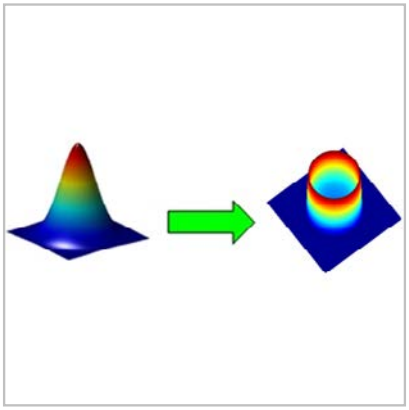
Optics

M-Shape Intensity Distribution for Scanning Applications

HOLO/OR's M-Shaper, is a diffractive optical element (DOE) used to transform a Gaussian laser beam (or other) into a unique 2D M-shaped intensity profile, with sharp edges in a specific work plane.



Features

- Round M-Shape output profile (before integration)
- Uniform output intensity profile when integrated over a scanned line
- Sharp beam edge
- High efficiency
- High power threshold
- Wavelengths from UV to IR
- Optional Ar/Ar coating

Applications

- Laser materials processing:
  - welding
  - cutting
  - scribing
- Strong weld seams (also in Plastics)

The M-Shaper optical function is not possible by conventional reflective or refractive optical elements. It provides higher quality of the process & enables more flexibility in the system configuration. For example, it allows optimization of the intensity profile, and image size, without changing the laser, fiber cable and/or optic head.

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In general, the intensity profile influences the heat distribution during laser material processing. The benefits of our optimized M-shaped intensity profile (refer to figure 1), in scanning applications (i.e., for the welding process) include:

- Uniform exposure over the scanned line
- Ensures a defined edge
- Enables very strong weld seams

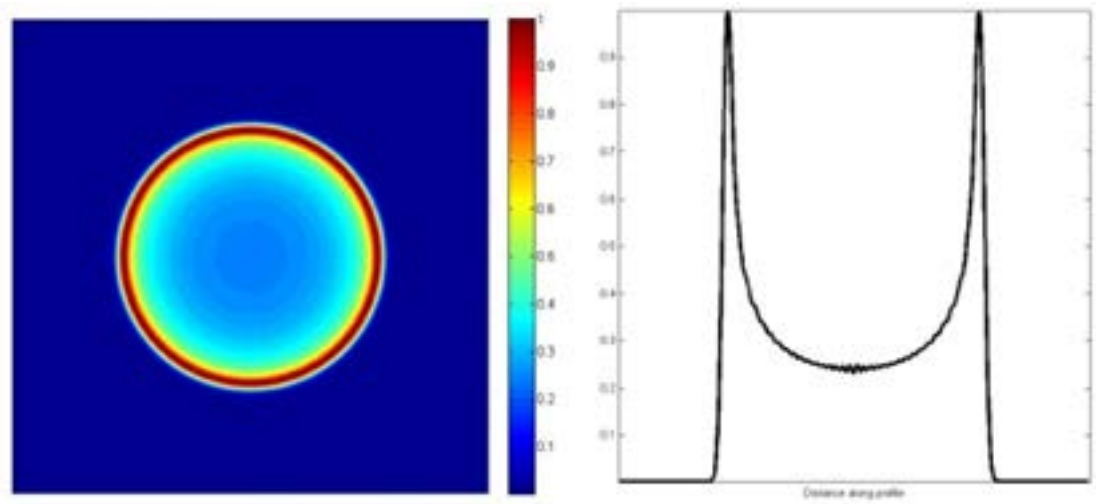

Figure 1: Simulated intensity profiles of diffractive M-Shaper laser spots (Without integration).
Left fig.: Upper view, Right fig.: Side view.

