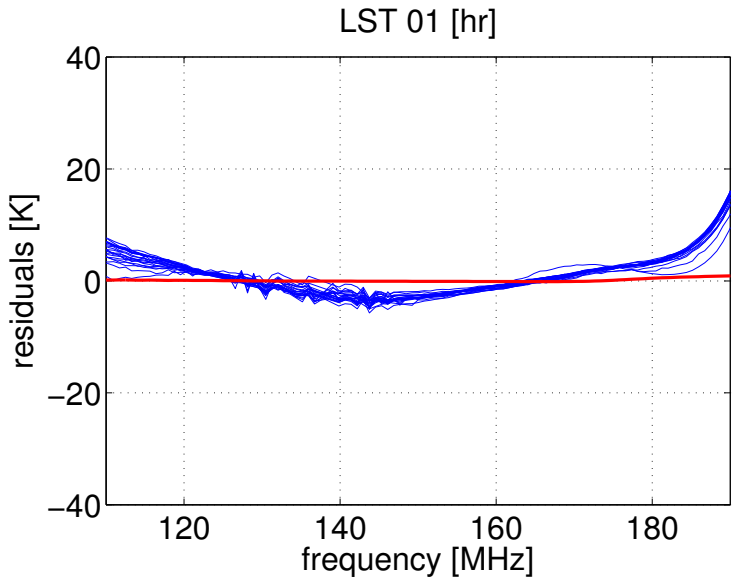


Figure : (1): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

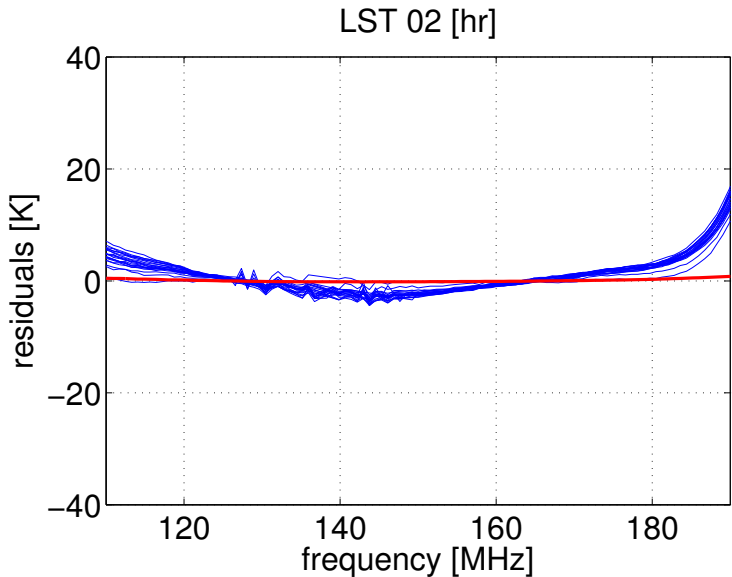


Figure : (2): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

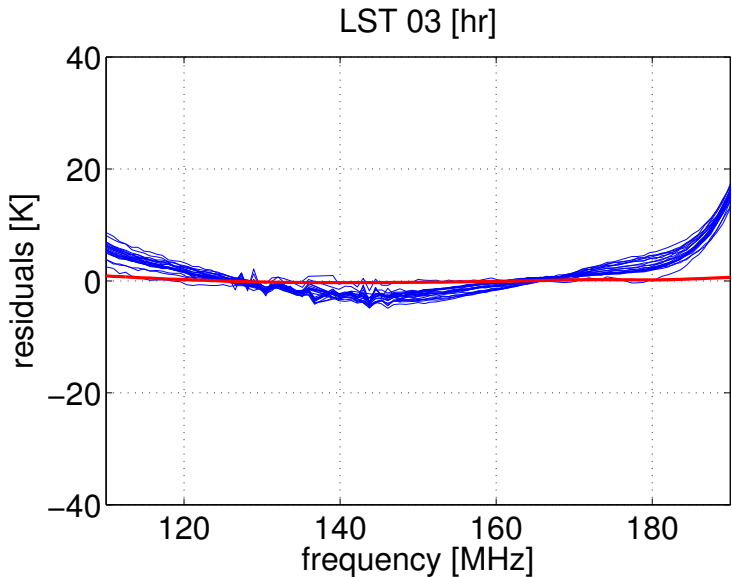


Figure : (3): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

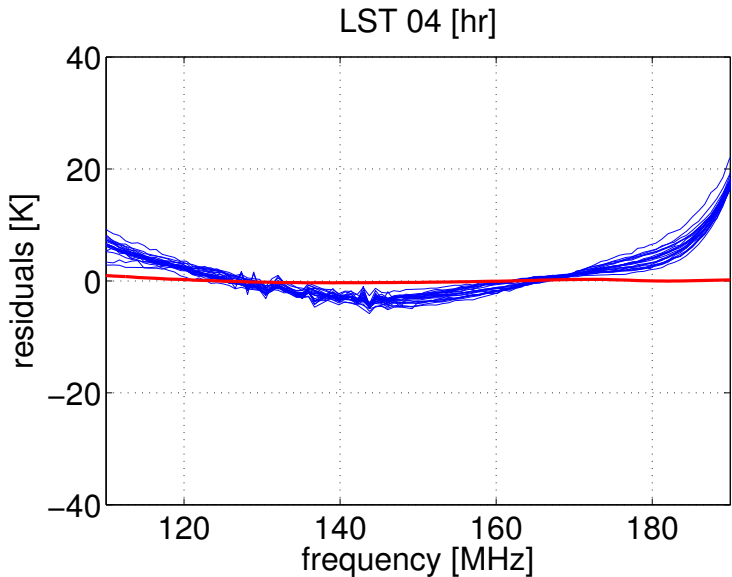


