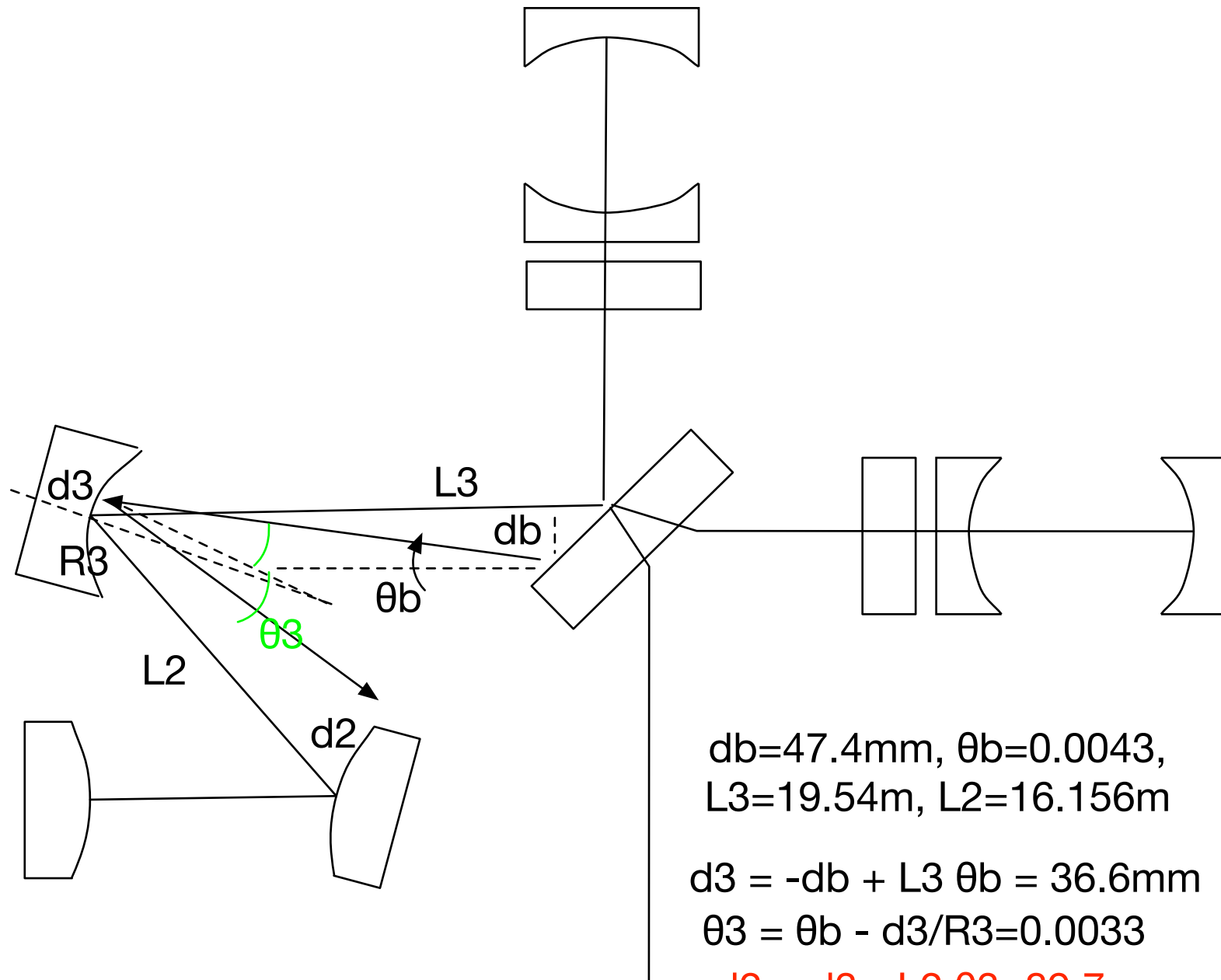


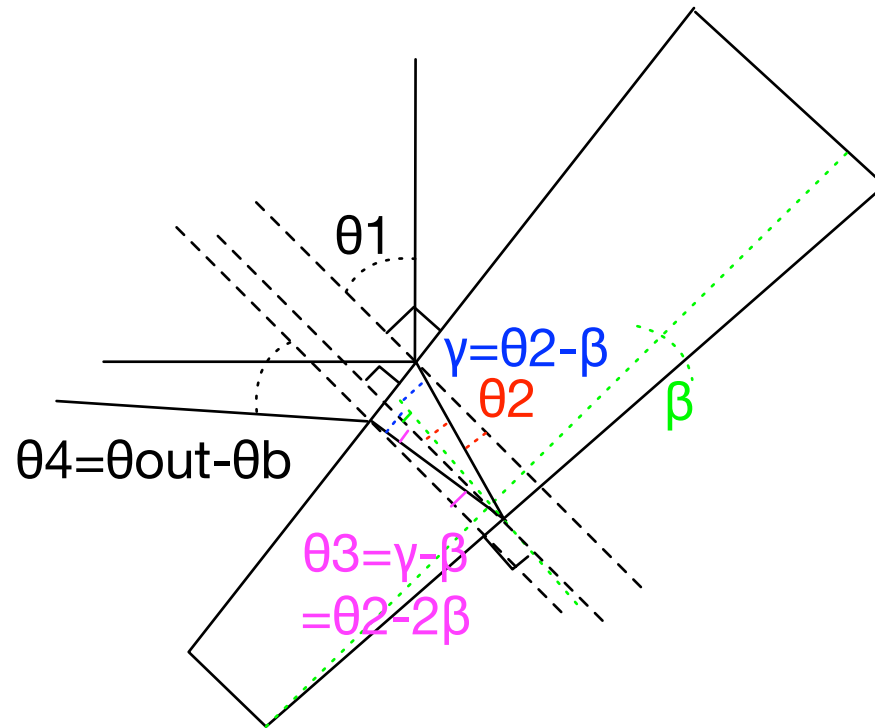


$$db=47.4\text{mm}, \theta_b=0.0043, \\ L3=19.54\text{m}, L2=16.156\text{m}$$

$$d3 = -db + L3 \theta_b = 36.6\text{mm}$$

$$\theta3 = \theta_b - d3/R3=0.0033$$

$$d2 = d3 - L2 \theta3=89.7\text{mm}$$



$$\begin{aligned}\sin(\theta_4) &= \sin(\theta_{out} - \theta_b) = \sin(\theta_{out}) - \cos(\theta_{out})\theta_b \\ &= n \cdot \sin(\theta_3) = n \cdot \sin(\theta_2 - 2\beta) = n \cdot (\sin(\theta_2) - 2\beta \cos(\theta_2))\end{aligned}$$

$$\sin(\theta_1) = n \cdot \sin(\theta_2)$$

$$\sin(\theta_{out}) = \sin(\theta_1)$$

$$\begin{aligned}\theta_b &= 2\beta n \cos(\theta_2) / \cos(\theta_{out}) \\ &= 2\beta \sqrt{n^2 - \sin(\theta_1)^2} / \cos(\theta_{out}) \\ &= 3.55\beta = 0.0043\end{aligned}$$