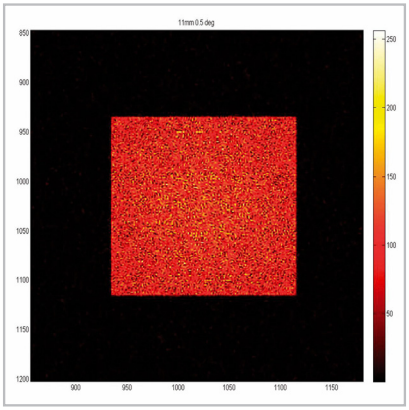
High Power Homogenizer

Smoothened Cross Section to Avoid Hot Spots



Simulation of intensity profile of HM-106 homogenizer type

Homogenizers – also known as diffusers – smoothen the cross section.

These elements are commonly used in medical application such as hair or tattoo removal. In such application, it is crucial to avoid hot spots to prevent the burning of the skin.

Holo/Or introduces a new series HM homogenizers that consist of pure fused silica (or ZnSe) with an optional high power AR coating on both surfaces, which makes them superior to competing solutions. This can reduce the back reflection to typically 0.2 % (0.1 % per surface). Back reflection usually hinders the stable operation of the laser and should therefore be reduced to a minimum, as in this design.

Besides the HM-Serie, Holo/Or has elliptical diffuser ED and round diffuser RD in their programm. The only difference to the HM Serie is that the beam output is not square but round or elliptical.

In 2011, Holo/Or has developed a new Homogenizer product line with improved homogeneity performance, by utilizing the substrate window's opposite face to add another homogenizing diffractive pattern, optimized in angle and size for best output performance. The HH product's improved homogeneity, is an important functional advantage in many applications.

Features

- High damage threshold
- Low back reflection
- AR/AR coated option
- High efficiency
- Works at any distance
- Accepts any beam shape
- Pure fused silica or ZnSe for 10.6 mm
- Small diffusing angle
- Low "0" order
- Custom angles, wavelengths, and dimensions possible

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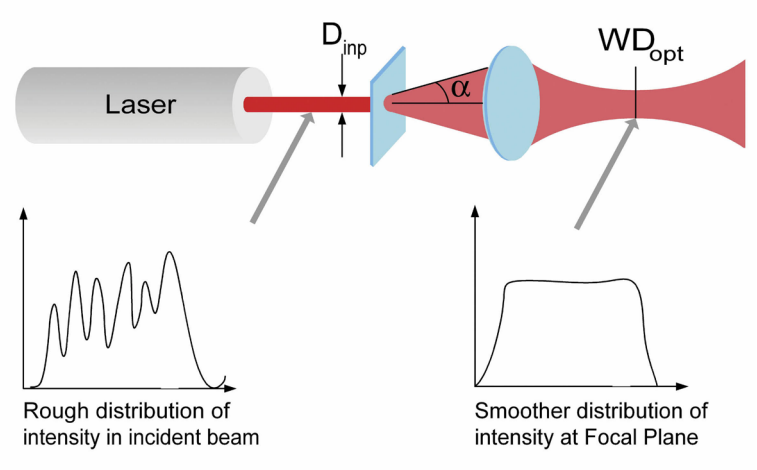
Design Details

The optical scheme for the homogenizer shall be according to below figure. The input beam doesn't have to be defined clearly.

The homogenizer smoothens the profile from the moment it leaves the element.



Optical set up for mohogenizer / diffusor

- Homogenizers are not very sensitive on the incident beam profile.
- From the optimal working distance (WD_{opt}) onwards, homogeneity of a high quality is achieved.
- Through smoothing of the hot spots, the output beam is improved.
- Homogenizers are available with different diffusing angles, which define the recommended operating distance (with $WD_{opt} = D_{inp}/\tan\alpha$)
- At shorter distances as WD_{opt} there will be certain homogenization
- At longer distances as WD_{opt} the homogenization will be even stronger, but the beam will become significantly larger as well.
- The WD_{opt} can be reduced by the use of a positive lens, to the focal plane of the lens.
- The homogenizers are available in different degrees of quality. They vary in intensity of the zero order.
- For standard parts the output beam has a square spot. Round and Elliptical diffusers are also available from Holo/Or.

