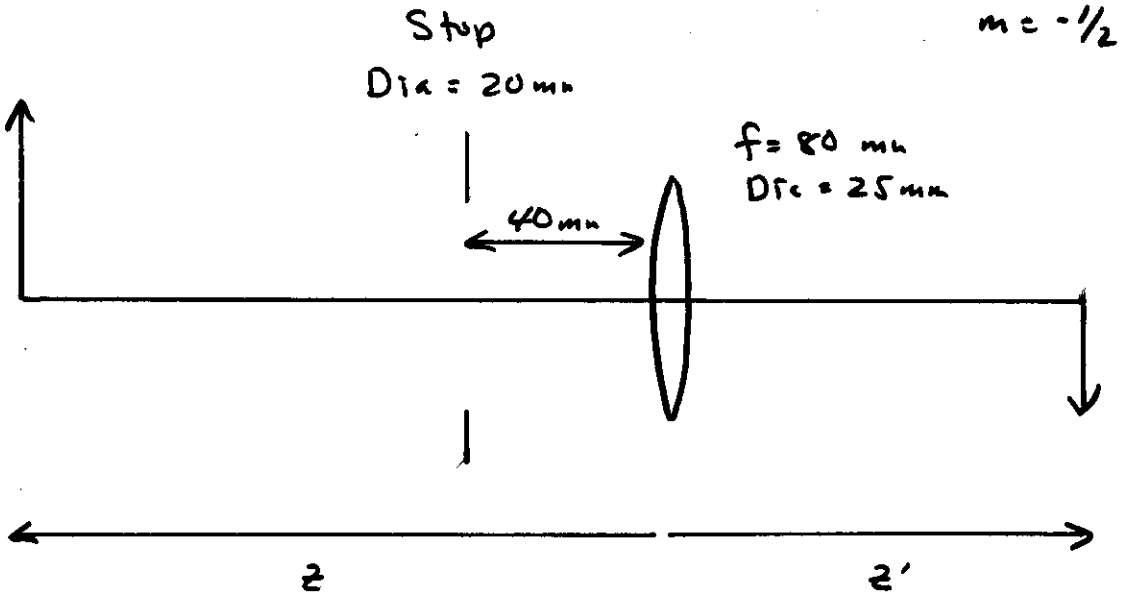
Stop + Lens - Vignetting



First compute z and z'

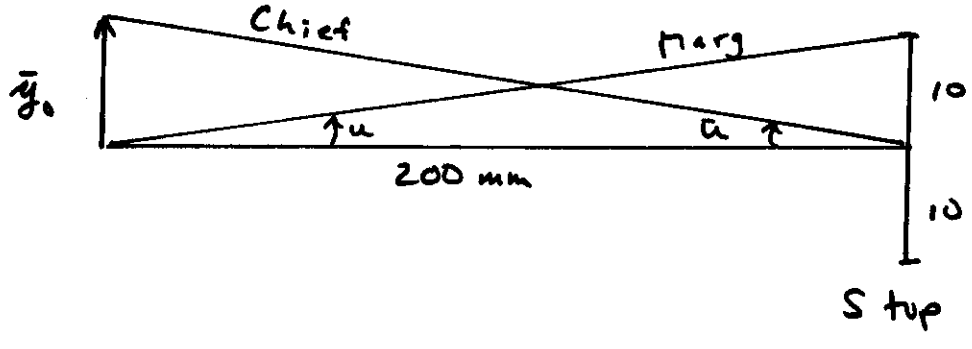
$$m = z'/z = -1/2 \qquad z = -2z'$$

$$\frac{1}{z'} = \frac{1}{z} + \frac{1}{f} = \frac{-1}{2z'} + \frac{1}{80}$$

$$z' = 120 \text{ mm}$$

$$z = 240 \text{ mm}$$

We now need to trace the marginal and chief rays:



$\bar{y}_0$ = object height

At Stop: $y = 10$

$u = 10/200 = .05$

$\bar{y} = 0$

$\bar{u} = -\bar{y}_0/200$

Transfer to the lens: $t = 40$ mm

$y' = y + ut$

$y_L = 10 + .05 \cdot 40 = \underline{12 \text{ mm}}$

$\bar{y}_L = 0 - (\bar{y}_0/200)\,40 = \underline{-.2\,\bar{y}_0}$

Neither Angle Changes

Lens Diameter = 25 mm $\quad a = 12.5$ mm

For Unvignetted: $a = |y| + |\bar{y}|$

$12.5 = 12 + .2\,\bar{y}_0$

$\bar{y}_0 = 2.5$ mm $\quad \bar{u} = -.0125$

The unvignetted field has a diameter of 5 mm

For Fully Vignetted: $a = |\bar{y}| - |y|$

$12.5 = .2\,\bar{y}_0 - 12$

$\bar{y}_0 = 122.5$ mm $\quad \bar{u} = -.61$

The fully vignetted field has a diameter of 245 mm