Figure : (4): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

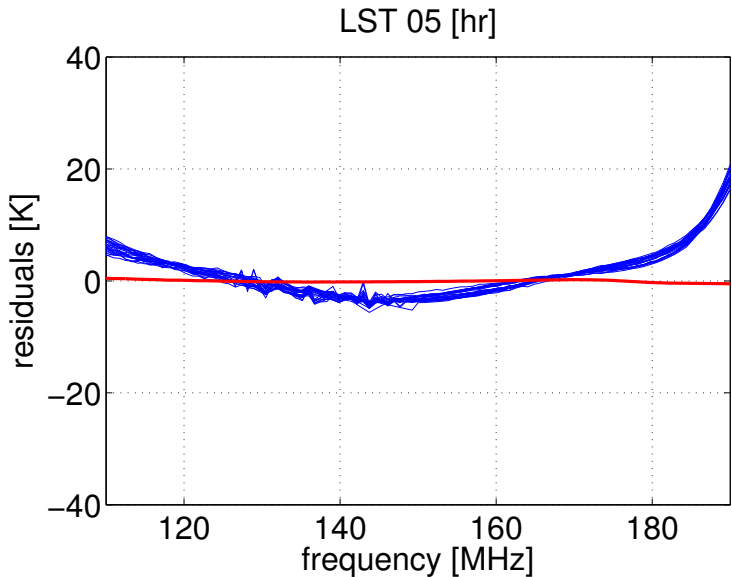


Figure : (5): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

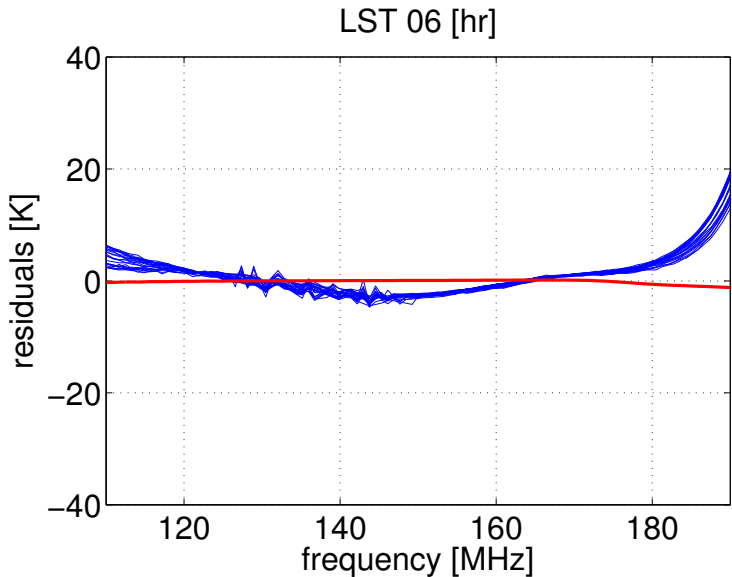


Figure : (6): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

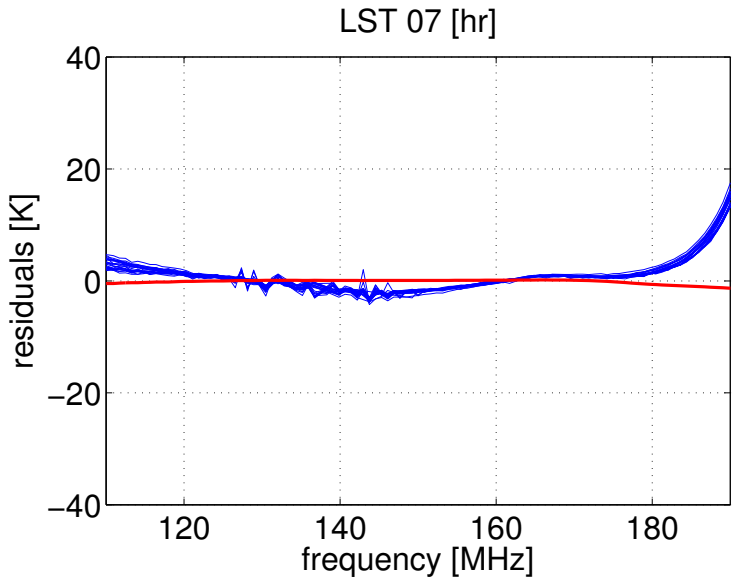


