GTH-5-250-4 GAUSS-TO-TOP-HAT BEAM SHAPING LENS

Square top hat size and correspondingly working distance can be changed by placing extra lens or objective behind beam shaping lens GTH-5-250-4.

Dependence of square size and working distance vs focal length of additional lens or objective:

Focal length, mm	**Top hat square size,** mm	**Working distance,** mm
+50	0.67 x 0.67	42
+100	1.1 x 1.1	71
+200	1.8 x 1.8	111
+300	2.2 x 2.2	136
-1000	5.3 x 5.3	333
-500	8.0 x 8.0	500

GTH-5-250-4 OPERATION SPECIFICATIONS

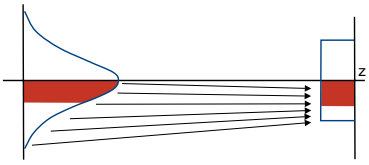
Recommended operation wavelength range	400-1500 nm
Input beam	TEM_{00}, diameter (1/e²): 5.0 ± 0.15 mm
Output beam	Top hat size at 250 mm working distance: 4 × 4 mm² (adjustable with additional lens)
Working distance	250 mm (adjustable with additional lens)
Beam energy distribution efficiency	> 95% of input energy within Top Hat profile
Beam homogenity	± 5 % (rel. to average intensity within top hat)
Lens diameter	12.0 +0.0/-0.1 mm
Thickness	4.0 ± 0.1 mm

Catalogue number	**Description**	**Price,** EUR
GTH-5-250-4	uncoated lens	450
GTH-5-250-4-VIS	VIS coated lens (400-700 nm (R<1% per face))	495
GTH-5-250-4-IR	IR coated lens (700-1300 nm (R<1% per face))	495

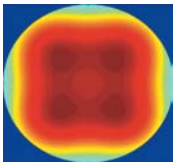
Other specific laser wavelengths are available on request.

GTH-5-250-4 OPERATION INSTRUCTIONS

Principles of Beam Shaper Operation and Lens Shape

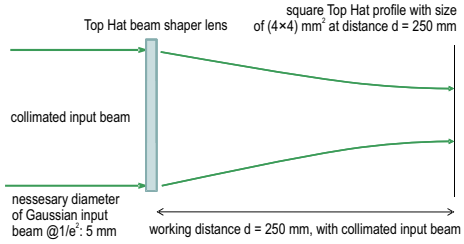


Energy of Gaussian input beam is re-distributed to a Top Hat beam profile by beam shaper lens (mapping).



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

Optical Setup for Gauss-toTop Hat Beam Shaper Lens

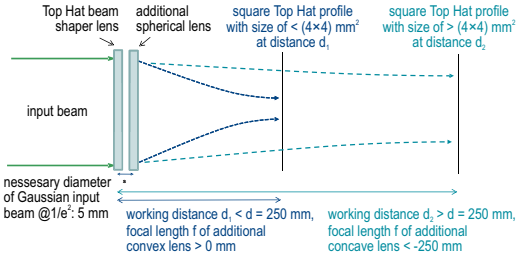


If a collimated Gaussian beam is used the Top Hat beam shaper lens delivers at the working distance d = 250 mm a square Top Hat beam profile with the size of (4×4) mm².

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 5 mm @ 1/e².

For divergent (or convergent) beams the size of Top Hat and working distance increase (or decrease).

Adjustment of Square Top Hat Size by Additional Spherical Lens



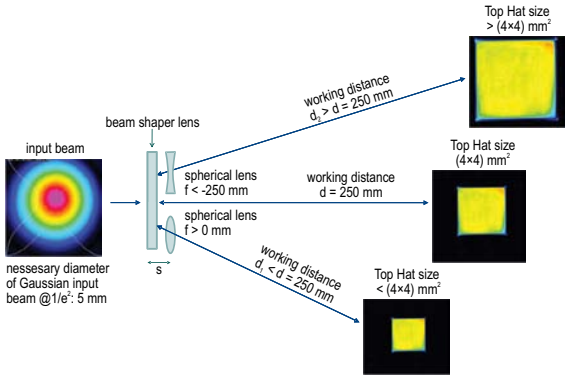
The working distance and the size of the Top Hat profile can be changed (same ratio) by an additional spherical lens. For a convex lens the size of the Top Hat profile and the working distance becomes smaller. For a concave lens the size of the Top Hat profile and the working distance becomes bigger.

