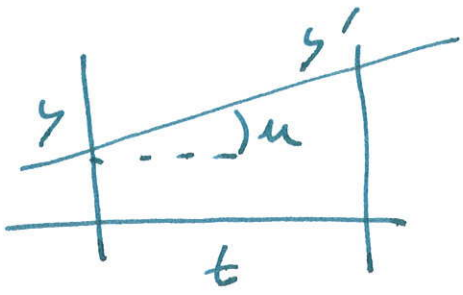
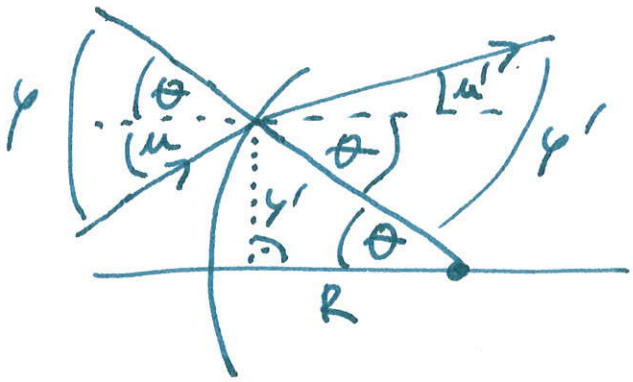
Trasování paprsků

translace:



$$y' = y + t u \rightarrow y' = y + \frac{t}{n}(n u)$$

refrakce:

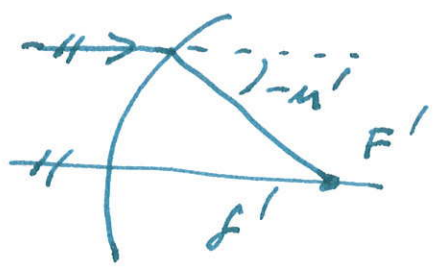


$$\theta = \frac{y'}{R}$$

$$n\left(u + \frac{y'}{R}\right) = n'\left(u' + \frac{y'}{R}\right)$$

$$n'u' = nu - \frac{y'}{R}(n'-n) \quad ; \phi \qquad (1)$$

spec. případ



$u = 0 \Rightarrow u' = -\frac{y'}{f'}$

z (1) plyne

$$-n'\frac{y'}{f'} = -\phi y' \Rightarrow \phi = \frac{n'}{f'}$$

matice

translace

$$\begin{pmatrix} y + \frac{t}{n}(nu) \\ nu \end{pmatrix} = \begin{pmatrix} \cdot & \cdot \\ \cdot & \cdot \end{pmatrix} \begin{pmatrix} y \\ nu \end{pmatrix}$$

refrakce

$$\begin{pmatrix} y' \\ nu - \phi y' \end{pmatrix} = \begin{pmatrix} \cdot & \cdot \\ \cdot & \cdot \end{pmatrix} \begin{pmatrix} y' \\ nu \end{pmatrix}$$

obecně

$$\begin{pmatrix} y^{out} \\ n' u^{out} \end{pmatrix} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} \begin{pmatrix} y^{in} \\ n u^{in} \end{pmatrix}$$