Figure : (7): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

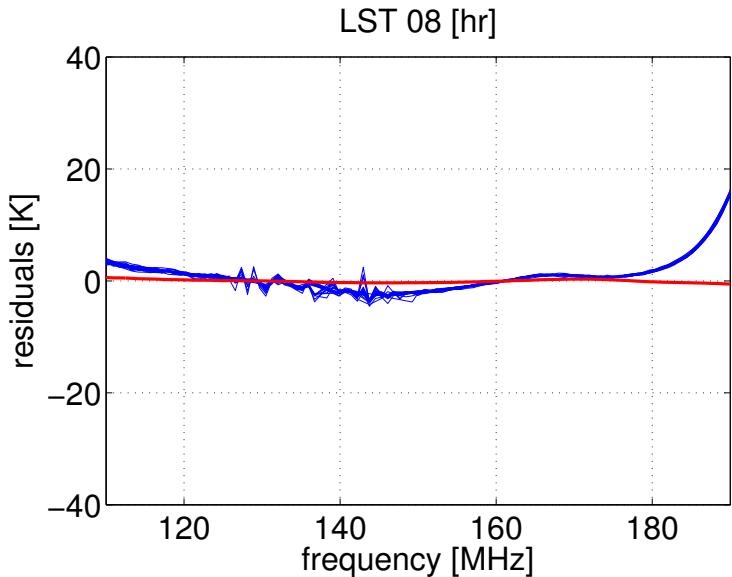


Figure : (8): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

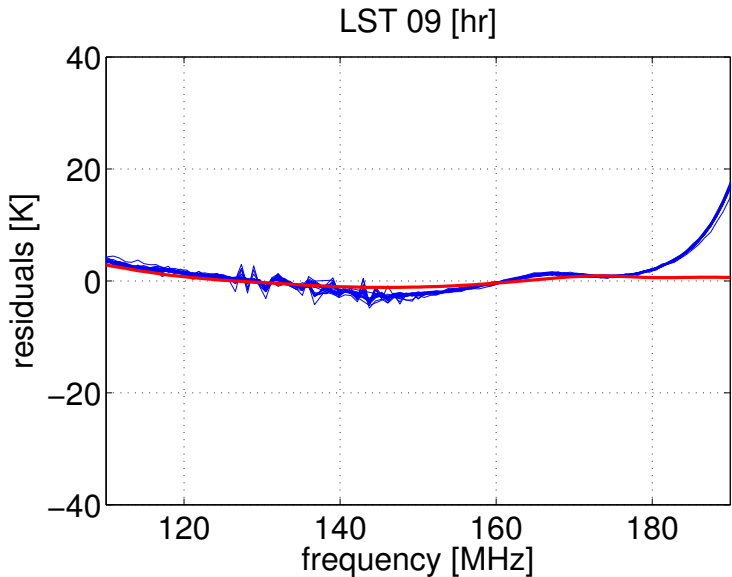


Figure : (9): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

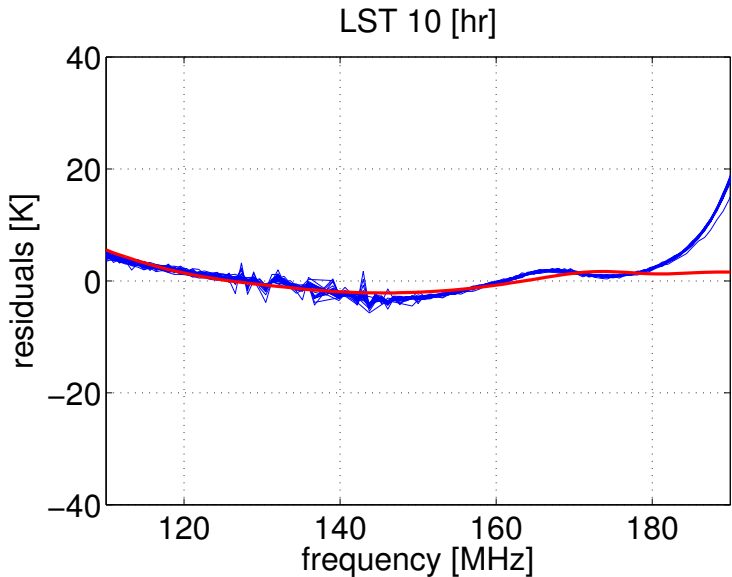


Figure : (10): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

