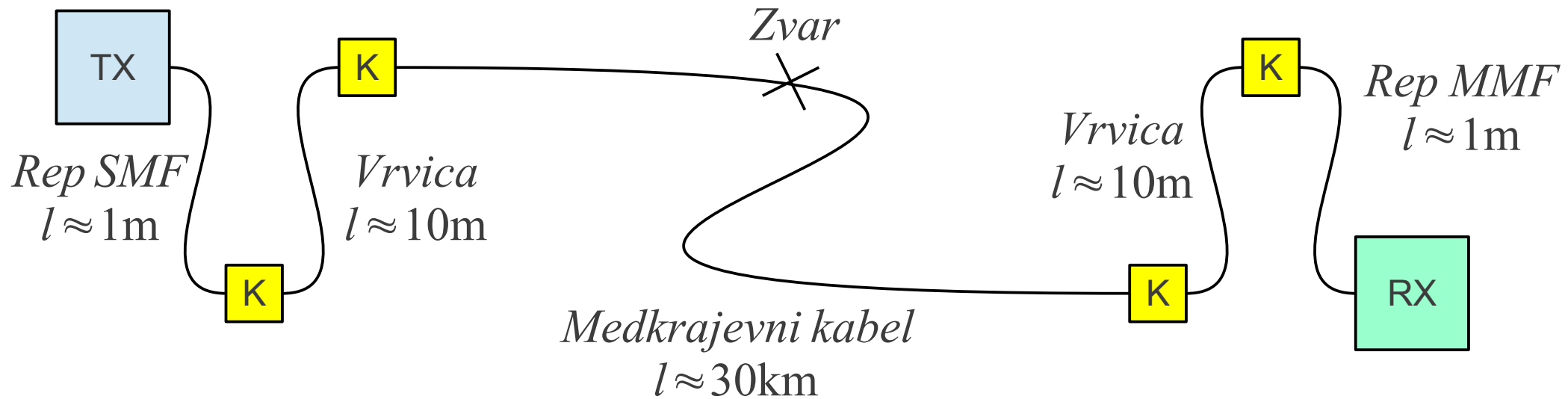


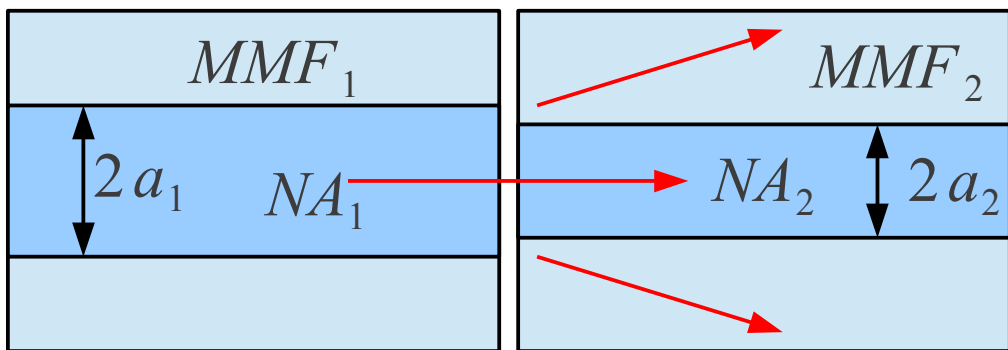
Optične komunikacije

Predavanje 8:

Sklop svetlobe v vlaknu



Različna vlakna: SMF ali MMF ?



$$NA_1 > NA_2$$

$$a_1 > a_2$$

Recipročnost ?

$$NA_1 < NA_2$$

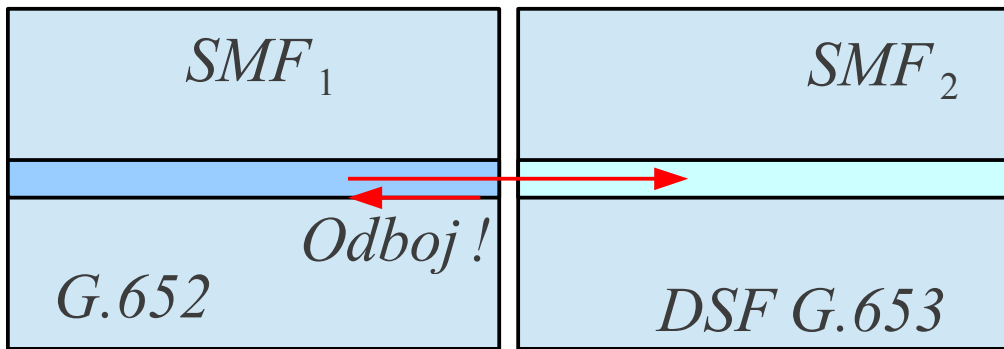
$$a_1 < a_2$$

$$\eta = \frac{P_2}{P_1} \approx \left(\frac{a_2}{a_1}\right)^2 \left(\frac{NA_2}{NA_1}\right)^2$$

$$\eta = \frac{P_2}{P_1} \approx 1$$

SMF → MMF

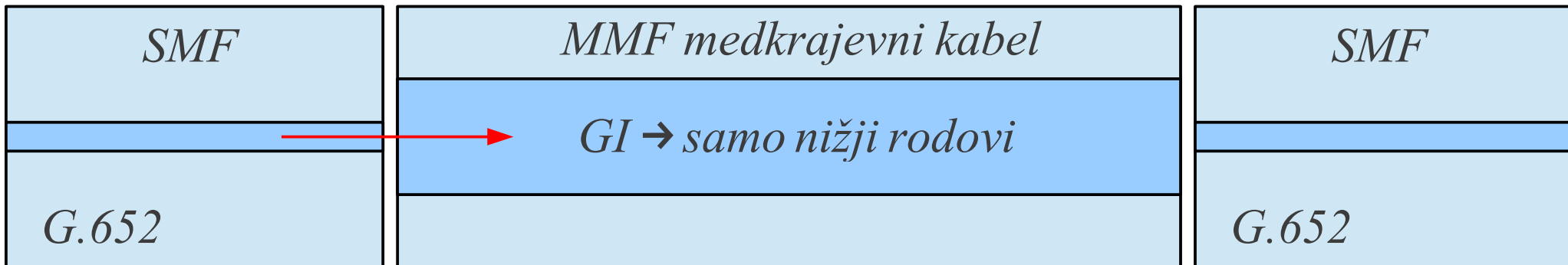
MMF → SMF ???



