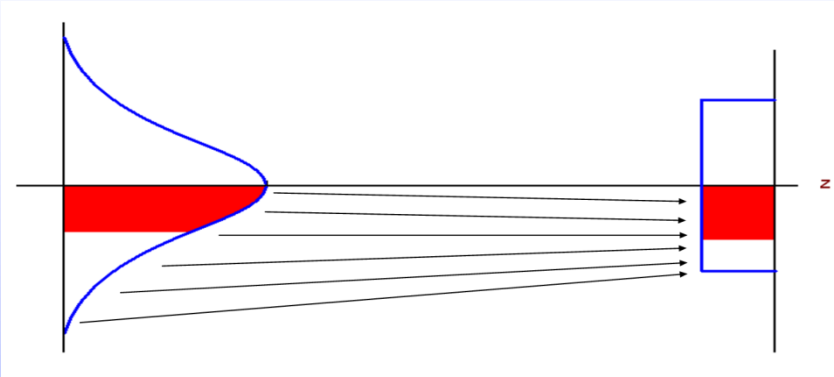
Product Technical Description

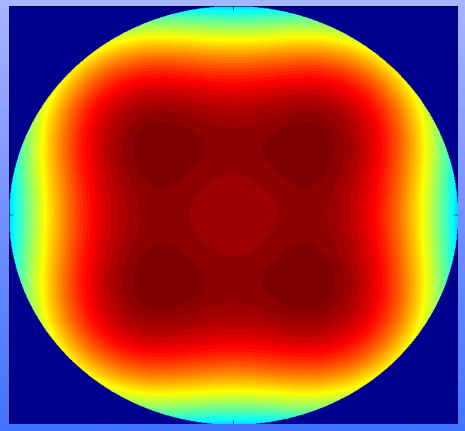
Gauss-to-Top-Hat beam shaper lens

GTH-5-250/4

1. Principle of beam shaper operation and lens shape

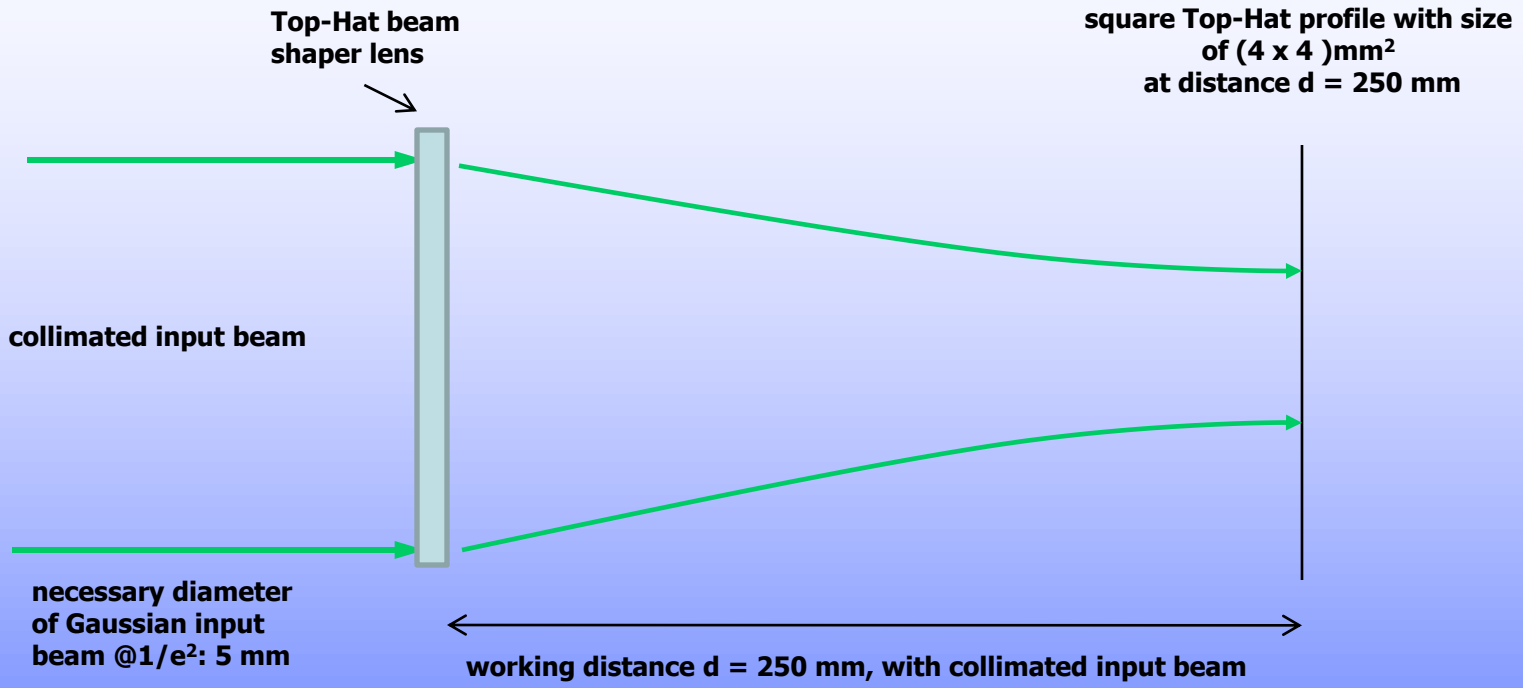


