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

\[ \sin(\theta) = \frac{\Delta x}{f} \left( \frac{1}{\int_0^1 F(r)r^3 dr} \right) \]

where \( \theta \) 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

\[ F(r) = \exp(-2.57 \tan^{-1}(0.5952r)) \]

For the 12 Meter Telescope, \( f = 0.42 \times D \), which means that the beam deviation factor is 0.827 and that

\[
\text{the plate scale for prime focus subreflector lateral movement} = 31.5 " /mm
\]