$\eta > 90\% \approx -0.5\text{dB}$

Konektorski spoj \rightarrow odboj

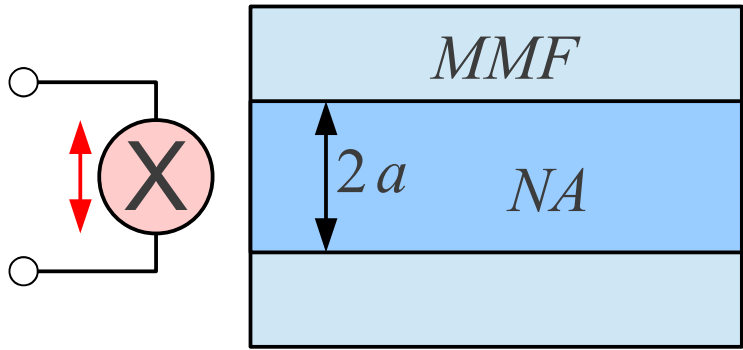
Zvar \rightarrow majhno slabljenje



$SMF \rightarrow MMF$

*Pogojno uporabno!
Običajno NE počnemo!*

$MMF \rightarrow SMF ???$



Neusmerjen vir

$$\eta \approx \frac{NA^2}{4}$$

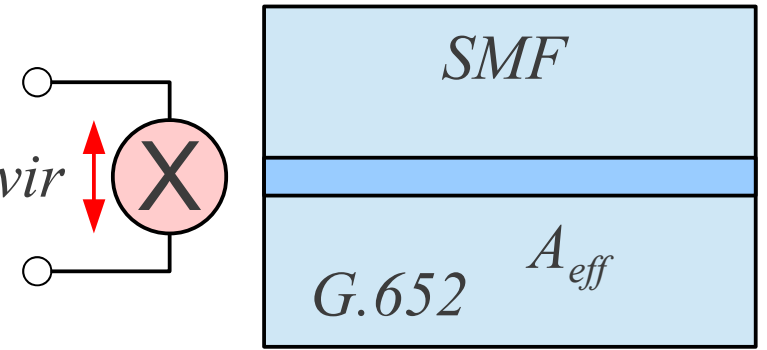
$$NA \approx 0.2$$

$$\eta \approx 1\%$$

$$P_{LED} \approx 10\text{mW}$$

$$P_{VLAKNO} = \eta \cdot P_{LED} \approx 100\mu\text{W}$$

Nekoherentni vir



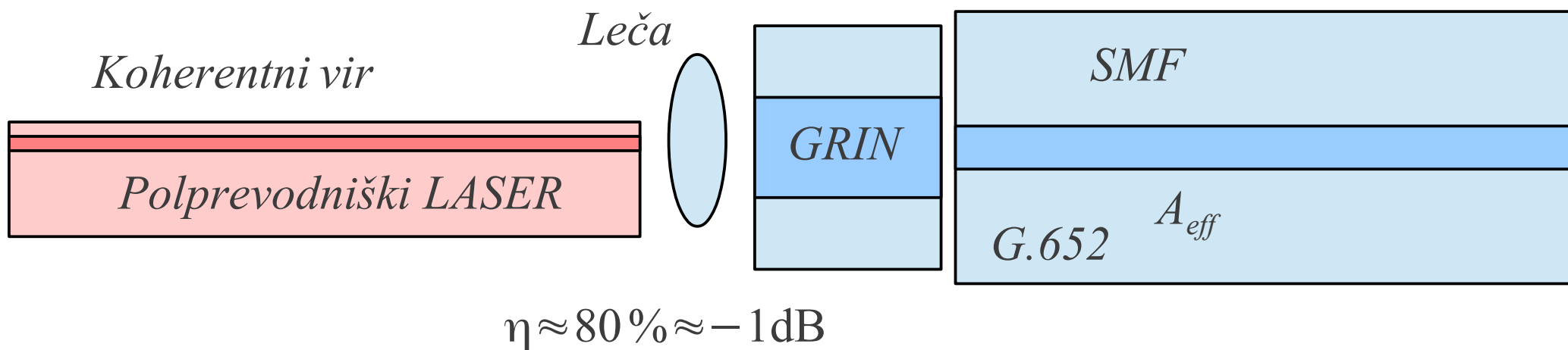
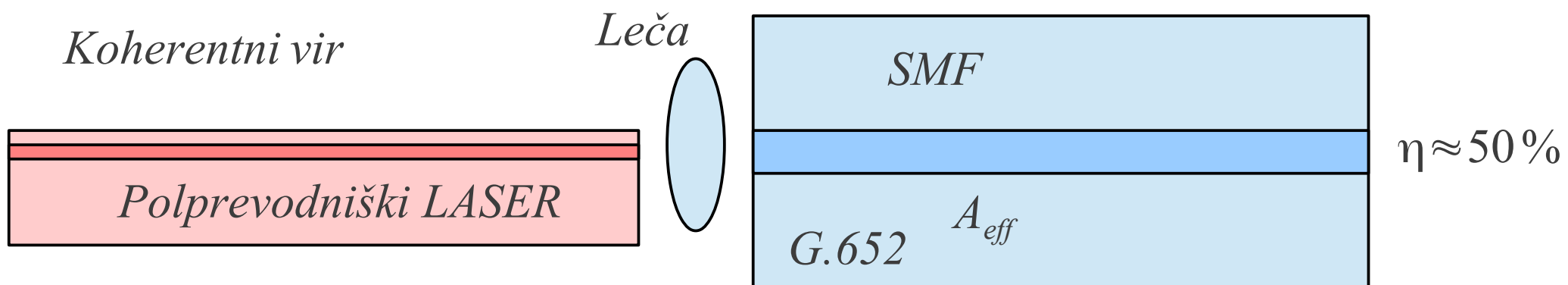
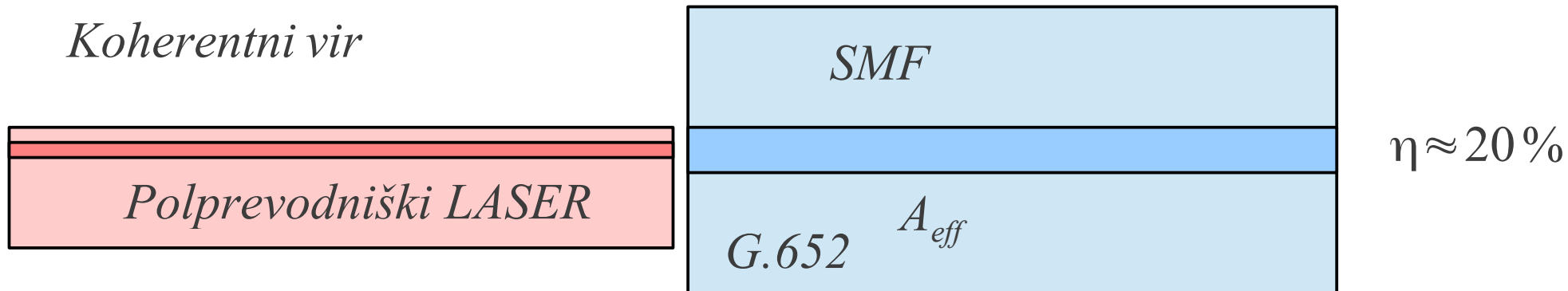
Spektralna svetlost $B_f = \frac{dP}{df d\Omega dA}$

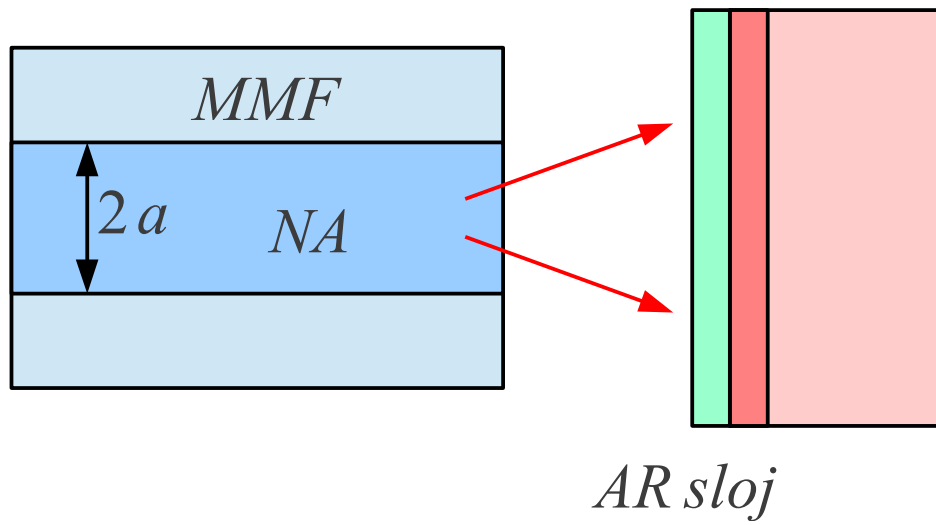
Koherentni sprejem $P = B_f \cdot \Delta f \cdot \lambda^2$