The beam shaper lens is a free form refractive glass optic which redistributes the energy of a Gaussian input beam to a Top-Hat beam profile (mapping)



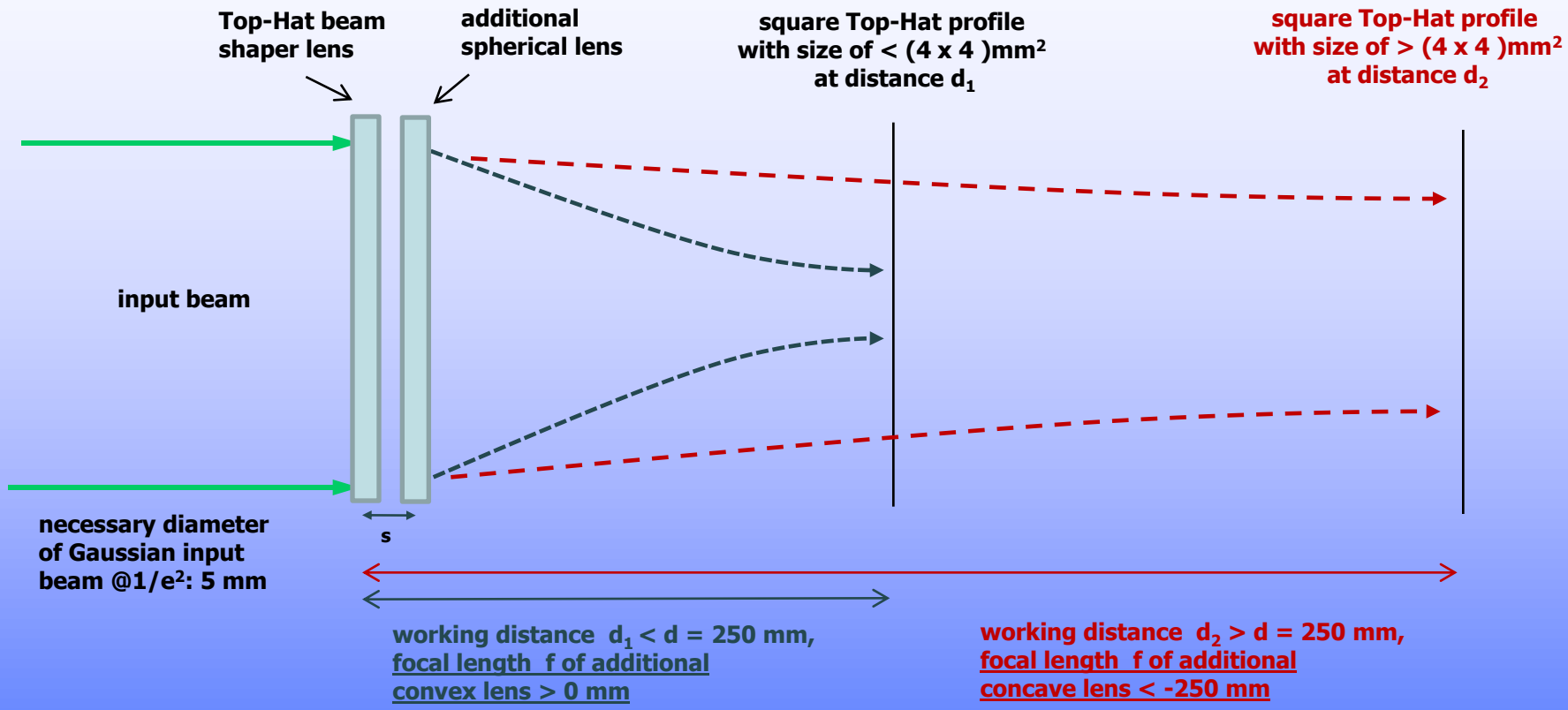
Surface contour plot of beam shaper lens. (free form optic)

