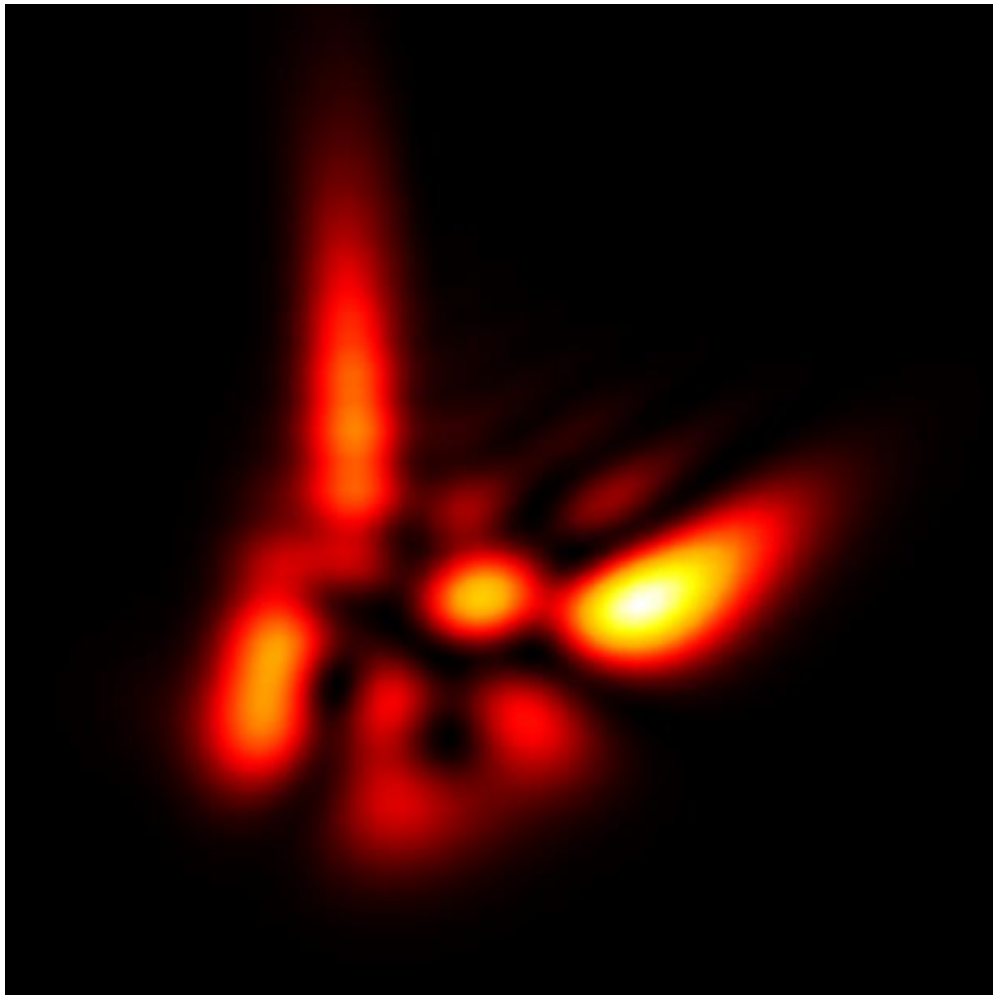
Huiying Zhong

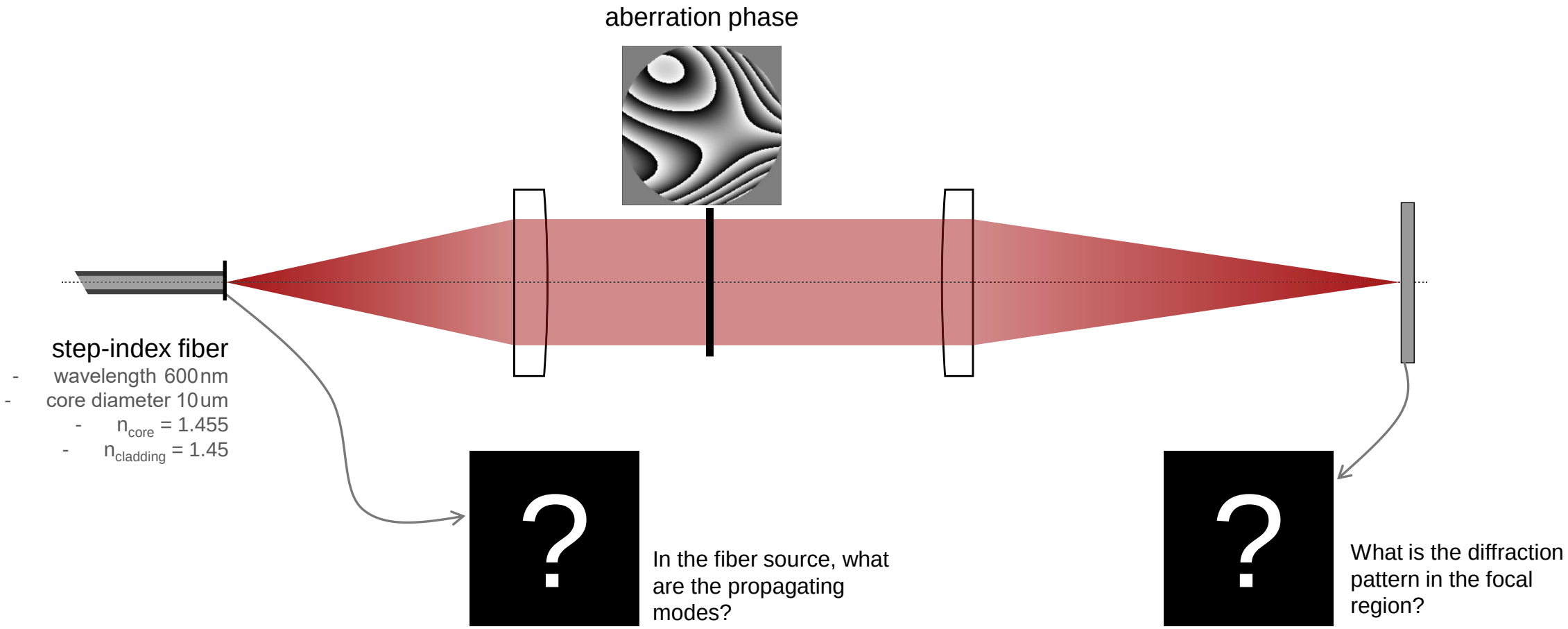
Investigation of Aberration Effects on LP Fiber Modes in the Focal Region

Abstract



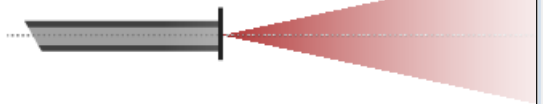
Fibers are widely used as sources in optical systems. Investigating the effects of the aberrations of the optical system on the propagation of the fiber modes is