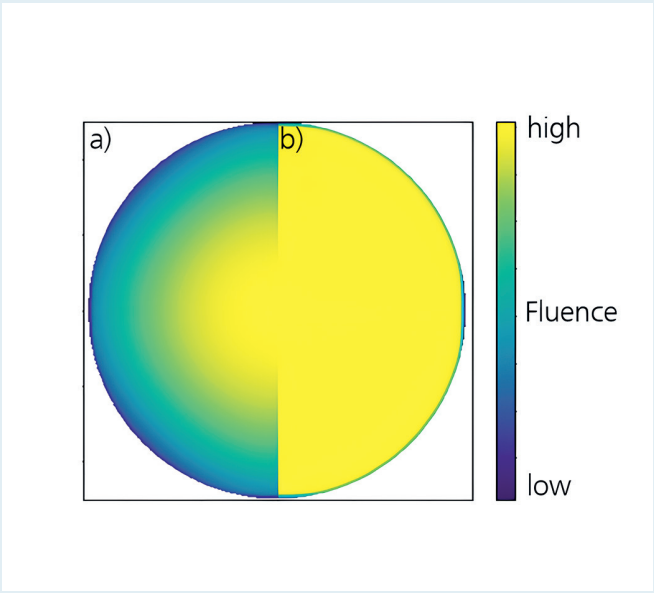

1 Homogenized energy input by path planning tool: a) without and b) with optimized path planning.
2 Laser polishing machine for free-form glass optics.

Laser polishing of aspheres and free-form optics made of glass

Machine technology and CAM-NC data chain

In recent years, process development for laser polishing of glass has made such considerable progress that the technology is increasingly relevant for imaging optics as well. Current challenges are the development of a suitable machine technology and the CAM-NC data chain for programming these machines even for non-planar surfaces.

Since laser radiation strikes the edges of optics at a non-perpendicular angle during laser polishing at high process velocities of more than 5 cm²/s, there is distortion of the interaction surface and changes in absorption behavior. In addition, local deviations in the radius of curvature (aspheres, freeform) lead to altered heat conduction conditions. All of this contributes to an uneven polishing result already at angular deviations < 10°.

The effects described can be compensated for by geometry-dependent, local adaptation of the process parameters. For this purpose, Fraunhofer ILT has developed software for CAM-NC path planning.

New software for CAM-NC path planning

The resulting CAM-NC data chain can calculate the path planning for a free-form lens with a diameter of 100 mm within a few minutes. Based on the lens geometry, process parameters such as laser power and scanning speed are locally adapted to the optical geometry, and a similarly adapted machine technology implements this path planning. The calculated adaptation achieves uniform polishing with roughness Sa < 1 nm even for incidence angles of up to 45° to the optical axis.

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