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Subject: Effects of tilted subreflector and offset pointing on Radome diffraction.

When holography is performed with an offset feed the subreflector is tilted to obtain symmetrical illumination and a pointing offset is used to correct the beam offset. In the current holography the beam is offset high by 0.134 degrees so that the angle needed to place the beam on the satellite is reduced by 0.134 degrees. The pointing offset, θ_0, of -0.134 degrees shifts the radome diffraction by

$$\Delta y \approx \left(z_0 + \left(x^2 + y^2 \right)^{1/2} \Big/ 4F \right) \theta_0$$

where z_0 = distance from elevation axis to antenna vertex

x, y =aperture plane coordinates

F = focal length

θ_0 = pointing offset in elevation

This shift is smaller than the shift which would result if the offset were to be incorrectly applied to the satellite elevation. In this case

$$\Delta y \approx r\theta_0$$

where r is the radome radius.

The offset pointing also introduces another more subtle effect, which if not corrected shifts and distorts the scale of y in the holography map of the antenna surface. This produces a shift

$$\Delta y \left(z_0 + \left(x^2 + y^2 \right) \Big/ 4F \right) \theta_0$$

For a pointing offset of θ_0 in elevation. This results from the path length change with scan angle,

$$-r\cos\left(\theta + \phi + \theta_0\right) \approx -z\left(1 - \phi\theta_0\right) + y\left(\phi + \theta_0\right) \approx \phi\left(y + z\theta_0\right) - z - y\theta_0$$

where y=r $\sin\theta$ and z = r $\cos\theta$

and the constant terms are subtracted by phase calibration on beam center when $\phi = 0$. For $\theta_0 = -0.134$ degrees and $z_0 = 182"$ $z\theta_0$ has a maximum value of only about one inch.