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

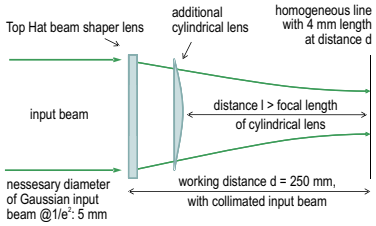
$$\text{Working distance} = \frac{250\,mm \cdot f}{250\,mm + f}$$

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

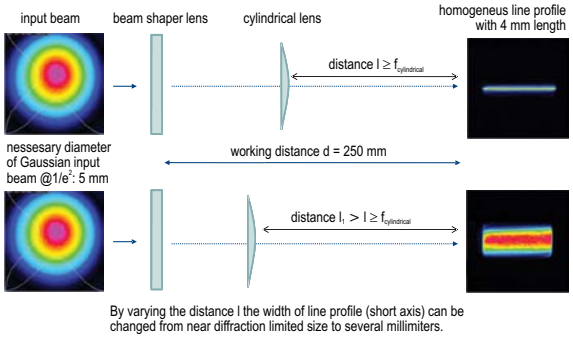
$$\text{Square Top Hat Size} = \left(\frac{4mm \cdot \text{working distance}}{250\,mm}\right)^2 = \left(\frac{4mm \cdot f}{250\,mm + f}\right)^2$$



Homogeneous Line Generation with Top Hat Beam Shapper Lens and Additional Cylindrical Lens

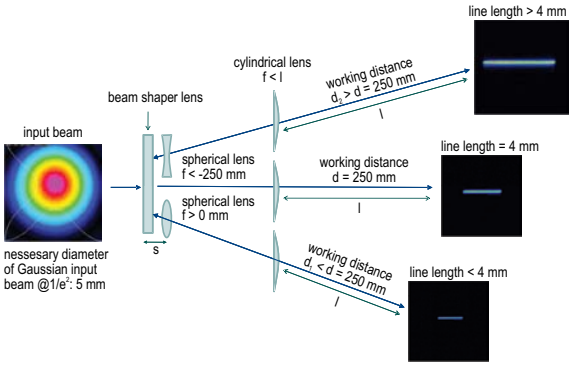


By introducing an additional cylindrical lens behind the Top Hat beam shaper lens (thereby one has to consider that the distance l between cylindrical lens and working plane must be bigger or same as focal length of cylindrical lens) it's possible to generate a line profile at working plane. Along the long axis the intensity profile is homogeneous. Along short axis, which is focused by cylindrical lens, the profile is near Gaussian.



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

Adjustment of Length of Homogeneous Line by Additional Spherical Lens



GTH-4-2.2FA GAUSS-TO-TOP-HAT BEAM SHAPING LENS

Working distance is given by focal length of additional lens which is needed always. Top Hat appears always at focal plane of additional lens.

For instance if an additional lens f = 100 is used, Top Hat appears at 100 mm behind additional lens. So GTH-4-2.2FA could be easily put in front of objectives for example.

The distance between GTH-4-2.2FA and additional lens is not critical (up to several tens of centimeters).

The full fan angle of Top-Hat generation for GTH-4-2.2FA is 2.2 mrad. This leads to Top-Hat sizes:

– 110×110 µm for lens with f = 50 at 50 mm distance
– 220×220 µm for lens with f = 100 at 100 mm distance
– 2.2×2.2 mm for lens with f = 1000 at 1000 mm distance
– 4.4×4.4 mm for lens with f = 2000 at 2000 mm distance

GTH-4-2.2FA OPERATION SPECIFICATIONS

Recommended operation wavelength range	400-1550 nm
Input beam	TEM_{00}, diameter (1/e²): 4.0 ± 0.15 mm
Achievable Top Hat size	6x diffraction limited @ 1064 nm, 12x diffraction limited @ 532 nm
Full fan angle of Top-Hat generation	2.2 mrad
Beam energy distribution efficiency	> 95% of input energy within Top Hat profile
Beam homogenity	± 5 % (rel. to average intensity within Top Hat)
Lens diameter	12.0 +0.0/-0.1 mm
Lens thickness	4.0 ± 0.1 mm

Catalogue number	Description	Price, EUR
GTH-4-2.2FA	uncoated lens	450
GTH-4-2.2FA-VIS	VIS coated lens (400-700 nm (R<1% per face))	495
GTH-4-2.2FA-IR	IR coated lens (700-1300 nm (R<1% per face))	495

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