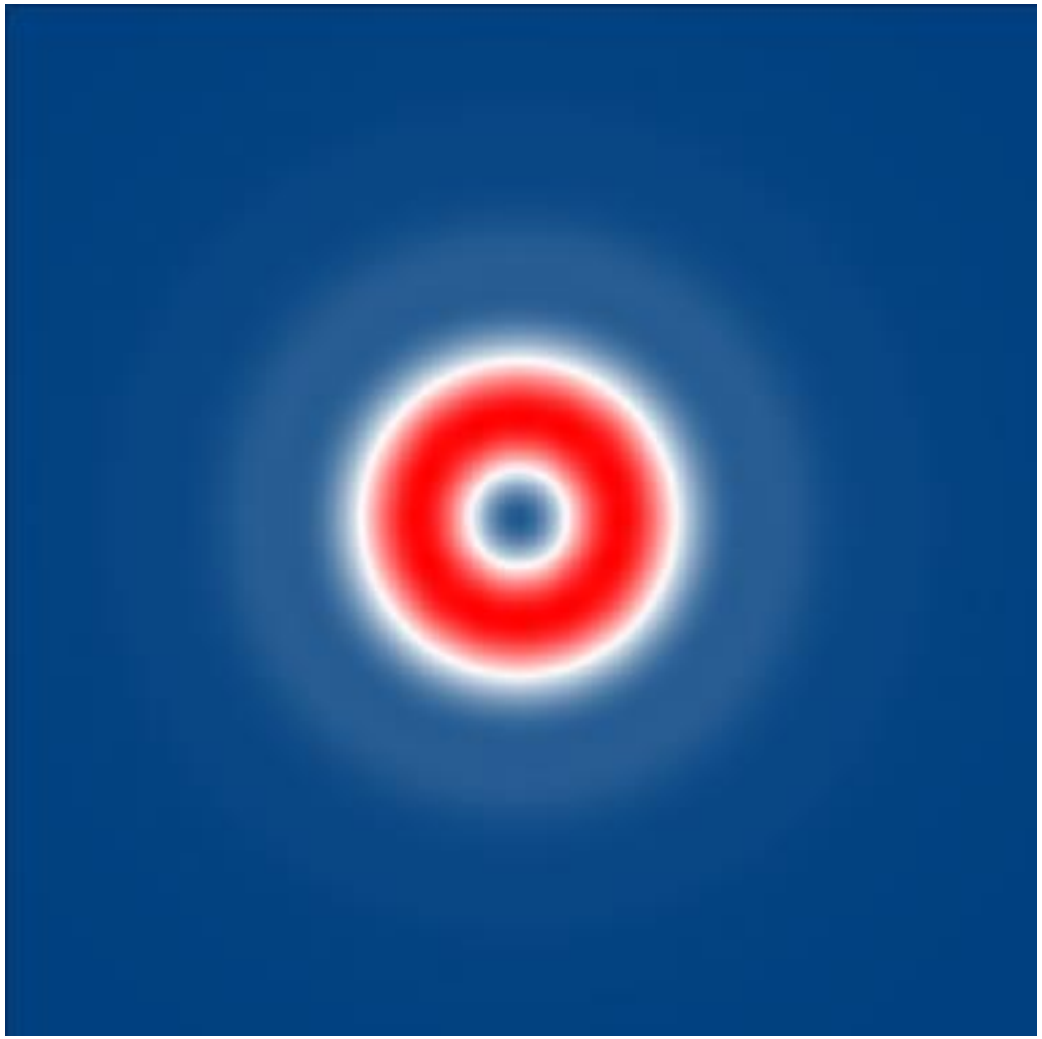
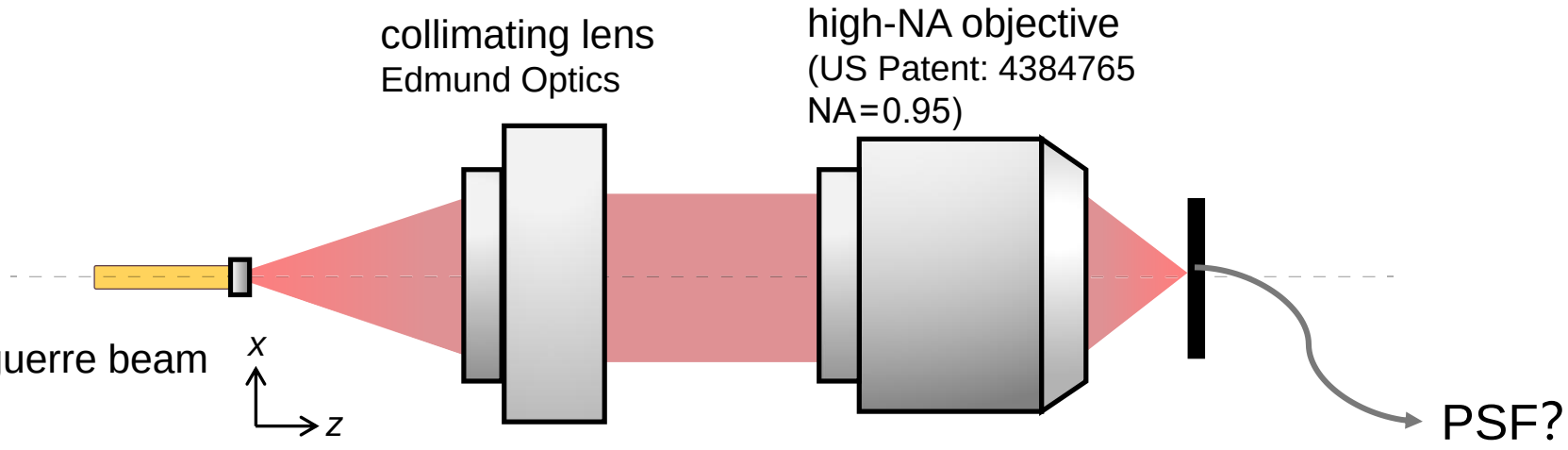
Focusing of Gaussian-Laguerre Beam for STED Microscopy

Abstract



STimulated Emission Depletion (STED) microscopy uses a tiny spot in the focal plane to generate super resolution. Two focused beams are needed. One is the excitation beam. The other one is the depletion beam, which can eliminate the emission light. The depletion beam needs to be donut-shaped. In [P. Török and P.R.T Monro, (2004)], the authors investigated the donut-shaped PSF can be generated by focusing high order Gaussian-Laguerre beam. In VirtualLab Fusion, the focusing of such high-order Gaussian-Laguerre beam is modeled and analyzed straightforwardly.

Scenario



Gaussian-Laguerre beam

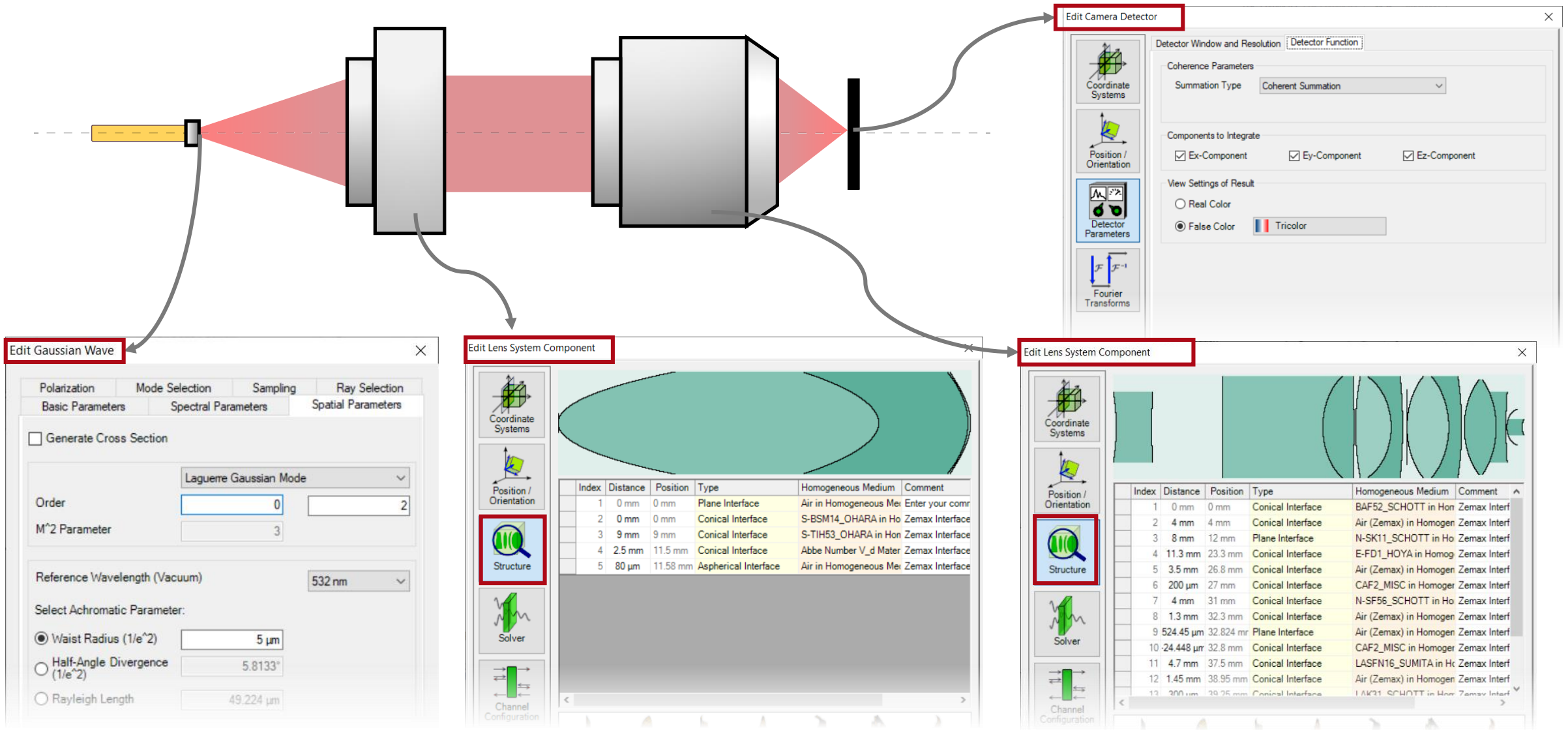
- order 0X1
- order 0X2
- order 0X3
- order 0X4
- wavelength 532 nm
- circularly polarized

P. Török and P.R.T Monro, (2004)

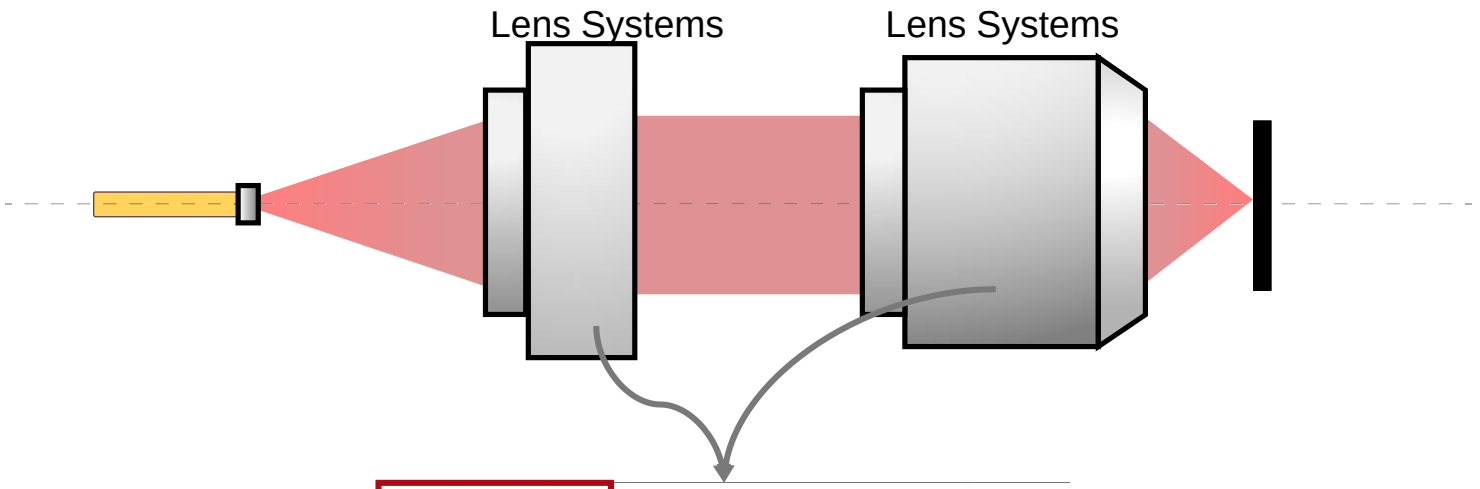
Comparison of the PSFs for different orders of Gaussian-Laguerre beams, which are used for STED microscopy

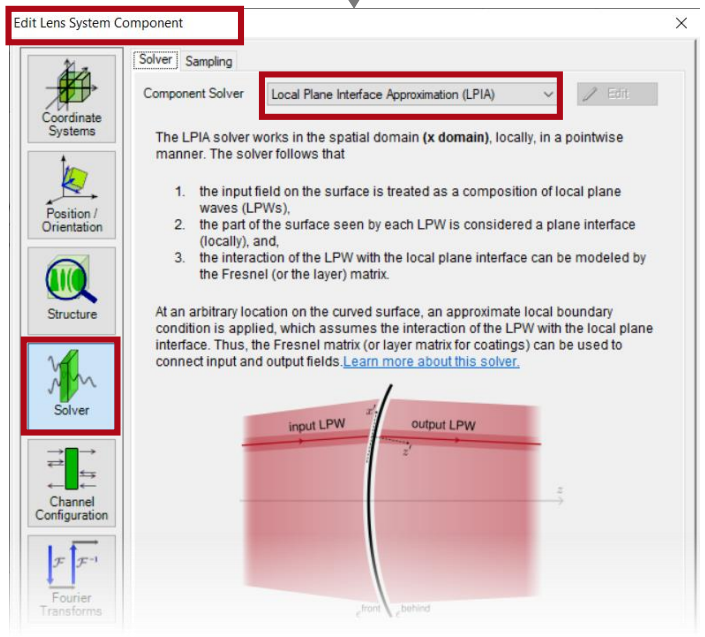
Building the System in VirtualLab Fusion

System Building Blocks



Solvers for Components



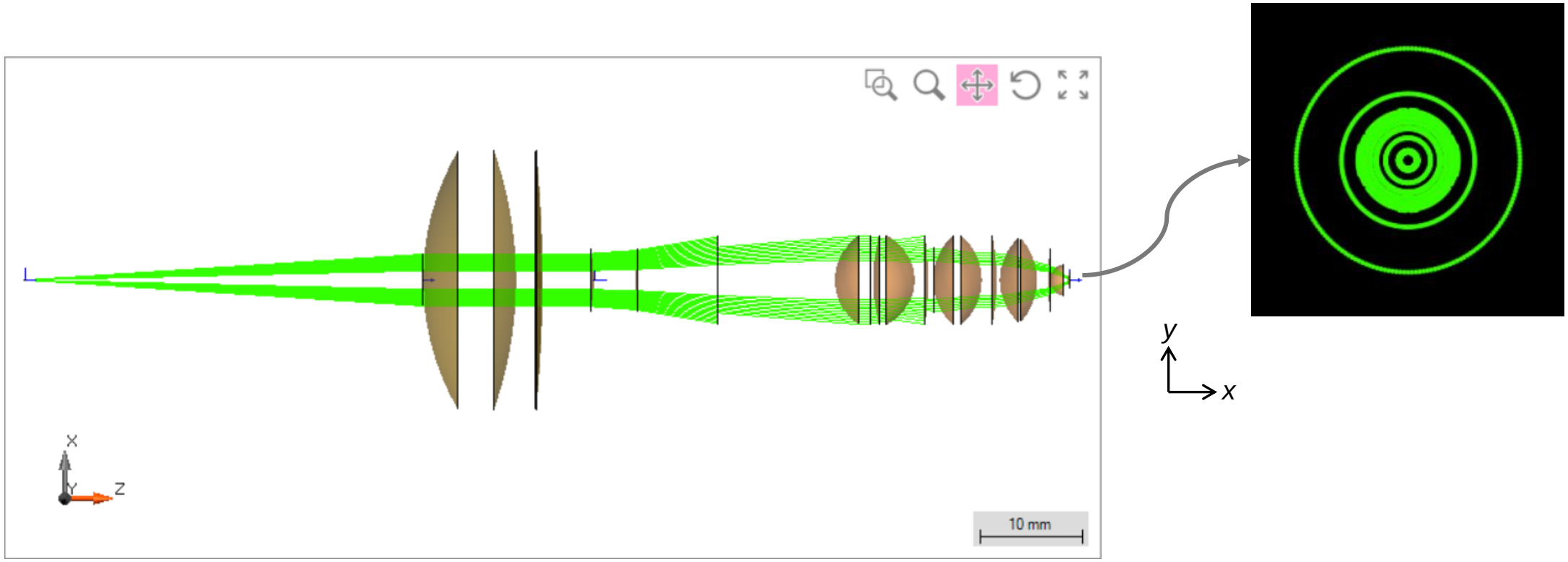


Components	Solvers
Lens Systems	Local Plane Interface Approximation (LPIA)

Geometric-Optics Simulations

by Ray Tracing

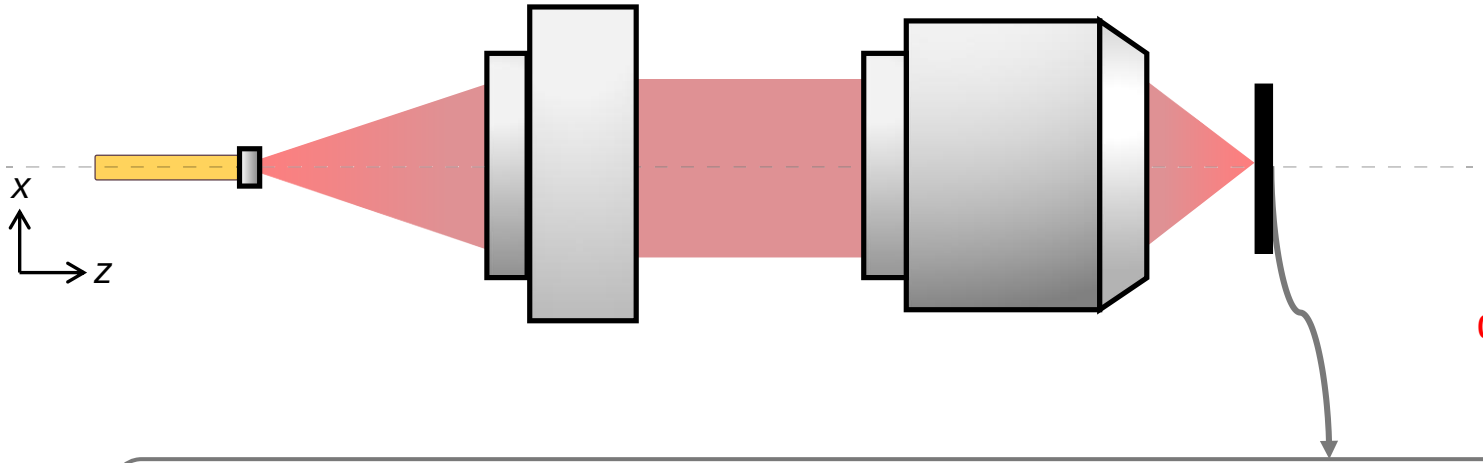
Results: Ray Tracing



Fast Physical-Optics Simulations

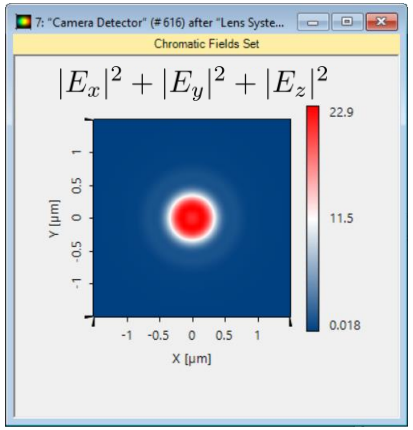
by Field Tracing

Focusing of Gaussian-Laguerre Beams

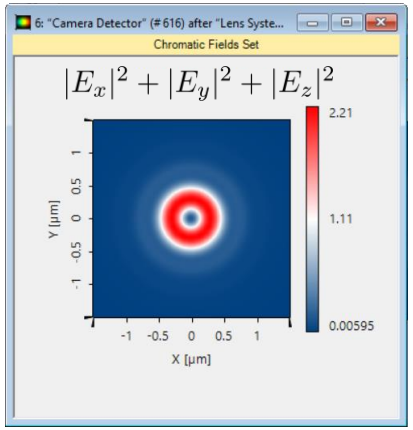


Focusing of higher orders of the Gaussian-Laguerre beam generates the donut-shaped PSFs, which are applied in the STED microscopy.

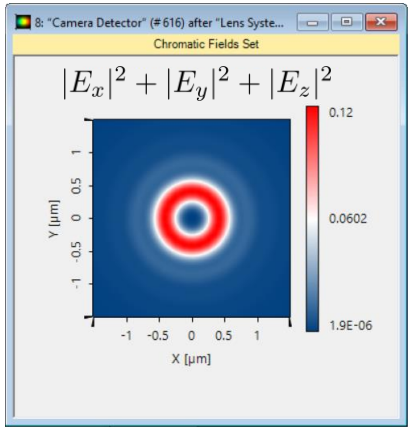
order 0X1



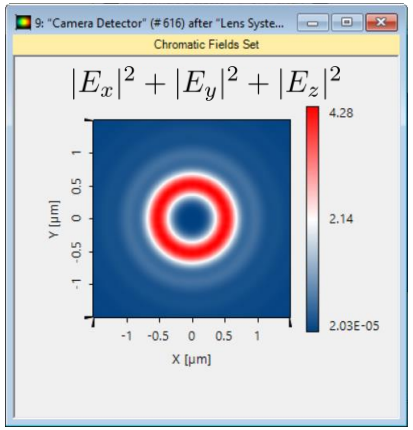
order 0X2



order 0X3



order 0X4



y
x

Document Information

title	Focusing of Gaussian-Laguerre Beam for STED Microscopy
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further reading	- Debye-Wolf Integral Calculator - Analyzing High-NA Objective Lens - Resolution Investigation for Microscope Objective Lenses by Rayleigh Criterion