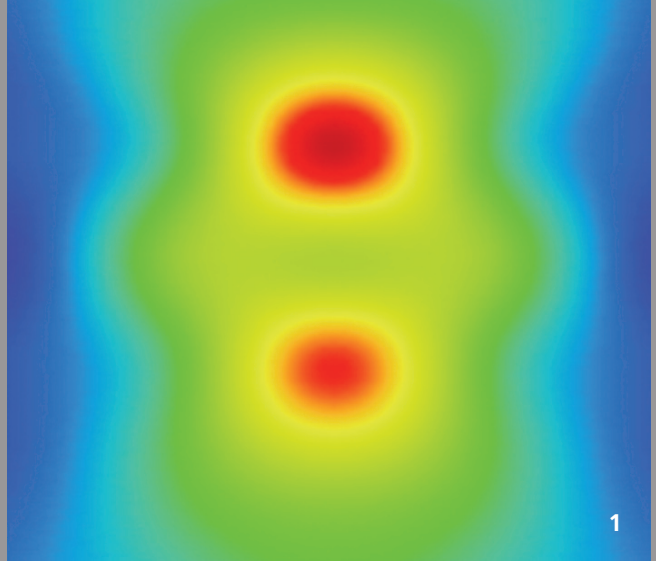

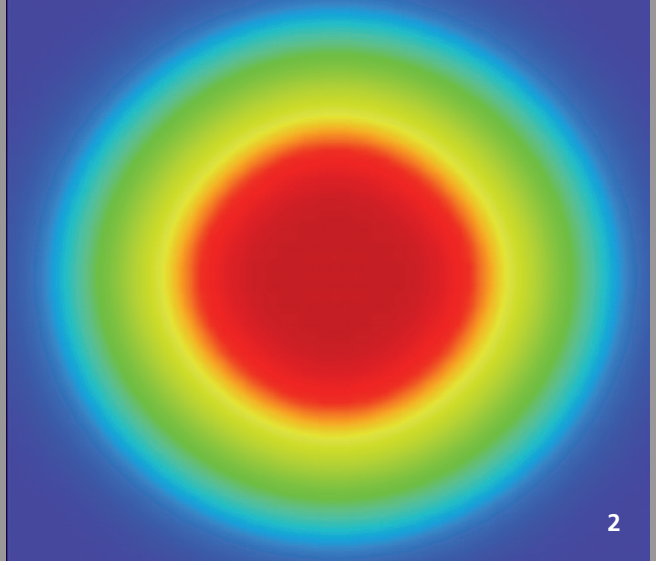

# SIMULATION: SOLVING AN INVERSE TASK FOR BEAM PROPAGATION

**Task**

Beam shaping can be advantageous to optimally achieve application-specific criteria for a processing result, one which cannot be achieved with standard optics. The task presented here consists of indicating a systematics for calculating optimal optical surfaces and, in addition, of guaranteeing that the optimal beam shape is adjusted to the entire processing depth and not only to one position (transversal plane) of the propagation path of the radiation.

**Method**

In order to receive the desired radiation field along the entire processing depth, an appropriate mode decomposition is first determined. In a second step, the optical surfaces are identified which form a given beam field upon the predetermined contributions of the constituent modes. For a successful procedure, a coupled adjustment of absolute value (intensity distribution) and phase is essential by changing the optical surfaces.

The calculated optical surfaces are validated by the use of commercial beam propagation software (e.g. ZEMAX).

**Result**

A system to calculate optimal optical surfaces was numerically implemented and has already been successfully used. Before the experimental tests are conducted in the laboratory, the system was validated with commercial software, and the sensitive dependency on parameters of manufacturing and adjustment were analyzed.

**Applications**

The procedures implemented for calculating optics are independent of the manufacturing process investigated. Two relevant fields of application can be seen: analyzing the potential for beam shaping specific to an application and being better able to estimate the costs and benefits of using optimal optics in comparison to approximate solutions with standard optics.

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*1,2 ZEMAX validation of beam distribution produced with calculated optical surfaces, cross-section.*