

a)

Rayleigh-Kriterium

$$\Delta x = 0.61 \cdot \lambda / NA$$

$$NA = 0.61 \cdot \lambda / \Delta x$$

Höchste Wellenlänge limitiert Auflösung

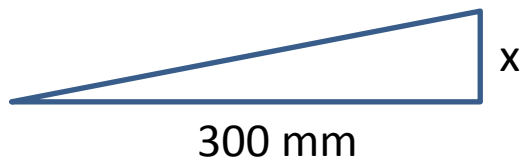
$$\lambda = 760 \text{ nm}$$

$$NA = 0.61 \cdot \lambda / \Delta x$$

$$NA_{\min} = 0.61 \cdot \lambda / \Delta x = 0.091$$

b)

$$NA_{\min} = 0.61 \cdot \lambda / \Delta x = 0.091$$



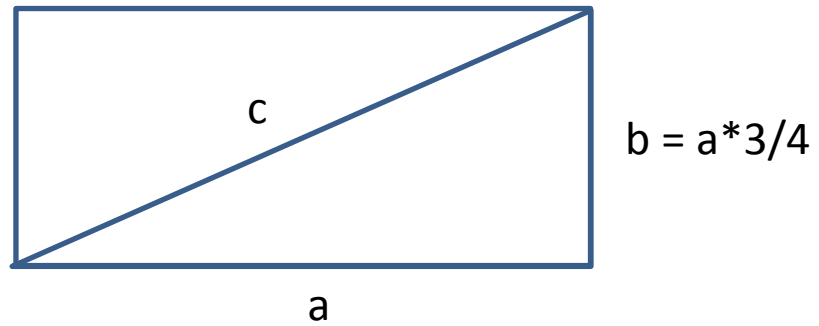
$$NA = n \cdot \sin(\alpha)$$

$$\alpha = \arcsin(NA/n) = 5.22^\circ$$

$$x = \tan(\alpha) \cdot 300 \text{ mm}$$

$$EPD = 2 \cdot x = 2 \cdot 27,41 = 54,8 \text{ mm}$$

c)



$$a^2 + b^2 = c^2$$

$$a^2 \cdot \left(1 + \frac{9}{16}\right) = c^2$$

$$a = \sqrt{c^2 / \left(1 + \frac{9}{16}\right)} = 6,4 \text{ mm}$$

$$b = a \cdot \frac{3}{4} = 4,8 \text{ mm}$$

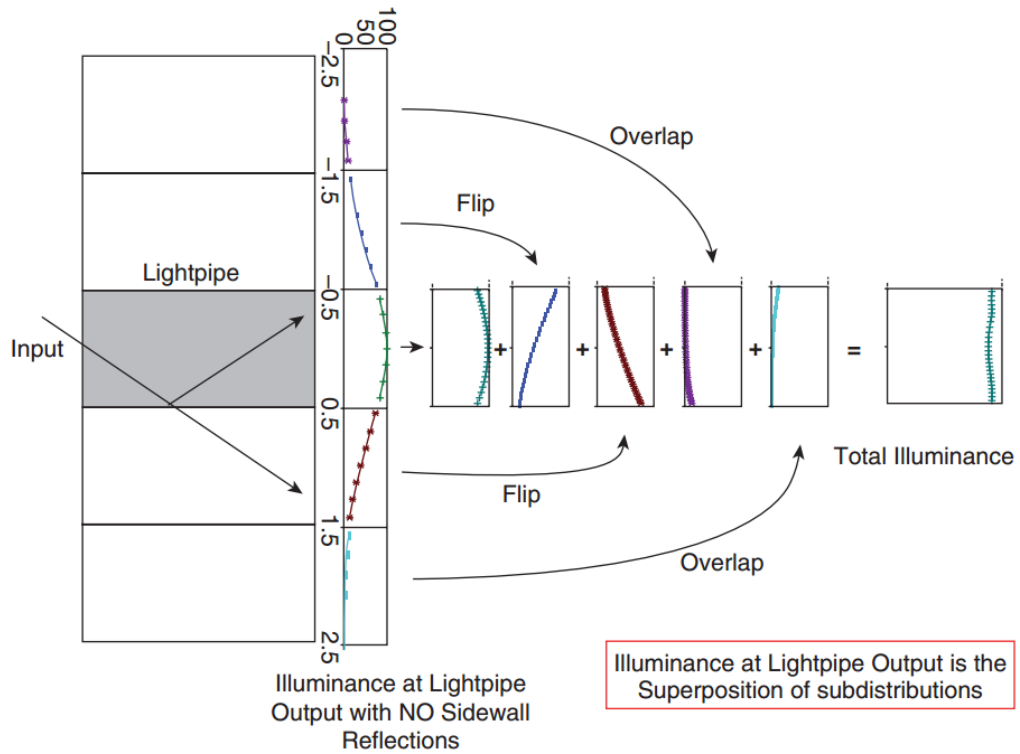
$$A = a \cdot b = 30,72 \text{ mm}^2 = 30,72 (1000\mu\text{m})^2 = 30,72 \text{ e6 } \mu\text{m}^2$$

$$A_{\text{pixel}} = A / 3\text{MPX} = 30,72 \text{ e6 } \mu\text{m}^2 / 3\text{e6} = 10,24 \mu\text{m}^2$$