$$A_{SVETILA} \gg A_{eff} \gg \lambda^2 \quad \eta \approx 0.1\%$$

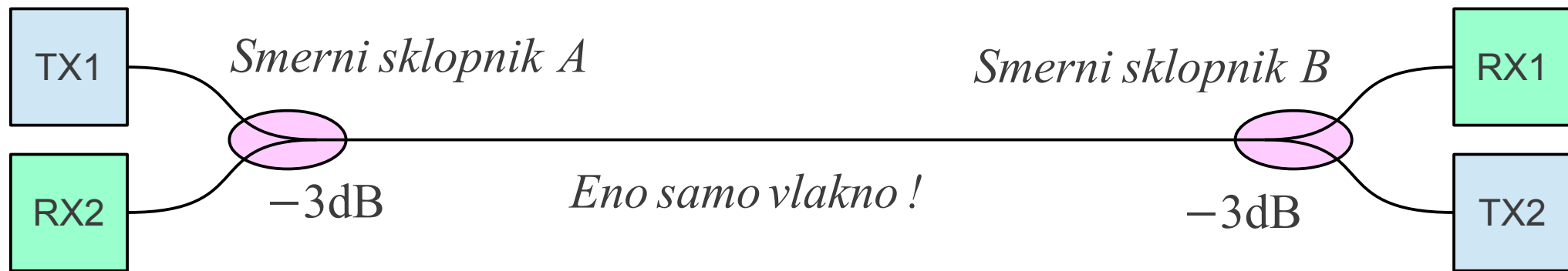
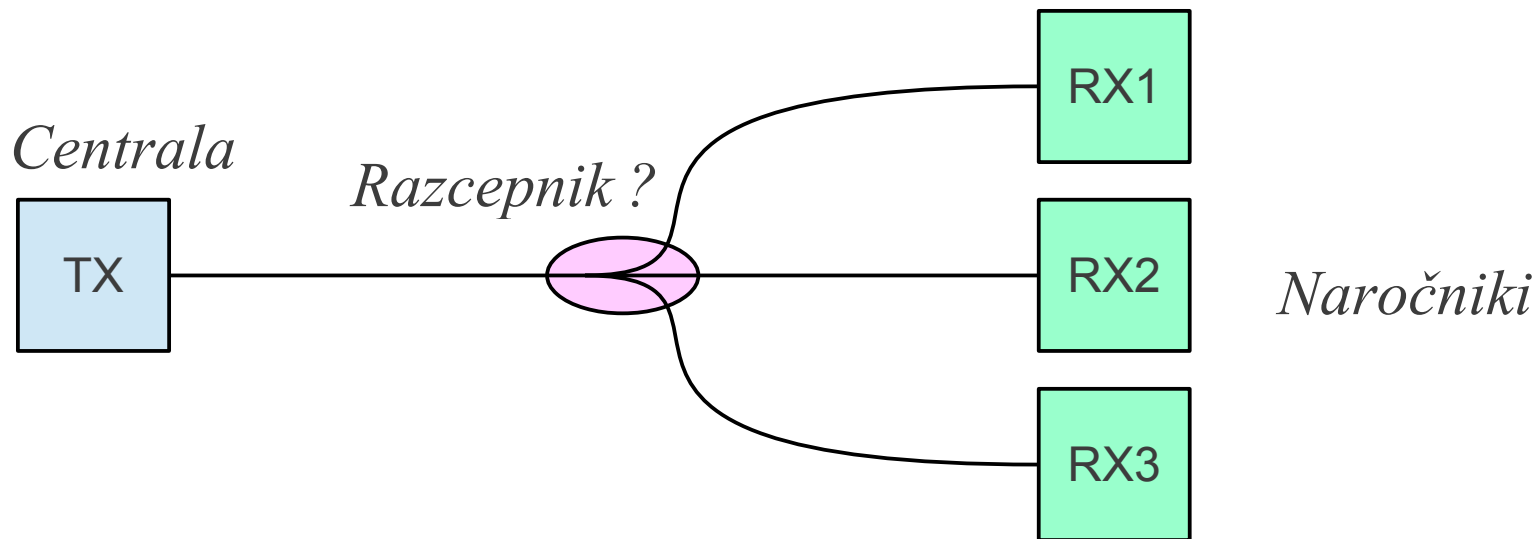
$$P_{LED} \approx 10\text{mW}$$

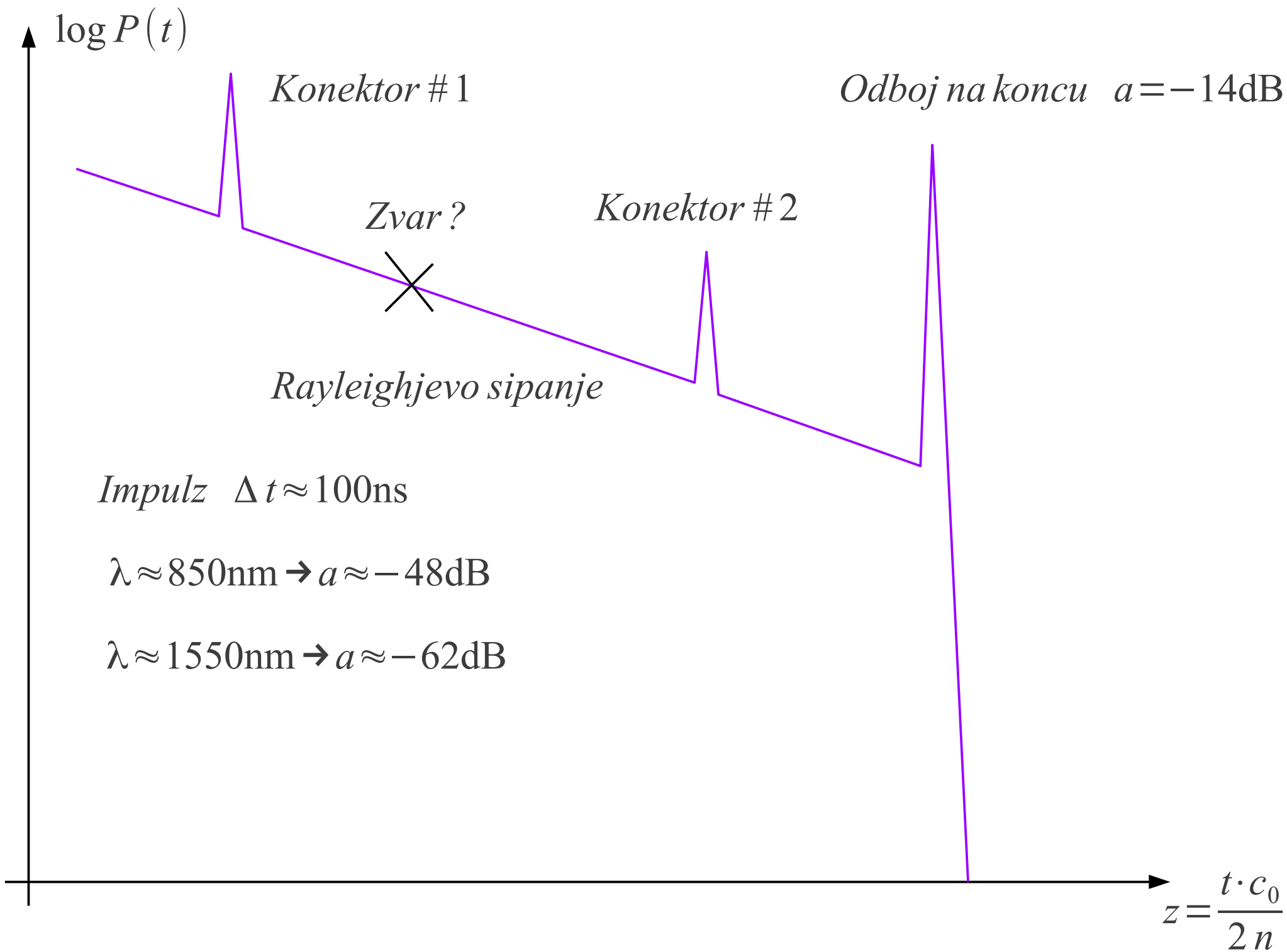
$$P_{VLAKNO} = \eta \cdot P_{LED} \approx 3...10\mu\text{W}$$