therefore worthwhile. In this use case, we employ a specific fiber, either step- or graded-index, as a source to generate a couple of propagating modes, and evaluate the diffraction pattern after the propagation of said modes through an aberrated optical system.

Modeling Task with a Step-Index Fiber



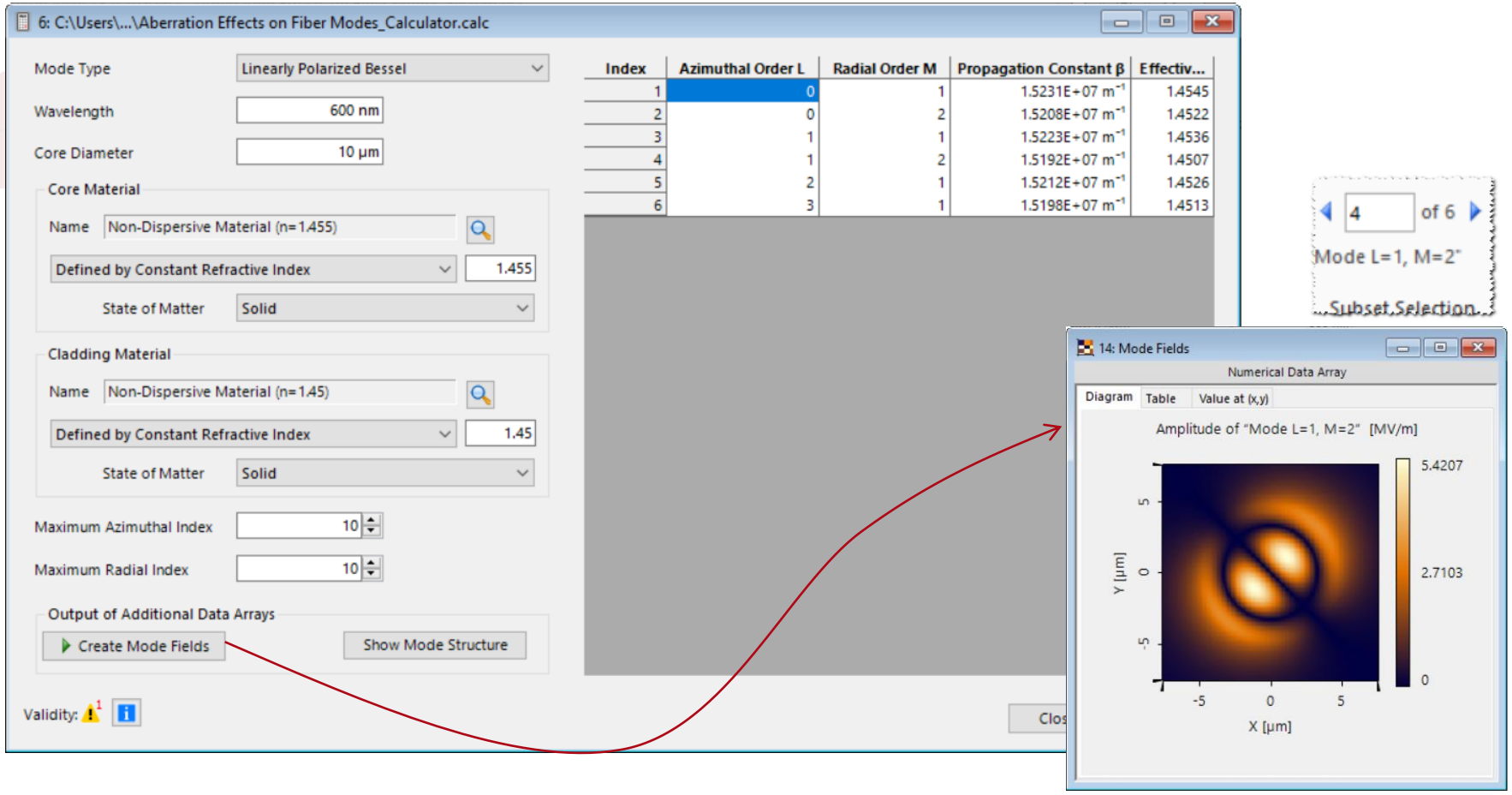
Setup from Appl. Opt. 59,6584-6592 (2020)

