

#92-19

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

15 December 1992

Telephone: 508-692-4764

Fax: 617-981-0590

To: Holographers
From: Alan E.E. Rogers *AEE R*
Subject: Methods to improve holography

The holography is limited by multiple reflections from the radome panels. Two mechanisms are dominant. In the first mechanism, the radome panels are illuminated by the power from the main dish, while in the second case, the panels are illuminated by the spill-over from the holography feed. The first mechanism introduces an additional path of $2 \times (75' - 14') = 122' = 0.124$ microsec which is canceled by using 2 frequencies 4 MHz apart. In the second case the added path $2 \times (75' - 14' - 48' + 3.6') = 33' = 0.034$ microsec which could be canceled by using 2 frequencies 14.8 MHz apart. Alternately the direct illumination of the radome panels could be reduced by using a feed with a very sharp pattern cut-off beyond the 6.7 degrees subtended by the subreflector. Another method suggested by P.J. Charpentier is to average 2 maps with different subreflector positions. If the satellite position and antenna pointing is the same for both maps, a $\lambda/4 = 0.25''$ change in focus should reverse the phase of the panel reflections provided the pressurized panels also remain stable. Alternately the subreflector could be tilted to randomize the reflections between maps, thereby giving some reduction in the average.

Another method of reducing the illumination of radome panels would be to place an aperture made of absorber in front of the feed. This "collimator" would have to be in the far field of the feed which is about 64 inches out for the shortened horn (8"x5.5" aperture). An open frame structure made of plastic pipe could be used to support a sheet of microwave absorber about 6 feet out in front of the feed.

To summarize:

- 1) Two frequencies 4 MHz apart suppress radome reflections from main dish only - not those from feed spillover.
- 2) Two frequencies 14.8 MHz could suppress feed spillover reflections but it is probably not practical to do simultaneously with #1.
- 3) Adding two maps with $\lambda/4$ subreflector focus (I suggest $\pm 0.125''$ from nominal) motion should suppress radome reflections from the feed spillover but will not suppress those from the main dish.
- 4) A feed collimator could reduce feed illumination of the radome panels.

Right now, we do #1 as standard method - I suggest we consider adding #3, at least when using the shorter than normal holography feed.

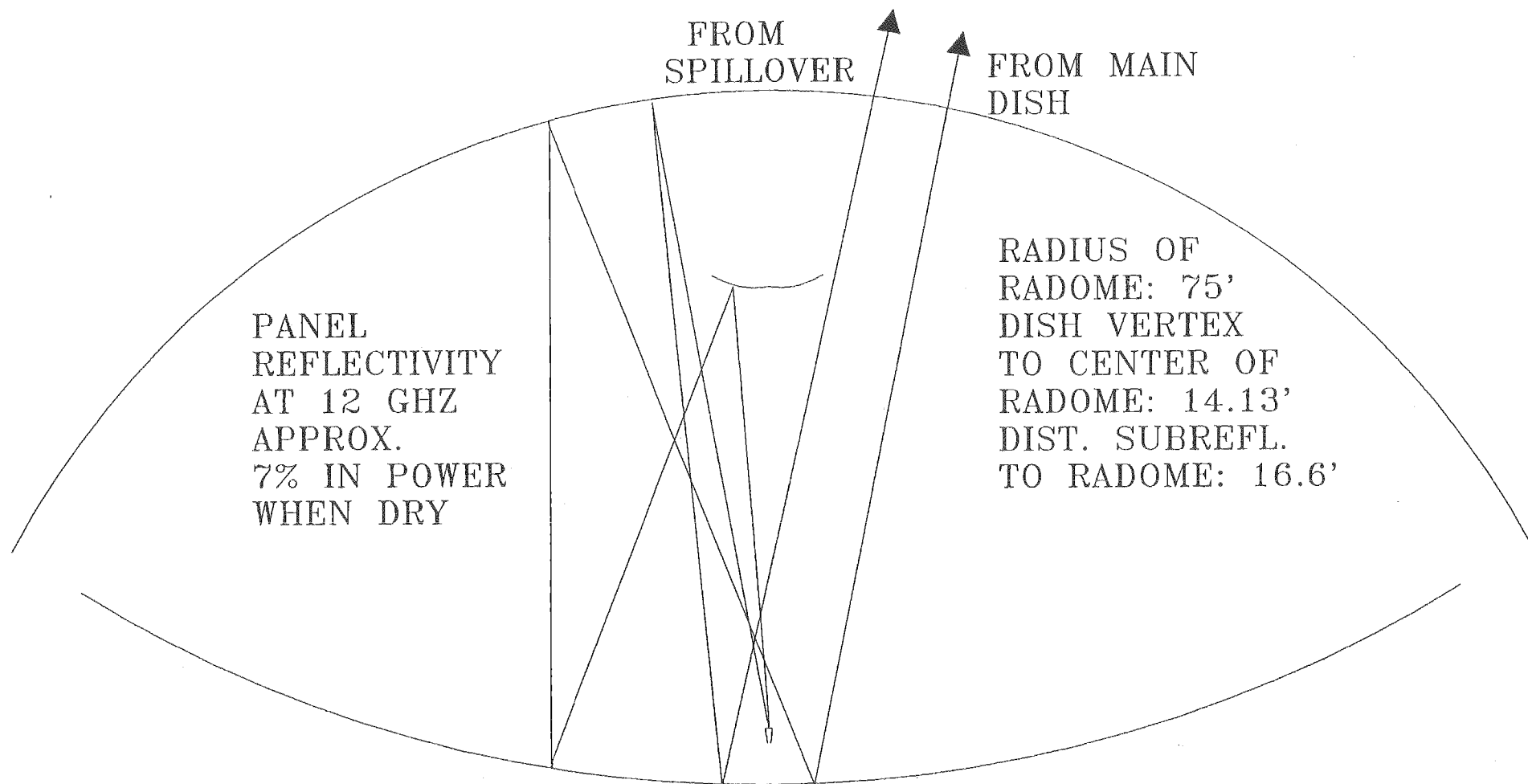


Figure Panel reflections