EDGES MEMO #254

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To: EDGES Group

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Subject: Simulations of the effects of systematics on signature detection.

Recent results from the recalibration of the lowband1 receiver are seen to be consistent with earlier results when the recent antenna S11 measurements are corrected using the corrections for the S11 calibration based on the S-parameters for the internal path between the antenna S11 reference plane and the internal calibration SOL. The magnitude of the changes in receiver calibration and S11 measurements has been accessed using simulated data according to the cases listed in Table 1.

Case	Antenna s11		S11 correction		Receiver calibration		Beam correction	
0	a	a	None	None	2017	2017	g4	g4
1	a	a	None	0.001	2017	2017	g4	g4
2	b	c	None	None	2017	2017	g4	g4
3	d	e	None	None	2017	2017	g4	g4
4	f	a	None	None	2017	2017	g4	g4
5	a	a	None	None	2017	2015	g4	g4
6	a	a	None	None	2017	2017	g4	niv

Table 1. Parameters of simulations. The first column in each case for the simulations and the second gives the processing parameters.

a = S11_blade_low_band_2017_093

b = S11_blade_low_band_152

c = S11_blade_low_band_152_2015_switch_parameters

d = S11_blade_low_band_153_NORMAL

e = S11_blade_low_band_153_INPIT

f = S11_blade_low_band_2015_342_03_14

The S11 correction in Case 1 was for a change of -0.001 in the calibration load measurement. In each case the data was simulated at GHA=12 hrs. In Case 1 a change of -0.001j results in a similar residual.

Case	Max. freq. MHz	SNR	Signature amp. K	Width MHz	rms1 mK	rms2 mK	amp2 K
0	72.7	3	0	1	0	0	0
1	78.1	26	0.22	16.5	49	17	0.27
2	78.1	27	0.26	16.0	58	20	0.33
3	87.9	22	0.21	15.4	43	18	-0.22
4	99.3	24	0.17	15.9	37	14	0.20
5	78.1	27	0.49	15.7	115	40	0.62
6	79.7	14	0.18	18.3	33	19	0.16

Table 2. Signature search results. rms 1 is the rms residual with 4 polynomial terms removed. rms2 is the rms residual with 4 terms plus signature removed. amp2 is the amplitude at fixed values of 78 MHz center, 19 MHz width and tau = 7.

Table 2 gives the results of the searches. Figure 1 shows the results for the search for Case 1 and Figure 2 plots the residuals for 4 polynomial terms removed for each case. In general, the effects of error in beam correction average out for a range of GHA.

