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To: EDGES group
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Subject: Evidence for scintillations of Cas A as the source of spiky data from Devon Island

There is evidence that the unknown source of “RFI” studied in memos 419 and 420 is due to scintillations of the radio source Cas A from refraction effects in the ionosphere which focus and defocus the radio emission of Cas A. Cas A has a radio flux of 1.4×10^4 Jy at 100 MHz which results in an antenna temperature of 23K in the EDGES antenna at the zenith.

When analyzing data from Devon Island we observed occasional TV and FM radio signals via sporadic E as described in memo 400 in addition to the solar emission expected from the active Sun described in memo 397. What remained a mystery was the extreme of variability especially below 65 MHz.

Figure 1 of memo 402 shows the calibrated data without beam correction vs UT for 2022 days 221 to 233 on the left compared with the expected result in the middle and the expected result with added emission from the Sun on the right. Figure 1 below shows the same plot as in memo 402 on the left with the expected results for enhanced emission from Cas A in the middle and enhanced emission from Cygnus on the right. The Cas A plot was made by adding to the Haslam map at the location of Cas A so that the power from the convolution of the beam with the antenna increases with a spectral index of the intrinsic spectral index of -0.7 enhanced to a spectral index of -2.7 by the ionosphere. Furthermore the effect is increased by a factor of 8 corresponding to a sky noise increase of 184K at 100 MHz in order to have an effect close to what is observed. While variation of the residuals, which have two physical terms removed, look similar for the simulation of Cas A and for the observed there are probably contributions from scintillations of Cygnus and other sources. It is also emphasized the plots in Figure 1 are averages over 221 to 233 days there are large variations in the residuals on the scale of a few minutes shown in figure 2 of memo 420.

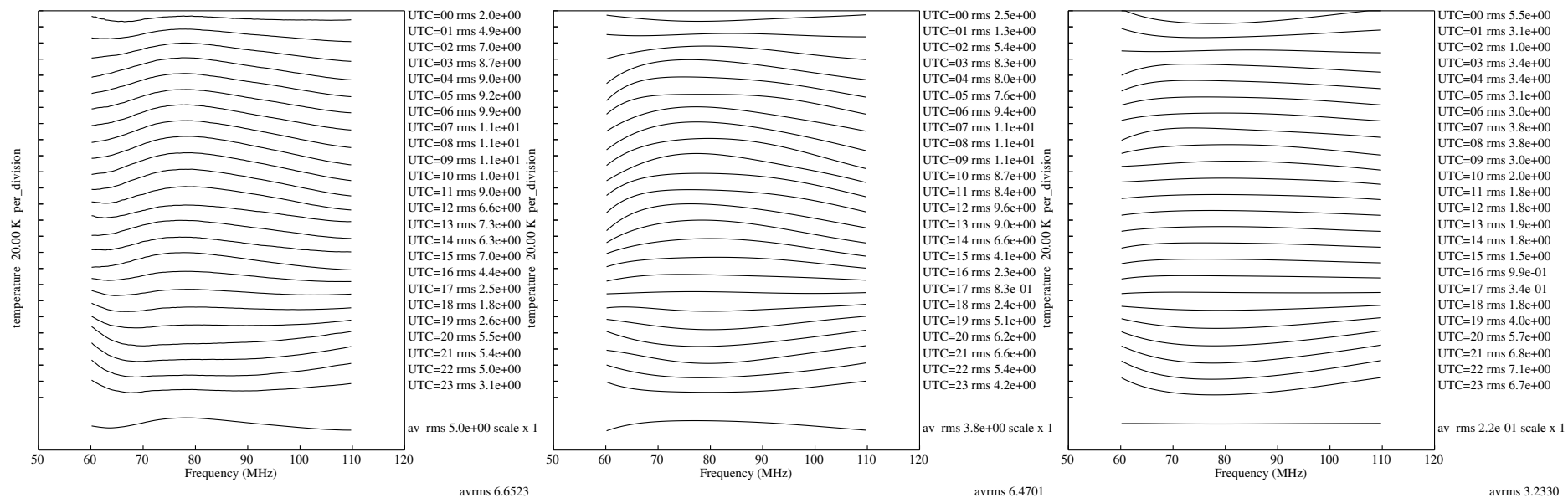


Figure 1. Plot of rms residuals vs UT with 2 terms removed for calibrated data without beam correction on the left with simulated data for scintillations of Cas A in the middle and for Cygnus on the right.