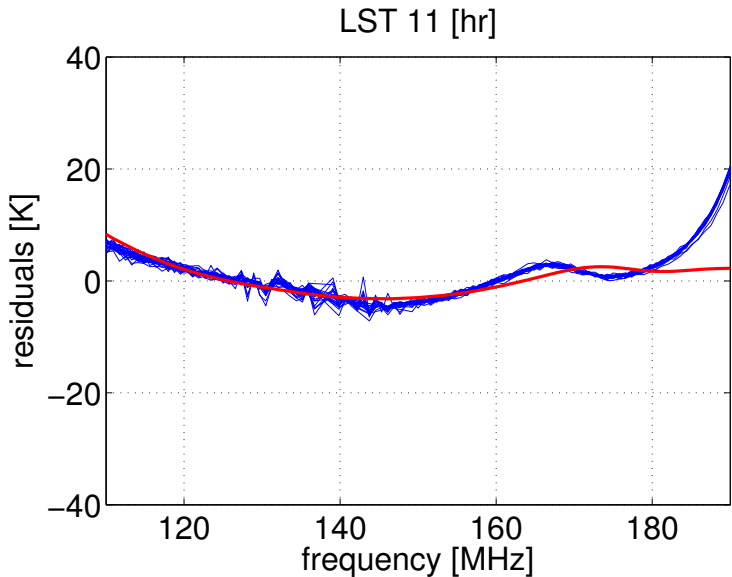


Figure : (11): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

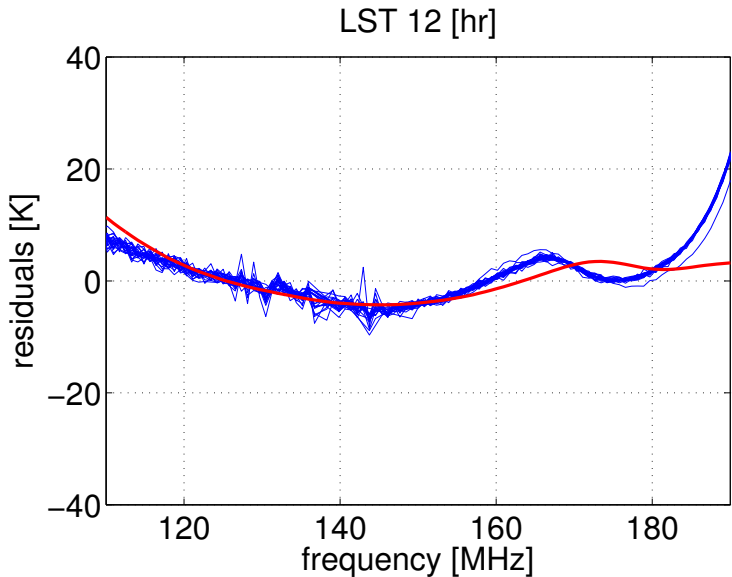


Figure : (12): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

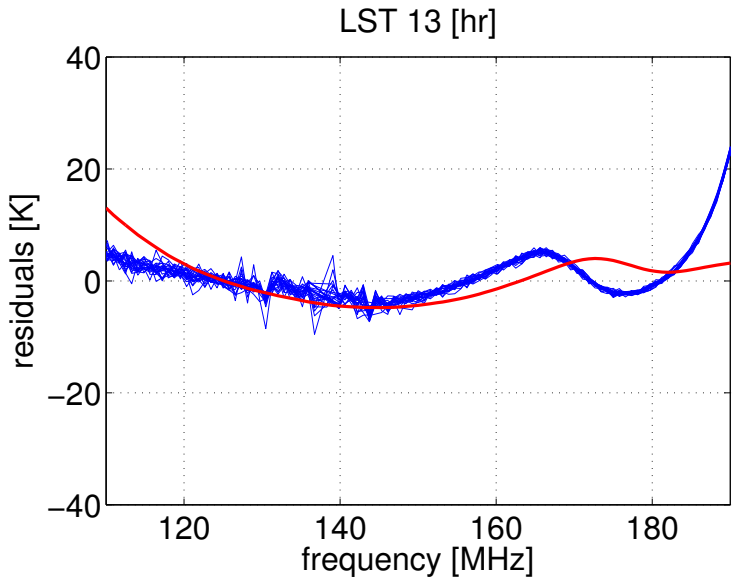


Figure : (13): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

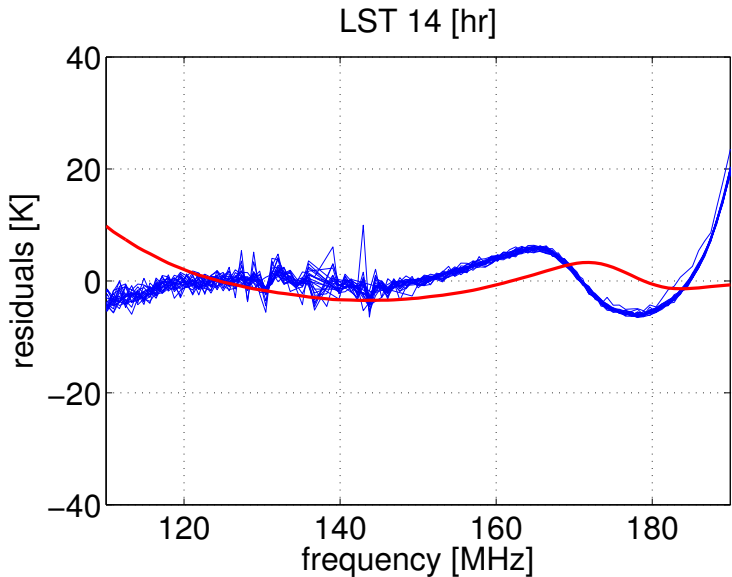