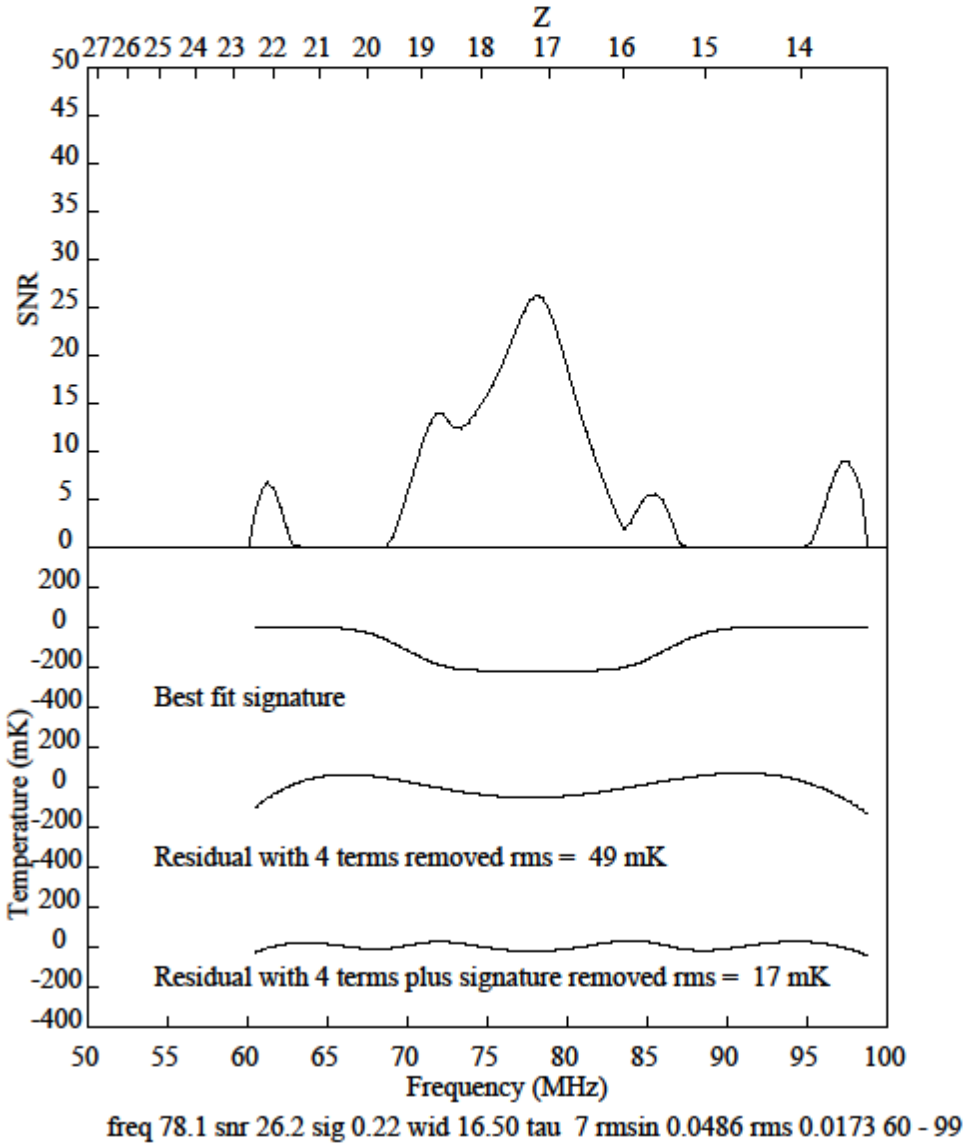

Figure 1. Signature search for case 1.

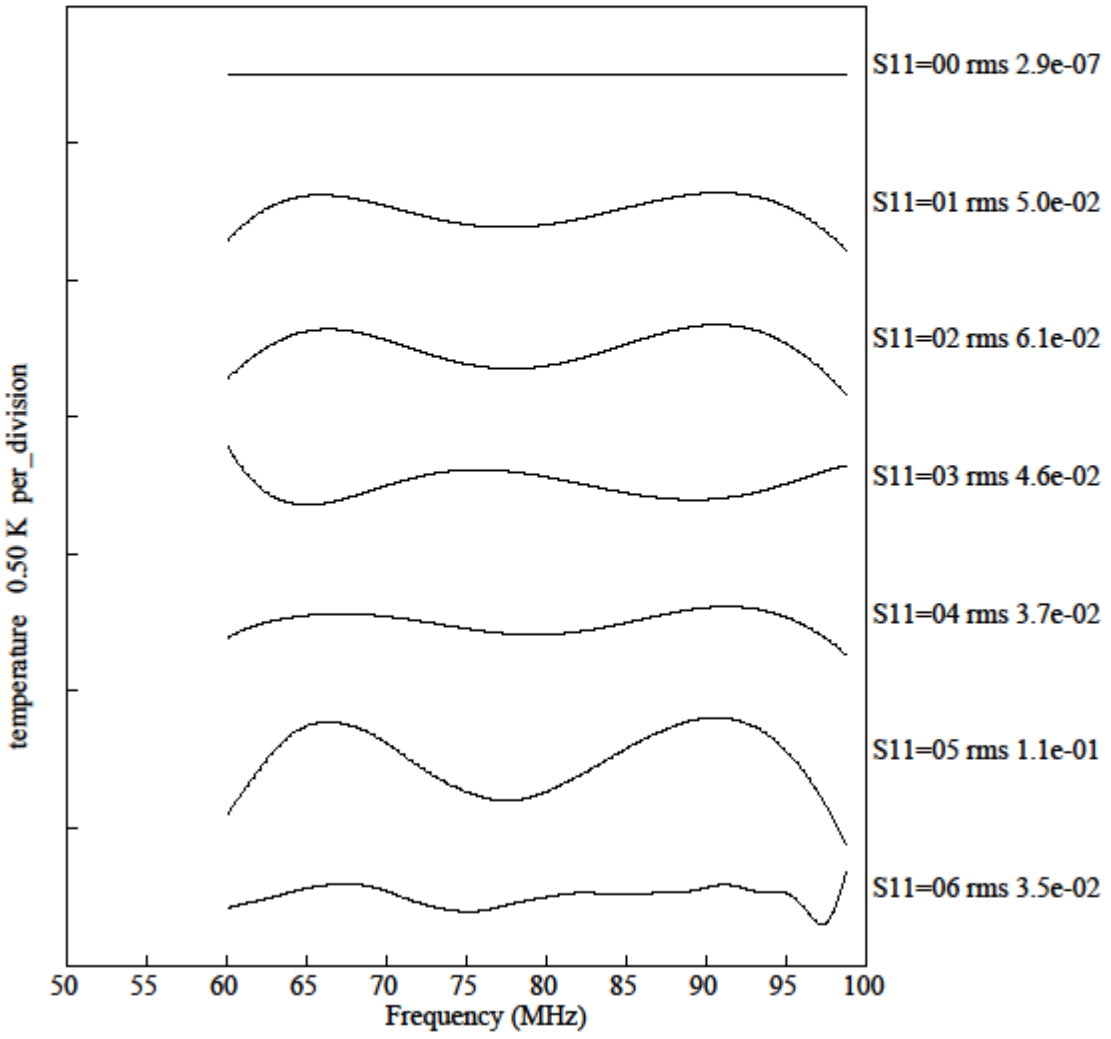

Figure 2. Residuals for each case for 4 polynomial terms removed.