Linearly-Polarized Mode Calculator



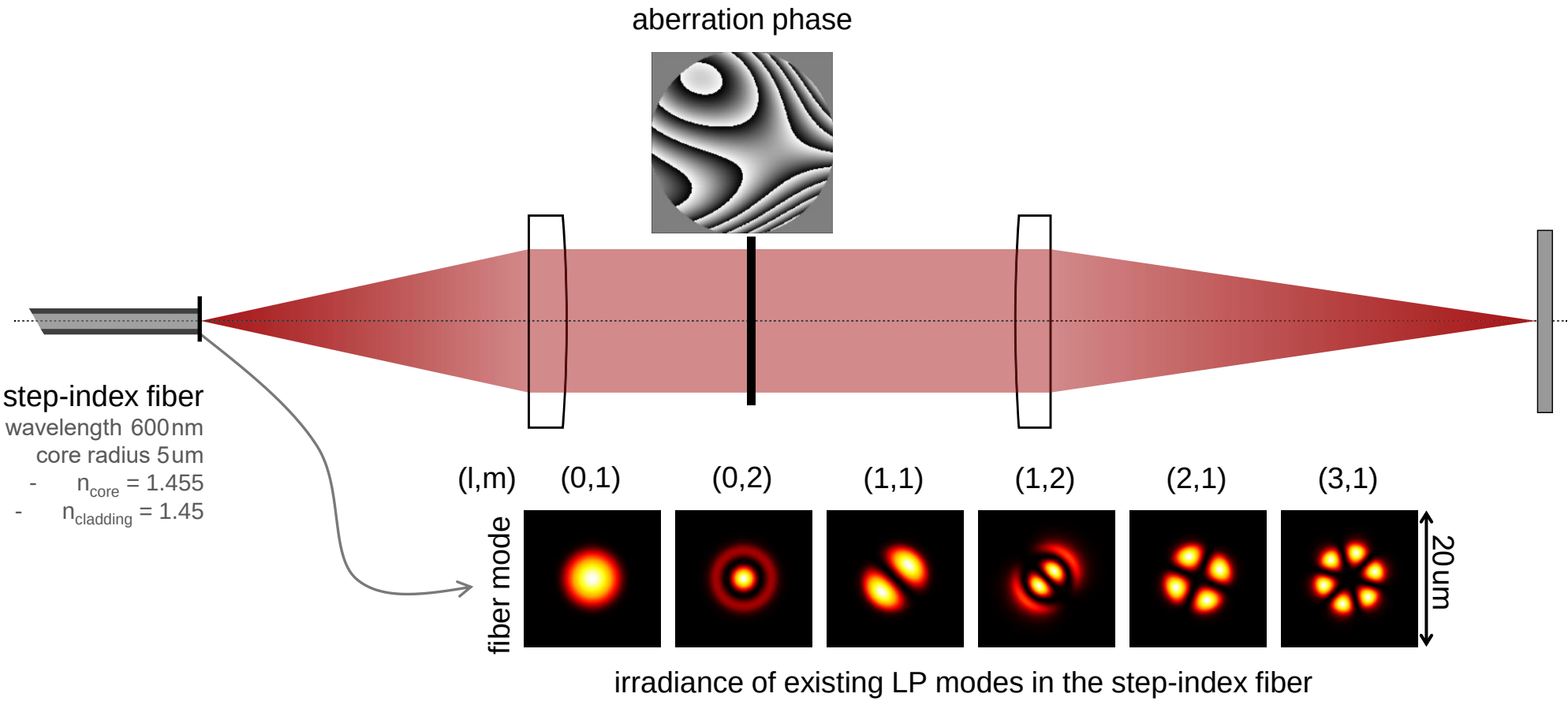
step-index fiber
- wavelength 600nm
- core radius 5um
- n_{core} = 1.455
- $n_{cladding}$ = 1.45