Figure : (14): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

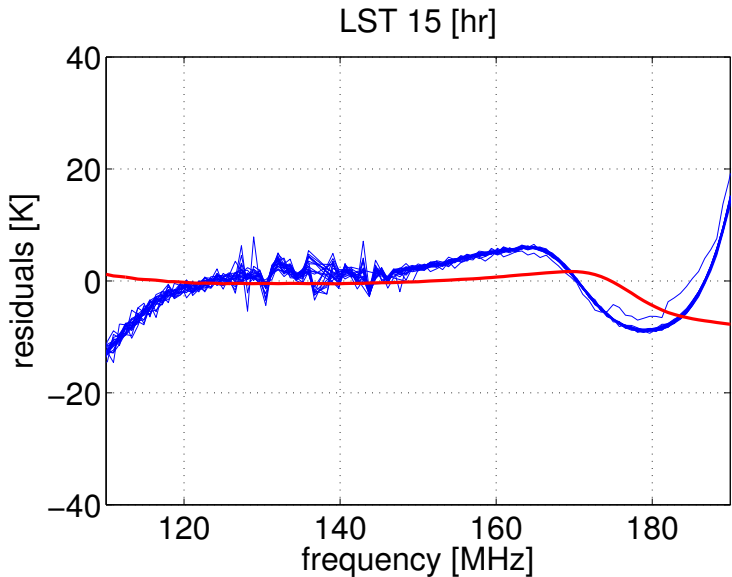


Figure : (15): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

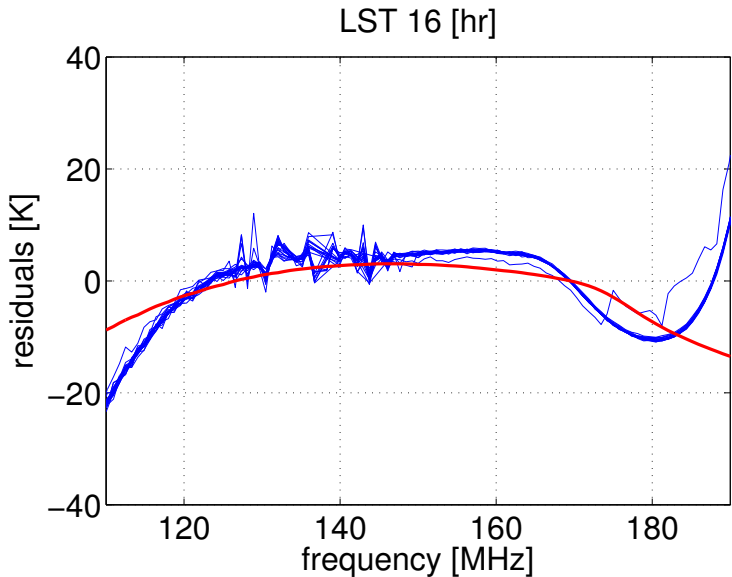


Figure : (16): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

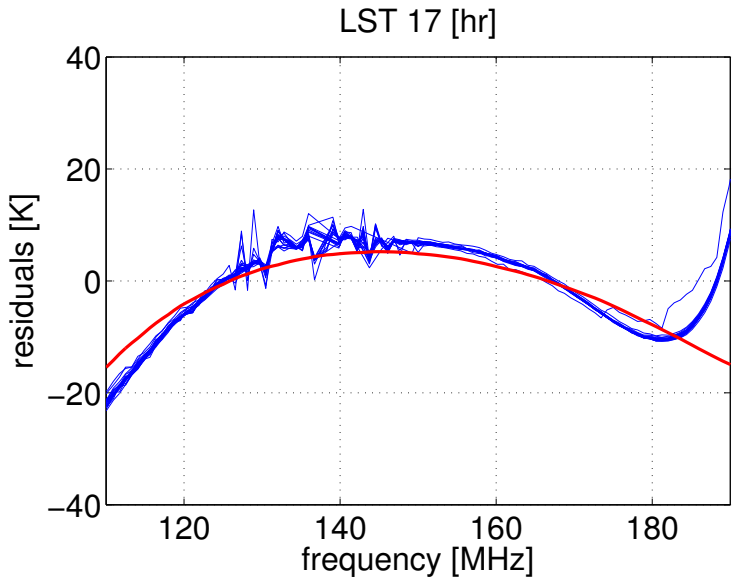