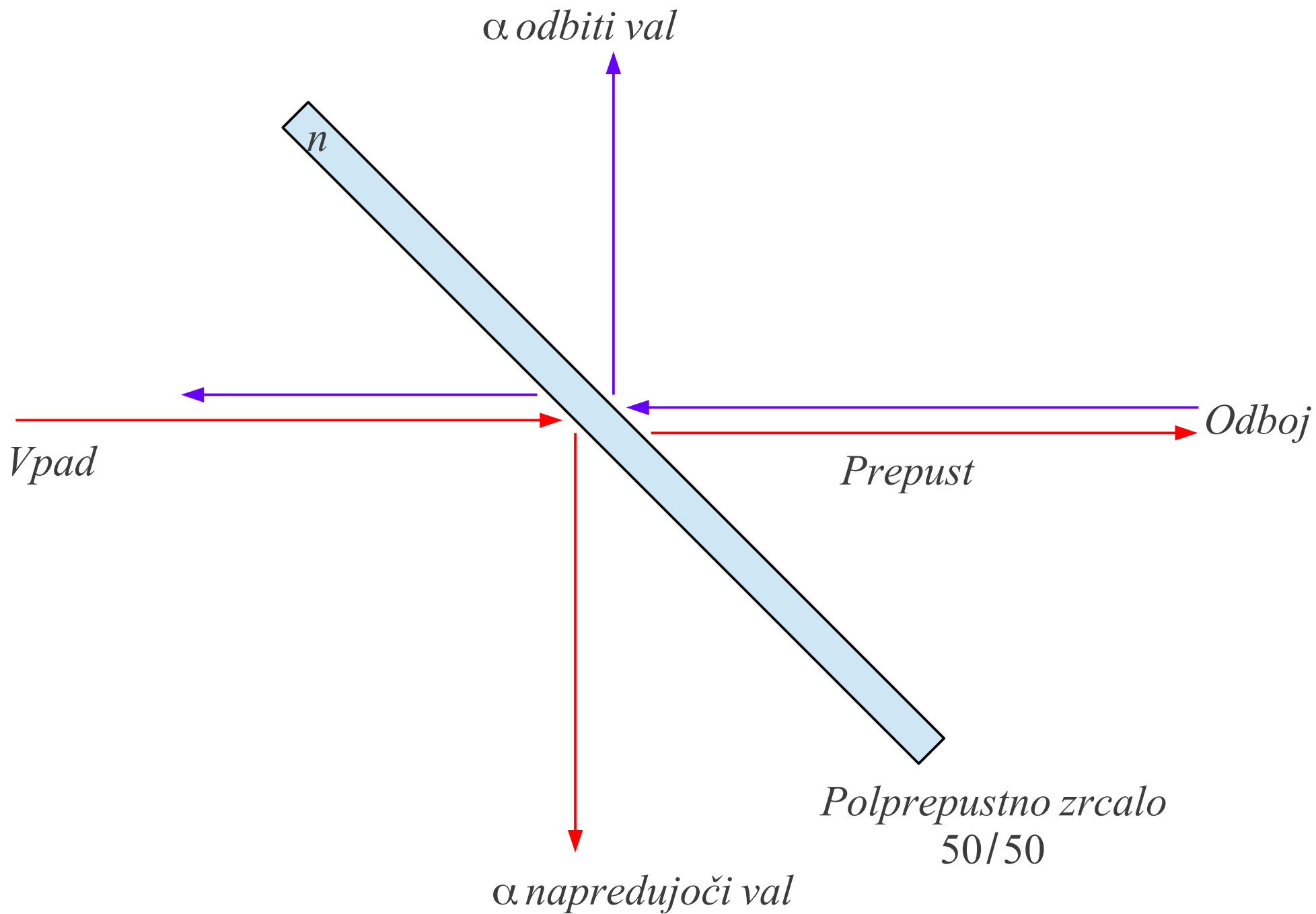


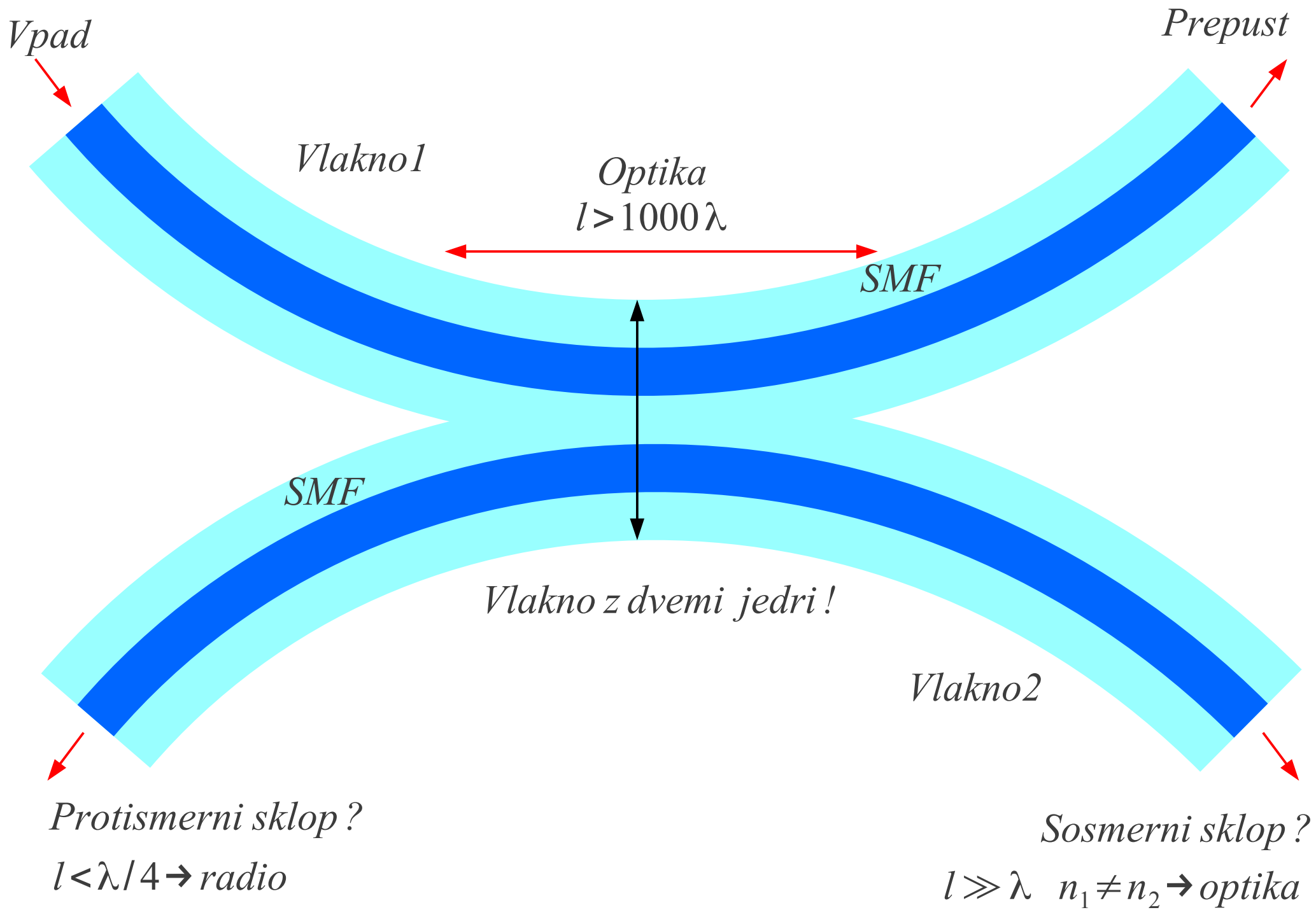


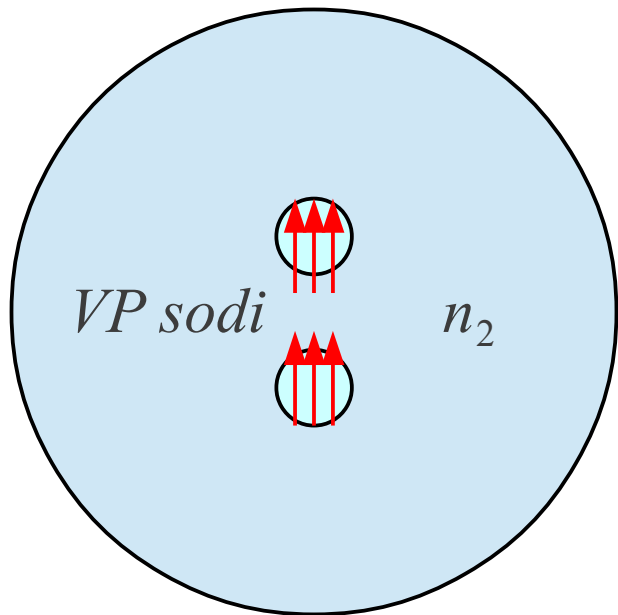
Čip fotodiode $\rightarrow \eta \approx 90\% \approx -0.5\text{dB}$