určení matice ABCD

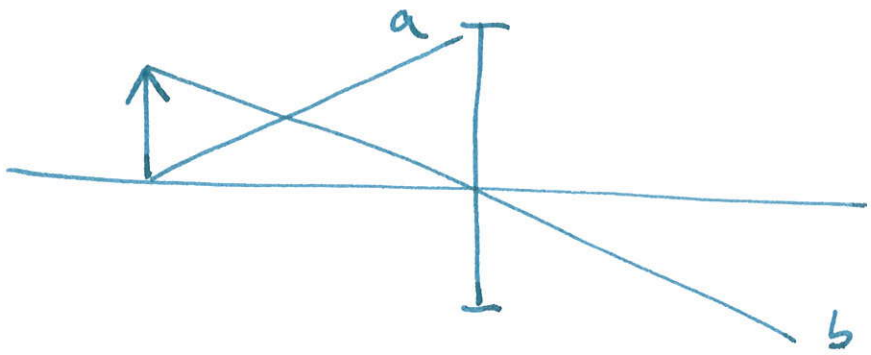
dva paprsky

a: y_a^{in}, $n u_a^{in}$ b: y_b^{in}, $n u_b^{in}$

y_a^{out}, $n' u_a^{out}$ y_b^{out}, $n' u_b^{out}$

4 rovnice pro 4 neznámé A, B, C, D

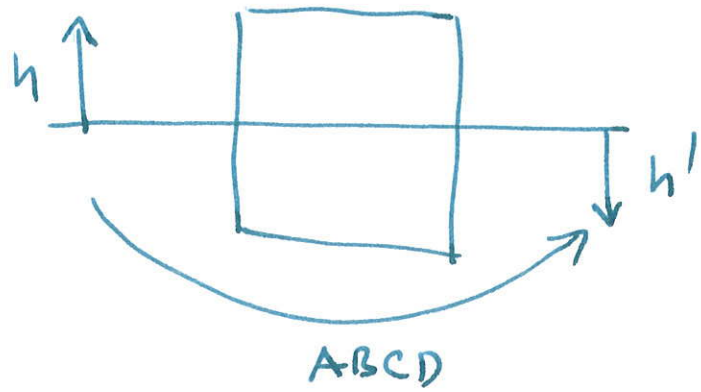
např.



a - osový paprsek

b - hlavní paprsek

konjugované roviny



a) osové paprsky

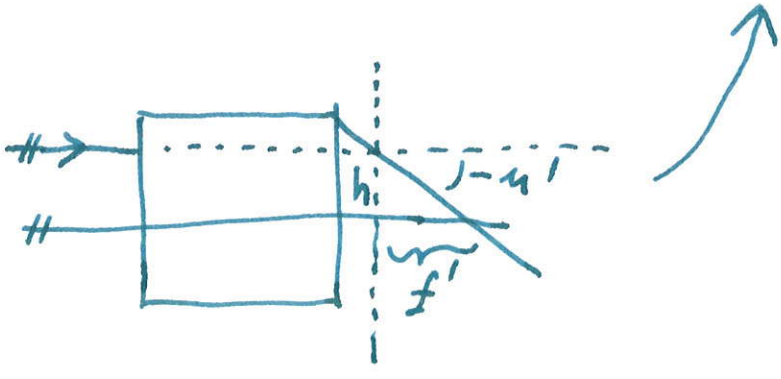
$$\begin{pmatrix} 0 \\ n'u' \end{pmatrix} = \begin{pmatrix} & \\ \bullet & \end{pmatrix} \begin{pmatrix} 0 \\ nu \end{pmatrix}, \quad \frac{nu}{n'u'} = m$$

b) okrajové paprsky

$$\begin{pmatrix} h' \\ n'u' \end{pmatrix} = \begin{pmatrix} \bullet & \bullet \\ & \end{pmatrix} \begin{pmatrix} h \\ nu \end{pmatrix}, \quad \frac{h'}{h} = m$$

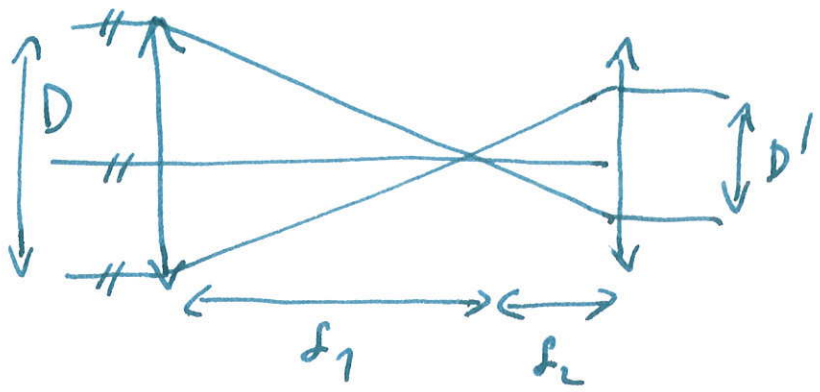
c) kolimované paprsky

$$\begin{pmatrix} h' \\ n'u' \end{pmatrix} = \begin{pmatrix} & \\ \bullet & \end{pmatrix} \begin{pmatrix} h \\ 0 \end{pmatrix}, \quad u' = -\frac{h}{f'}$$



zvětšení teleskopu

zobr. vstupní pupily



příčné zvětšení

$$m_p = \frac{D'}{D} = \frac{f_2}{f_1}$$

úhlové zvětšení

$$\gamma = \frac{\varphi'}{\varphi} = \frac{1}{m_p}$$

$$\gamma = \frac{f_1}{f_2}$$