2. Optical setup for Top-Hat beam shaper GTH-5-250/4



If a collimated Gaussian beam is used, the Top-Hat beam shaper lens delivers at the working distance d= 250 mm a square Top-Hat beam profile with the size of (4x4) mm².
The Top-Hat beam shaper lens works also for divergent and convergent Gaussian beams. Important: One has to consider that input beam diameter at beam shaper lens plane must be 5mm@1/e².
For divergent (or convergent) beams the size of Top-Hat and working distance increase (or decrease).

3. Adjustment of square Top-Hat size by additional spherical lens



The working distance and the size of the Top-Hat profile can be changed (same ratio) by an additional spherical lens. For a convex lens the size of the Top-Hat profile and the working distance becomes smaller. For a concave lens the size of the Top-Hat profile and the working distance becomes bigger.

3a. Adjustment of square Top-Hat size by additional spherical lens

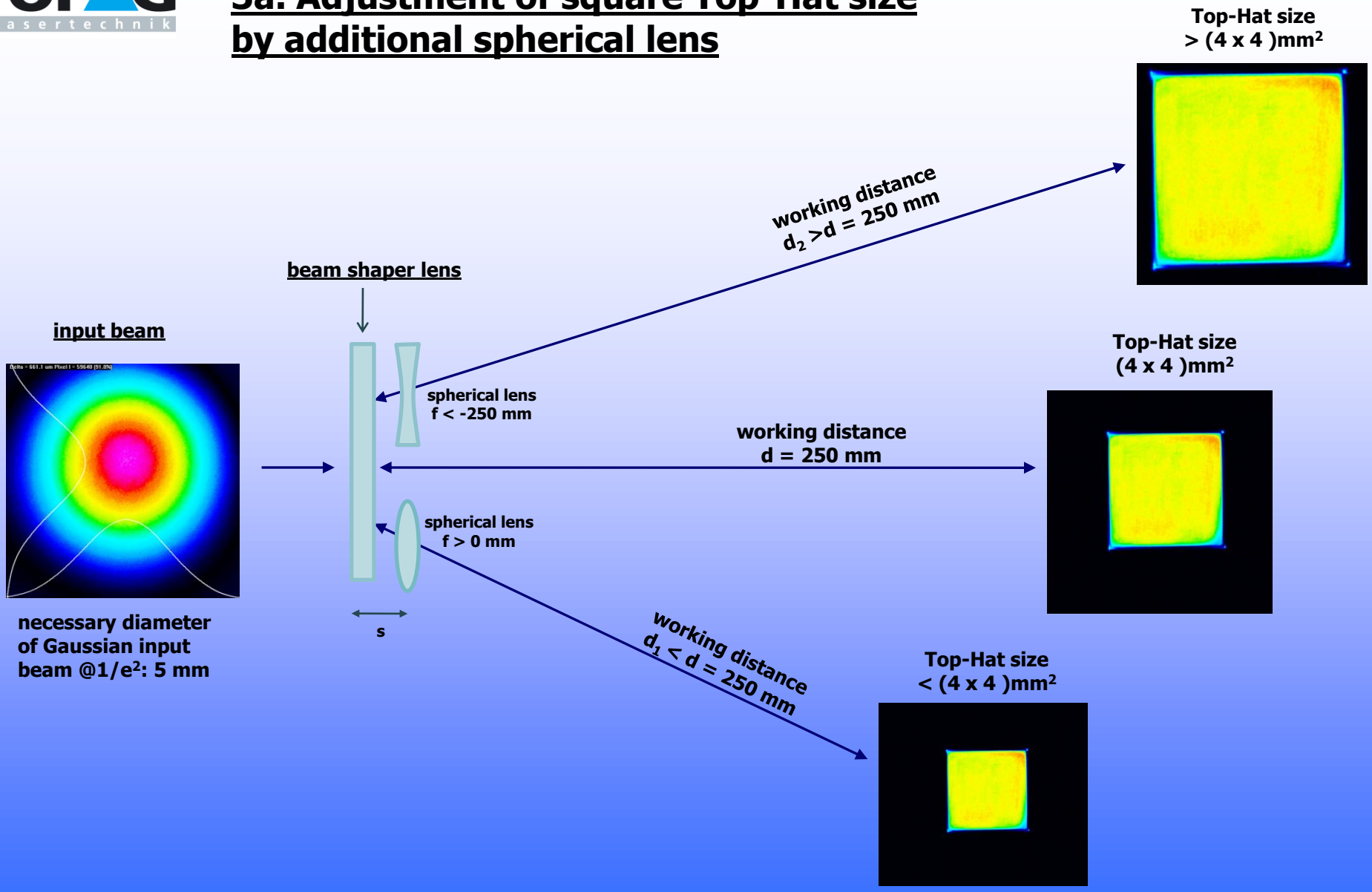
The new working distance and the size of the Top-Hat profile can be calculated:

for focal length f > 0 mm (additional convex lens) respectively focal length f < -250 mm (additional concave lens); s -> 0