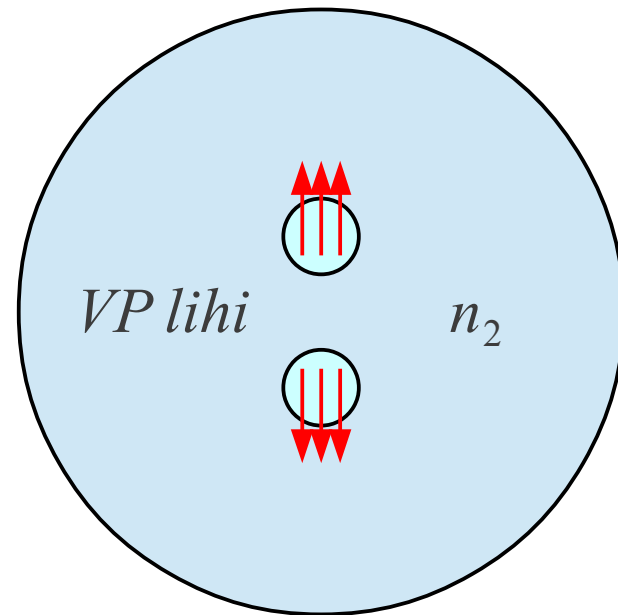






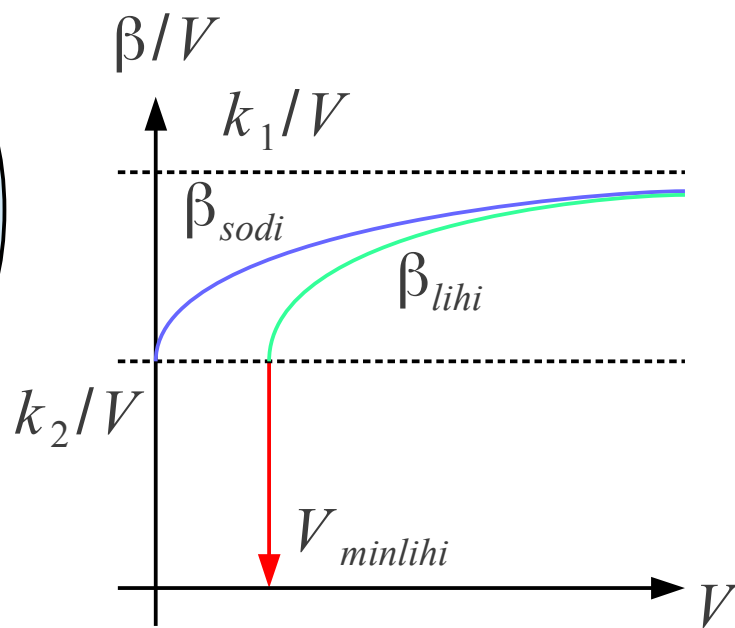
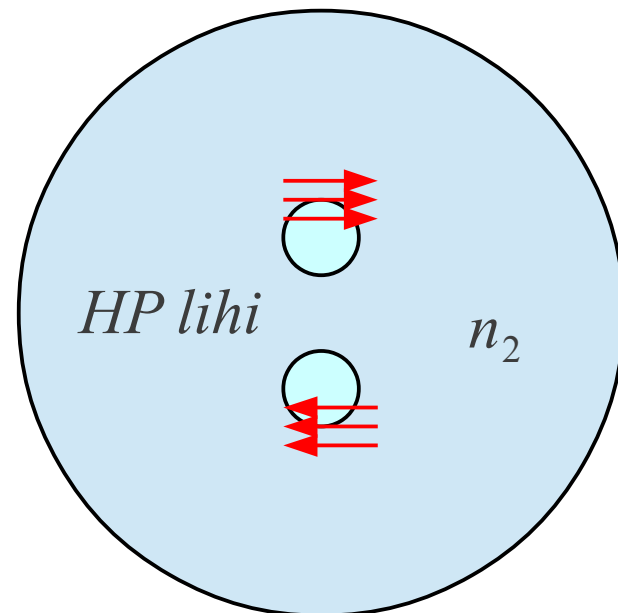
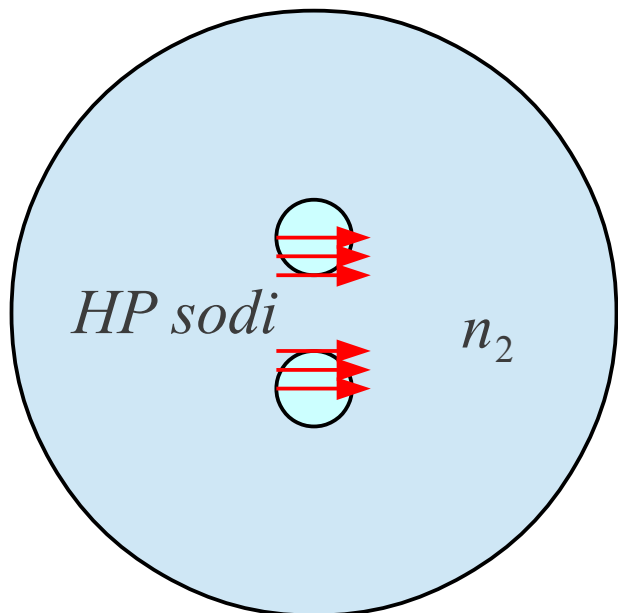


