

power at fiber tip

$$P_{\text{tip}}$$

Metrology bench

Coherent monochromatic light source

Translation stage

Light detector

Single mode fibers

Metrology baseline

Mirror

White light source

mirror irradiance

$$E_{\text{mirror}} = L_{\text{fibre}} \frac{\pi d^2}{4L_0}$$

Pseudo stars
(object plane)

Vacuum chamber
Optical bench

fiber radiance

$$L_{\text{fibre}} = T \int_{\lambda_{\min}}^{\lambda_{\max}} B(\lambda, T_s) d\lambda \approx T(\lambda_{\max} - \lambda_{\min}) \times B(\lambda_{\text{eff}}, T_s)$$

maximum e- flux per pixel

$$F_{\text{max/pix}}^{\text{e-}} \approx 2(1 + V) F_{\text{pix}}^{\text{e-}}$$

e- flux per pixel

$$F_{\text{pix}}^{\text{e-}} = \frac{\rho_{\text{pix}} P_{\text{pix}} \lambda_{\text{met}}}{hc} \approx \frac{2P_{\text{tip}} e^2 \lambda \rho_{\text{pix}}}{\pi \theta^2 L^2 hc}$$

power per pixel

$$P_{\text{pix}} \approx \frac{2P_{\text{tip}} e^2}{\pi \theta^2 L^2}$$

power per star

$$P_{\text{im}} = E_{\text{mirror}} S_{\text{mirror}} = L_{\text{fibre}} \frac{\pi d^2}{4L_0} \frac{\pi D^2}{4}$$

photon flux per star

$$F_{\text{im}}^{\gamma} = P_{\text{im}} \frac{\lambda_{\text{eff}}}{hc}$$

maximum e- flux per pixel

$$F_{\text{max/pix}}^{\text{e-}} = \rho_{\text{pix}} F_{\text{max/pix}}^{\gamma} = R_{\text{flux}} \rho_{\text{pix}} F_{\text{im}}^{\gamma}$$

**Valid for both
metrology
and stars:**

source limited integration time

$$T_i^{\gamma} = \frac{w}{F_{\text{max/pix}}^{\text{e-}}}$$

source optimality factor

$$\eta = \frac{T_{\min}}{T_i^{\gamma}}$$

total integration time

$$T_{\text{tot}} = N_{\text{frames}} T_i$$

integration time between two frames

$$\text{with } T_i = \begin{cases} T_{\min} & \text{if } \eta \geq 1 \\ \frac{T_{\min}}{\eta} & \text{if } \eta < 1 \end{cases}$$

number of frames needed

$$N_{\text{frames}} = \frac{R_{\text{flux}} N_{\text{e-}}^*}{w}$$

$$N_{\text{frames}} = \frac{N_{\text{e-}}^p}{wV}$$