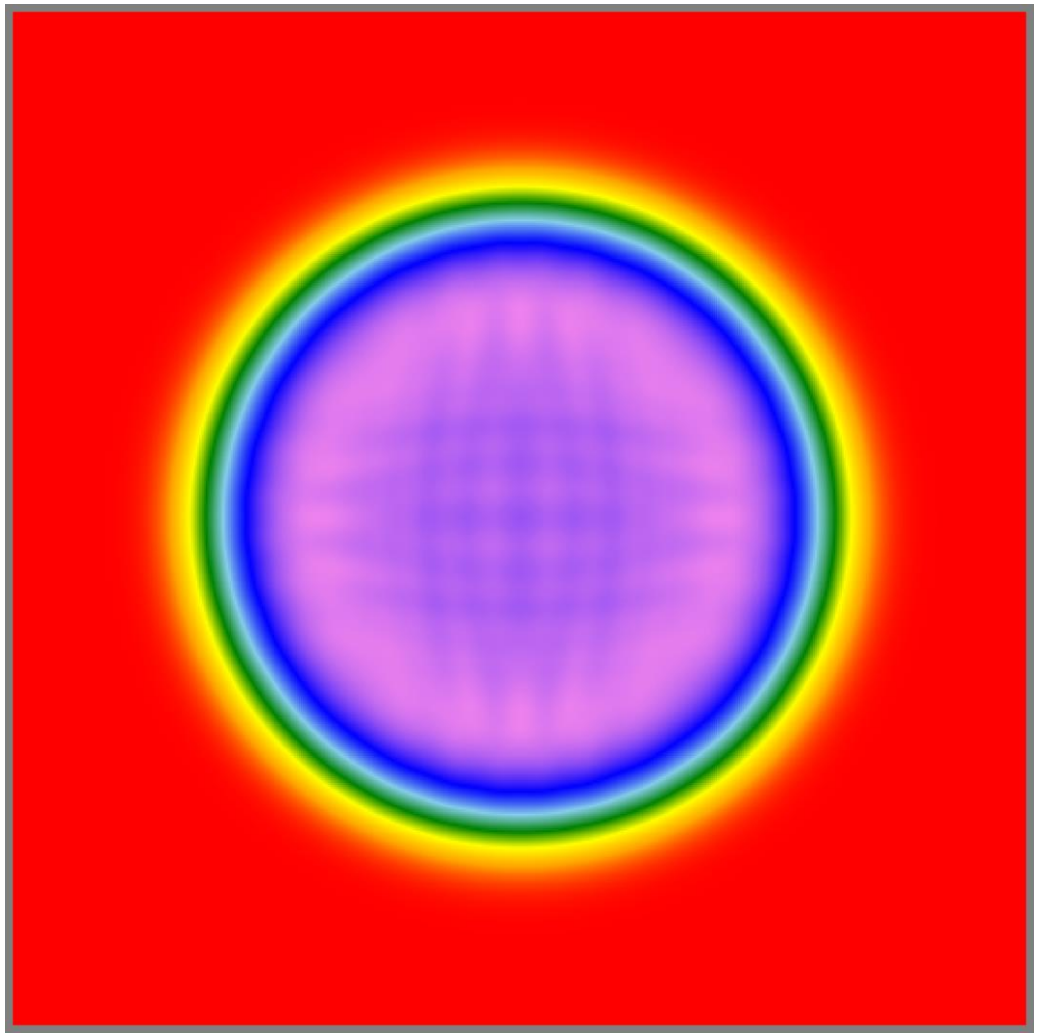
Design of a Refractive Beam Shaper to Generate a Circular Top-Hat

