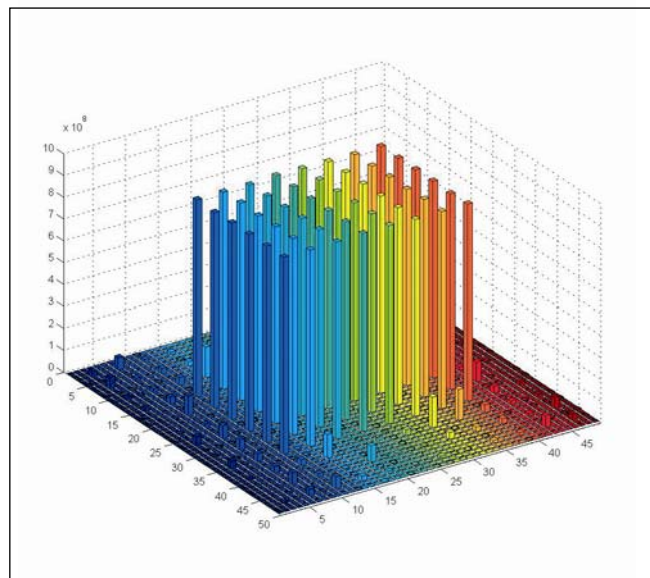


# Diffractive Beam Splitters

## TURNING A MASTER BEAM INTO THE REQUESTED NUMBERS OF SPOTS OR BEAMS

Beam splitting by means of diffractive elements is advantageous when one element is needed to produce several beams or when very exact power separation is required. Precise positioning can also be achieved, for example, to create holes at clearly defined and accurate distances.



Intensity profile of a 6 x 8 spot

## APPLICATIONS

- Laser perforation
- Medical surface treatment
- Parallel processing
- Parallel laser scanning

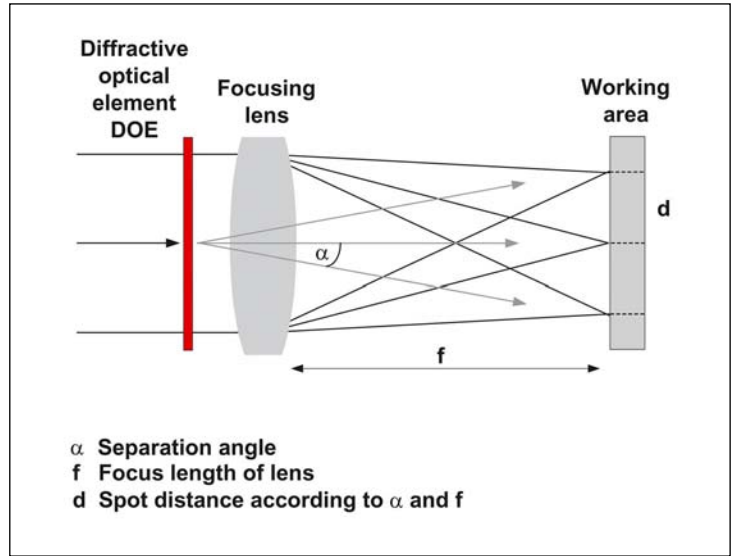
## FEATURES

- Accurate angle separation
- Intrinsic alignment
- High power threshold
- Uniform power in symmetric orders
- Robust design, insensitive for X-Y-Z displacement



DESIGN DETAILS

Using a diffractive element, a collimated incident beam is split into several collimated beams. These beams are characterized by an equal intensity and equal angle to one another. There are both one-dimensional (1D) and two dimensional (2D) elements. 1D elements split beams along a straight line whereas 2D elements produce beams arranged in a matrix of, for example, 2 x 2 or 3 x 3 spots.



- The beam diameter and quality of the output beams will be like that of the input beam.
- The etched structure is applied to a plano-parallel substrate, which then results in the DOE.
- The deflection angles between the beams are defined by the diffractive structure. For a given element, the deflection angle of a collimated beam is always constant.
- With a suitable lens, the distance between the spots can be adjusted.
- A focussing lens can be placed close to the element, to create an array of spots.
- The elements are not sensitive to x, y and z displacement.
- The elements are sensitive to rotation, for easier alignment a notch on the substrate is possible. The spots will rotate when the element rotates.

