

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

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Telephone: 781-981-5407

Fax: 781-981-0590

To: RFI Group
From: Alan E.E. Rogers
Subject: Absolute sky calibration using EDGES

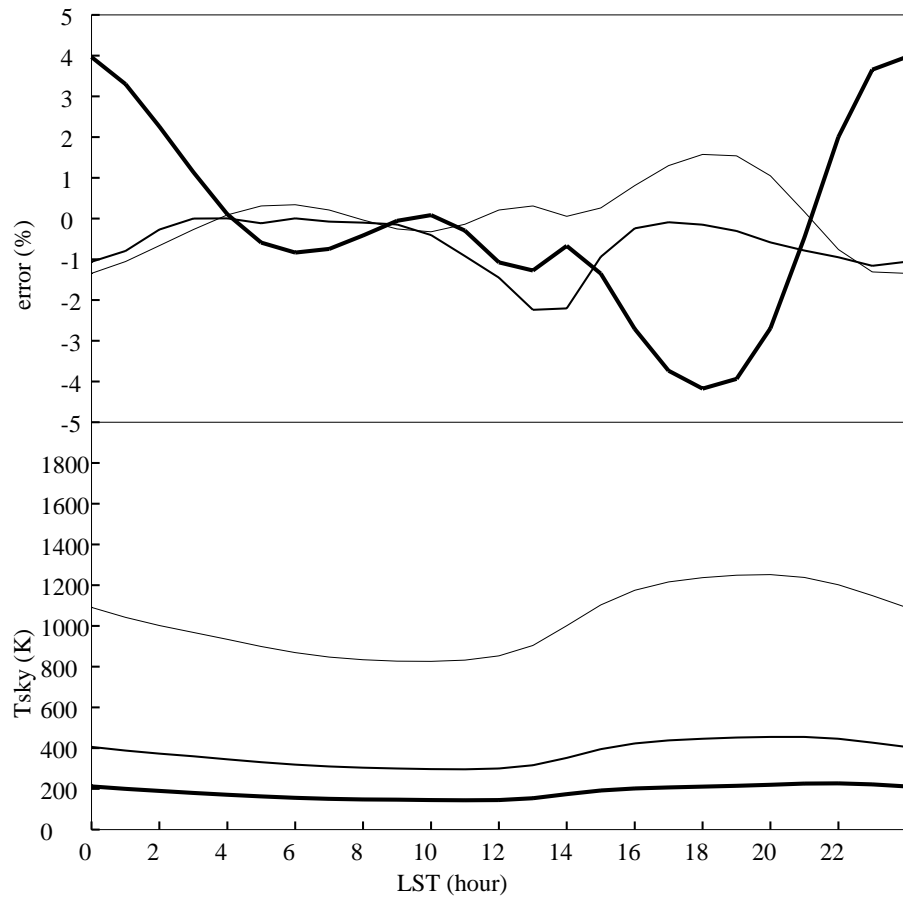
We plan to use EDGES system to make absolute sky noise measurements. The accurate measurement of antenna temperature is provided by 3 position switching (see memo #30). The RFI and VSWR ripple is removed by a sliding least squares fit to a constant plus a single period of the VSWR ripple. The frequency channels which have positive residuals above 10 sigma are unweighted in a second pass to determine the amplitude and phase of the VSWR ripple which is then removed from the data. The amplitude of the VSWR ripple is also used to derive the antenna reflection coefficient (see memo #30) or the antenna reflections coefficient can be separately measured with a network analyzer. The measured antenna temperature T_m is corrected for the reflection coefficient Γ and cable loss τ using

$$T_m = T_A (1 - |\Gamma|^2) e^{-\tau} + T_L (1 - e^{-\tau})$$

Then corrections may be needed for

- a. Ground loss (which should be negligible when ground screen is used).
- b. Balun loss estimated to be 0.1 dB (2%) at 150 MHz from measurements made with back-to-back baluns with wire cross-over.
- c. Ground pick-up from horizon which is estimated to be less than 1% for a 10 degree horizon.

In addition the spectral index inferred from antenna temperature measurements with frequency will need to be corrected for the change of beam pattern with frequency. The antenna orientation which minimizes the effect of the change of the beam convolved with a sky map is to arrange the effective dipole to point north south. Figure 1 shows then percentage temperature error as a function of LST. The thin line is the error due to the change of beam at 100 MHz. The medium line is the error introduced by a 10 degree horizon at 150 MHz and the thick line is the error due to the change in the beam at 200 MHz. Note that the errors are minimized when most of the Galaxy is below the horizon between 6 and 12 hours LST.



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