

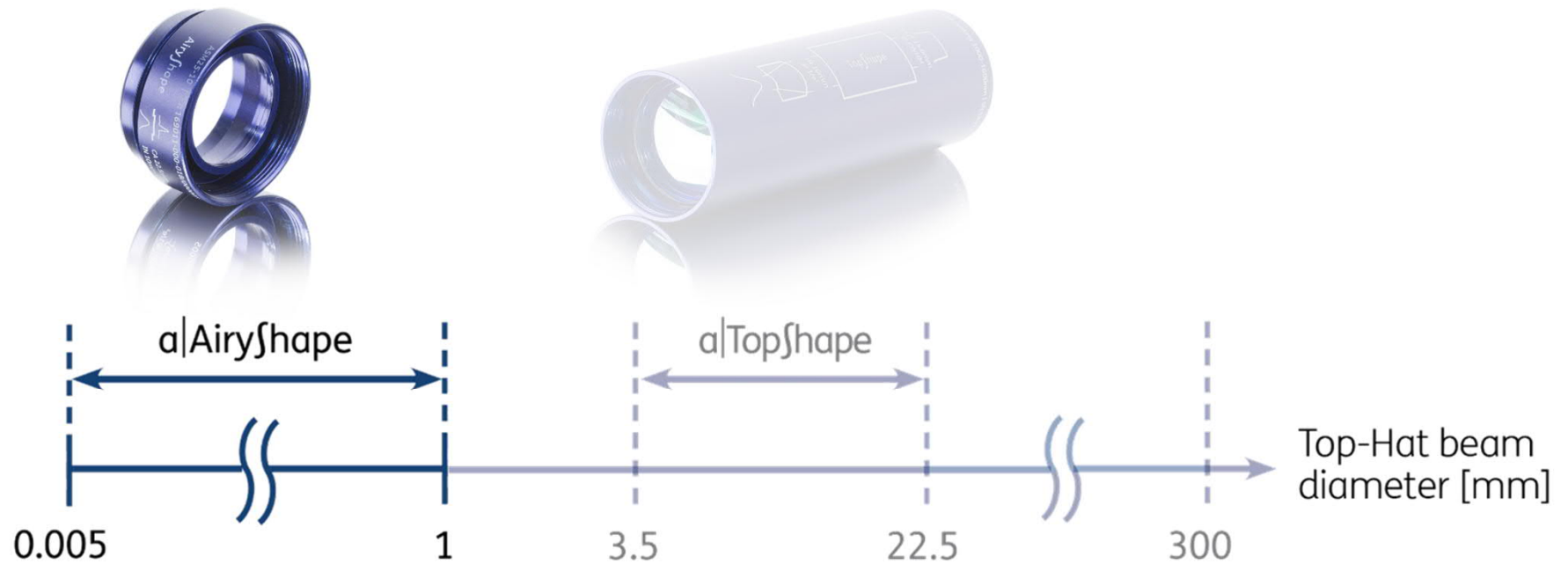
Refractive Beam Shaping

Sabrina Matthias



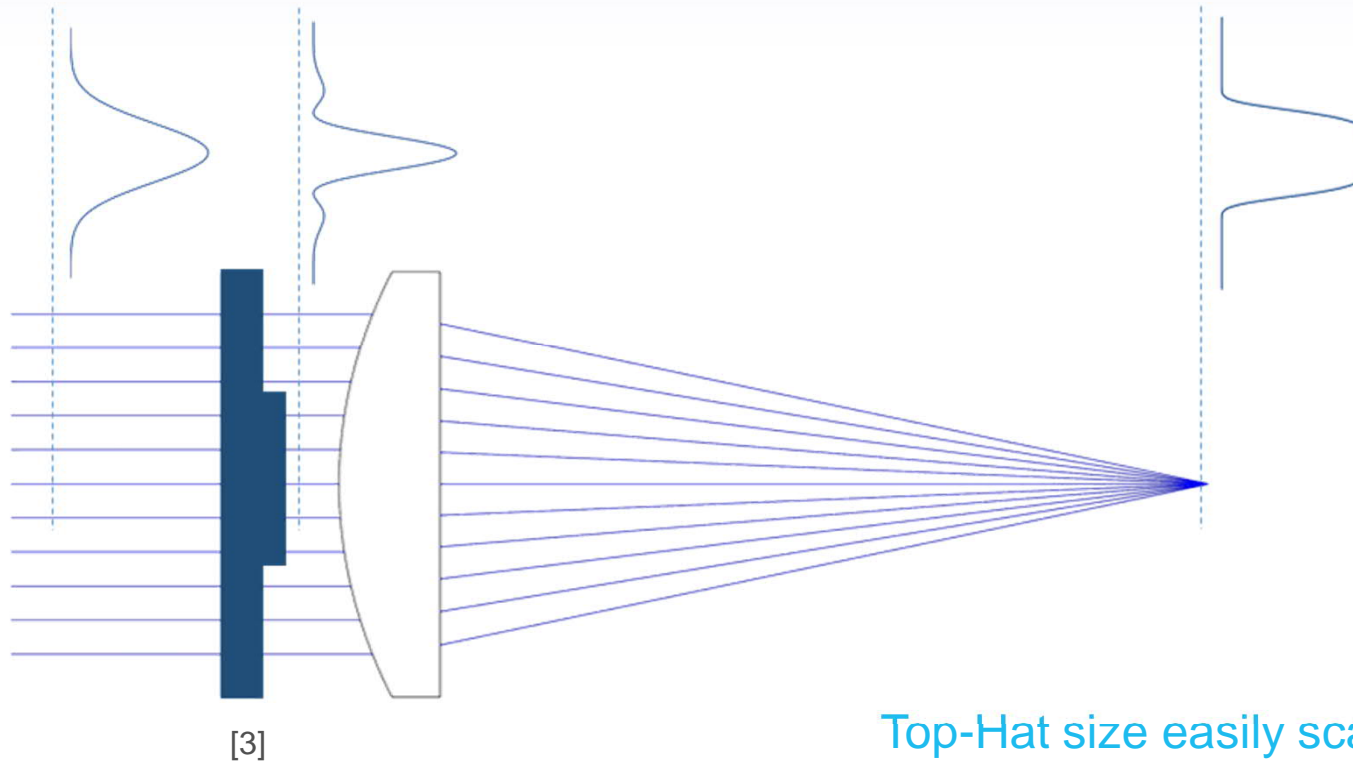
= EPIC Online Technology Meeting on Laser Beam and Pulse Shaping
May 25, 2020

