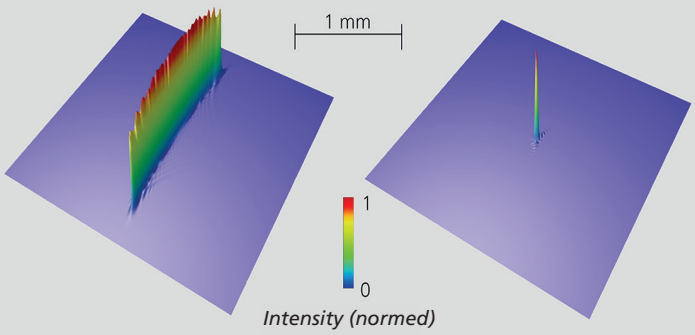

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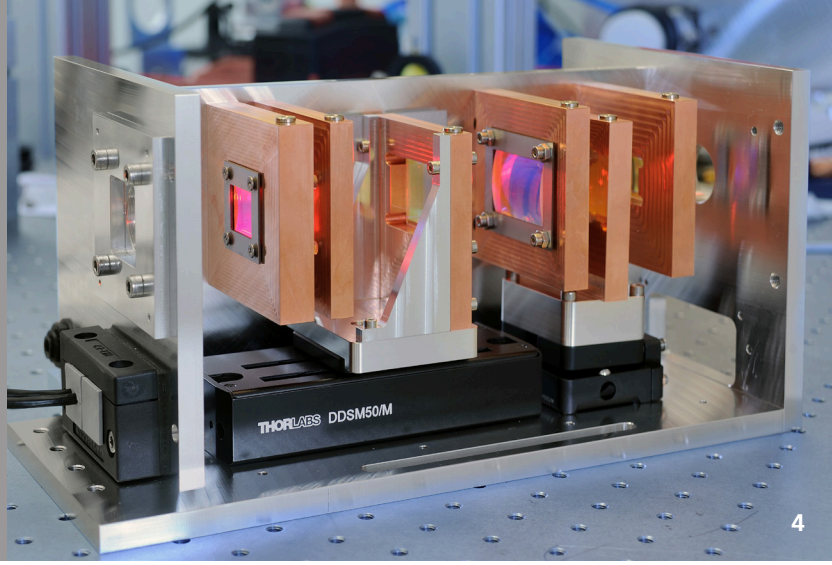

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OPTICAL SYSTEM FOR VARIABLE BEAM SHAPING

Task

As an important process parameter, the intensity profile of the laser beam significantly influences the machining result of laser-assisted machining processes. The often Gaussian intensity profile emitted by a laser beam source is transformed into process-adapted intensity profiles in many applications by means of optical beamforming elements. However, the intensity profiles thus formed are static, and a dynamic adaptation to the process is not possible. Therefore, an optical system has been developed that provides a rotationally symmetric, Gaussian or a homogeneous, linear spot in the working plane.

Method

So that the Gaussian input beam could be formed into a homogeneous, linear spot in the working plane, an optical system consisting of cylindrical lenses has been designed. The process, patented by Fraunhofer ILT, will adjust the system so that it will be possible to vary the degree of homogenization.

Results

Thanks to the developed optical system, a linear intensity distribution with an aspect ratio of 30:1 can be generated in addition to a rotationally symmetric intensity distribution with Gaussian profile. The linear intensity distribution has a high homogeneity in the longitudinal axis. During the switching process between the intensity profiles, the working distance is not changed. To change to another intensity profile, the system needs < 0.2 s. Furthermore, the quartz glass cylindrical lenses also allow the use of laser powers up to 2 kW.

Applications

In principle, all laser material processing methods that currently homogenize the intensity profile in the working plane can benefit from the new possibility of variable beam shaping. Thanks to the newly gained degree of freedom, Gaussian profiles can also be used. This opens up new possibilities in these processing methods for machining strategies that will have a positive effect on the processing time and quality.

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3 Adjustable intensity profiles (simulation).

4 Prototype of line optics.

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