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Typical Performance

	AR/AR coated	Uncoated (not for 10.6 mm)	Possible for custom design
Transmission Efficiency	> 95 %	> 84 %	> 95 %
Part of energy expected within defined angle	80 %	72 %	95 %
Zero Order	Depend on grade	Depend on grade	< 2.5 %
Back reflection	< 0.5 %	< 9 %	< 0.2 %
Typ. substrate diameter /dimensions	Dia. 25.4 +0/-0.1 mm → clear aperture 23 mm Dia. 11 +0/-0.1 mm → clear aperture 8.5 mm		
Substrate thickness	typ. 3.0 mm		
Material	Fused silica, ZnSe, Sapphire		
Damage threshold	> 4 kW for 10.6 µm > 10 J/cm² at 5 ns and 1064 nm		

Options

Grade A	Less than 5 % energy in zero order at 1064 nm Less than 7.5 % energy in zero order at 532 nm Less than 15 % energy in zero order at 266 nm
Grade B	Less than 20 % energy in zero order

Standard Parts

Part Number Nomenclature

HM -	201 -	A -	x -	A
function	design descripition	wavelength code	coating code	grade
HM: square homogenizer RD: round diffusor ED: elliptical diffusor HH: high homogenizer DF: square diffusor XH: hexagonal homogenizer RH: round homogenizer		A: 10.6 µm D: 2940 nm I: 1064 nm Q: 532 nm U: 355 nm Z: 193 nm	Y: with AR coating N: uncoated typical all parts come with AR coating	see options

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Note:

Holo/Or is very flexible to tailor elements to very narrow defined requests of a customer. After having your detailed needs we can clarify what is possible.

If you look for a more robust solution a stable top could be suitable solution, please contact us for further details.

Part No.	Wavelength	Diffusion Full Angle (°)	Dimensions (mm)	Shape	Size (mm)	Material
HM-212-A-Y-A	10600	5x5	25.4	Square	6	ZnSe
HM-207-A-Y-B	10600	5x5	15	Square	9	ZnSe
ED-203-A-Y-A	10600	12.25X7.85	25.4	Elliptical		ZnSe
ED-201-A-Y-A	10600	12.25X7.85	15	Elliptical		ZnSe
DF-202-A-Y-A	10600	20x20	11	Square		Fused Silica
RD-221-X-Y-A	4500	0.69	11	Round	4.5-5.5	Fused Silica
RD-220-X-Y-A	4500	1.38	11	Round	4.5-5.5	Fused Silica
HM-215-X-N-A	4150	1.95x1.95	11	Square	6	Fused Silica
HM-202-D-Y-A	2940	5.5x5.5	11	Square	5	Fused Silica
DF-202-H-Y-B	1320	2.49x2.49	11	Square		Fused Silica
XH-201-I-Y-A	1064	2.15	18	Hexagonal	2	Fused Silica
RH-219-I-Y-A	1064	1	25.4	Round	10	Fused Silica
RH-217-I-Y-A	1064	2	25.4	Round	6	Fused Silica
RH-215-I-Y-A	1064	4	25.4	Round	4	Fused Silica
RH-206-I-Y-A	1064	2	11	Round	6	Fused Silica
RH-204-I-Y-A	1064	2	25.4	Round	6	Fused Silica
RD-216-I-Y-A	1064	1.6	25.4	Round	5	Fused Silica
RD-215-I-Y-A	1064	4	25.4	Round	4	Fused Silica
RD-208-I-Y-A	1064	16	11	Round	2	Fused Silica
RD-207-I-Y-A	1064	0.6	25.4	Round	12	Fused Silica
RD-206-I-Y-A	1064	2	11	Round	6	Fused Silica
RD-204-I-Y-A	1064	2	25.4	Round	6	Fused Silica
RD-203-I-Y-A	1064	0.5	25.4	Round	10	Fused Silica

