LoCo Lab EDGES Memo 193
Fits of Absorption Feature to Mid-Band 2018 Data

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1 Description

Here we show fits of a flattened Gaussian absorption feature to Mid-Band 2018 data. We use data with and without beam correction, first binned into 2-hour integrations and then binned into 24-hour integrations. For the 2-hour integrations, the frequency ranges used are 65-110 MHz for the high foreground range GHA=0h, 2h, 4h, 18h, 20h, 22h, and 60-110 MHz for the low foreground range GHA=6h, 8h, 10h, 12h, 14h, 16h. For the 24-hour integrations we use the range 60-110 MHz. For the beam correction we use the Haslam map scaled down in frequency and the beam model of the corresponding instrument that includes a realistic ground plane. We do the fits using three foreground models with 5 terms: 1) EDGES polynomial, 2) LinLog, and 3) Physical model. The best-fit absorption feature is found using a grid search. The parameter ranges used for the parameters in the grid search are: Amplitude A=[-1.2 to -0.05K], Center frequency ν_0=[60-110MHz], Width w=[1-30MHz], Flattening τ=[1-10]. For the fits we also report the chi squares for a foreground model alone (χ^2_1) and a foreground model plus the best-fit flattened Gaussian (χ^2_2), as well as the corresponding reduced chi squares ($\chi^2_{\nu 1}$ and $\chi^2_{\nu 2}$). For reference, we show in Figures 1-3 the residuals and RMS for the 2- and 24-hour integrations for a LinLog model, with and without beam correction.

Table 1: EDGES polynomial, 5 terms, No Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-1	89	13	1	1863	400	17.1	3.8	65-110
2	-1.15	89	17	1	1721	374	15.8	3.6	65-110
4	-0.75	82	16	1	1083	347	9.9	3.3	65-110
6	-0.2	106	12	6	812	530	7.4	4.5	60-110
8	-0.45	78	24	4	582	364	5.3	3.1	60-110
10	-0.35	94	27	8	557	341	5.1	2.9	60-110
12	-0.35	79	18	8	896	379	8.2	3.2	60-110
14	-0.7	78	22	4	1222	500	11.2	4.2	60-110
16	-0.5	79	22	8	1102	655	10.1	5.6	60-110
18	-0.3	85	7	1	973	397	8.9	3.8	65-110
20	-1	99	19	1	534	316	4.9	3.0	65-110
22	-1.15	94	24	5	566	293	5.2	2.8	65-110

Table 2: EDGES polynomial, 5 terms, Yes Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-0.7	89	13	3	1305	370	12.0	3.5	65-110
2	-1	89	17	2	1719	403	15.8	3.8	65-110
4	-0.9	82	17	1	1043	337	9.6	3.2	65-110
6	-0.6	80	23	3	800	556	7.3	4.7	60-110
8	-0.65	78	25	3	630	364	5.8	3.1	60-110
10	-0.65	94	27	5	689	333	6.3	2.8	60-110
12	-0.45	73	31	10	759	375	7.0	3.2	60-110
14	-0.65	94	28	8	1101	408	10.1	3.5	60-110
16	-0.85	94	28	8	1421	479	13.0	4.1	60-110
18	-0.9	98	35	10	830	450	7.6	4.3	65-110
20	-0.6	85	35	10	593	384	5.4	3.7	65-110
22	-0.45	94	23	10	407	295	3.7	2.8	65-110

Table 3: LinLog Model, 5 terms, No Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-0.75	89	12	2	1944	376	17.8	3.6	65-110
2	-1.2	89	18	1	2556	365	23.5	3.5	65-110
4	-1.2	80	18	1	1084	352	9.9	3.2	65-110
6	-0.2	106	12	6	837	533	7.7	4.5	60-110
8	-0.35	78	21	5	588	377	5.4	3.2	60-110
10	-0.35	78	21	5	544	358	5.0	3.0	60-110
12	-0.55	78	19	5	911	329	8.4	2.8	60-110
14	-0.5	78	20	6	1108	570	10.2	4.8	60-110
16	-0.2	104	7	1	1362	741	12.5	6.3	60-110
18	-0.3	85	7	1	973	400	8.9	3.8	65-110
20	-1.1	99	19	1	682	317	6.3	3.0	65-110
22	-1.2	94	22	5	818	370	7.5	3.5	65-110

