$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ -\frac{1}{f} & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & -\frac{1}{f} & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ -\frac{1}{f_x} & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & -\frac{1}{f_y} & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & z_{prop} & 0 & 0 & low_{defx}z_{prop} \\ 0 & 1 & 0 & 0 & low_{defx} + up_{defx} \\ 0 & 0 & 1 & z_{prop} & low_{defy}z_{prop} \\ 0 & 0 & 0 & 1 & low_{defy} + up_{defy} \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & defx \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & defy \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$x'_{ray} = x'_{ray} + |x_{ray}|\theta_{biprism}$$

$$z_{ray} = \begin{cases} z_{aper}, & \text{if } r_{ray} > r_{aper} \\ z_{next}, & \text{otherwise} \end{cases}$$