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HM-264-I-Y-A	1064	0.6	25.4	Square	5	Fused Silica
HM-263-I-Y-A	1064	0.5	11	Line	3	Fused Silica
HM-260-I-Y-A	1064	2	25.4	Line	5	Fused Silica
HM-214-I-Y-A	1064	2x2	11	Square	5	Fused Silica
HM-213-I-Y-A	1064	1x1	22	Square	5	Fused Silica
HM-212-I-Y-A	1064	0.5x0.5	25.4	Square	6	Fused Silica
HM-211-I-Y-A	1064	2x2	25.4	Square	5	Fused Silica
HM-210-I-Y-A	1064	2x2	11	Square	5	Fused Silica
HM-208-I-Y-A	1064	2.75x2.75	25.4	Square	5	Fused Silica
HM-203-I-Y-A	1064	2x2	25.4	Square	5	Fused Silica
HM-201-I-Y-A	1064	0.5x0.5	25.4	Square	9	Fused Silica
HM-200-I-Y-B	1064	0.5x0.5	11	Square	6	Fused Silica
HM-200-I-Y-A	1064	0.5x0.5	11	Square	6	Fused Silica
HH-214-I-Y-A	1064	2x2	11	Square	5	Fused Silica
HH-211-I-Y-A	1064	2x2	25.4	Square	5	Fused Silica
HH-208-I-Y-A	1064	2.75x2.75	25.4	Square	5	Fused Silica
HD-200-I-Y-A	1064	2.15	18	Hexagonal	2	Fused Silica
ED-203-I-Y-A	1064	1.23X0.79	25.4	Elliptical		Fused Silica
ED-202-I-Y-A	1064	1.23X0.79	11	Elliptical		Fused Silica
DF-200-I-Y-C	1064	0.5x0.5	11	Square		Fused Silica
DF-200-I-Y-A	1064	0.5x0.5	11	Square		Fused Silica
RD-211-K-Y-A	980	0.46	11	Round	10	Fused Silica
HM-211-L-Y-A	940	1.8x1.8	25.4	Square	5	Fused Silica
HM-203-X-Y-A	808	1.52x1.52	25.4	Square	5	Fused Silica
RD-210-X-Y-A	800	0.38	25.4	Round	10	Fused Silica
HM-203-N-Y-A	755	1.42x1.42	25.4	Square	5	Fused Silica
ED-203-N-Y-A	755	0.87X0.56	25.4	Elliptical		Fused Silica
ED-202-N-Y-A	755	0.87X0.56	11	Elliptical		Fused Silica
RD-202-O-Y-A	694	0.4	25.4	Round	12	Fused Silica