Figure : (17): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

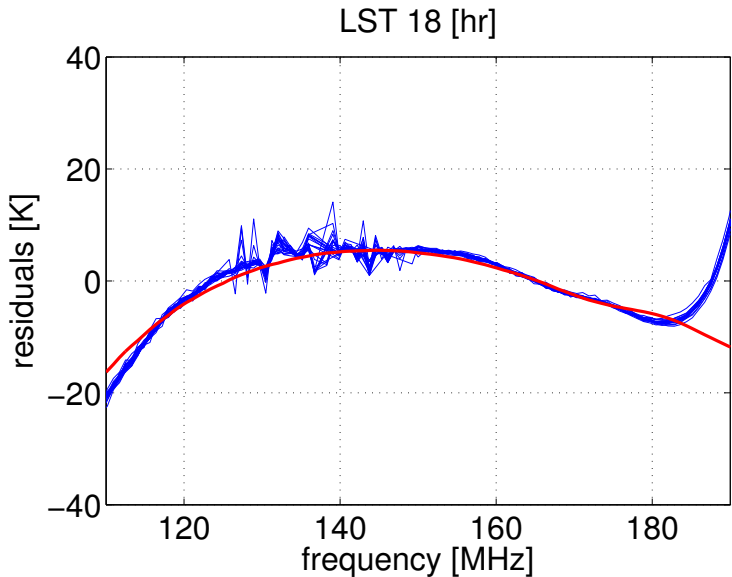


Figure : (18): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

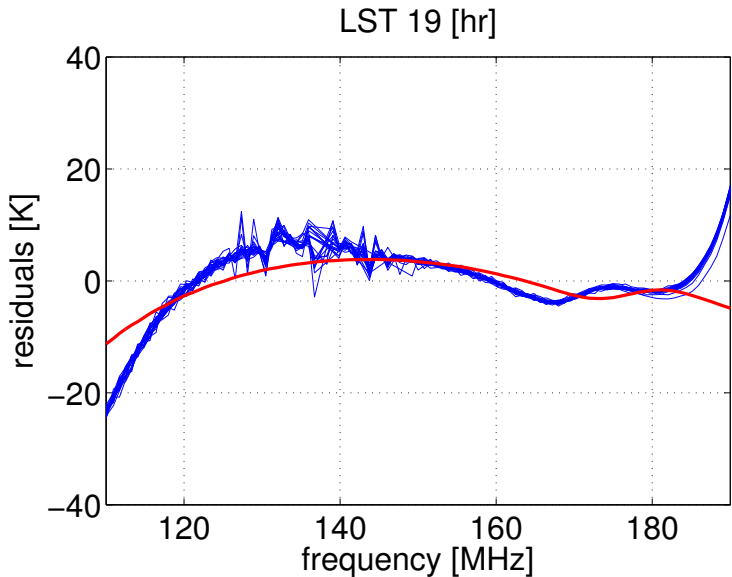


Figure : (19): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

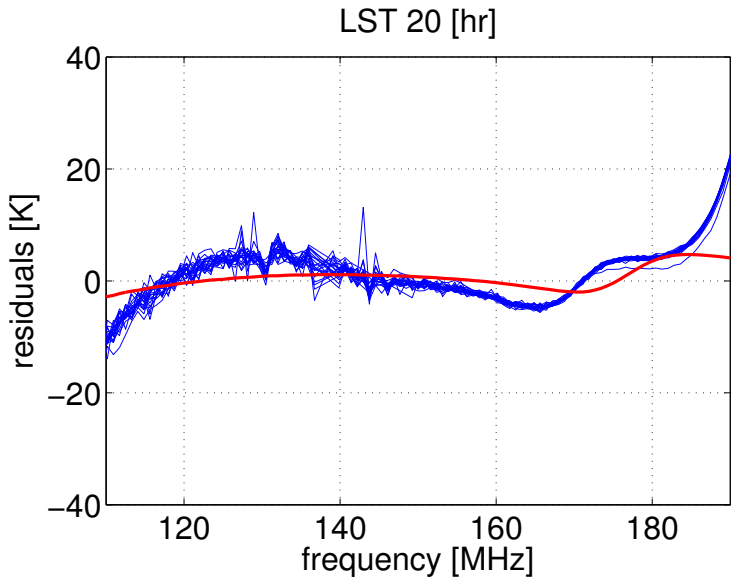


Figure : (20): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