TYPICAL PERFORMANCE

General specifications	
Substrate	window or plano-convex lens
Materials	ZnSe, Sapphire, Fused Silica and others
Mounting	unmounted
Power handling	up till kW's CW
Number of beams (spots)	up to 100 and more
Uniformity of multiplication	depending on the design, typically < 15 %
Efficiency	up to 95 %
Coating	AR/AR (on request / optional)

PART NUMBER NOMENCLATURE

<b>DS –</b>	<b>001 –</b>	<b>A –</b>	<b>x –</b>	<b>A</b>
function	design description	wavelength code	coating code	grade
DS: double spot TS: triple spot MS: multi spot		A: 10.6 µm I: 1064 nm Q: 532 nm U: 355 nm W: 266 nm	Y: with AR coating N: uncoated for 10.6 µm typically always with coating, for other wavelengths to customer need	A to E typically A

STANDARD PARTS

1 D BEAM SPLITTER

Part No.	Type	Material	Dia.	Wave-length [µm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
DS-001-A-Y-A	1x2	ZnSe	1.1"	10.6	1.35 deg	1.18 mm	2.36 mm	
DS-002-A-Y-A	1x2	ZnSe	1.1"	10.6	2.70 deg	2.36 mm	4.72 mm	
DS-025-A-Y-A	1x2	ZnSe	1.1"	10.6	1.52 deg	1.33 mm	2.65 mm	
DS-026-A-Y-A	1x2	ZnSe	1.1"	10.6	1.0 deg	0.87 mm	1.75 mm	
DS-029-A-Y-A	1x2	ZnSe	15 mm	10.6	1.0 deg	0.87 mm	1.75 mm	
DS-200-A-Y-A	1x2	ZnSe	20 mm	10.6	1.43 deg	1.25 mm	2.50 mm	
DS-201-A-Y-A	1x2	ZnSe	1.1"	10.6	0.314 deg	0.27 mm	0.55 mm	
TS-003-A-Y-A	1x3	ZnSe	1.1"	10.6	0.68 deg	0.59 mm	1.19 mm	
TS-004-A-Y-A	1x3	ZnSe	1.1"	10.6	1.35 deg	1.18 mm	2.36 mm	
TS-027-A-Y-A	1x3	ZnSe	1.1"	10.6	0.76 deg	0.66 mm	1.33 mm	
TS-028-A-Y-A	1x3	ZnSe	1.1"	10.6	0.5 deg	0.44 mm	0.87 mm	
TS-004-A-Y-A	1x3	ZnSe	1.1"	10.6	1.35 deg	1.06 mm	2.12 mm	
TS-205-A-Y-A	1x3	ZnSe	1.1"	10.6	0.9022 deg	0.79 mm	1.57 mm	
TS-201-A-Y-A	1x3	ZnSe	1.1"	10.6	4.83 deg	4.22 mm	8.45 mm	
TS-200-C-Y-A	1x3	ZnSe	1.1"	9.27	4.64 deg	4.06 mm	8.12 mm	