Table 4: LinLog Model, 5 terms, Yes Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-0.35	89	12	6	876	371	8.0	3.5	65-110
2	-1.05	89	17	2	2880	405	26.4	3.9	65-110
4	-1.15	94	31	5	771	337	7.1	3.2	65-110
6	-0.35	80	22	4	777	587	7.1	5.0	60-110
8	-0.45	79	22	4	643	349	5.9	3.0	60-110
10	-0.45	78	24	5	613	331	5.6	2.8	60-110
12	-0.45	79	19	6	752	335	6.9	2.8	60-110
14	-0.8	77	25	4	1161	423	10.7	3.6	60-110
16	-1.15	95	30	6	1435	496	13.2	4.2	60-110
18	-0.95	98	35	10	954	452	8.8	4.3	65-110
20	-0.25	99	12	6	591	342	5.4	3.3	65-110
22	-0.45	94	24	10	403	314	3.7	3.0	65-110

Table 5: Physical Model, 5 terms, No Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-0.75	89	12	2	1921	375	17.6	3.6	65-110
2	-1.2	89	18	1	2533	359	23.2	3.4	65-110
4	-1.2	93	32	6	1110	357	10.2	3.4	65-110
6	-0.2	106	12	5	870	544	8.0	4.6	60-110
8	-0.25	109	19	5	607	401	5.6	3.4	60-110
10	-0.3	109	19	3	580	387	5.3	3.3	60-110
12	-0.5	78	18	6	938	338	8.6	2.9	60-110
14	-0.5	94	26	10	1126	587	10.3	5.0	60-110
16	-0.2	103	6	1	1472	777	13.5	6.6	60-110
18	-0.3	85	7	1	973	399	8.9	3.8	65-110
20	-1.15	99	19	1	776	318	7.1	3.0	65-110
22	-1.2	99	35	10	871	394	8.0	3.8	65-110

Table 6: Physical Model, 5 terms, Yes Beam Correction.

GHA Bin [h]	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$	Freq range [MHz]
0	-0.3	89	12	7	791	390	7.3	3.7	65-110
2	-1.05	89	17	2	2922	401	26.8	3.8	65-110
4	-1.05	94	30	5	760	335	7.0	3.2	65-110
6	-0.3	80	22	5	776	597	7.1	5.1	60-110
8	-0.4	79	21	5	633	355	5.8	3.0	60-110
10	-0.65	94	27	5	591	334	5.4	2.8	60-110
12	-0.5	78	20	5	755	330	6.9	2.8	60-110
14	-0.8	78	23	4	1143	419	10.5	3.6	60-110
16	-1.15	95	30	6	1415	497	13.0	4.2	60-110
18	-0.9	98	35	10	951	452	8.7	4.3	65-110
20	-0.3	99	13	5	710	352	6.5	3.4	65-110
22	-0.35	80	19	10	418	321	3.8	3.1	65-110

Table 7: 24h Integration, 60-110 MHz, 5 terms.