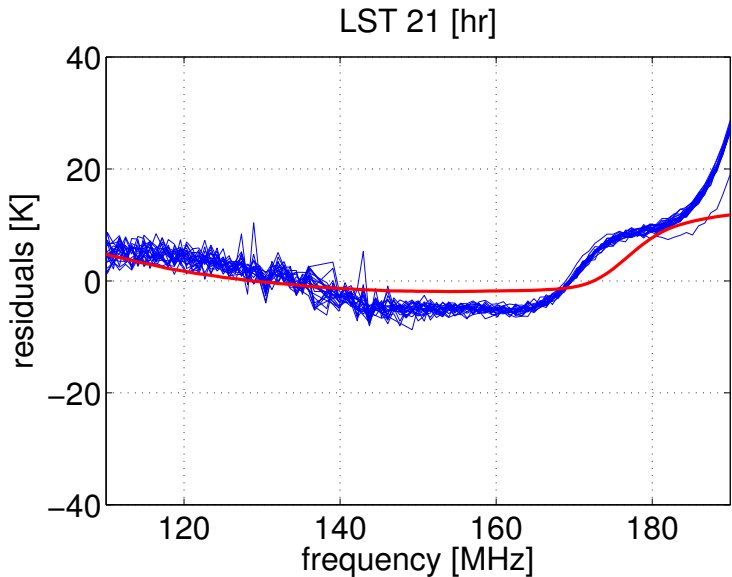


Figure : (21): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

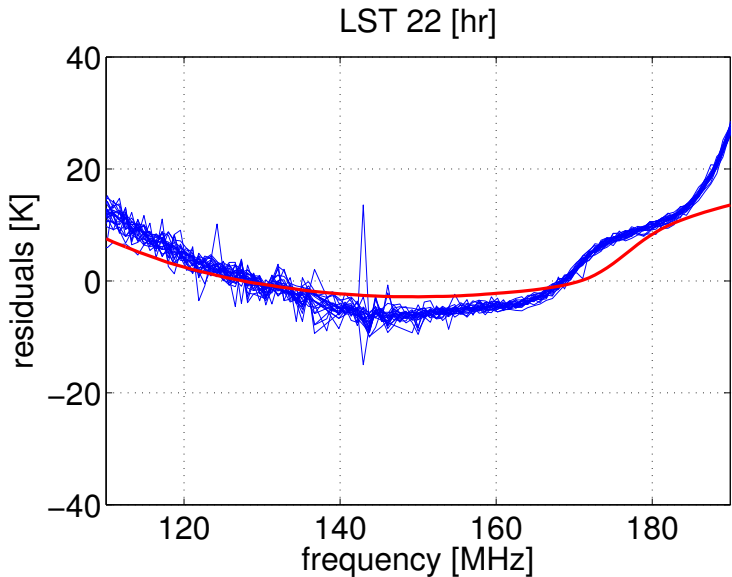


Figure : (22): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

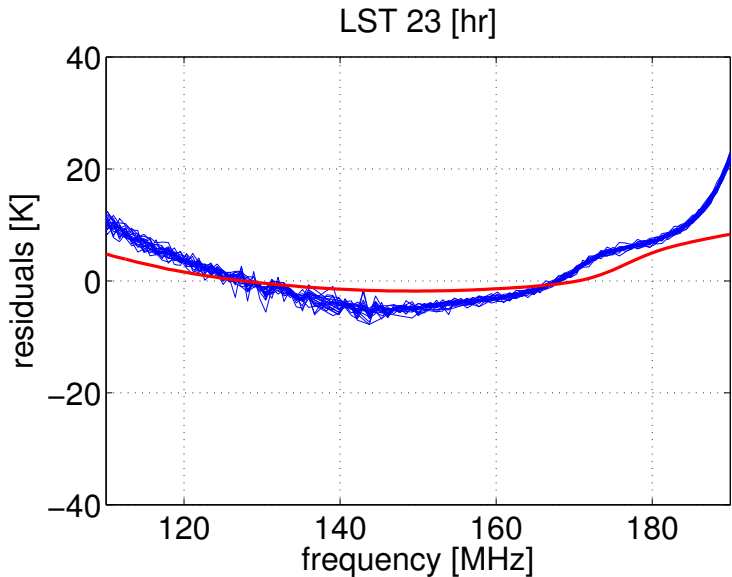


Figure : (23): Residuals for 26 measurements (BLUE) and synthetic antenna temperature (RED).