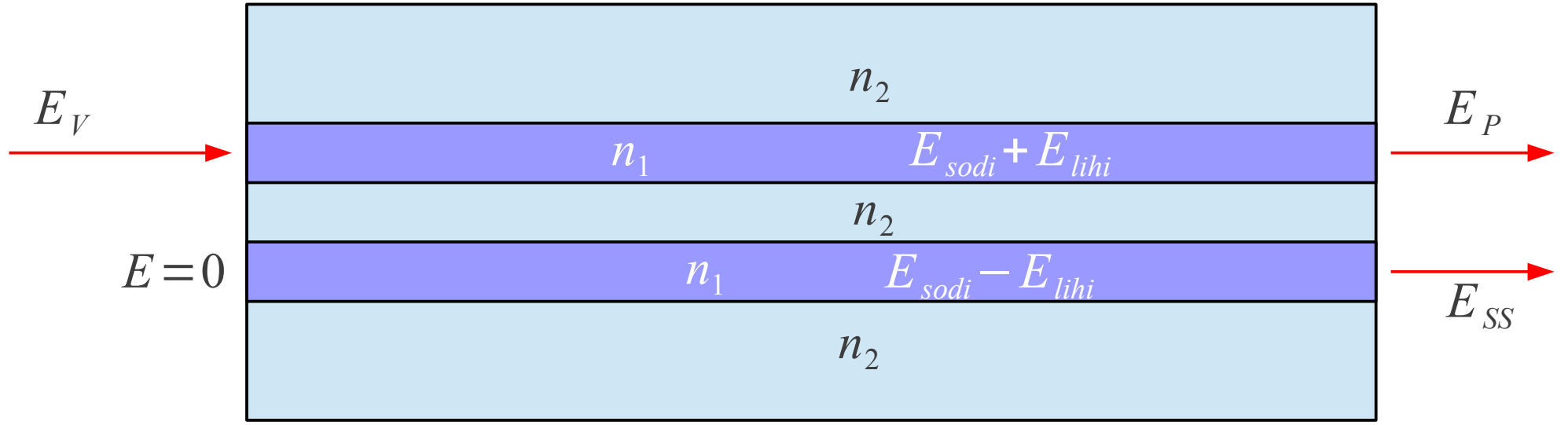
Sodi (sofazni) rod



Lihi (protifazni) rod

$$\beta_{\text{vlakno}} > \beta_{\text{sodi}} > \beta_{\text{lihi}}$$





$$E_{sodi}(0) = E_{lihi}(0) = E_V/2 \quad l \gg \lambda \quad E_{sodi}(l) = E_V/2 \cdot e^{-j\beta_{sodi}l}$$

$$\beta_{sodi} = \beta + \Delta\beta/2 \quad E_{lihi}(l) = E_V/2 \cdot e^{-j\beta_{lihi}l}$$

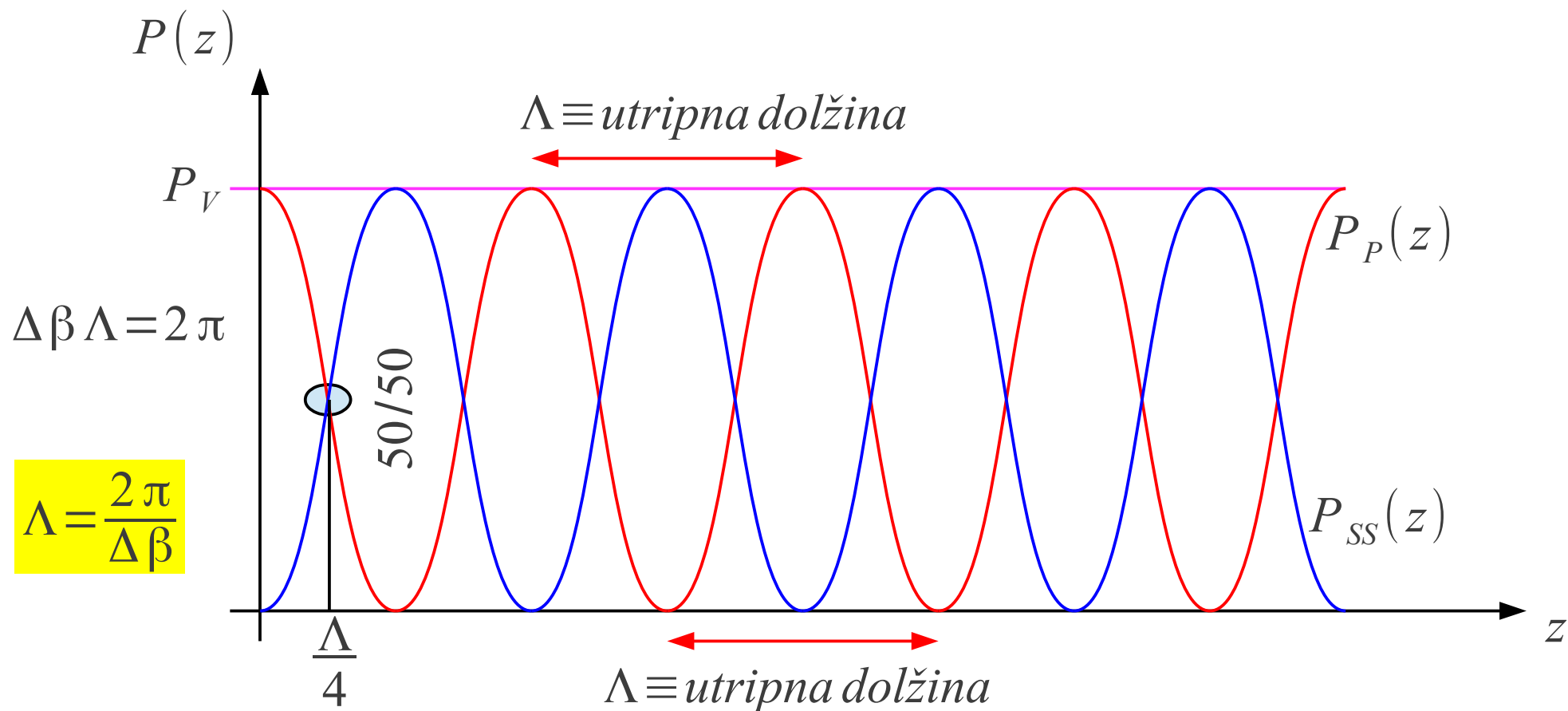
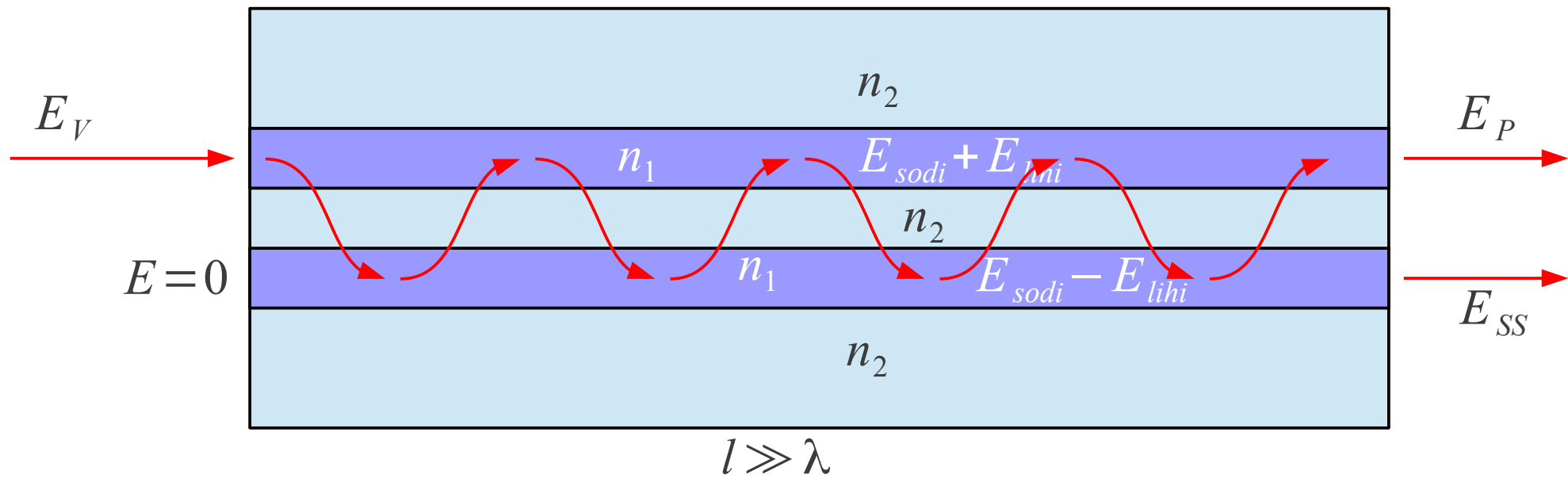
$$\beta_{lihi} = \beta - \Delta\beta/2 \quad E_P = E_{sodi}(l) + E_{lihi}(l) = E_V e^{-j\beta l} \cos \Delta\beta l/2$$