Case	A [K]	ν_0 [MHz]	w [MHz]	τ	χ^2_1	χ^2_2	$\chi^2_{\nu 1}$	$\chi^2_{\nu 2}$
No Beam Correction, EDGES Polynomial	-1.1	95	25	3	3536	477	29.0	4.0
No Beam Correction, LinLog	-1.2	94	25	3	2181	582	17.9	4.9
No Beam Correction, Physical Model	-1.2	95	26	3	1937	556	15.9	4.7
Yes Beam Correction, EDGES Polynomial	-0.8	95	25	4	2887	567	23.7	4.8
Yes Beam Correction, LinLog	-1.2	95	26	3	1921	531	15.7	4.5
Yes Beam Correction, Physical Model	-1.2	95	26	3	1845	542	15.1	4.6

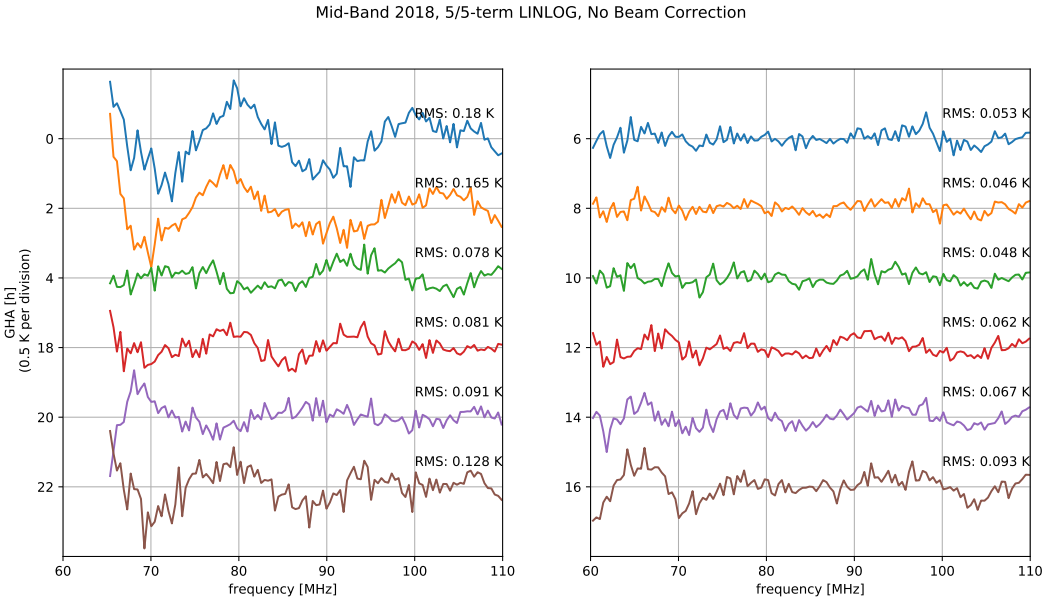

Figure 1:

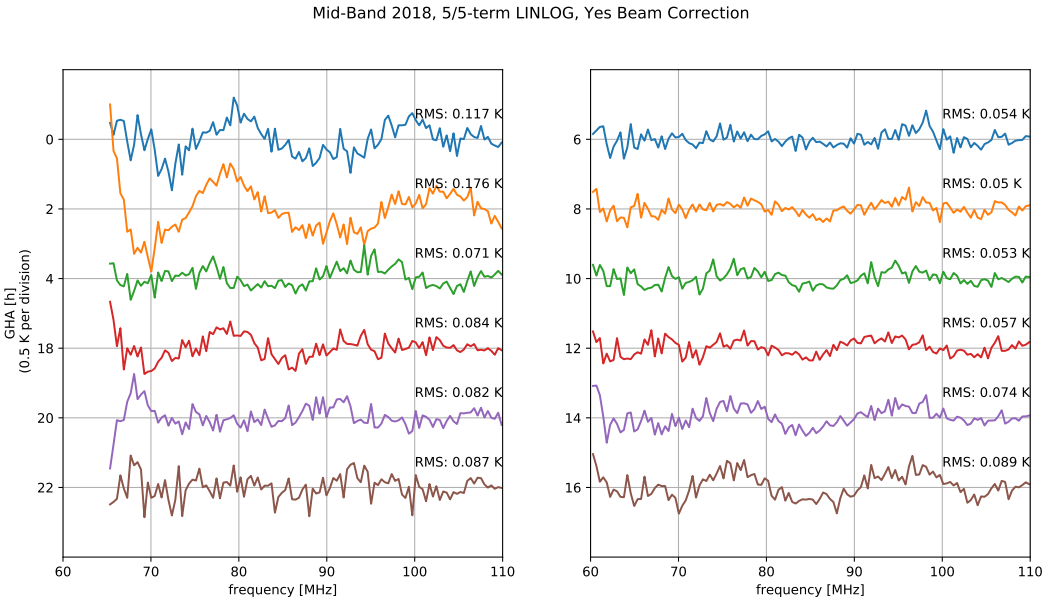

Figure 2:

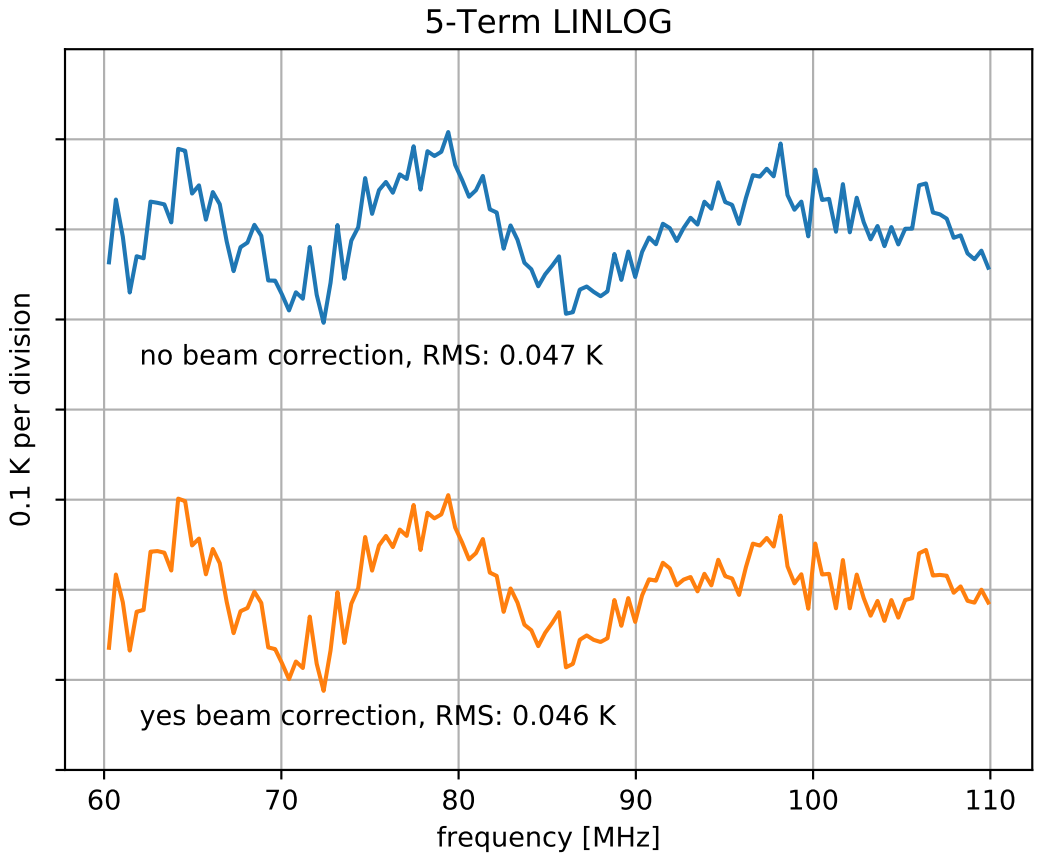
5-Term LINLOG
no beam correction, RMS: 0.047 K
yes beam correction, RMS: 0.046 K
0.1 K per division
60
70
80
90
100
110
frequency [MHz]

Figure 3: