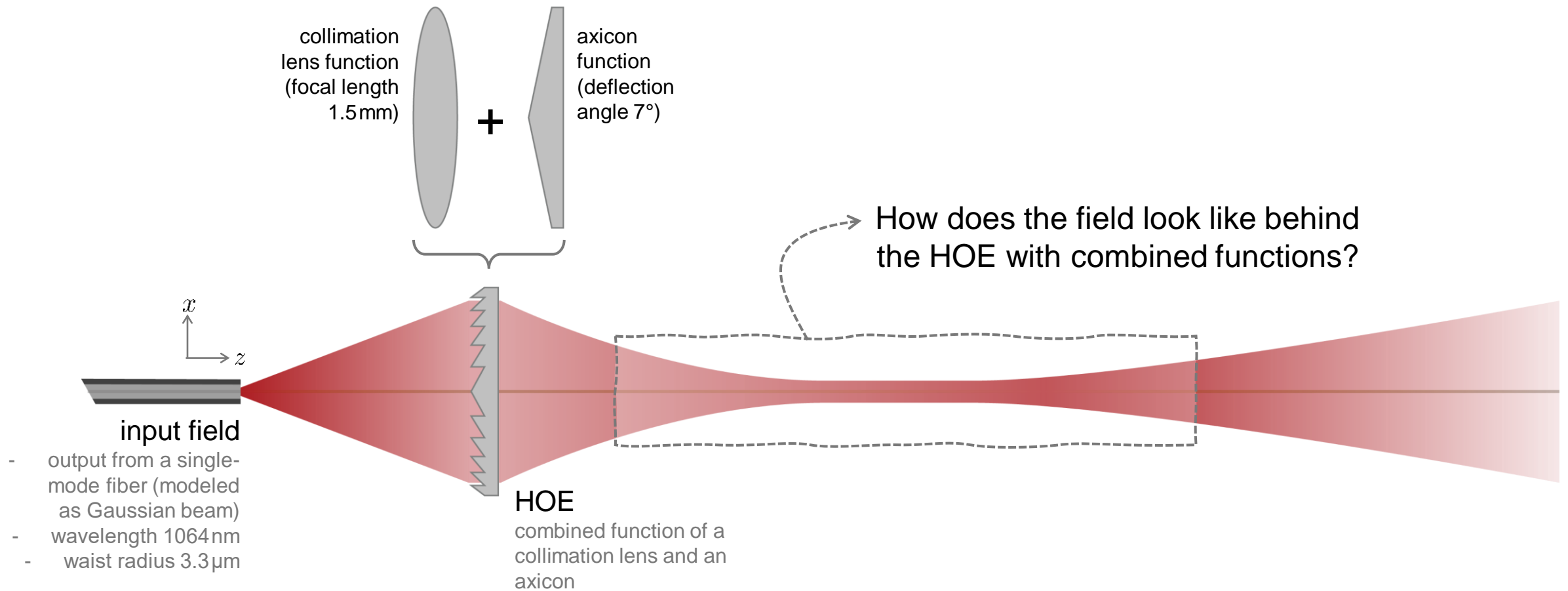# Bessel Beam Generation behind a Fiber with a Holographic Optical Element
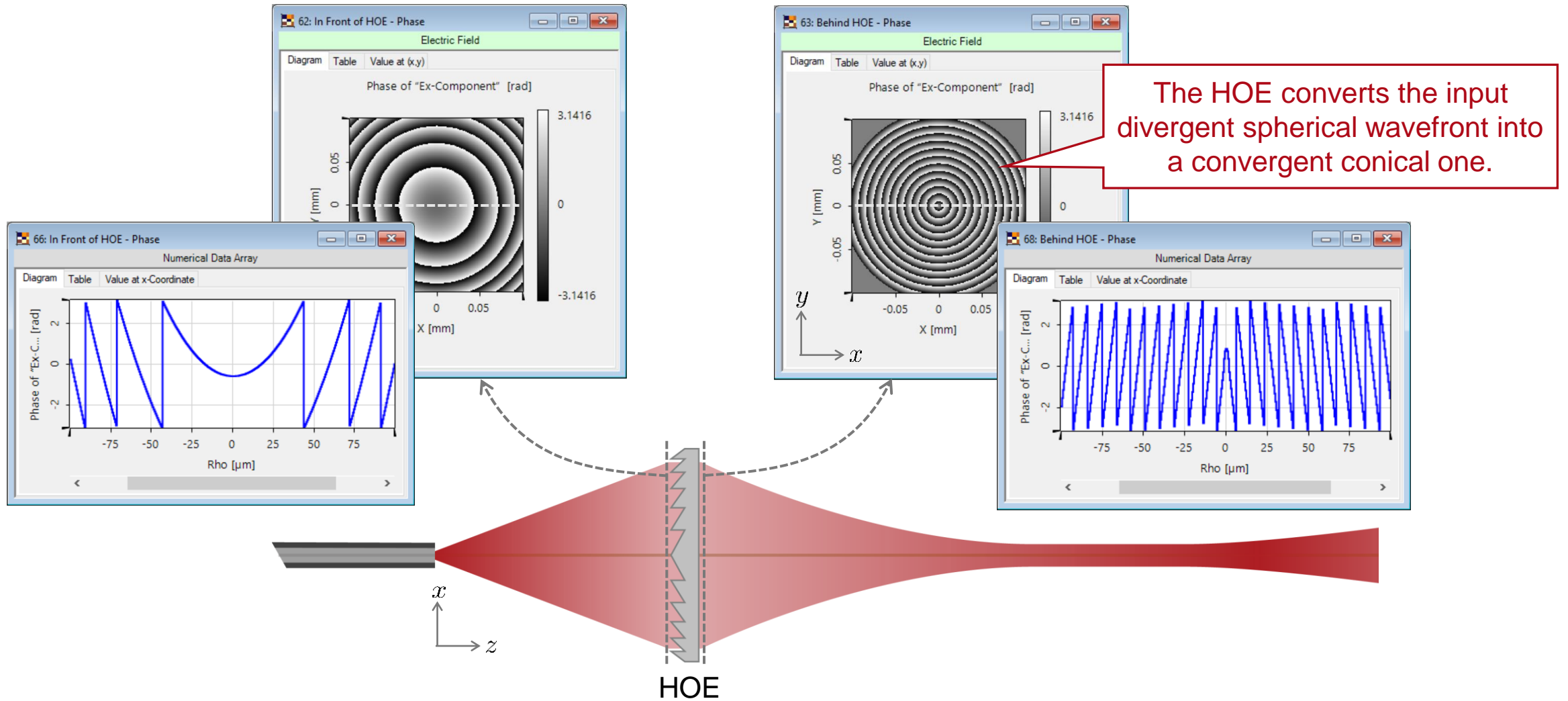
Abstract