Part No.	Type	Material	Dia.	Wave-length [μm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
MS-226-D-x-A	1x5	Sapphire	1.0"	2.94	1.38 deg	1.20 mm	2.41 mm	~69 %
MS-228-D-x-A	1x7	Sapphire	11 mm	2.94	1.9 deg	1.66 mm	3.32 mm	~69 %
MS-214-E-x-A	1x6	Sapphire	1.0"	2.79	1.5 deg	1.31 mm	2.62 mm	~69 %
MS-243-E-x-A	1x8	Sapphire	1.0"	2.79	3.9 deg	3.41 mm	6.82 mm	~69 %
MS-244-E-x-A	1x10	Sapphire	1.0"	2.79	2 deg	1.75 mm	3.49 mm	~69 %
MS-245-E-x-A	1x10	Sapphire	1.0"	2.79	1.5 deg	1.31 mm	2.62 mm	~69 %
MS-022-G-x-A	1x15	F.S.	1.0"	1.55	0.72 mrad	0.04 mm	0.07 mm	~90 %
MS-210-G-x-A	1x27	F.S.	12.5 mm	1.55	0.4 deg	0.35 mm	0.70 mm	~75 %
DS-006-I-x-A	1x2	F.S.	1.0"	1.064	2.53 deg	2.21 mm	4.42 mm	
DS-033-I-x-A	1x2	F.S.	1.0"	1.064	10 deg	8.82 mm	17.63 mm	
DS-033-I-x-A	1x2	F.S.	1.0"	1.064	10 deg.	8.82 mm	17.6 mm	
TS-008-I-x-A	1x3	F.S.	1.0"	1.064	1.27 deg	1.11 mm	2.22 mm	
TS-030-I-x-A	1x3	F.S.	1.0"	1.064	10 deg	8.82 mm	17.63 mm	
TS-031-I-x-A	1x3	F.S.	1.0"	1.064	5 deg	4.37 mm	8.75 mm	
TS-202-I-x-A	1x3	F.S.	18 mm	1.064	10deg	8.82 mm	17.6 mm	
TS-203-I-x-A	1x3	F.S.	1.0"	1.064	0.13deg	0.11 mm	0.23 mm	
MS-263-I-x-A	1x4	F.S.	11 mm	1.064	1.5 deg	1.31 mm	2.62 mm	
MS-262-I-x-A	1x5	F.S.	1.0"	1.064	0.5 deg	0.44 mm	0.87 mm	
MS-206-I-x-A	1x5	F.S.	1.0"	1.064	4 deg sep	3.5 mm	7.0 mm	~69 %
MS-214-I-x-A	1x6	F.S.	1.0"	1.064	0.57 deg	0.50 mm	0.99 mm	
MS-107-I-x-A	1x7	F.S.	1.0"	1.064	30 mrad	1.50 mm	3.00 mm	~75 %
MS-232-I-x-A	1x7	F.S.	1.0"	1.064	0.7 deg	0.61 mm	1.22 mm	
MS-233-I-x-A	1x7	F.S.	11 mm	1.064	0.7 deg	0.61 mm	1.22 mm	
MS-245-I-x-A	1x10	F.S.	1.0"	1.064	0.57 deg	0.50 mm	0.99 mm	~69%
MS-213-I-x-A	1x11	F.S.	11 mm	1.064	0.12 deg	0.10 mm	0.21 mm	
DS-033-J-x-A	1x2	F.S.	1.0"	1.03	9.68 deg	8.53 mm	17.1 mm	
MS-207-X-x-B	1x81	F.S.	1.0"x1.0"	0.905	0.213 deg	0.19 mm	0.37 mm	~69%
MS-264-M-x-A	1x4	F.S.	11 mm	0.78	1.1 deg	0.96 mm	1.92 mm	
MS-265-M-x-A	1x8	F.S.	11 mm	0.78	1.09 deg	0.95 mm	1.90 mm	
DS-006-Q-x-A	1x2	F.S.	1.0"	0.532	1.27 deg	1.11 mm	2.22 mm	
DS-032-Q-x-A	1x2	F.S.	1.0"	0.532	10 deg	8.82 mm	17.63 mm	
DS-033-Q-x-A	1x2	F.S.	1.0"	0.532	5 deg	4.37 mm	8.75 mm	
TS-030-Q-x-A	1x3	F.S.	1.0"	0.532	5 deg	4.37 mm	8.75 mm	
TS-031-Q-x-A	1x3	F.S.	1.0"	0.532	2.5 deg	2.18 mm	4.37 mm	
TS-008-Q-x-A	1x3	F.S.	1.0"	0.532	0.64 deg	0.56 mm	1.12 mm	
MS-214-Q-x-A	1x6	F.S.	1.0"	0.532	0.28 deg	0.24 mm	0.49 mm	



