# Solar cell processing with Top Hat converted Gaussian beams

LIMO
Lissotschenko Mikrooptik

## Top Hat profiles improve

## solar cell processing

### Advantages

**Process and quality improvement in various solar cell processing techniques:**

- Direct Laser structuring raises the efficiency in structuring of solar cell and thin film panels
- Laser edge isolation to achieve high opto-electrical efficiency
- Laser fired contacts for a higher electron mobility
- Metal Wrap Through (MWT)

**Safe and economical laser processing with:**

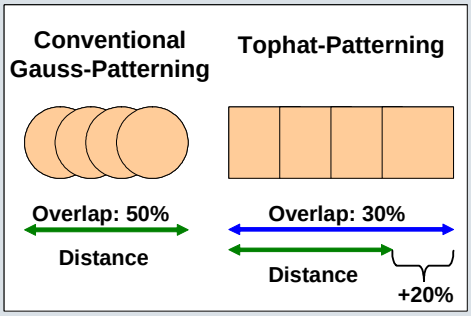
- No sawtooth pattern, which reduces the fracture of solar cells and the electrical break through
- High throughput
- For use with all kinds of single mode lasers

**Innovative and reproducible micro structuring (maskless) of holes, contacts and grooves with:**

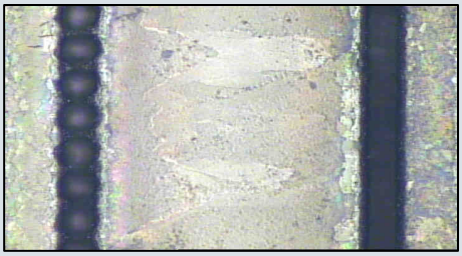
- Safe removal of thin films due to a homogeneous profile without intensity spikes
- Groove widths down to 50 µm
- Straighter grooves compared to conventional structuring techniques
- Steep edges (no v-grooves)

**Structuring of a broad range of materials including:**

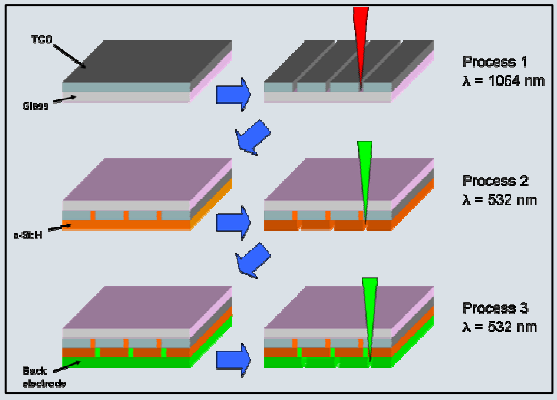
- Ceramics ($SiO_2$, SiN, SiC; $TiO_2$)
- Metals (Aluminium, CIS, CdTe, GaAs)
- Oxides (TCO), organic thin films




Advantage for Top-Hat patterning: **+20% faster in processes**



Left: Gaussian Grooves in TCO-Layer. Right: Top-Hat-Grooves in TCO-Layer. Laser: Nd:YAG, SHG @532nm, 4W, 500kHz, 10ps-pulses




P1, P2 and P3 process for thin film solar cells (structure width < 100 µm)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## Solution for your application

## Gauss-to-Top-Hat-Converter Series 410.000

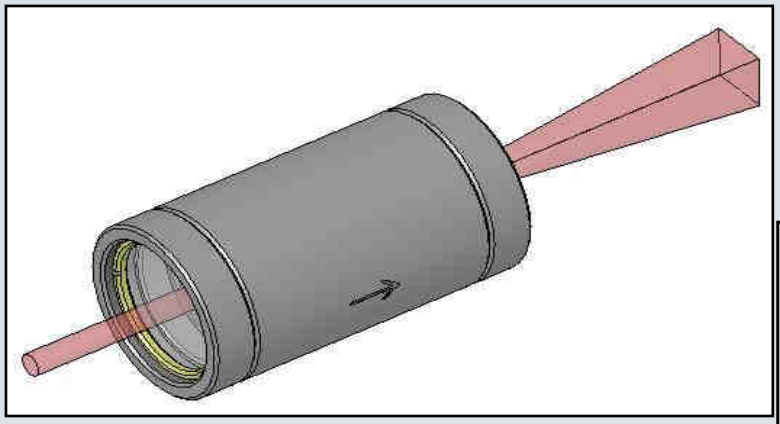
### Performance

- Various field-shapes possible (squares, rectangles, lines)
- Output field-sizes from 50x50 µm² up to 10x10 mm²
- Working distances between 50 – 500 mm
- Deep depth of focus
- Improved homogeneity up to 95 %
- Transmission > 97% (355, 532, 1064 nm)
- Robust and compact design (diameter = 31.5 mm; length = 58 mm)

Compact Gauss-to-Top-Hat-Converter Series 410.000

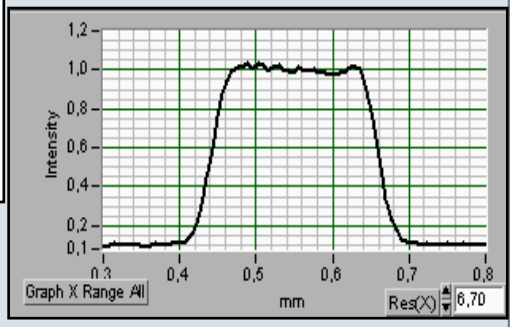
## Easy integration into your system

The module has a solid industrial design, the Gauss-to-Top-Hat lenses are compact mounted and the module can be easily integrated in the beam path of the collimated laser beam.



This **Gauss-to-Top-Hat-Converter** produces a Top Hat beam profile by point-to-point mapping of the Gaussian input rays to relocate the intensity to a light line or rectangular field.

Typical beam profile (generated from a green laser @ 532 nm and a Gaussian input profile with $M^2$ < 1.1, 96% $TEM_{00}$ mode)



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