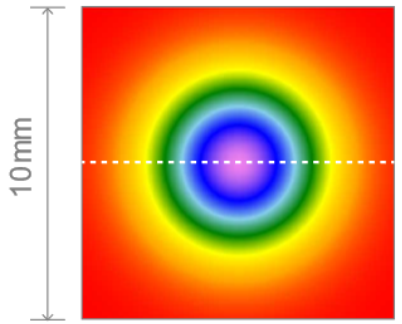
Abstract



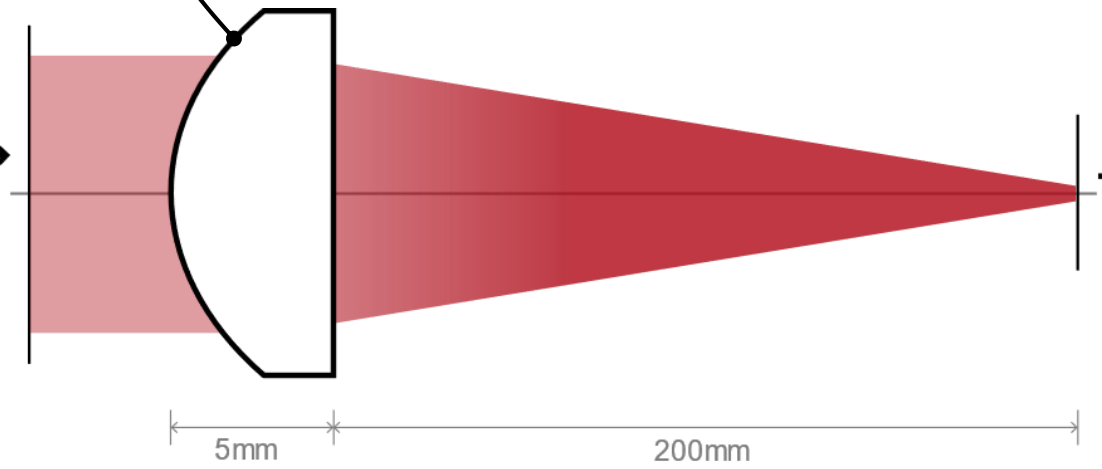
For applications like laser material processing, the laser beam must be shaped into certain distributions on the target plane. Typically, it is desired to obtain homogeneous distributions within an area, for example, a top-hat beam profile. With the user-friendly design tools in VirtualLab, a refractive beam shaper with an aspherical surface is designed for shaping a fundamental Gaussian beam into top-hat profile on the target plane. The performance of the beam shaping element is analyzed in terms of conversion efficiency, SNR, etc.

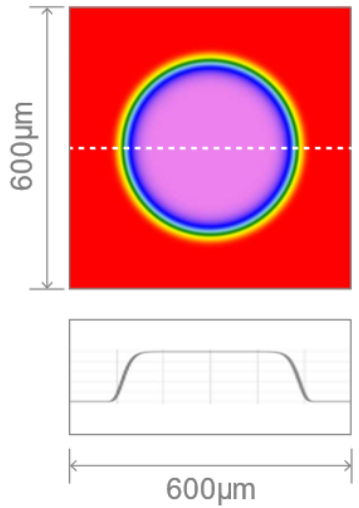
Design Task

How to design the surface of the beam shaper, so to convert the input beam into the target profile on the target plane?



input field
- wavelength: 632.8 nm
- profile: fundamental Gaussian
- diameter (waist): 8 mm