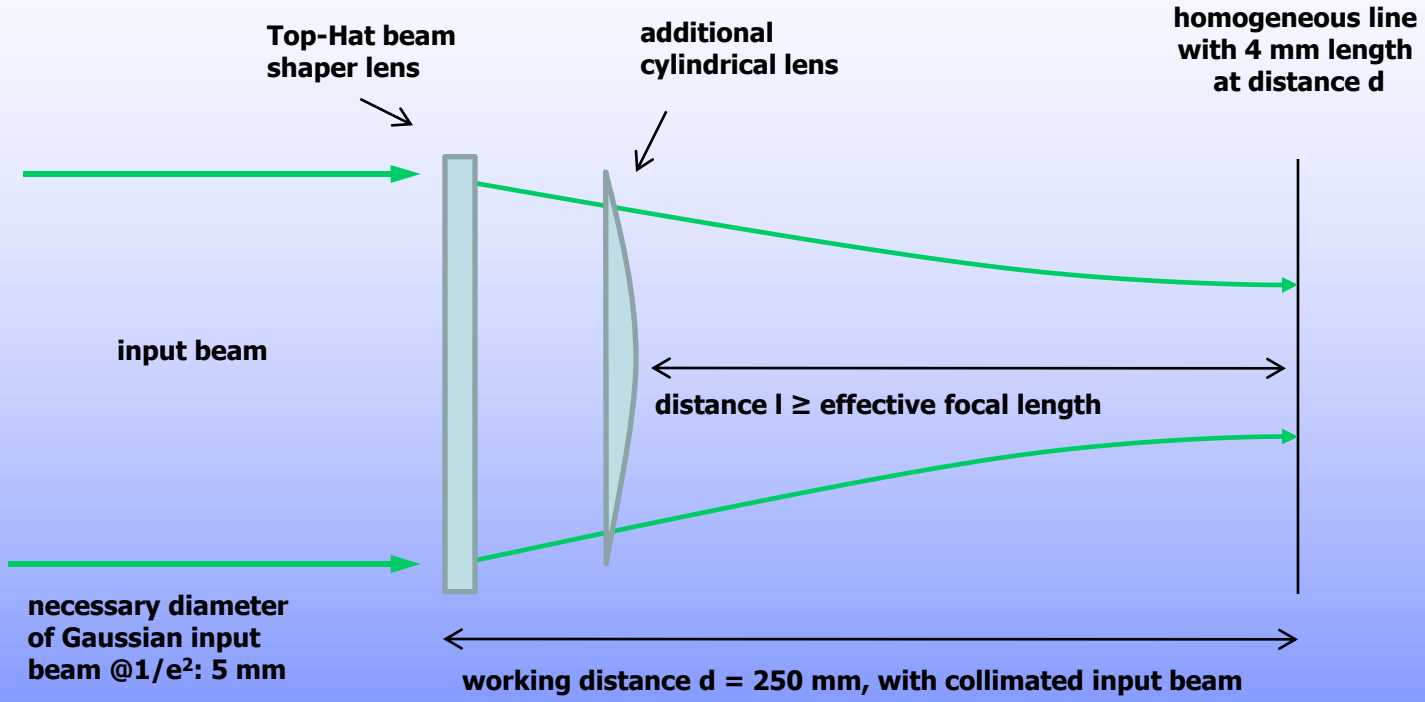
$$\text{Working distance} = \frac{250\,mm \cdot f}{250\,mm + f}$$

$$\text{Square Top Hat Size} = \left(\frac{4mm \cdot \text{working distance}}{250\,mm} \right)^2 = \left(\frac{4mm \cdot f}{250\,mm + f} \right)^2$$

