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To: EDGES Group
 From: Alan E.E. Rogers
 Subject: Insulation cover for EDGES

In order to maintain a reasonable temperature range for the EDGES-3 installation at the MRO air will be circulated from the hut. For an airflow rate of 35 CFM which is an estimate for what can be achieved by the San Ace 60×60×38 mm fan 22 watts per degree C can be supplied on a cold winter night of 7°C or removed on a hot summer day of 38 °C. Without insulation convention heat loss or gain could be as high as 100 watts/°C which exceeds what can be supported by the air flow. With 1" insulation of 0.03 watts/m/°C the heat exchange with the outside air temperature is reduced to 3.5 watts/°C.

Feko simulations have been made using 1" thick polyethylene foam panels with dimensions given in Table 1.

Panel	# panels		
Cover	1	0.953	1.504
Sides	2	0.953	0.155
Sides	2	0.155	1.555
Bottom	2	0.953	0.709

Table 1. dielectric panel dimensions in meters.

A dielectric of 1.08 and loss tangent of 2×10^{-3} are assumed. With this loss tangent the antenna loss is about 0.2% but this is a very conservative estimate of loss tangent which is more likely about 1×10^{-4} for an antenna loss of about 0.01%. Figure 1 shows the antenna with dielectric panels which cover the whole antenna with the exception of a small region around the brass pipes on the bottom.

The effect of the cover on the antenna S11 is less than 0.2 dB from 50 to 180 MHz and there is no significant effect on the beam chromaticity.

Estimates of expected temperatures based on 100 W dissipation in receiver and 25 C hut and soil temperature

- a) 100 m PVC pipe temperature rise 3°C for 0.2 W/m/K soil conductivity.
- b) Temperature rise in antenna box 10°C for 0.5 m³/sec air flow.
- c) Heat loss for antenna with cover 70 watts at 18°C outside air temperature.
- d) Heat gain for antenna with cover 25 watts at 45°C outside temperature.
- e) Pressure drop due to pipe friction 630 Pa (2.5 inches H₂O) dominated by brass pipe.
- f) Expected average temperature in antenna box 38°C.
- g) Expected best control temperature for front-end 38°C with hot load at about 140°C.

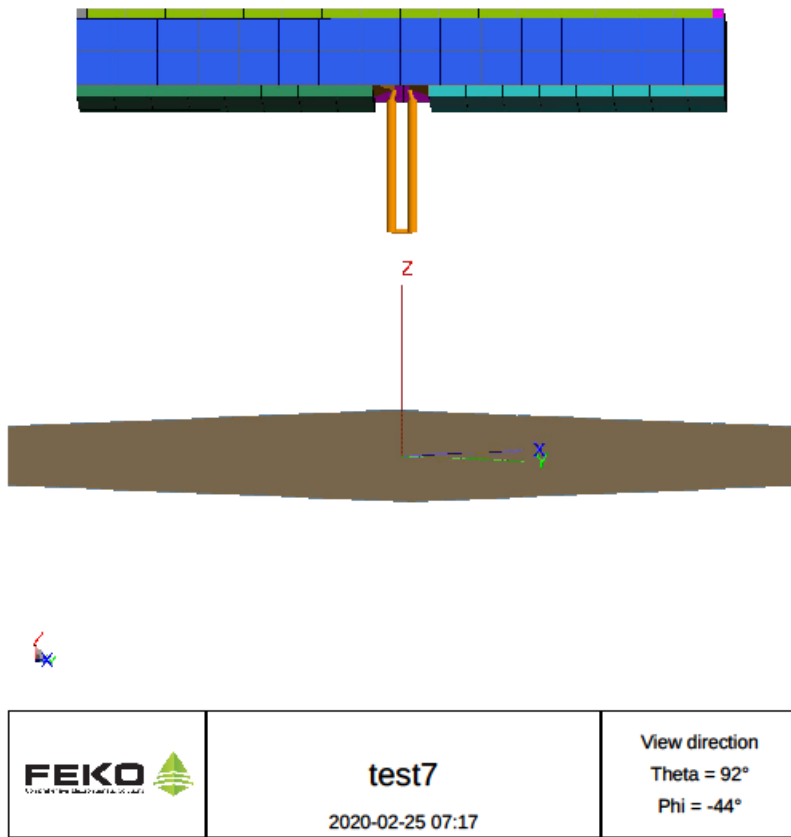


Figure 1.