Part No.	Type	Material	Dia.	Wave-length [µm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
MS-233-Q-x-A	1x7	F.S.	11 mm	0.532	0.35 deg	0.31 mm	0.61 mm	
MS-107-Q-x-A	1x7	F.S.	1.0"	0.532	0.14 deg	9.12 mm	0.24 mm	~75 %
MS-232-Q-x-A	1x7	F.S.	1.0"	0.532	0.35 deg	0.31 mm	0.61 mm	
MS-207-Q-x-B	1x81	F.S.	1.0"x1.0"	0.532	0.125 deg	0.11 mm	0.22 mm	~69 %
MS-208-Q-x-B	1x81 Type5	F.S.	1.0"x1.0"	0.532	0.25 deg	0.22 mm	0.44 mm	~67 %
MS-209-Q-x-B	1x81 Type0	F.S.	1.0"x1.0"	0.532	0.25 deg	0.22 mm	0.44 mm	~67 %
TS-209-X-x-A	1x3	F.S.	1.0"	0.515	2.46 deg	2.15 mm	4.3 mm	
DS-006-W-x-A	1x2	F.S.	1.0"	0.266	0.64 deg	0.56 mm	1.12 mm	
DS-016-U-x-A	1x2	F.S.	1.0"	0.355	0.85 deg	0.74 mm	1.48 mm	
TS-204-U-x-A	1x3	F.S.	1.0"	0.355	0.81 deg	0.71 mm	1.41 mm	
TS-008-U-x-A	1x3	F.S.	1.0"	0.355	0.42 deg	0.37 mm	0.73 mm	
TS-020-U-x-A	1x3	F.S.	1.0"	0.355	0.32 deg	0.28 mm	0.56 mm	
TS-008-U-x-A	1x3	F.S.	1.0"	0.355	0.42 deg	0.37 mm	0.73 mm	
MS-233-U-x-A	1x7	F.S.	1.0"	0.355	0.23 deg	0.20 mm	0.40 mm	
DS-017-W-x-A	1x2	F.S.	1.0"	0.266	0.64 deg	0.56 mm	1.12 mm	
DS-006-U-x-A	1x2	F.S.	1.0"	0.355	0.85 deg	0.74 mm	1.48 mm	
TS-008-W-x-A	1x3	F.S.	1.0"	0.266	0.32 deg	0.28 mm	0.56 mm	
MS-208-W-x-B	1x81	F.S.	1.0"x1.0"	0.266	0.125 deg	0.11 mm	0.22 mm	~69 %

## 2 D BEAM SPLITTER

Part No.	Type	Material	Dia.	Wave-length [µm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
MS-205-A-Y-A	2x2	ZnSe	1.0"	10.6	10 deg sep	8.75 mm	17.5 mm	~63 %
MS-030-A-Y-A	2x2 HE with notches	ZnSe	1.0"	10.6	10 deg sep	8.75 mm	17.5 mm	~75 %
MS-001-A-Y-A	3x3	ZnSe	1.1"	10.6	1.5 deg	1.31 mm	2.62 mm	
MS-221-A-Y-A	7x7	ZnSe	15 mm	10.6	1.9 deg	1.66 mm	3.32 mm	~69 %
MS-225-A-Y-A	9x9	ZnSe	15 mm	10.6	1.2 deg	1.05 mm	2.09 mm	~69 %
MS-232-A-Y-A	9x9	ZnSe	15 mm	10.6	1.5 deg	1.31 mm	2.62 mm	~69 %
MS-247-D-x-A	5x5	Sapphire	11 mm	2.94	2.75 deg	2.40 mm	4.80 mm	~69 %
MS-219-D-x-A	7x7	Sapphire	11 mm	2.94	1.9 deg	1.66 mm	3.32 mm	~69 %
MS-227-D-x-A	7x7	Sapphire	1.0"	2.94	1.9 deg	1.66 mm	3.32 mm	~69 %
MS-218-D-x-A	9x9	Sapphire	11 mm	2.94	1.38 deg	1.20 mm	2.41 mm	~69 %
MS-254-D-x-A	9x9	Sapphire	1.0"	2.94	0.57 deg	0.50 mm	0.99 mm	~69 %