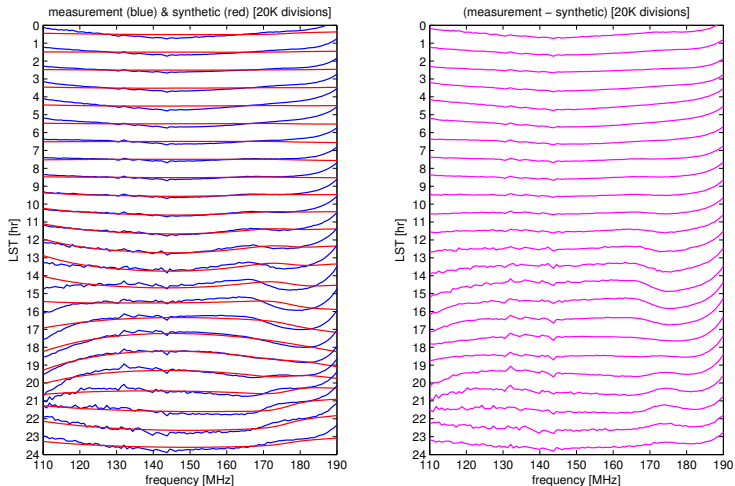


Figure : (24): The LEFT panel shows the residuals shown above, but only for day 108. The RIGH panel shows the DIFFERENCE between residuals from measurements and synthetic signal.

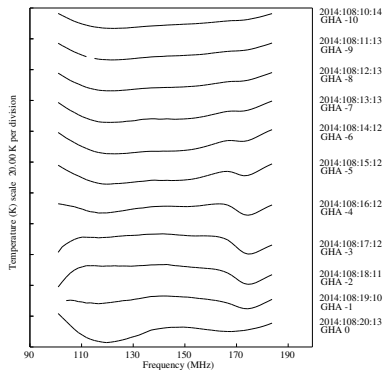
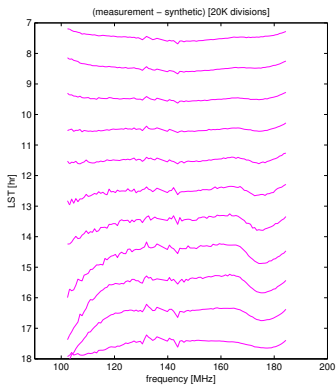


Figure : (25): DIFFERENCE between residuals from measurements and synthetic signal coming from my analysis (LEFT) and Alan's (RIGHT). The difference between the two could be attributed to the fitting of a power law in different frequency ranges, an also to the 1-hour averaging that I conduct for real data, which is not exactly replicated neither in the synthetic case nor by Alan.

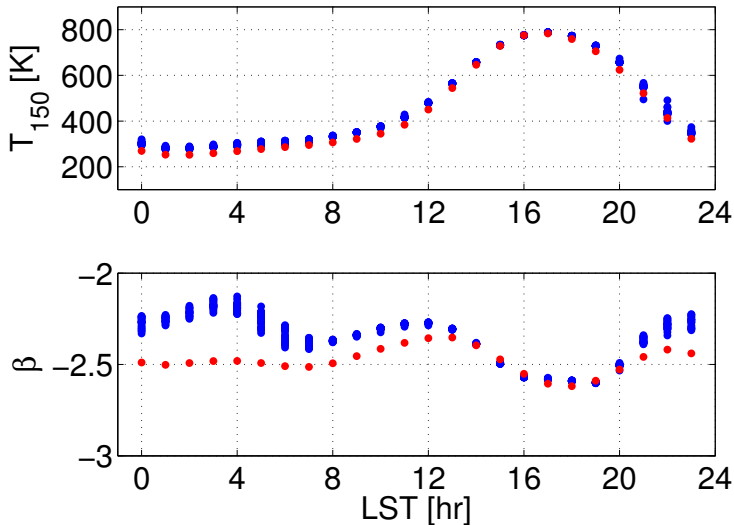


Figure : (26): Best fit parameters from measurements (BLUE) and synthetic case (RED). There is a significant difference in spectral index at low LSTs (and above 20 hrs).