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Subject: Sensitivity to ground plane defects

The sensitivity of low band to soil parameters was studied in memo 206. In this memo we simulate the following ground plane defects to examine the effects on the spectra:

- a) Severe tilt in ground plane panels due to uneven ground.
- b) Poor contact between ground plane panels.
- c) Resonant reflections from metal scrap within 10 meters of the antenna.

This study concentrates on 4 term residuals to the low band from 72 to 99 MHz.

This frequency range is chosen because the low band data with 4-terms removed has a signature of about 50 mK rms. Reflections from the electronics hut 50 m from the antenna are evident in the low band data and discussed in memo 206. However the reflections from the hut produces a “ripple” with period of about 3 MHz and cannot easily explain the signature in the 72 to 99 MHz band.

	GHA 0-23	GHA 8-16	Note
Tilt ~2°	84	16	1
Panel contact creating slot under antenna	42	17	2
1.68 m long metal scrap at 10 m on ground	19	10	3
1.68 m long metal scrap at 0.8 m above ground	280	314	4

Various potential defects are studied to determine if any defect can generate a beam effect that produces a signature that is not strongly dependent on the GHA. Table 1 shows the average rms residuals over the full range of GHA from 0 to 23 hours and a more limited range from 8 to 16 hours. Figure 1 shows the GHA dependence of the low band data signature uncorrected and corrected using a FEKO beam model of the low band blade antenna on the current ground plane with dielectric constant 3.5 and conductivity 2e-2 S/m. Also shown are various “defects” added to the model and corrected with the model without defects.

Notes on defects:

- 1] Ground plane model using 4 triangles with 10 and 20 cm gaps between ground at the extremities to simulate measured tilts of 1° and 2° degrees.
- 2] Poor panel contact can create resonant slots. Simulation made using 0.8x0.04 m gap under antenna. While this doesn’t produce on in band resonance its still has a significant effect.
- 3] Simulation using 1.68 m long metal scrap lying on the ground 10 m to the west of the antenna.

- 4] The metal scrap raised to 0.8 m above ground which results in a very large effect on the beam chromaticity.
- 5] An asymmetry created by having the source between panels and only one metal support to the ground plane.

#### Conclusions

All defects and variations tested on the antenna plus ground plane model produce a beam chromaticity which changes substantially with GHA 8 to 12 hours.

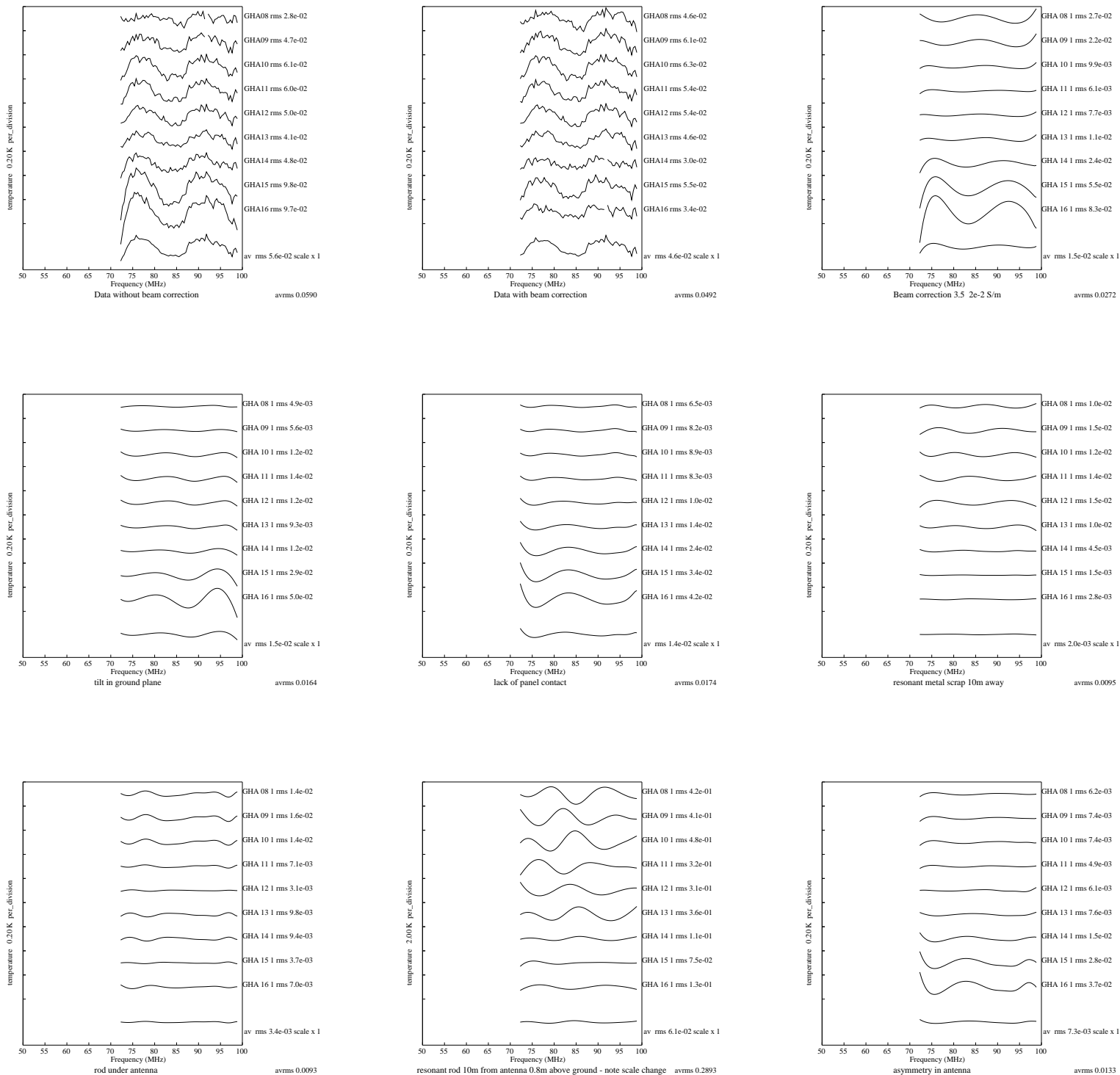


Figure 1. Low band data from 2015\_286 to 2016\_189 with 4 polynomial terms removed compared with various simulated defects in ground plane and surrounding environment.