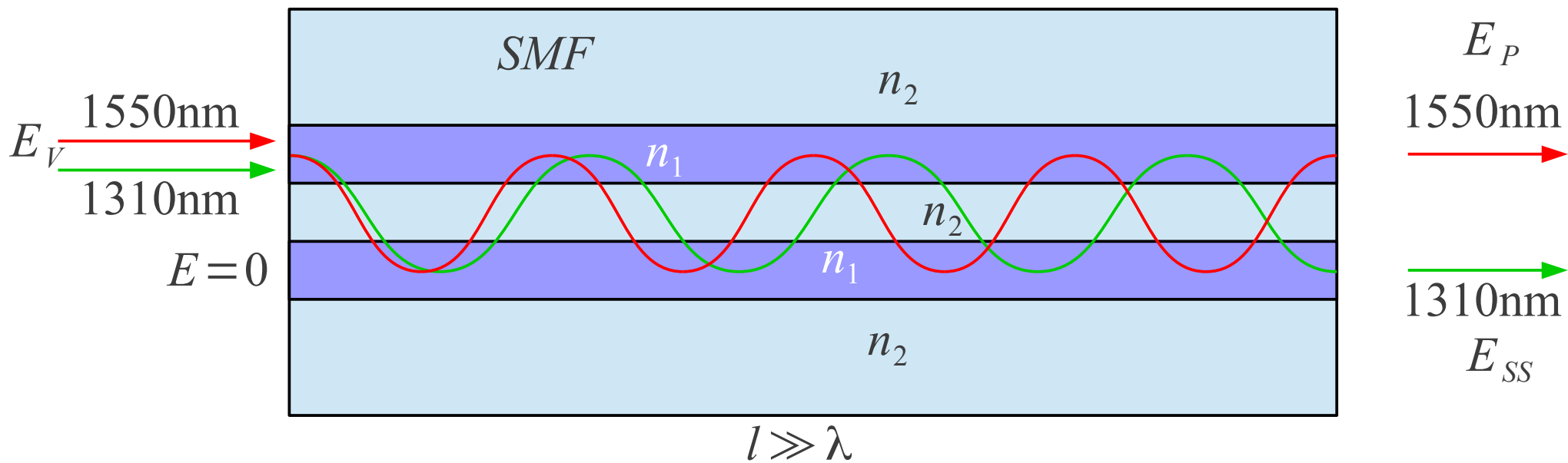
$$P = \alpha |E|^2 \quad E_{SS} = E_{sodi}(l) - E_{lihi}(l) = -jE_V e^{-j\beta l} \sin \Delta\beta l/2$$

$$P_P = P_V \cos^2 \Delta\beta l/2 = P_V \left(\frac{1}{2} + \frac{1}{2} \cos \Delta\beta l \right)$$

$$P_{SS} = P_V \sin^2 \Delta\beta l/2 = P_V \left(\frac{1}{2} - \frac{1}{2} \cos \Delta\beta l \right)$$