Refractive Beam Shaping Concepts



Refractive Beam Shaping Concepts

Working Principle

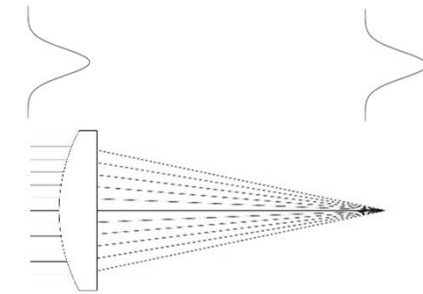
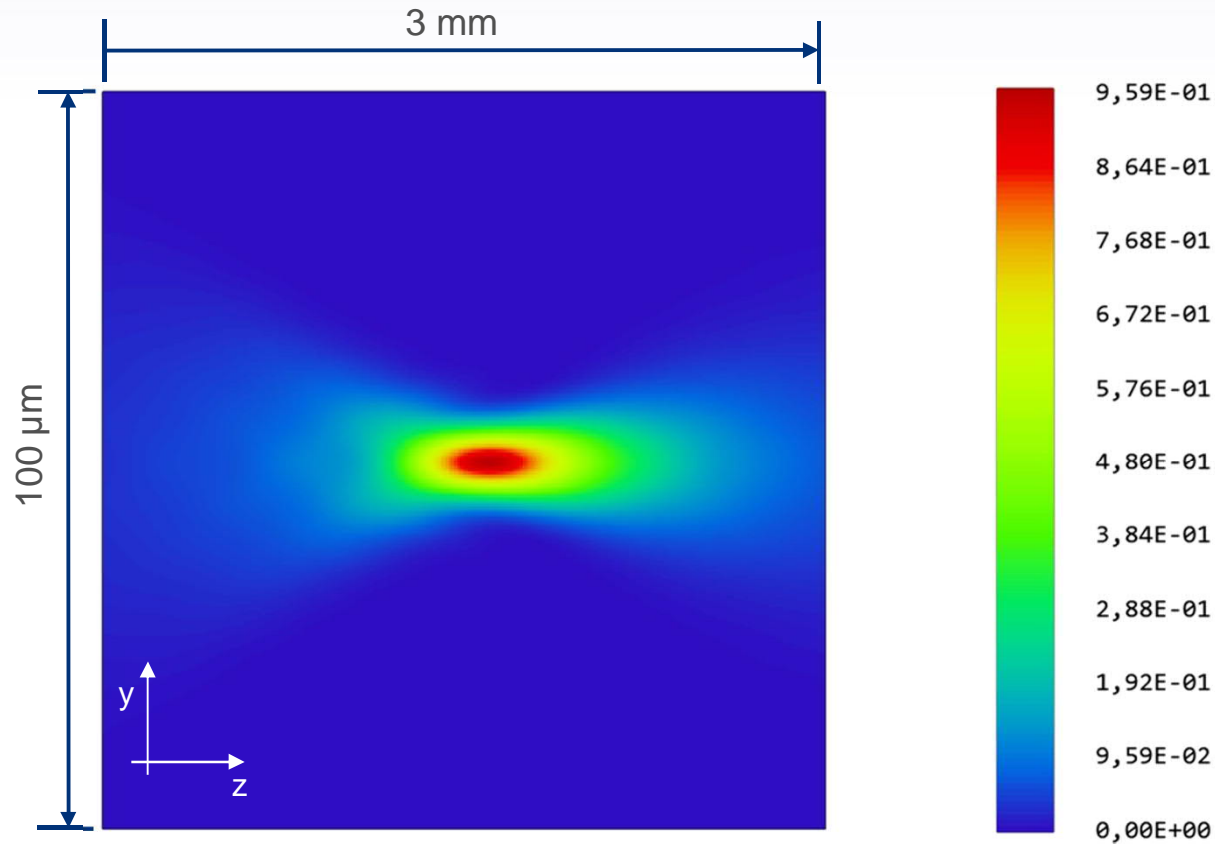


Top-Hat size easily scalable by
focal length of focusing lens

[3] J. J. Cordingley, "Method for Serving Integrated-Circuit Connection Paths by a Phase-Plate-Adjusted Laser Beam". US Patent 5300756, 5 April 1994.

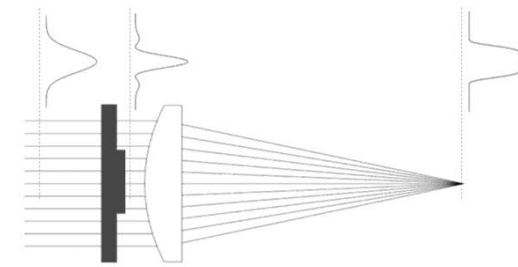
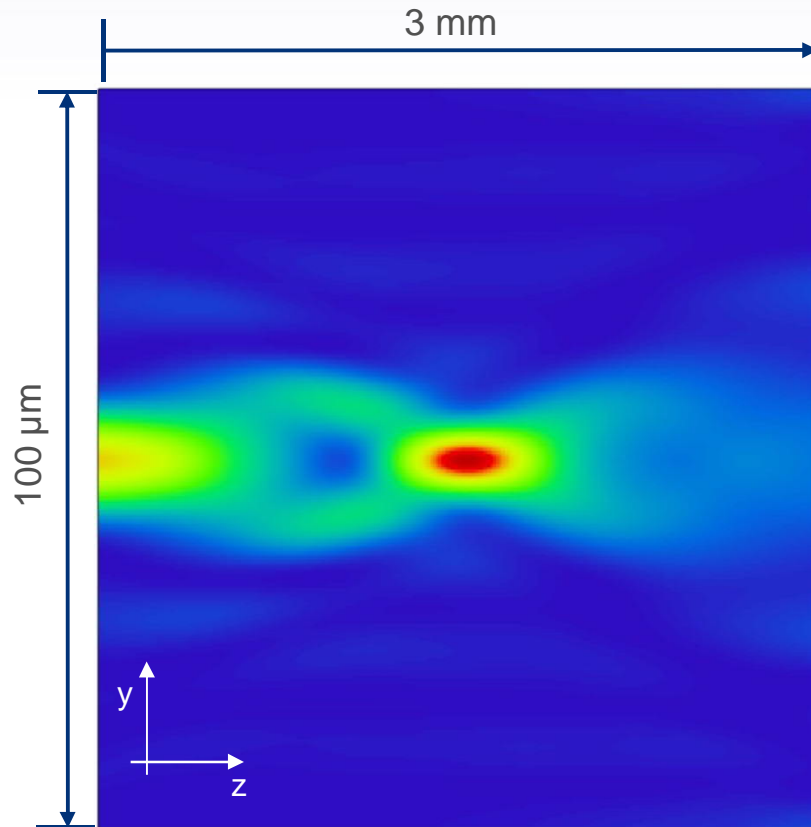
Gaussian Beam Profile

Beam Profile Sections along its Propagation Direction



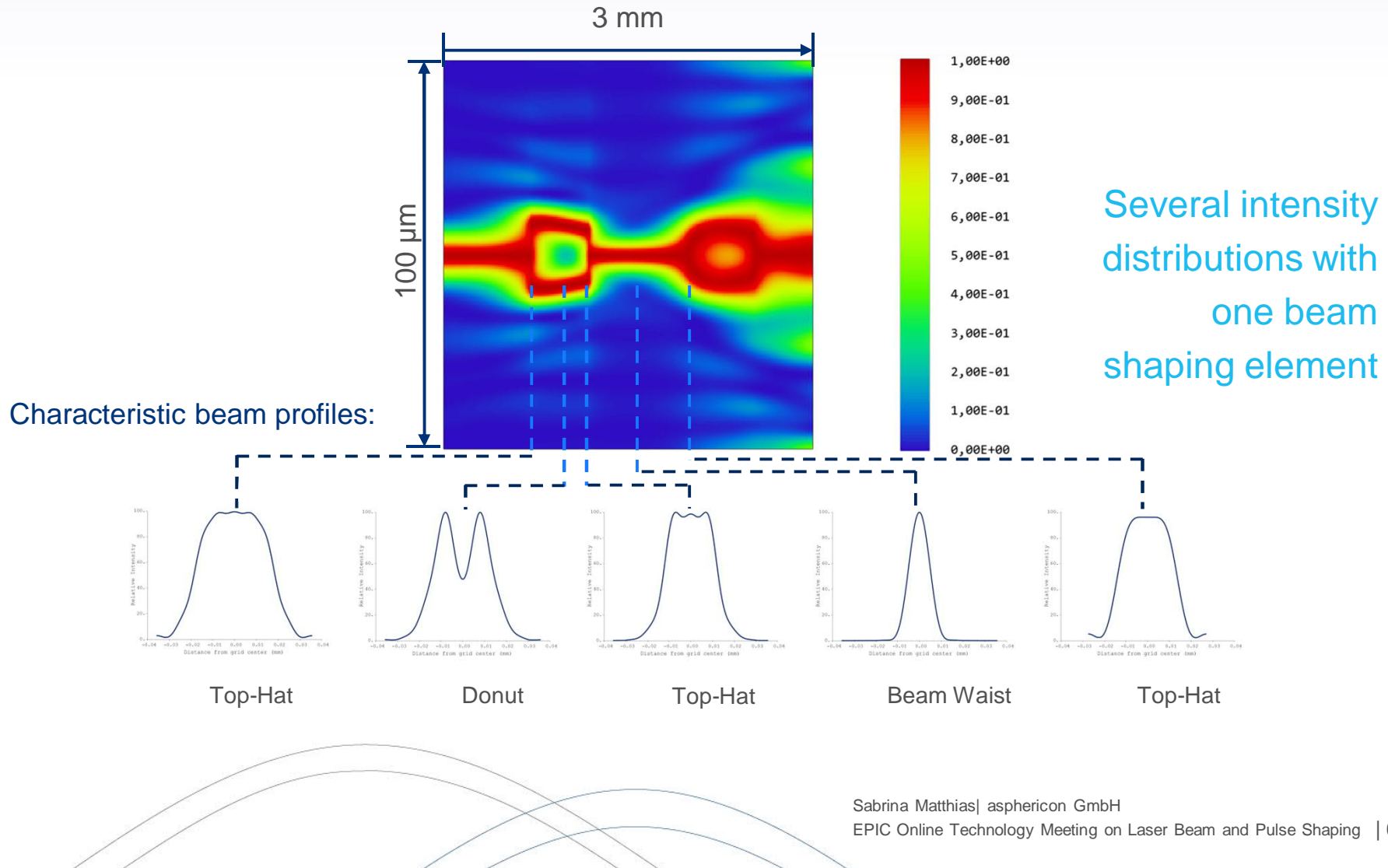
Generated Beam Profiles a|Airy|shape

Beam Profile Sections along ist Propagation Direction



Generated Beam Profiles a|Airy|hape

Normalized Beam Profile Sections Along its Propagation Direction



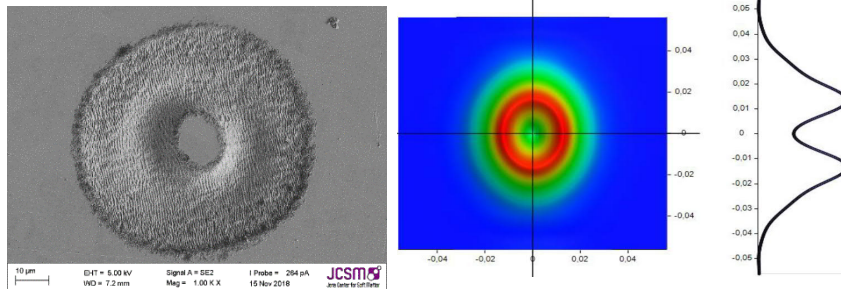
Beam Shaping Verification

Single Ablation Spots (200 Pulses) vs. Theoretical Simulation

Ablation spots have been performed by the OTTO SCHOTT Institute, Jena

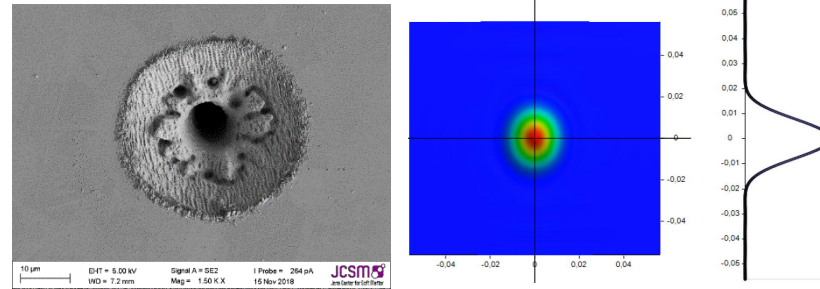


Donut (pos. 1)



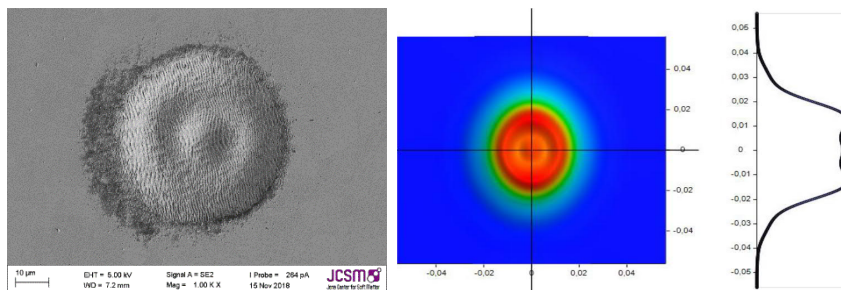
∅ 70 μm

Beam Waist (pos. 3)



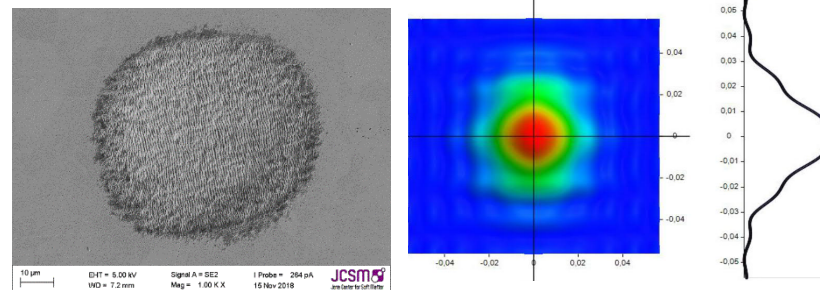
∅ 35 μm

Top-Hat (pos. 2)



∅ 53 μm

Top-Hat (pos. 4)



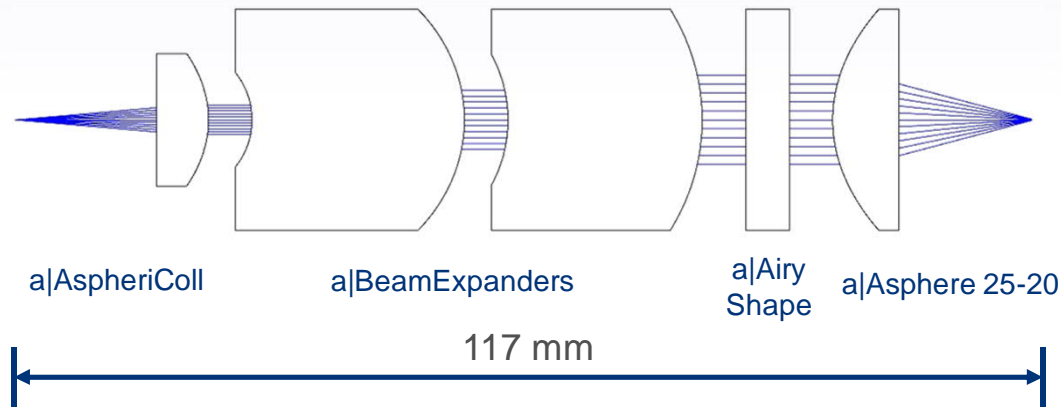
∅ 62 μm

Very good agreement with theoretical simulation



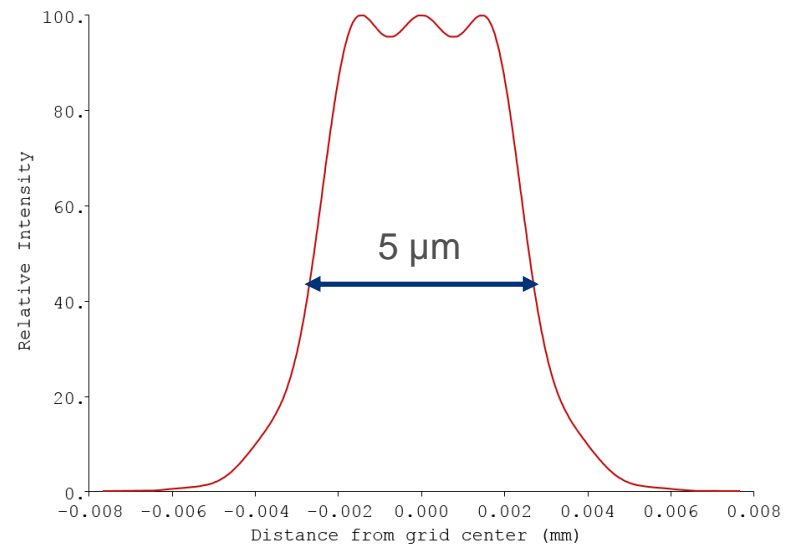
Characteristic Beam Profiles a|Airy|hape

Set-up to Generate a Top-Hat Beam Profile (5 μm)



$$d_{FWHM} \approx 2.44 \cdot \frac{f \cdot \lambda}{D_{in}}$$

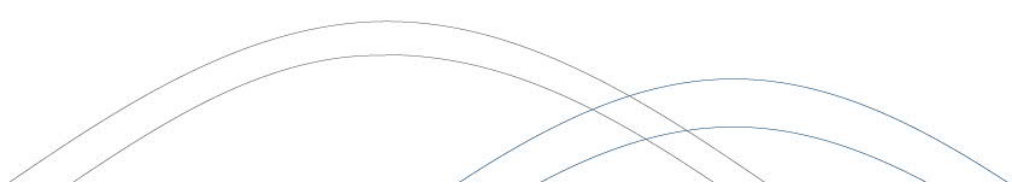
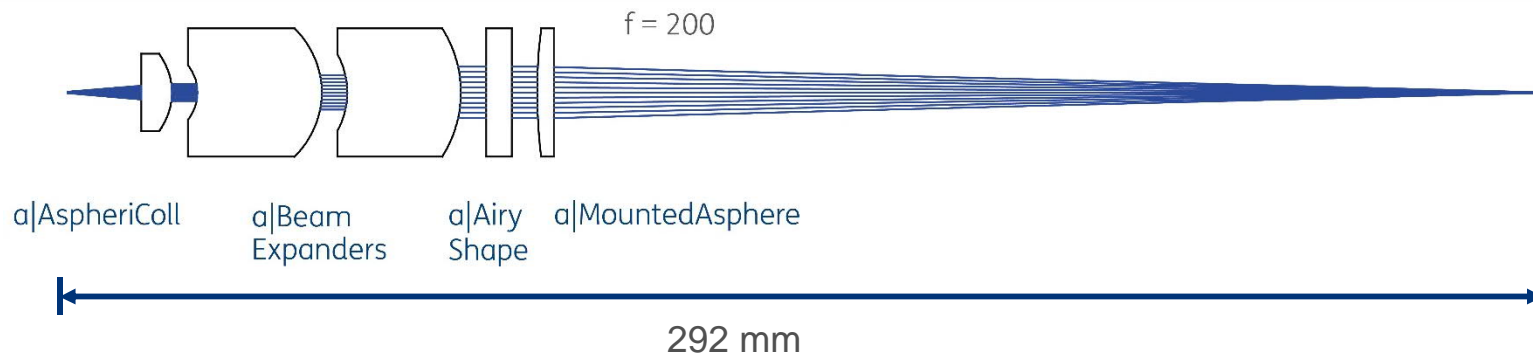
Cross-sectional plot of Generated Top-Hat intensity distribution



Characteristic Beam Profiles a|Airy|hape

Reduction of Working Distance – 50 μm Top-Hat

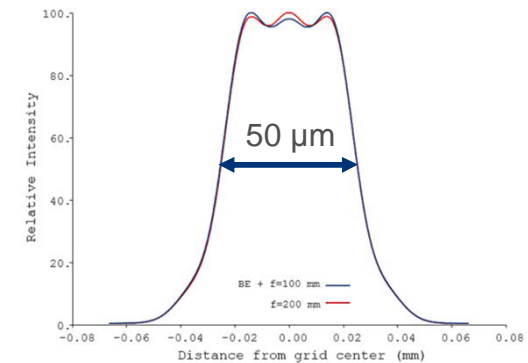
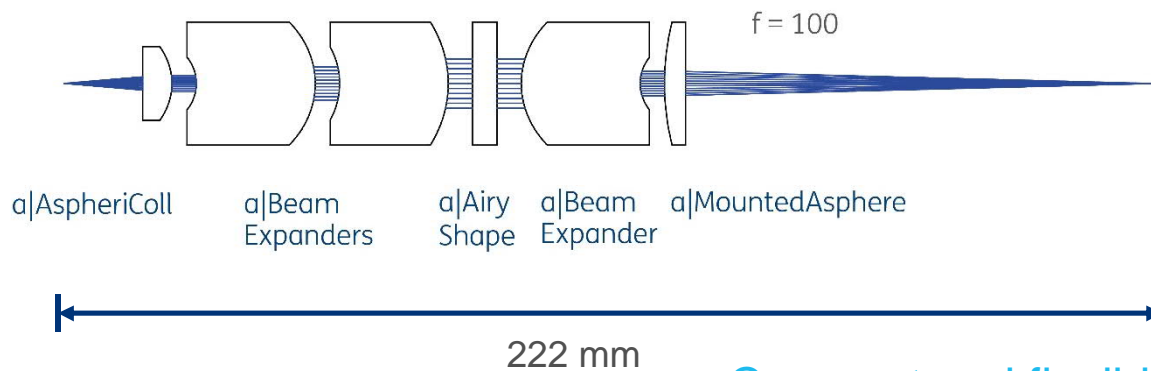
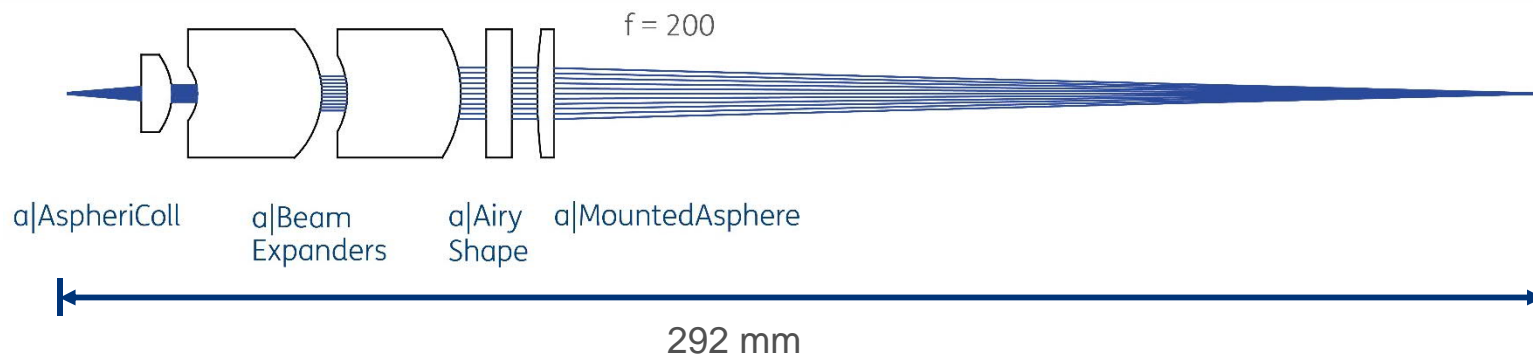
$$d_{FWHM} \approx 2.44 \cdot \frac{f \cdot \lambda}{D_{in}}$$



Characteristic Beam Profiles a|Airy|shape

Reduction of Working Distance – 50 μm Top-Hat

$$d_{FWHM} \approx 2.44 \cdot \frac{f \cdot \lambda}{D_{in}}$$

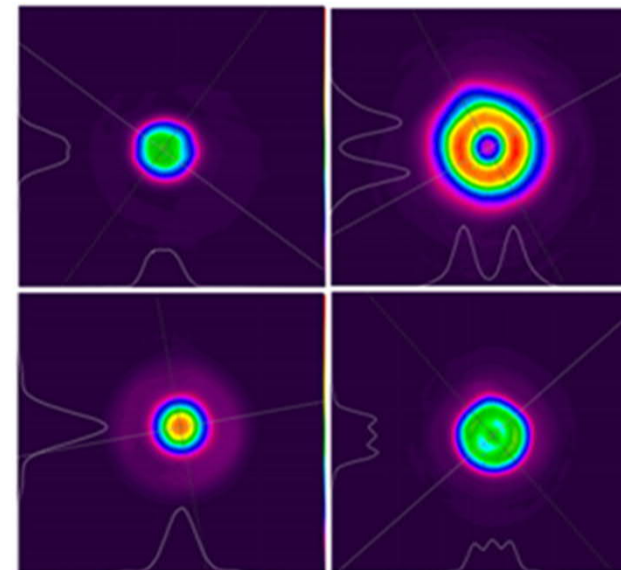
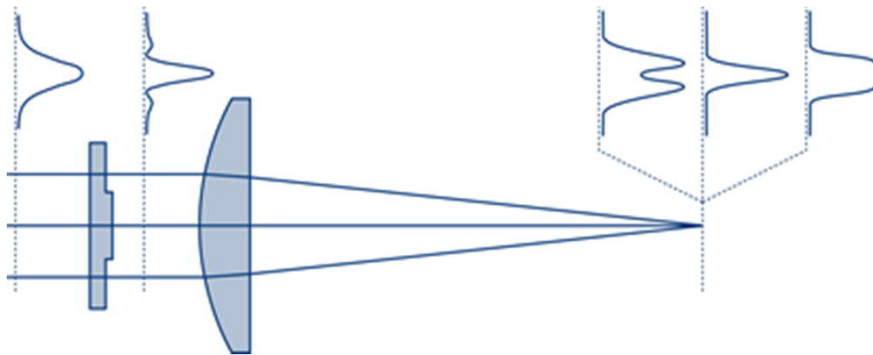


Compact and flexible beam shaping solution



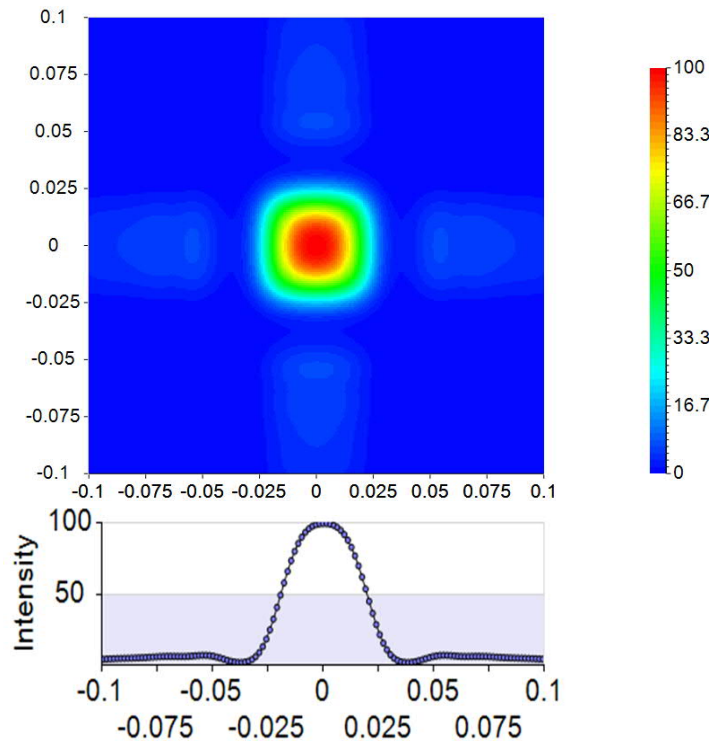
Beam Shaping at the next level

Further development of the known concept



Beam Shaping at the next level

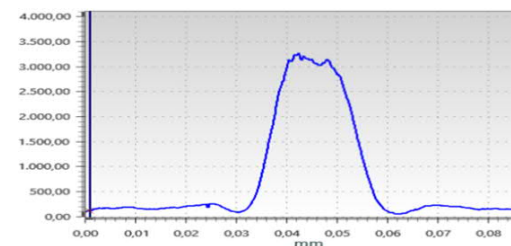
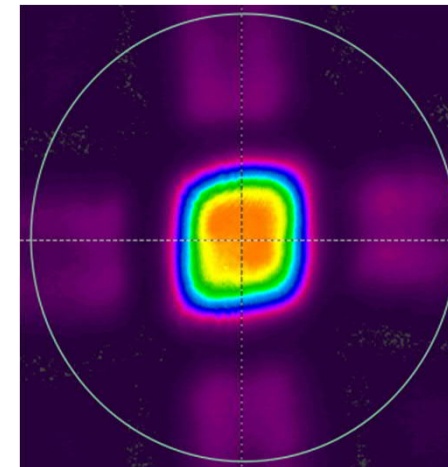
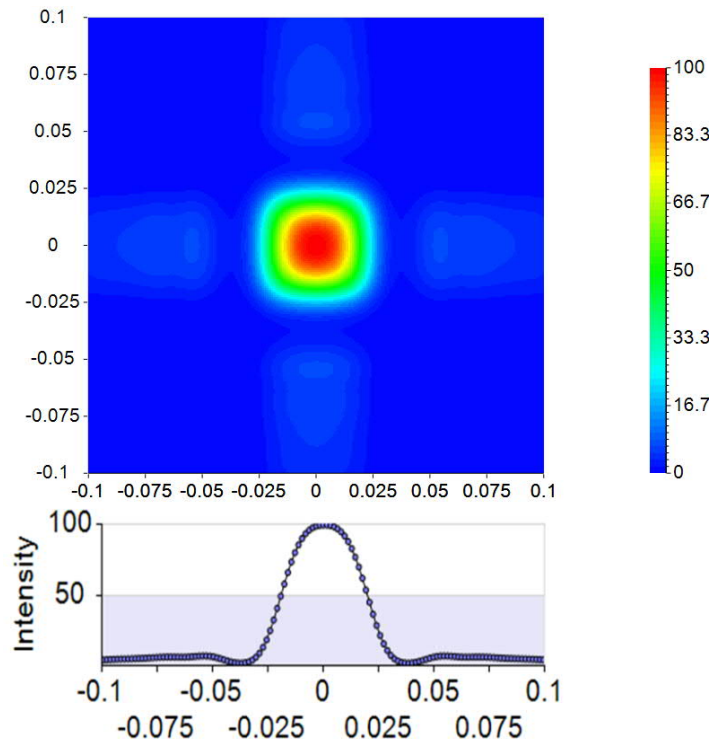
= The squared version of the AiryShape



Simulations show great results

Beam Shaping at the next level

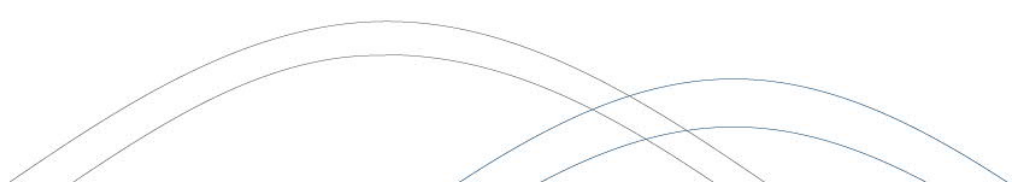
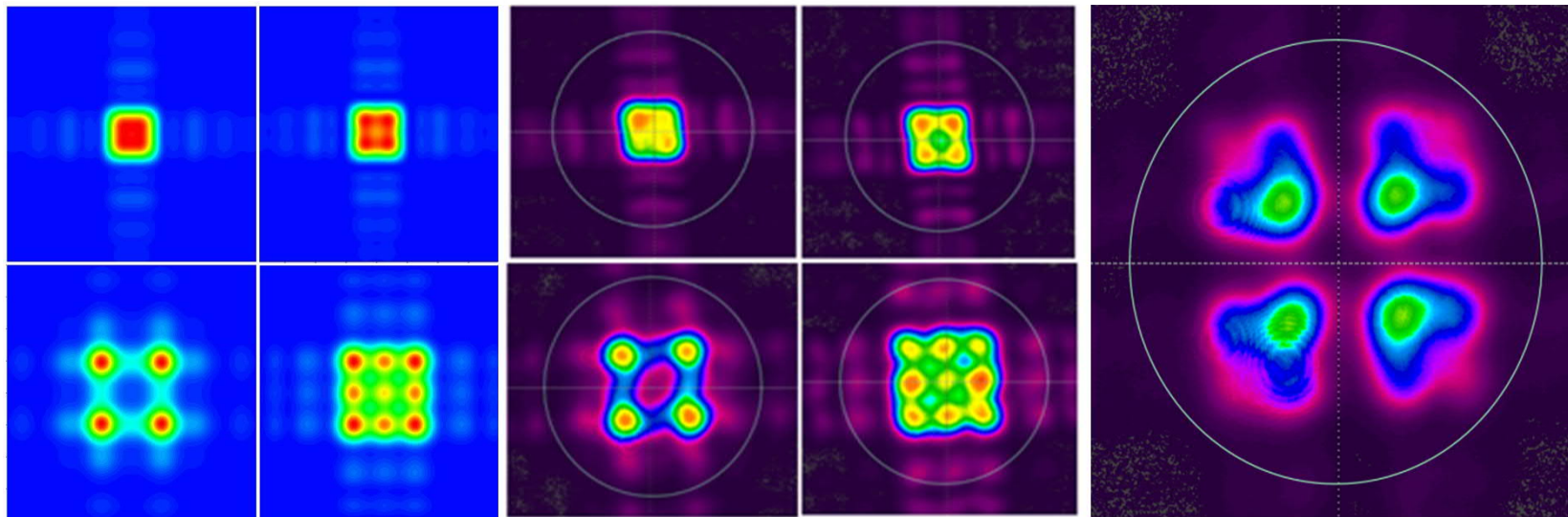
= The squared version of the AiryShape



What can you do for us

Help us develop new products for the market

- = Tell us what other profiles you need for your application
- = Tell us what you expect from your beam shaping element
- = Challenge us – We love it!



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