EDGES MEMO #297

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Subject: Sensitivity of the beam chromaticity midband antenna on large ground plane

The sensitivity of the midband antenna on the large 30×30m ground plane at MRO to changes in details the FEKO model have been evaluated by comparing the following models listed in Table 1.

Model	Antenna	Ground	File
1	Blade	Infinite	azelq_blade9mid0.78.txt
2	Blade	ε= 3.5 s= 2e-2	azelq_blade9perf7mid.txt
3	Blade	ε= 3.5 s= 2e-2	azelq_blade9perf7mid_2e_3.txt
4	Blade	ε= 4.5 s= 2e-2	azelq_blade9perf7mid_4.5.txt
5	panel sep 1.9”	ε= 3.5 s= 2e-2	azelq_blade9perf7mid_1.9in.txt
6	with balun	ε= 3.5 s= 2e-2	azelq_blade9perf7mid_balun.txt

Table 1.

Case	Reference model	Test model	5-term rms residual 60-150 MHz
1	1	2	37 mK
2	2	3	27 mK
3	2	4	11 mK
4	2	5	9 mK
5	2	6	36 mK
6	6	7[1]	28 mK

Table 2.

In order to evaluate the sensitivity to the soil under the ground plane and other changes to the FEKO model a spectrum for 2-hours block over the full ranges of GHA was simulated using the “reference” model and processed using the “test” model listed in Table 2. The spectra are plotted for each case in Figure 1 and the average rms over GHA blocks listed in Table 2. In case 6 the test model antenna is rotated by 180 degrees. The non zero residual shows that the balun introduces a small asymmetry in the beam so account should be made of the orientation of the balun. The rms values for the residuals of each block for each case for 5-terms using the quasi-physical polynomial

$$f^{-2.55}\left(\log(f)\right)^i$$

Where f is the normalized frequency.

[1] For test model 7 the antenna is rotated by 180˚

A test of the effects of using a 0.25 m mesh compared with a 0.5 m mesh used for the ground plane in cases 1-6 is shown in Figure 2 for which model 6 is used as the reference. The finer mesh is not used for other cases requires many hours to compute the beam for a single frequency.

