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

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

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

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

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

$$\boxed{\text{the plate scale for prime focus subreflector lateral movement} = 31.5\ ''/\text{mm}}$$