

Appendix G

The 12m Telescope Primary Focus Plate Scale

The primary focus plate scale, which determines the amount of beam displacement as a function of lateral displacement of the subreflector, is given by

$$\sin(\theta) = \frac{\Delta x}{f} \left\{ \frac{\int_0^1 F(r) r^3 dr}{1 + \left(\frac{r}{2f}\right)^2} \right\} \quad (\text{G.1})$$

where θ is the beam deviation on the sky, $F(r)$ is the receiver feed illumination pattern, and f is the primary focal length. The term in braces is often called the “beam deviation factor”. For the 12m receivers $F(r)$ is given by

$$F(r) = \exp(-2.57 \tan^{-1}(0.5952r)) \quad (\text{G.2})$$

For the 12m telescope, $f = 0.42 \times D$, which means that the beam deviation factor is 0.827 and that

the plate scale for prime focus subreflector lateral movement = 31.5 "/mm