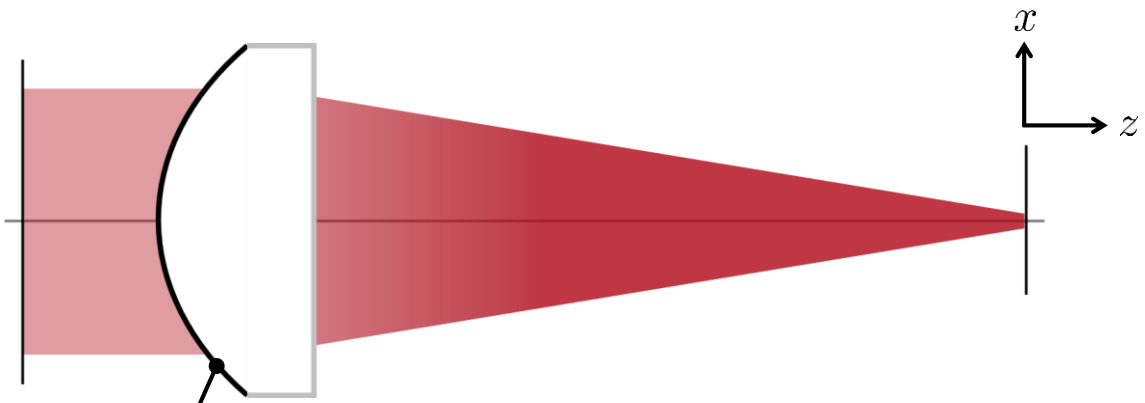


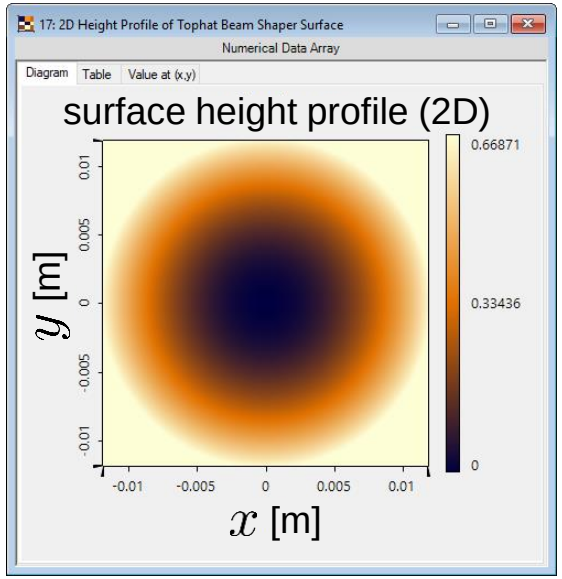


target field
- profile: top-hat
- diamter: 400 µm
- edge width: 40 µm

(14-order super Gaussian)

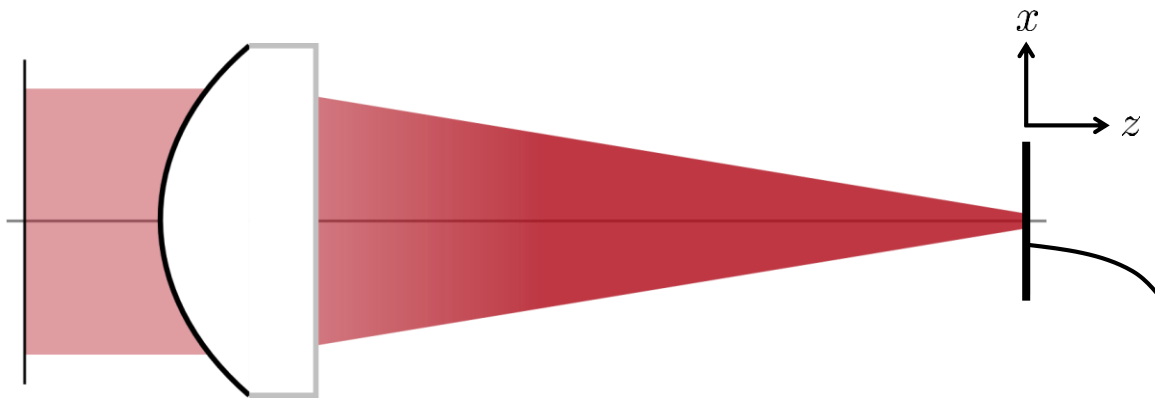
Design Result



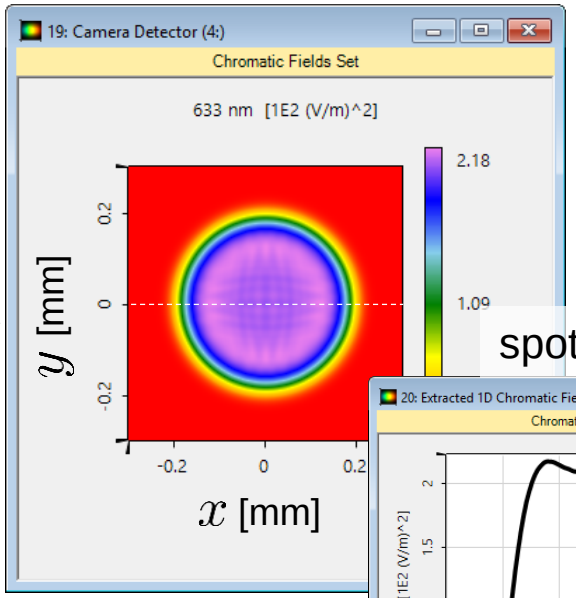


The step-by-step guided design session in VirtualLab delivers the result within 25 milliseconds!

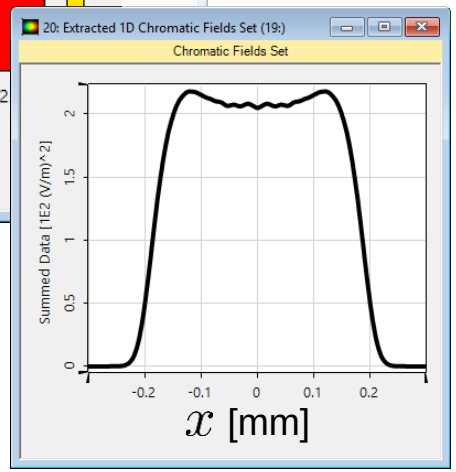
Performance Evaluation



spot profile (2D) on target plane



spot profile (1D)



Fast physical optics simulation of the light shaping system gives access to multiple merit functions.

Merit functions	Values
conversion efficiency	90.1%
SNR	22.4 dB
stray light	10.9%

Document Information

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