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HM-213-O-Y-A	694	0.65x0.65	22	Square	5	Fused Silica
HM-203-O-Y-A	694	1.3x1.3	25.4	Square	5	Fused Silica
ED-203-O-Y-A	694	0.8X0.51	25.4	Elliptical		Fused Silica
ED-202-O-Y-A	694	0.8X0.51	11	Elliptical		Fused Silica
DF-205-O-Y-A	694	0.33x0.33	25.4	Square	4	Fused Silica
DF-201-O-Y-A	694	0.33x0.33	25.4	Square		Fused Silica
DF-200-O-Y-A	694	0.33x0.33	11	Square		Fused Silica
HM-211-P-Y-A	633	1.2x1.2	25.4	Square	5	Fused Silica
HM-259-X-Y-A	542	6x6	25.4	Square		Fused Silica
RH-218-Q-Y-A	532	1	18	Round	6	Fused Silica
RH-217-Q-Y-A	532	1	25.4	Round	6	Fused Silica
RD-202-Q-Y-A	532	0.3	25.4	Round	12	Fused Silica
HM-208-Q-Y-A	532	1.38x1.38	25.4	Square	5	Fused Silica
HM-203-Q-Y-A	532	1x1	25.4	Square	5	Fused Silica
HM-202-Q-Y-A	532	1x1	11	Square	5	Fused Silica
HM-201-Q-Y-A	532	0.25x0.25	25.4	Square	9	Fused Silica
HM-200-Q-Y-A	532	0.25x0.25	11	Square	6	Fused Silica
ED-203-Q-Y-A	532	0.61X0.39	25.4	Elliptical		Fused Silica
ED-202-Q-Y-A	532	0.61X0.39	11	Elliptical		Fused Silica
DF-202-Q-Y-A	532	1x1	11	Square		Fused Silica
DF-201-Q-Y-A	532	0.25x0.25	25.4	Square		Fused Silica
DF-200-Q-Y-B	532	0.25x0.25	11	Square		Fused Silica
DF-200-Q-Y-A	532	0.25x0.25	11	Square		Fused Silica
HM-267-U-Y-A	355	2.86	48	Line	16	Fused Silica
HM-214-U-Y-A	355	0.68x0.68	11	Square	5	Fused Silica
HM-210-U-Y-A	355	0.67x0.67	11	Square	5	Fused Silica
HM-208-U-Y-A	355	0.92x0.92	25.4	Square	5	Fused Silica
HM-203-U-Y-A	355	0.68x0.68	25.4	Square	5	Fused Silica
HM-201-U-Y-A	355	0.17x0.17	25.4	Square	9	Fused Silica

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HM-200-U-Y-A	355	0.17x0.17	11	Square	6	Fused Silica
ED-203-U-Y-A	355	0.41X0.26	25.4	Elliptical		Fused Silica
ED-202-U-Y-A	355	0.41X0.26	11	Elliptical		Fused Silica
DF-201-U-Y-B	355	0.17x0.17	25.4	Square		Fused Silica
RD-207-W-Y-A	266	0.15	25.4	Round	12	Fused Silica
RD-205-W-Y-A	266	0.125	25.4	Round	10	Fused Silica
HM-214-W-Y-A	266	0.5x0.5	11	Square	5	Fused Silica
HM-211-W-Y-A	266	0.5x0.5	25.4	Square	5	Fused Silica
HM-202-W-Y-A	266	0.5x0.5	11	Square	5	Fused Silica
ED-203-W-Y-A	266	0.31X0.2	25.4	Elliptical		Fused Silica
ED-202-W-Y-A	266	0.31X0.2	11	Elliptical		Fused Silica
HM-203-Y-Y-A	248	0.48x0.48	25.4	Square	5	Fused Silica
HM-202-Y-Y-A	248	0.48x0.48	11	Square	5	Fused Silica
HM-201-Y-Y-A	248	0.12x0.12	25.4	Square	9	Fused Silica
ED-203-Y-Y-A	248	0.29X0.18	25.4	Elliptical		Fused Silica
ED-202-Y-Y-A	248	0.29X0.18	11	Elliptical		Fused Silica
HM-203-Z-Y-A	193	0.36x0.36	25.4	Square	5	Fused Silica
HM-202-Z-Y-A	193	0.36x0.36	11	Square	5	Fused Silica
ED-207-Z-Y-A	193	0.15x0.31	25.4x25.4	Elliptical	7	FS Q1-E193
ED-206-Z-Y-A	193	0.53x0.69	25.4	Elliptical	5	UV FS
ED-206-Z-N-A	193	0.53x0.69	25.4	Elliptical	5	UV FS
ED-205-Z-Y-A	193	0.34x0.5	25.4	Elliptical	10	UV FS
ED-205-Z-N-A	193	0.34x0.5	25.4	Elliptical	10	UV FS
ED-204-Z-Y-A	193	0.153x0.311	25.4	Elliptical	6	FS Q1-E193

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