Part No.	Type	Material	Dia.	Wave-length [µm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
MS-239-D-x-A	9x9	Sapphire	11 mm	2.94	0.57 deg	0.50 mm	0.99 mm	~69 %
MS-220-H-x-A	5x5	F.S.	11 mm	1.32	1.71 deg	1.49 mm	2.98 mm	
MS-219-H-x-A	7x7	F.S.	11 mm	1.32	0.87 deg	0.76 mm	1.52 mm	
MS-218-H-x-A	9x9	F.S.	11 mm	1.32	0.62 deg	0.54 mm	1.08 mm	
MS-203-I-x-A	2x2	F.S.	1.0"	1.064	4 deg sep	3.5 mm	7.0 mm	~63 %
MS-204-I-x-A	2x2	F.S.	1.0"	1.064	0.25 deg	0.22 mm	0.44 mm	~63 %
MS-261-I-x-A	3x3	F.S.	11 mm	1.064	0.57 deg	0.50 mm	0.99 mm	
MS-202-I-x-A	4x4	F.S.	1.0"	1.064	1.38 deg	1.2 mm	2.4 mm	~70-75 %
MS-216-I-x-A	4x4	F.S.	11 mm	1.064	1.38 deg	1.20 mm	2.40 mm	~70-75 %
MS-260-I-x-A	4x4	F.S.	11 mm	1.064	0.57 deg	0.50 mm	0.99 mm	
MS-025-Q-x-A	5x5	F.S.	1.0"	1.064	1.0 deg	0.88 mm	1.74 mm	~70-75 %
MS-215-I-x-A	5x5	F.S.	11 mm	1.064	1.0 deg	0.87 mm	1.75 mm	~70-75 %
MS-224-I-x-A	5x5	F.S.	11 mm	1.064	1.38 deg	1.20 mm	2.41 mm	~70-75 %
MS-201-I-x-A	7x7	F.S.	11 mm	1.064	0.7 deg	0.61 mm	1.22 mm	~70-75 %
MS-049-I-x-A	7x7	F.S.	1.0"	1.064	0.5 deg	0.44 mm	0.87 mm	~70-75 %
MS-211-I-x-A	7x7	F.S.	1.0"	1.064	0.19 deg	0.17 mm	0.33 mm	~75 %
MS-200-I-x-A	9x9	F.S.	1.0"	1.064	0.25 deg	0.22 mm	0.44 mm	~63 %
MS-027-I-x-A	9x9	F.S.	1.0"	1.064	0.5 deg	0.44 mm	0.87 mm	~70-75 %
MS-212-I-x-A	15x15	F.S.	1.0"	1.064	0.5 deg	0.44 mm	0.87 mm	~69 %
MS-217-X-x-A	5x5	F.S.	11 mm	0.89	1.63 deg	1.42 mm	2.85 mm	
MS-234-X-x-A	2x2	F.S.	1.0"	0.85	3.2 deg	2.79 mm	5.59 mm	
MS-248-X-x-A	2x2	F.S.	1.0"	0.8	3x3 deg	2.62 mm	5.24 mm	~61 %
MS-241-M-x-A	8x8	F.S.	1.0"	0.78	0.8 deg	0.70 mm	1.40 mm	
MS-235-N-x-A	5x5	F.S.	11 mm	0.55	1.9 deg	1.66 mm	3.32 mm	~69 %
MS-237-N-x-A	7x7	F.S.	11 mm	0.755	1.5 deg	1.31 mm	2.62 mm	~69 %
MS-240-P-x-A	2x2	F.S.	11 mm	0.6328	8 deg	7.03 mm	14.05 mm	~61 %
MS-237-P-x-A	7x7	F.S.	11 mm	0.6328	1.25 deg	1.09 mm	2.18 mm	~69 %
MS-203-Q-x-A	2x2	F.S.	1.0"	0.532	2 deg sep	1.8 mm	3.5 mm	~63 %
MS-202-Q-x-A	4x4	F.S.	1.0"	0.532	0.69 deg	0.61 mm	1.2 mm	~70-75 %
MS-235-Q-x-A	5x5	F.S.	11 mm	0.532	1.3 deg	1.13 mm	2.27 mm	~69 %
MS-025-I-x-A	5x5	F.S.	1.0"	0.532	0.5 deg	0.44 mm	0.87 mm	~70-75 %
MS-049-Q-x-A	7x7	F.S.	1.0"	0.532	0.25 deg	0.22 mm	0.44 mm	~70-75 %
MS-201-Q-x-A	7x7	F.S.	11 mm	0.532	0.35 deg	0.30 mm	0.61 mm	~70-75 %
MS-251-Q-x-A	7x7	F.S.	1.0"	0.532	0.095 deg	0.08 mm	0.17 mm	~69 %
MS-027-Q-x-A	9x9	F.S.	1.0"	0.532	0.25 deg	0.22 mm	0.44 mm	~70-75 %
MS-200-Q-x-A	9x9	F.S.	1.0"	0.532	0.125 deg	0.11 mm	0.22 mm	~63 %



## HEXAGONAL SPLITTER

Part No.	Type	Material	Dia.	Wave-length [µm]	Angle separat.	Spot separation with F 50 mm	Spot separation with F 100 mm	Efficiency
MS-231-J-Y-A	1 x7 HEX	F.S.	1.0"	1.030	0.125°		0.22 mm	
MS-250-J-x-A	1x37 HEX	F.S.	1.0"	1.037	0.09 deg	0.08 mm	0.16 mm	~78 %

Note:

Many of above mentioned substrate are also available with dia 11 mm, please ask us on availability. 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.