Bessel beams, due to their extended depth of focus, are found useful in many applications. In this example, we show how to generate Bessel beam from the output of a single-mode fiber. Instead of the typical approach with a collimation lens and an axicon, we designed a holographic optical element (HOE) that incorporates both the lens and axicon functions in one. Such an optical setup is built in VirtualLab Fusion. We check the function of the HOE and examine the evolution of the field behind the HOE.
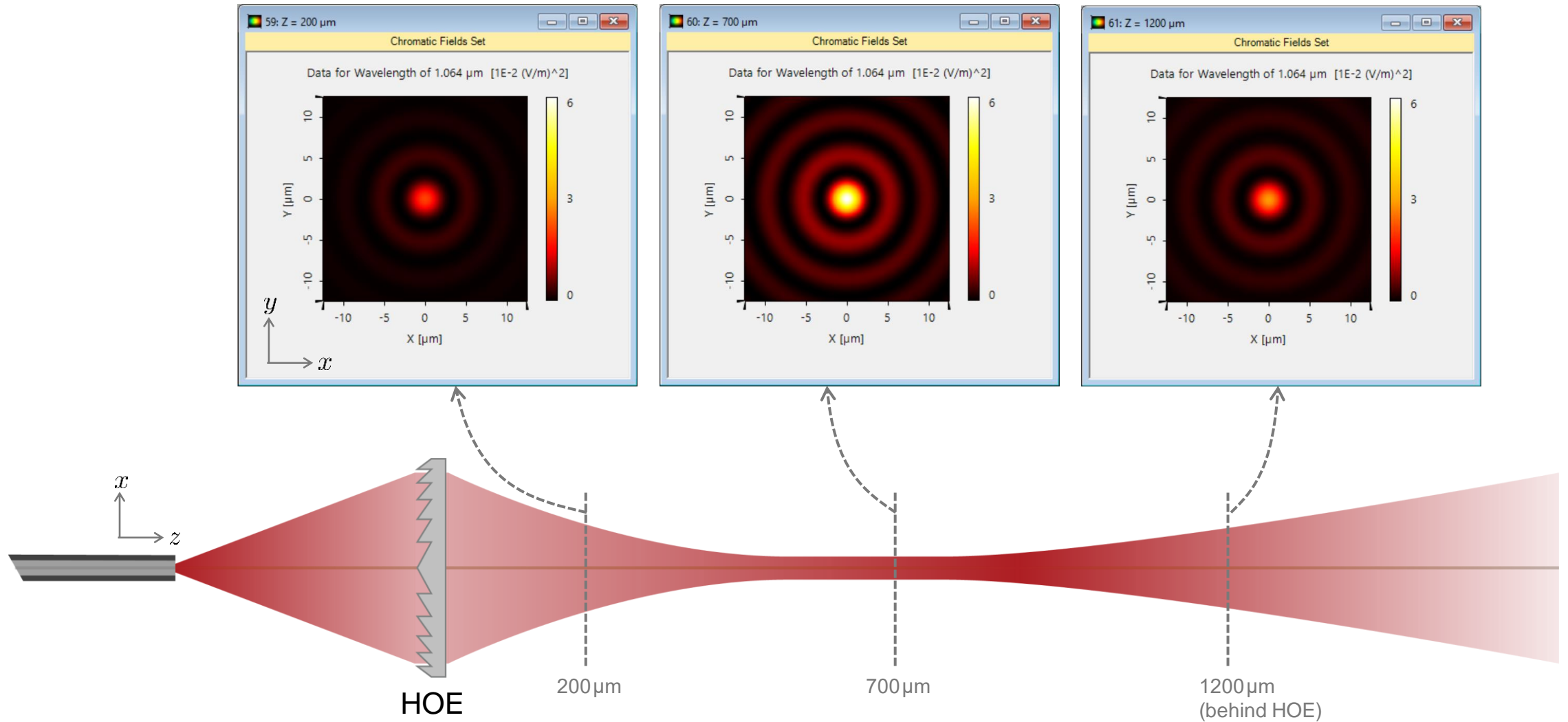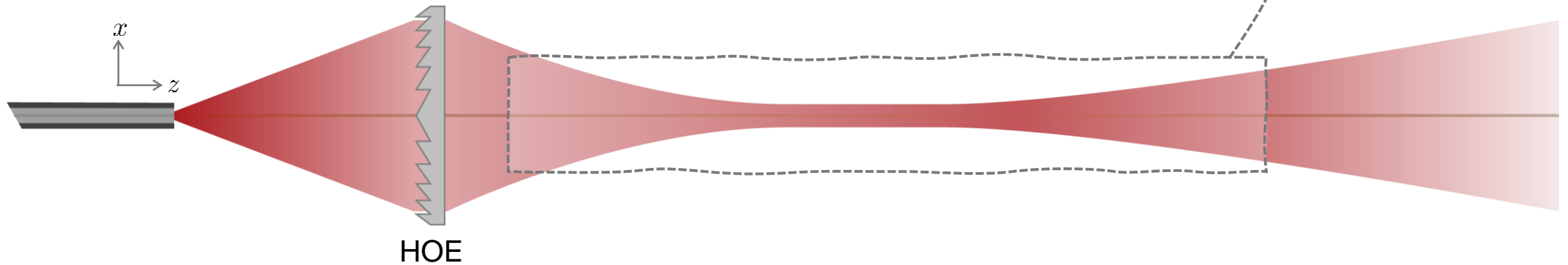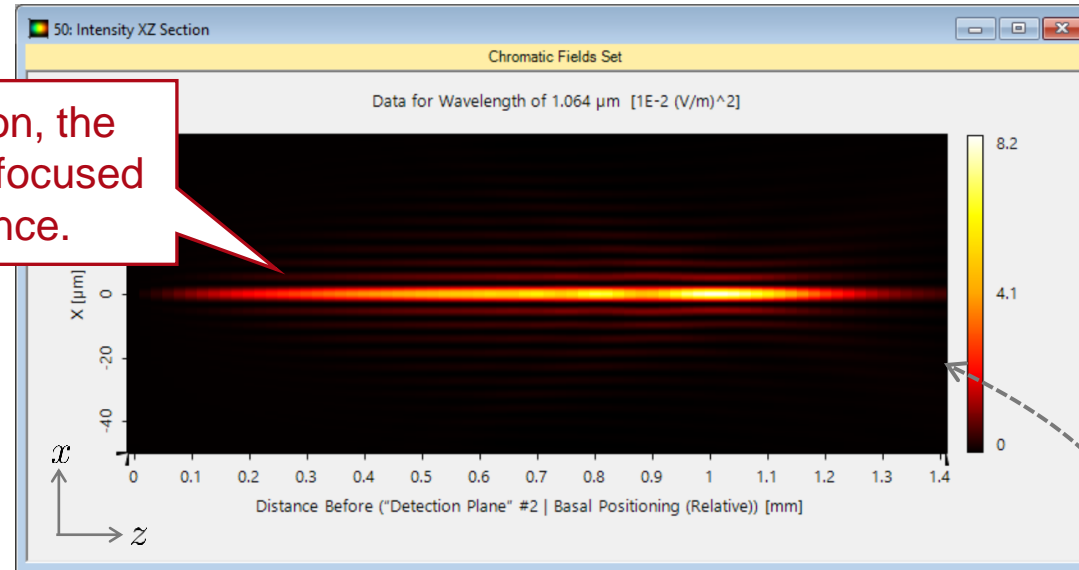
Modeling Task

