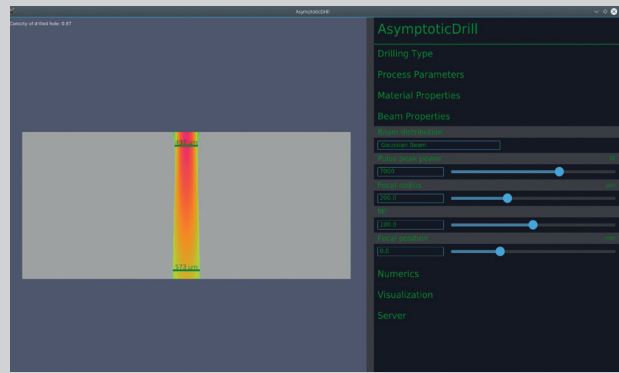3

4

SIMULATION APP FOR DRILLING WITH LASER RADIATION

Task

The simulation app »AsymptoticDRILL«, developed by Fraunhofer ILT, describes asymptotic drill forms when metallic materials are drilled with long-pulsed laser radiation – for Rayleigh lengths significantly larger than the drill depth. However, as this constitutes a relatively severe limitation on describable drill holes, the task here is to extend the scope of »Asymptotic DRILL« to laser radiation with Rayleigh lengths less than or equal to the drill hole depth.

Method

The underlying reduced model for asymptotic drilling has been extended to describe the radiation absorption in any propagation direction. Like the initial model, the extended model is based on equations that allow simple numerical methods to be applied with good solution properties and that can be solved on a seconds scale.

Results

The extended model equations have been implemented in the simulation app so that the new version allows asymptotic drilling to be described even with strong beam divergence. The latter can be set within the user interface using sliders. A strong beam divergence can, in particular, lead to drill holes whose outlet diameter is greater than the inlet diameter. The description of such undercuts is also possible in the new version (Fig. 4). In addition, »AsymptoticDRILL« now also allows the user to describe drill holes made at an angle to the surface of the workpiece (Fig. 3).

Applications

The app's current field of application is the process development for the production of cooling channels in turbine components. In the future, it is planned to use »AsymptoticDRILL« also in the field of screen and filter production as well as in the structuring of lightweight components.

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3 *Drill hole oriented transverse to the top of the workpiece.*

4 *Undercut and new user interface with sliders to adjust the beam divergence.*

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DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01

Annual Report 2018   **75**