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Design Considerations:

1. In principal, to get a flat-top scanning profile (as shown in Fig.3), optical designer needs to notice the following points:
   - Use a collimated laser beam with DOE
   - Place the DOE before the scanning head
   - Use a scanner lens (i.e. F-Theta lens) in order to achieve a well-focused spot at a certain distance, for all scanning angles, as shown in Fig.2.
   - Scan in straight lines

2. Energy distribution can be designed for any non-uniform distribution meeting the application's requirements

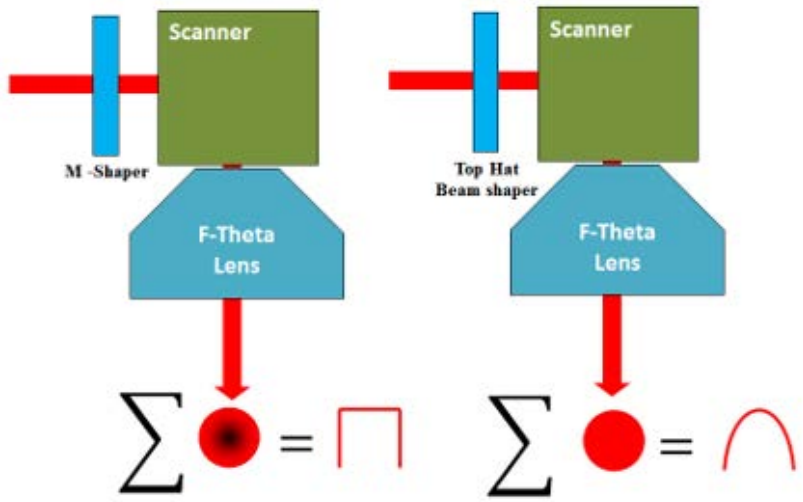

Figure 2: Schematic set-up and integrated (S) intensity profile across scan direction.
Left: with M-Shaper,. Right: with flat-top beam shaper.

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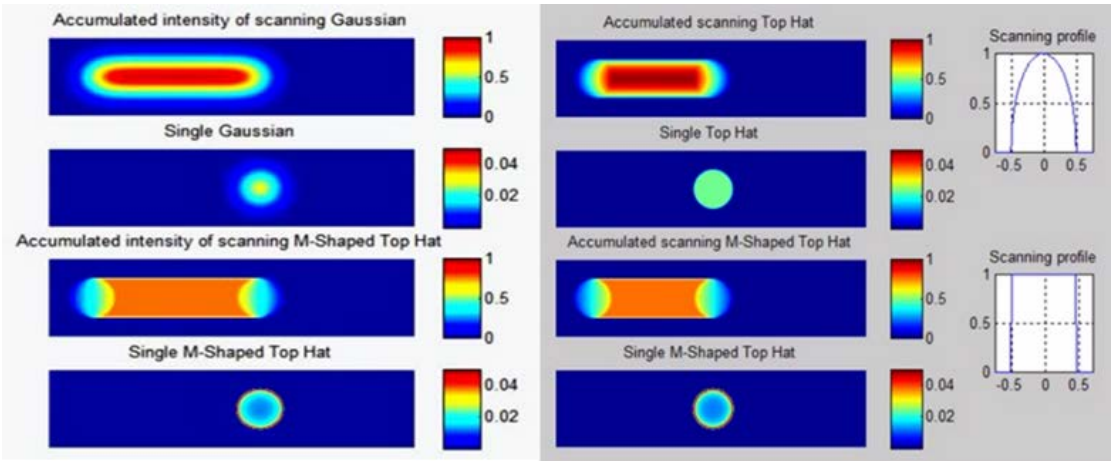

Figure 3: Left picture: Gaussian intensity profile vs. M-Shaped profile, in scanning mode.
Right picture: Top-Hat intensity profiles vs. M-Shaped profile.

https://www.youtube.com/watch?x-yt-ts=1421828030&v=WCRsa0a7jzc&x-yt-cl=84411374

https://www.youtube.com/watch?v=pWXK1fWwRw8&x-yt-ts=1421828030&x-yt-cl=84411374

Specifications

Materials:	Fused Silica, ZnSe
Wavelength range:	193 nm to 10.6 µm
Full angle:	Large range of full angles
DOE design:	2-level (binary) to 16-level
Diffraction efficiency:	86% - 96%
Element size:	Few mm to 100 mm
Coating (optional):	AR/AR Coating
Custom Design:	Almost any size

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