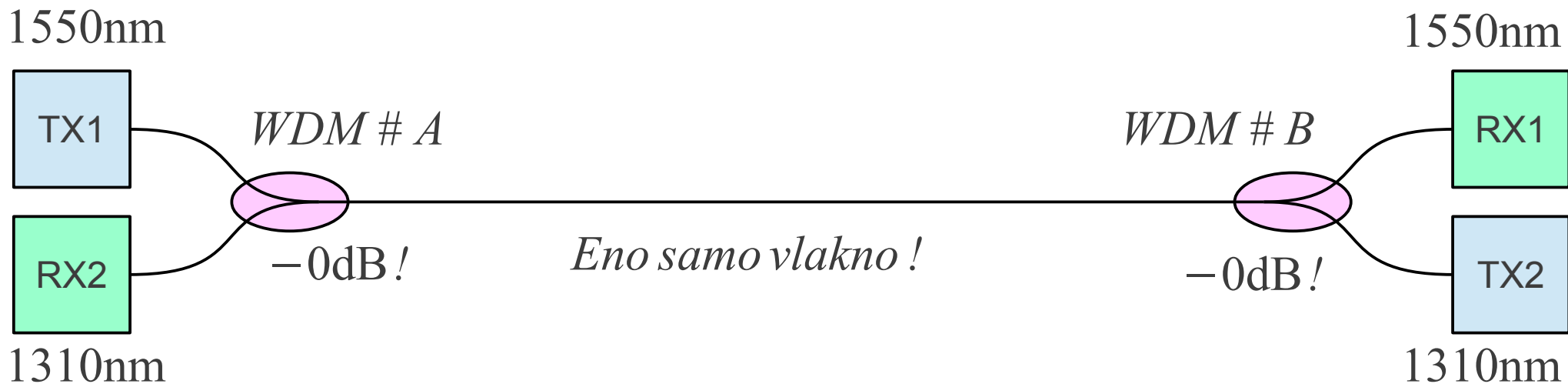
$$P_P + P_{SS} = P_V$$

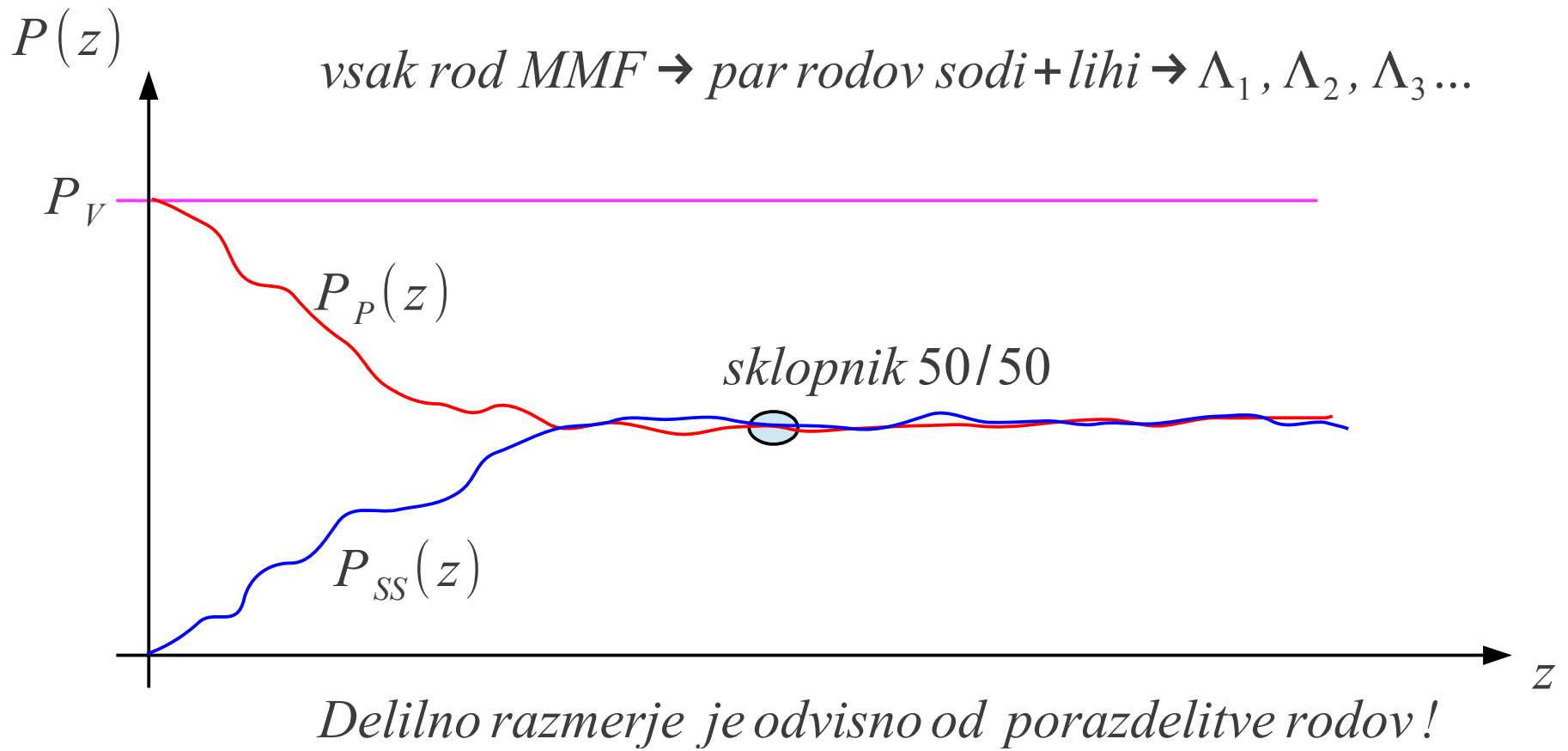
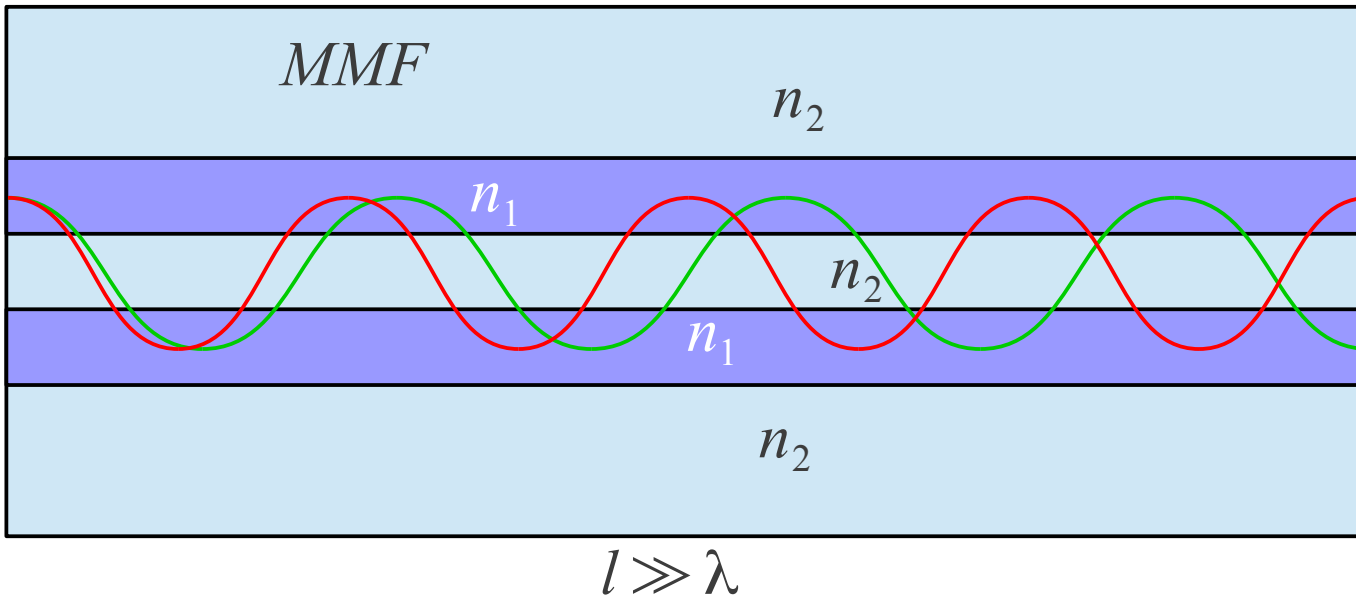


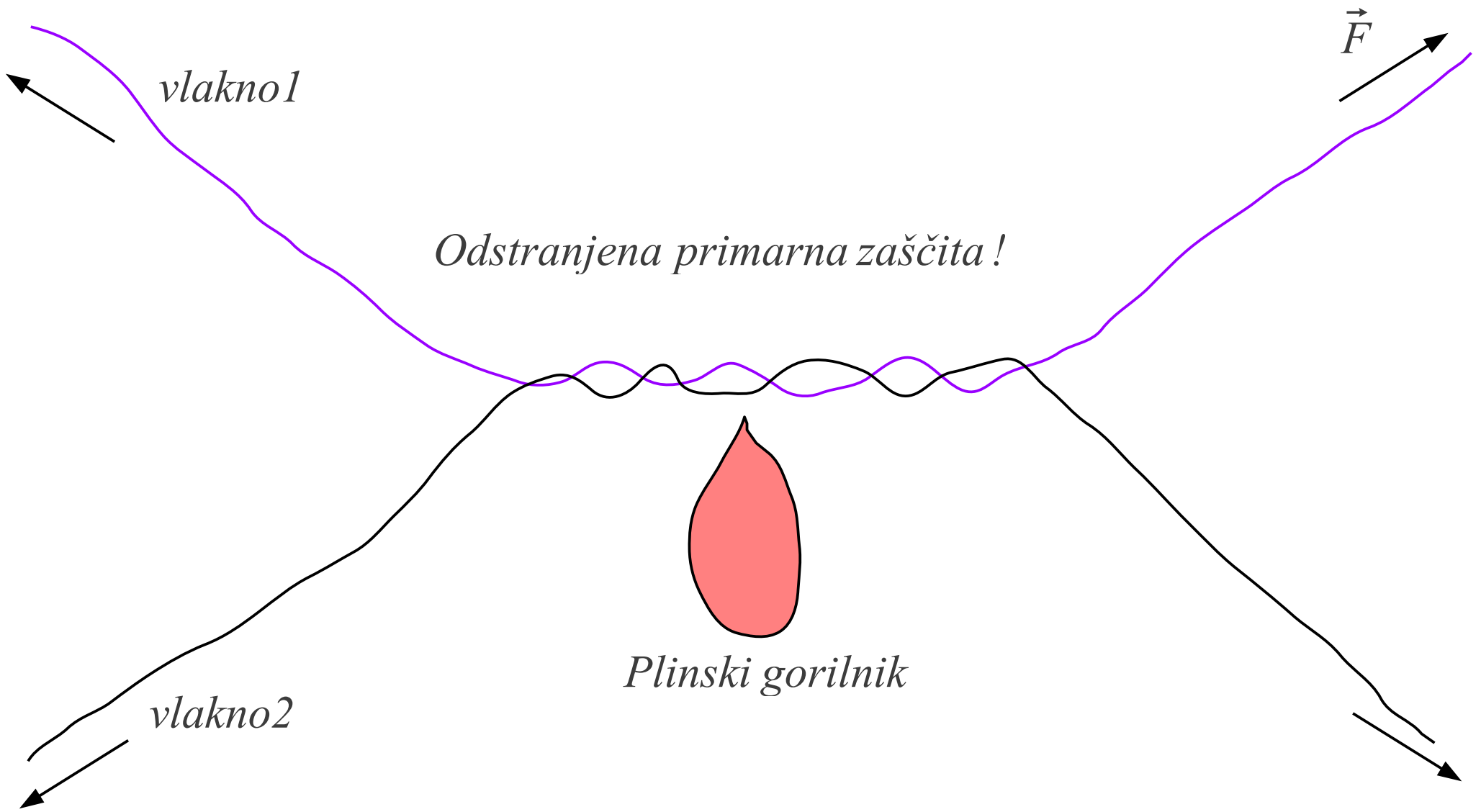


frekvenčna kretnica \equiv *valovnodolžinska kretnica* \equiv *WDM*

$$\lambda_2 = 1550\text{nm} > \lambda_1 = 1310\text{nm} \rightarrow \Lambda_2 < \Lambda_1$$







vlakno1

\vec{F}

Odstranjena primarna zaščita!

Plinski gorilnik

vlakno2