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HAYSTACK OBSERVATORY

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To: Holographers

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Subject: Panel expansion coefficient

The Haystack antenna panels are a composite of aluminum and fiberglass epoxy. The thickness of the epoxy is quite variable but is typically about equal to the 0.016" aluminum skin. In this case the expansion coefficient of the composite is

$$\chi = (\chi_a E_a + \chi_e E_e) / (E_a + E_e)$$

where

χ_a = expansion coefficient of aluminum ($22 \times 10^{-6} / ^\circ\text{C}$)

χ_e = expansion coefficient of epoxy ($\approx 50 \times 10^{-6} / ^\circ\text{C}$)

E_a = Young's modulus of aluminum (10^7 psi)

E_e = Young's modulus of epoxy ($\approx 10^6$ psi)

Since the expansion of coefficient of the epoxy is very uncertain (but is probably higher than aluminum) I have attempted to measure the differential expansion between the panel material and aluminum. I have a preliminary result of $10 \pm 3\%$ which, if confirmed, implies that the splice plate should be offset by 10% of the difference in panel temperature while observing and that during the holography used for rigging the dish. Thus, during a warm day the splice plate temperature will have to be offset by about 1.5°C .

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