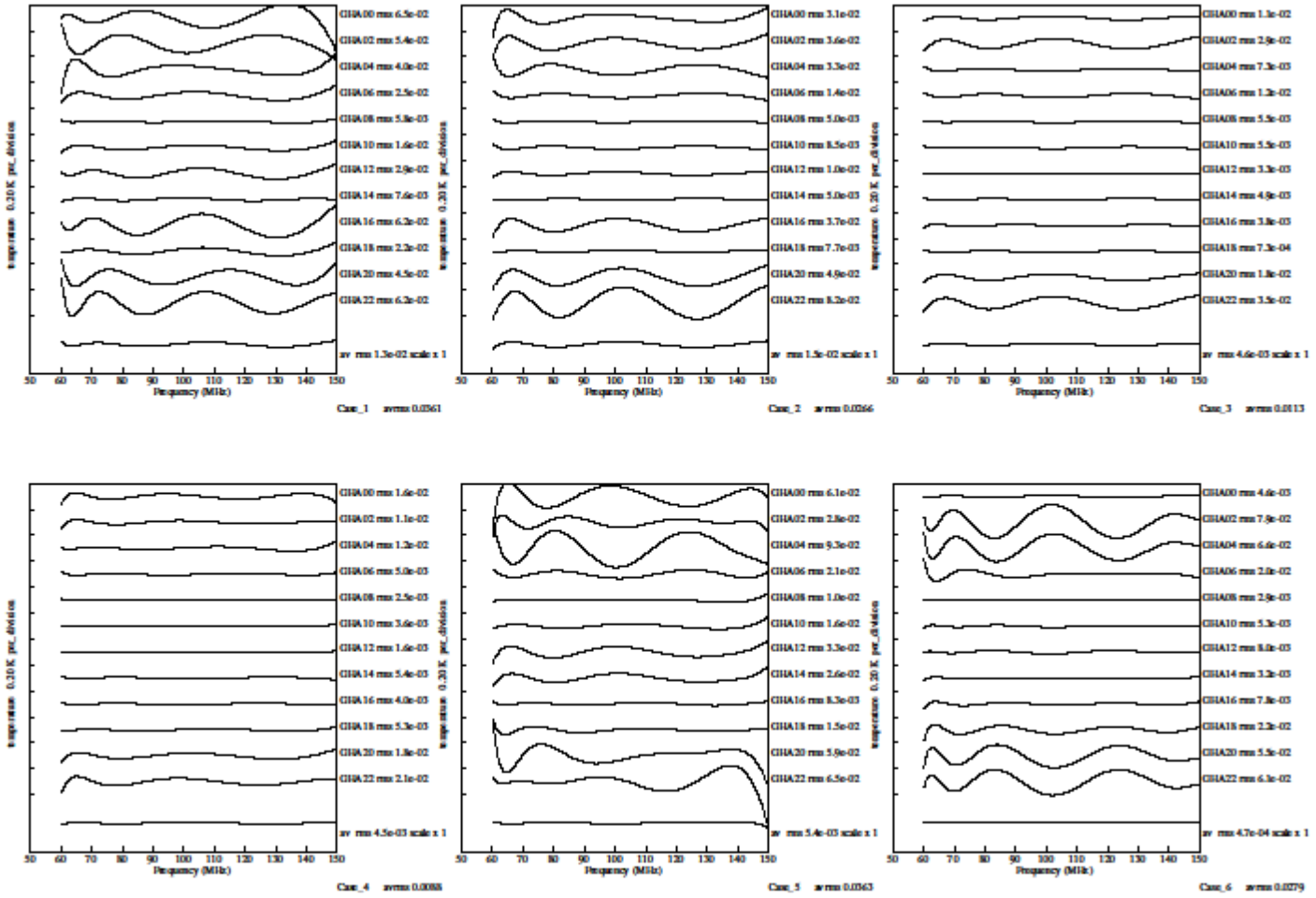

Figure 1. Residuals to spectra 5-term quasi-physical fit to changes in FEKO beam models.

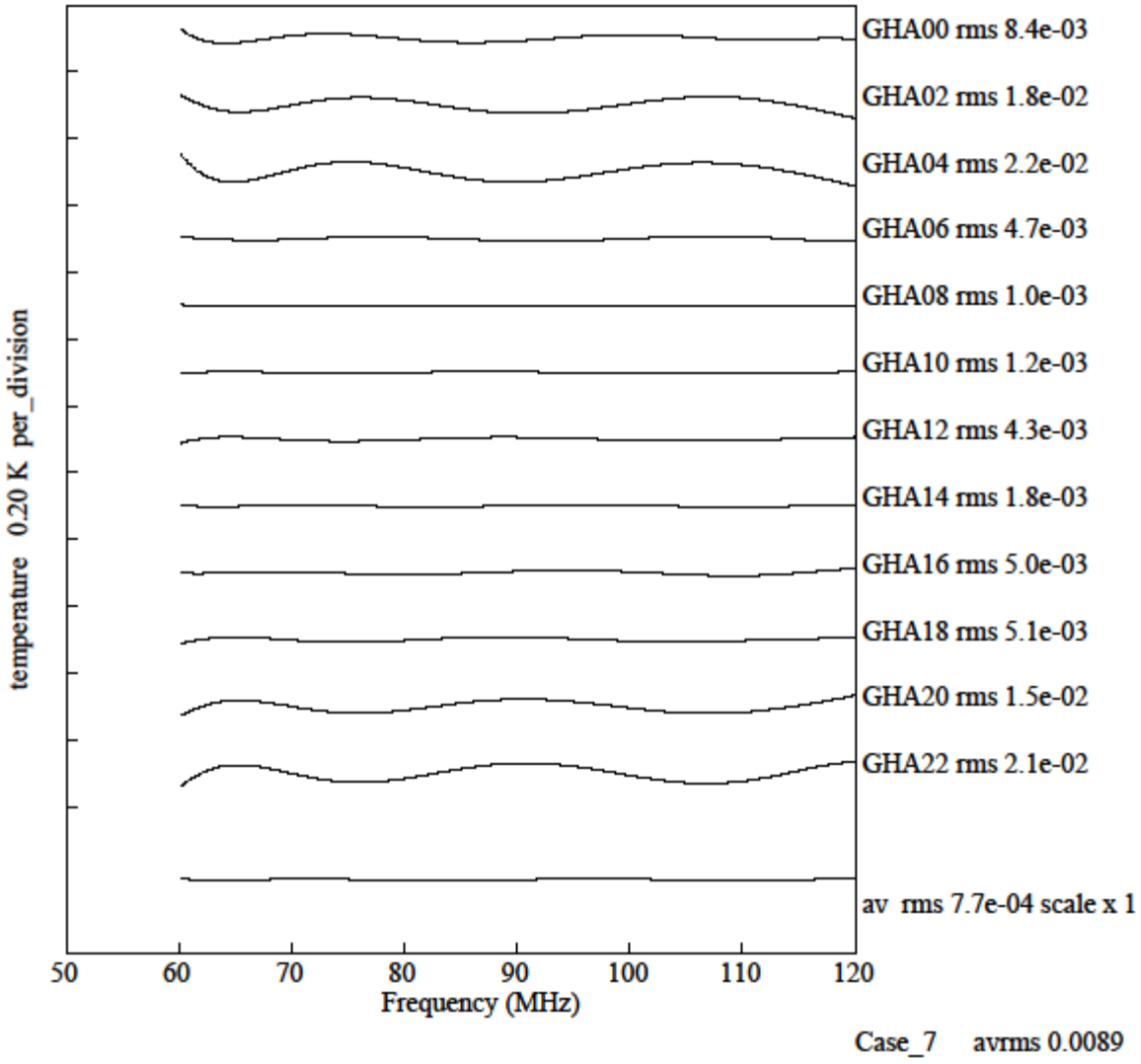

Figure 2. Residuals for a ground plane mesh of 0.25 m compared with a mesh of 0.5 m.