collimation lens function (focal length 1.5 mm)

$+$

axicon function (deflection angle 7°)

How does the field look like behind the HOE with combined functions?

x

z

input field

- output from a single-mode fiber (modeled as Gaussian beam)
- wavelength 1064 nm
- waist radius 3.3 μm

HOE
combined function of a collimation lens and an axicon

Function of the HOE

The HOE converts the input divergent spherical wavefront into a convergent conical one.

Field at Different Locations Behind HOE

59: Z = 200 μm — Chromatic Fields Set — Data for Wavelength of 1.064 μm [1E-2 (V/m)^2]

60: Z = 700 μm — Chromatic Fields Set — Data for Wavelength of 1.064 μm [1E-2 (V/m)^2]

61: Z = 1200 μm — Chromatic Fields Set — Data for Wavelength of 1.064 μm [1E-2 (V/m)^2]

HOE

200 μm

700 μm

1200 μm
(behind HOE)

Intensity Distribution on X-Z Section

Because of the axicon function, the field behind the HOE remains focused over a relatively long distance.

HOE

Peek into VirtualLab Fusion
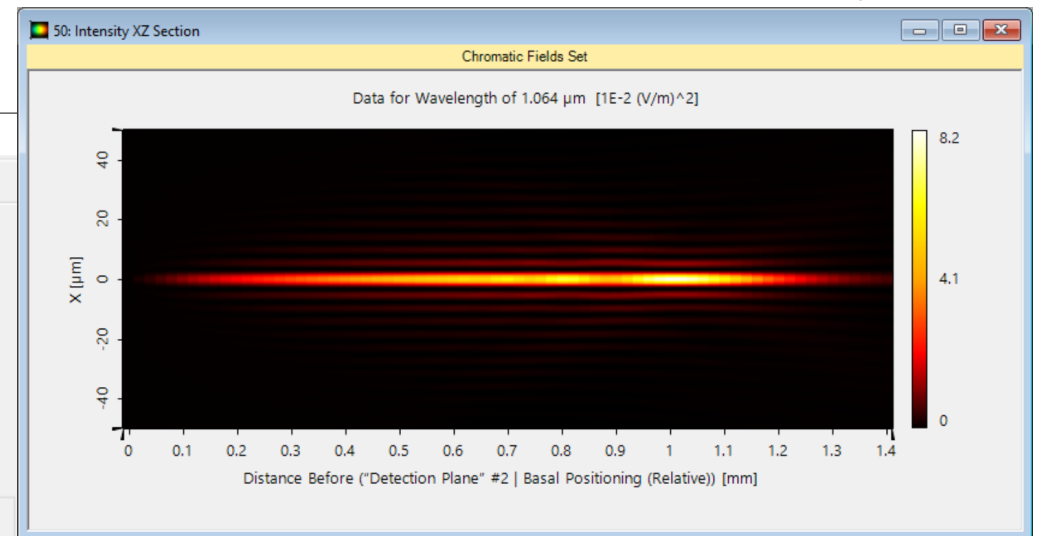
HOE component with flexible function definition
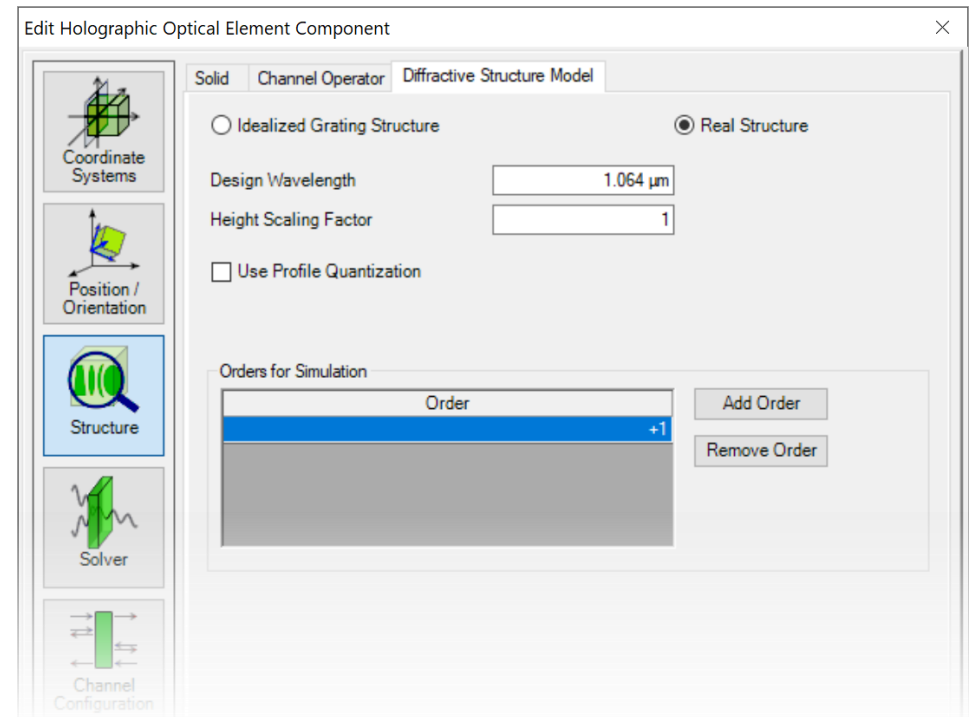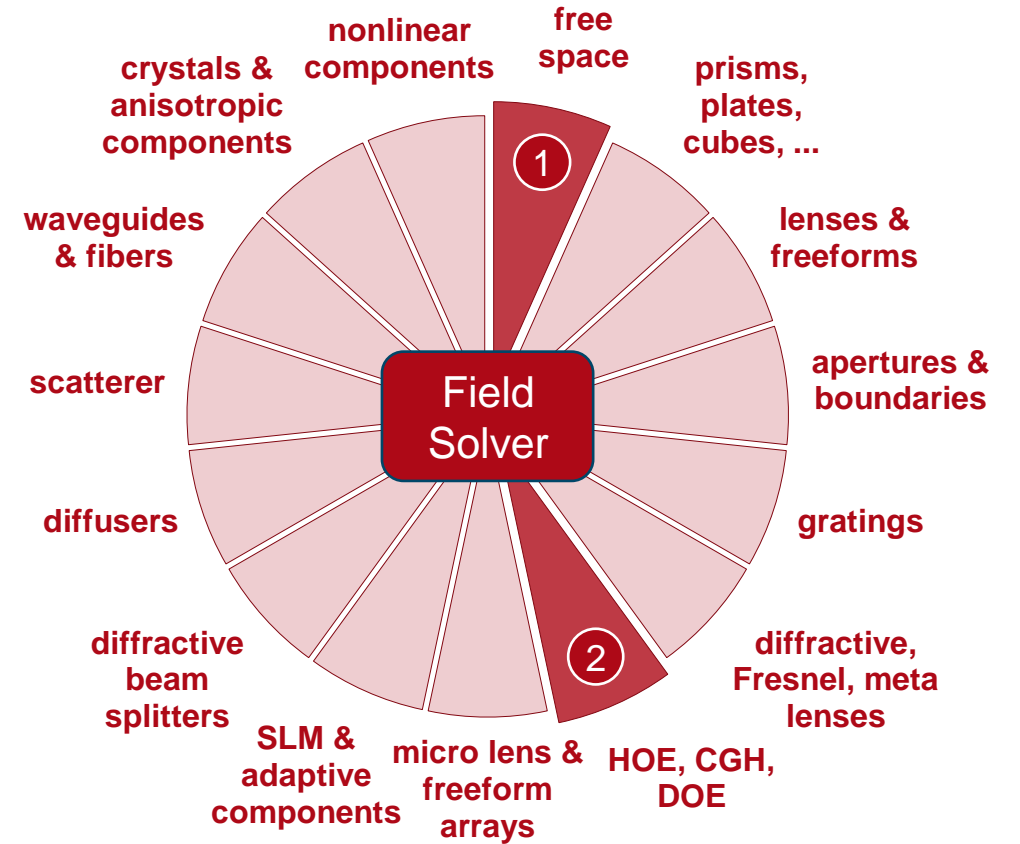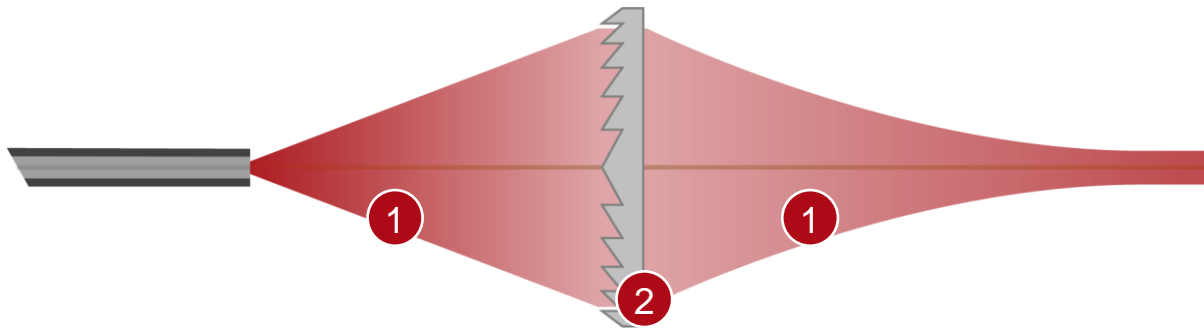

visualization of field quantities in any section

Workflow in VirtualLab Fusion

- Define customized HOE function via programming

- Set the Fourier transforms properly
  - Fourier Transform Settings – Discussion at Examples [Use Case]

- Use Parameter Run to check field evolution
  - Usage of the Parameter Run [Use Case]

VirtualLab Fusion Technologies

Document Information

title	Bessel Beam Generation behind a Fiber with a Holographic Optical Element
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category	Application Use Case
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