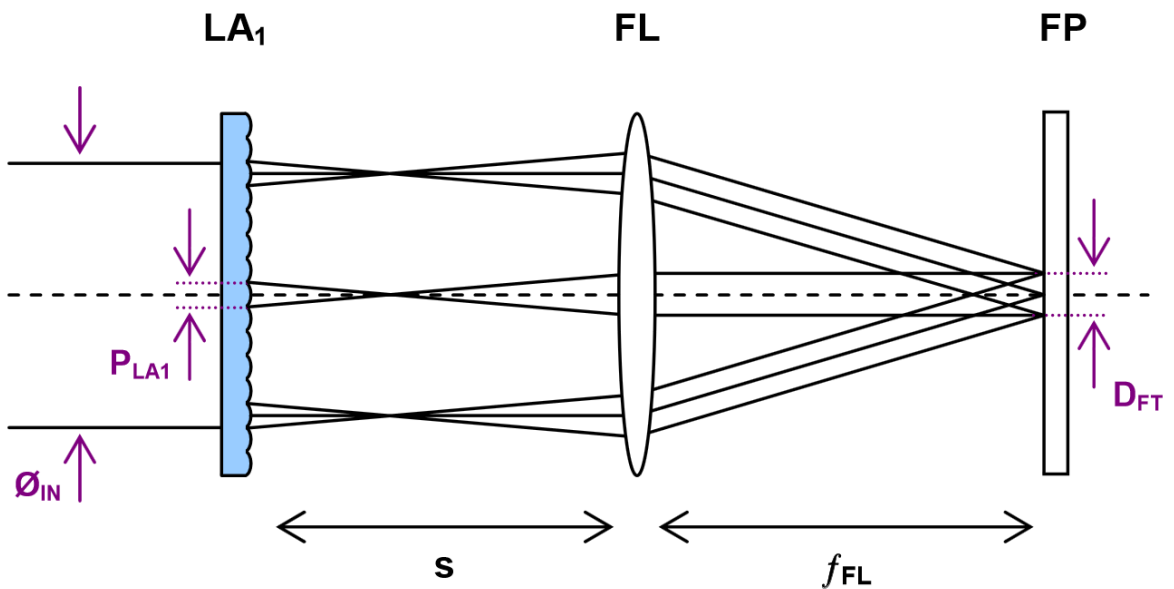
$$sl = \sqrt{A_{\text{pixel}}} = 3,2 \mu\text{m}$$

d)

Standard: Light-Pipes

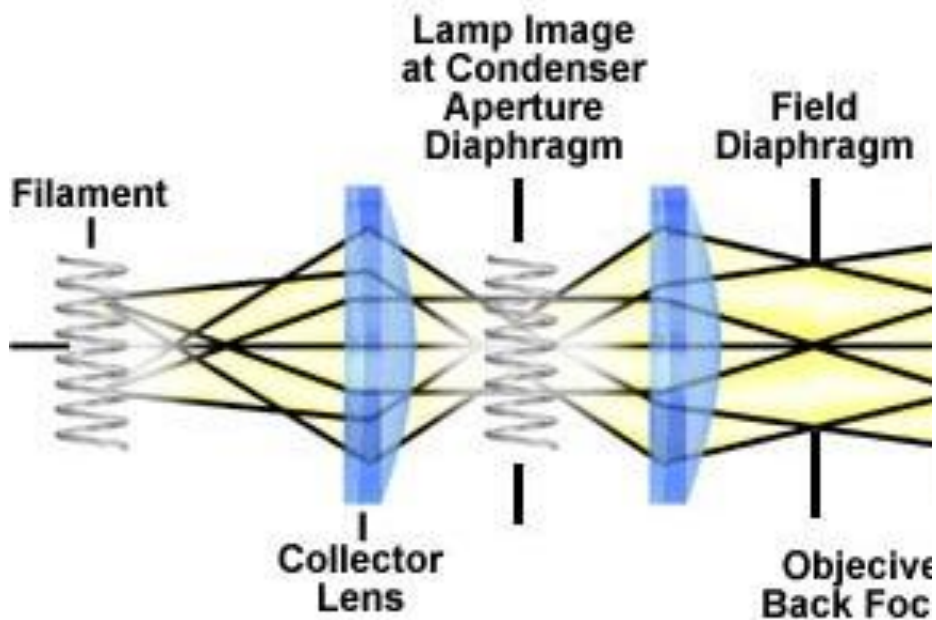


Möglichkeit 2: Mikrolinsen-Array



d)

Der Klassiker: Köhler-Beleuchtung



e)

Gewünschte Gesamtleistung auf Chip: $1 \mu\text{W}/\text{pix} * 3\text{e}6 \text{ pix}$
 $= 3 \text{ W}$

$$N * 1\text{W} * 0.85 * 0.5 * 0.8 = 3 \text{ W}$$

$N = 8.82 \rightarrow$ mindestens 9 LEDs, 3X3 array z.B.