SURP Week 4

Calculating Parameters

Focal length of telescope f_T

Using given values of $D_T = 406.40\,mm$, $F/\#_T = 18$

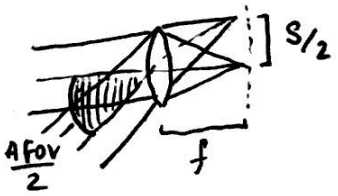
$$F/\#_T = \frac{f_T}{D_T} \Rightarrow f_T = \frac{F}{\#_T} D = (406.40)(18)$$

$$\boxed{f_T = 7315.20\,mm}$$

Effective image size on focal plane of telescope S_{XT}, S_{YT}

Using equation for angular field of view

$$AFOV = 2\arctan\left(\frac{S}{2f}\right)$$



And using given values of

$AFOV_x = 19.20'$, $AFOV_y = 25.60'$, $f_T = 7315.20\,mm$

$$S_{XT} = 2f_T \tan\left(\frac{AFOV_x\,(\pi/60\cdot 180)}{2}\right) = 2(7315.20)\tan\left(\frac{19.20\,(\pi/60\cdot 180)}{2}\right)$$

$$\boxed{S_{XT} = 40.86\,mm}$$

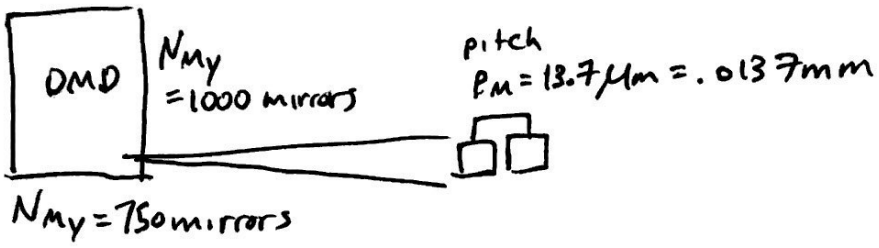
$$S_{YT} = 2f_T \tan\left(\frac{AFOV_Y\,(\pi/60\cdot 180)}{2}\right) = 2(7315.20)\tan\left(\frac{25.60\,(\pi/60\cdot 180)}{2}\right)$$

$$\boxed{S_{YT} = 54.47\,mm}$$

$\Rightarrow$ Effective telescope image size $= 40.86\,mm \times 54.47\,mm = 2{,}225.6\,mm^2$

Magnification of Relay optics M_R

Using given values of the DMD:



$$\Rightarrow S_{XDMD} = P_M N_{My} = (.0137)(750) = 10.275 \text{ mm}$$

$$S_{YDMD} = P_M N_{My} = (.0137)(1000) = 13.7 \text{ mm}$$

Notice that $\frac{S_{XDMD}}{S_{YDMD}} = \frac{S_{TX}}{S_{TY}} = \frac{.75}{1}$

So magnification of relay optics can be found by

$$M_R = \frac{S_{XDMD}}{S_{TX}} = \frac{10.275}{40.86} = .25 \Rightarrow \boxed{M_R = .25}$$