3a. Adjustment of square Top-Hat size by additional spherical lens

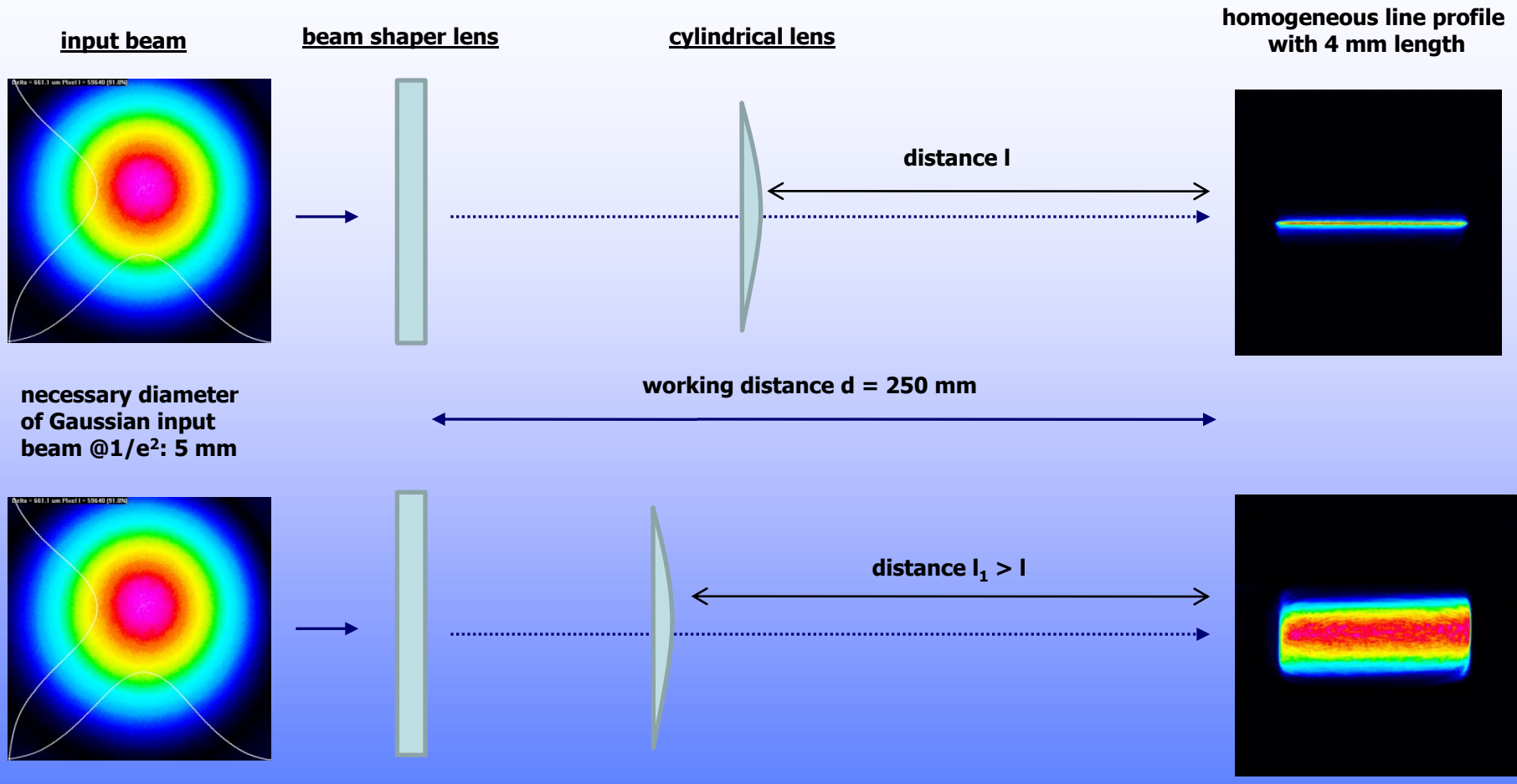


4. Homogeneous line generation with Top-Hat beam shaper lens and additional cylindrical lens



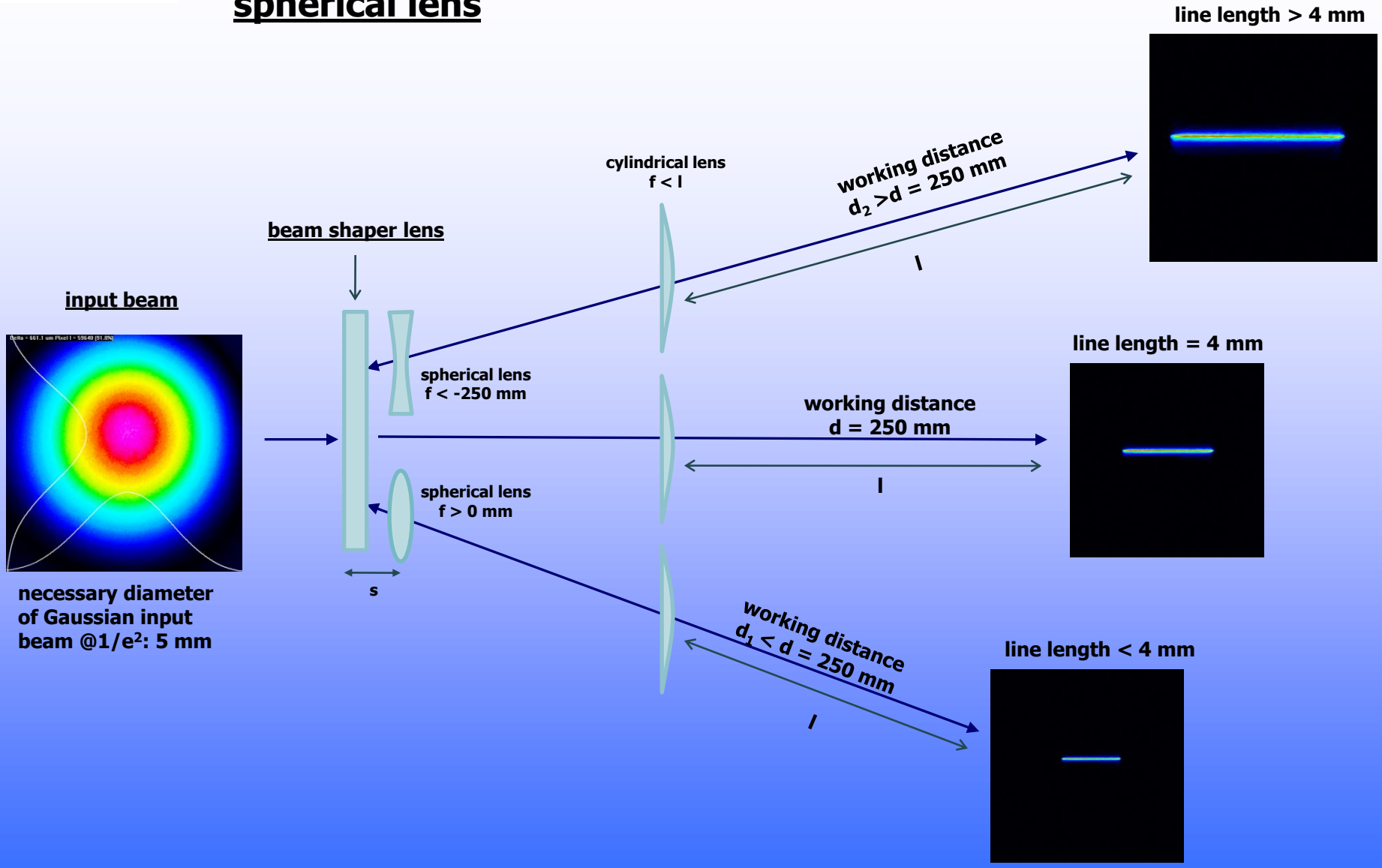
By introducing an additional cylindrical lens behind/before the Top-Hat beam shaper lens it's possibel to generate a line profile at working plane. Along the long axis the intensity profile is homogeneous. Along short axis, which is focused by cylindrical lens, the profile is near Gaussian.

4a. Homogeneous line generation with Top-Hat beam shaper lens and additional cylindrical lens



By variing the distance l the width of line profile (short axis) can be changed from near diffraction limited size to several millimeters.

5. Adjustment of length of homogeneous line by additional spherical lens



6. Specification beam shaper lens

GTH-5-250/4

- input beam: TEM_{00}, diameter ($1/e^2$): 5.0 mm +/- 0.15 mm
- working distance: 250 mm (adjustable with additional lens)
- top hat size at 250 mm working distance: 4 x 4 mm^2 (adjustable)
- efficiency > 95% of input energy within tophat profile
- homogenity +/- 5 % (rel. to average intensity within tophat)
- damage threshhold 3 J/cm^2 @ 532nm, 10 ns
- material LF5 (Schott glass, n= 1.5659 @1060 nm, 1.5848 @546 nm, 1.6192 @365 nm)
- recommended wavelength range 400…1550 nm
- diameter (12.0 -0.1) mm, thickness (4.0 +/- 0.1) mm
- clear aperture 11.0 mm
- AR/AR coating @ (400-700) nm or (700-1300) nm, others on request
- beam shaper mounted in ring holder, diameter 1 inch
- accessories: adjustable x-y holder (990-0050), beam expander