This calculator gives the propagation constants and mode fields of all existing linearly polarized (LP) modes.



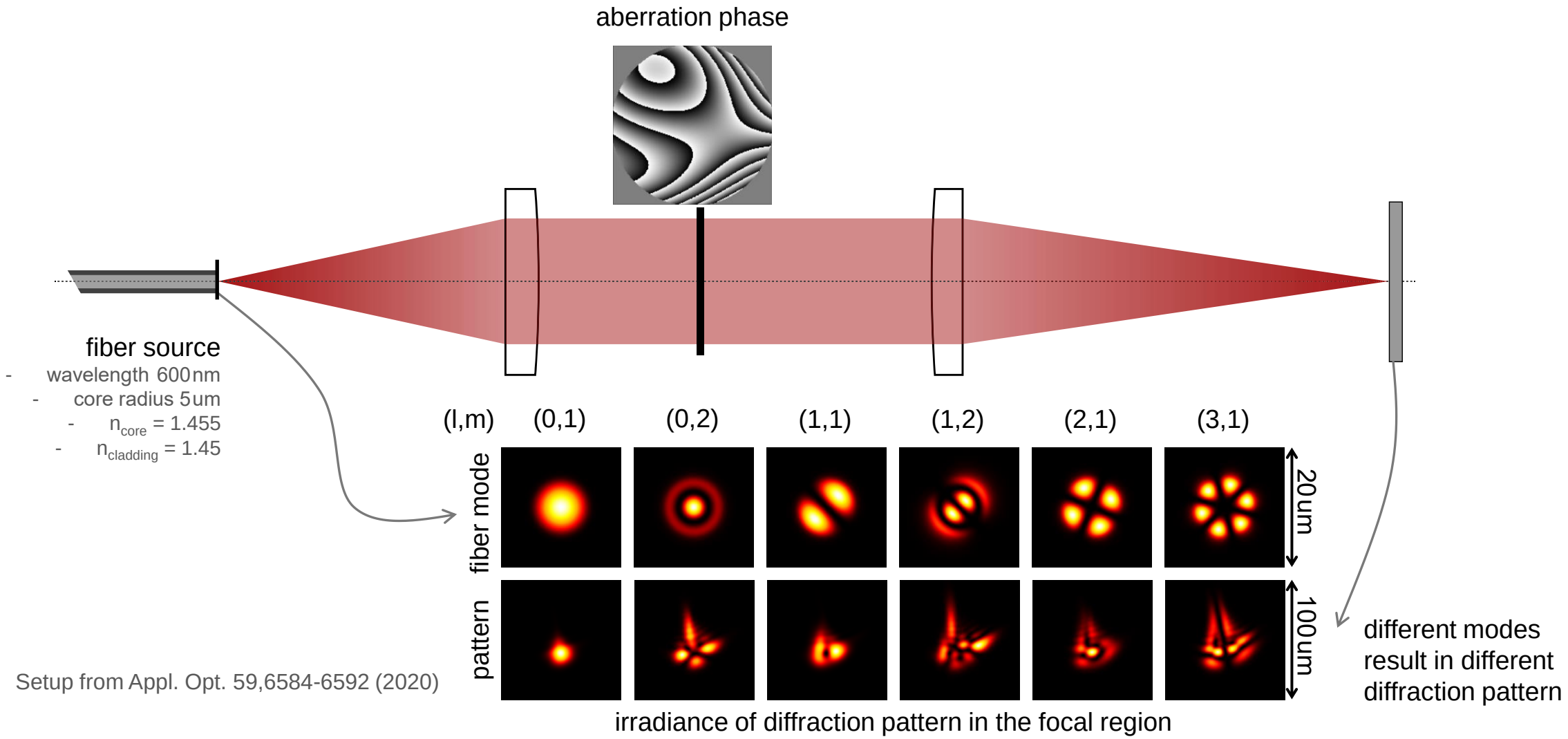
fields of all LP modes

Source of Fiber Modes



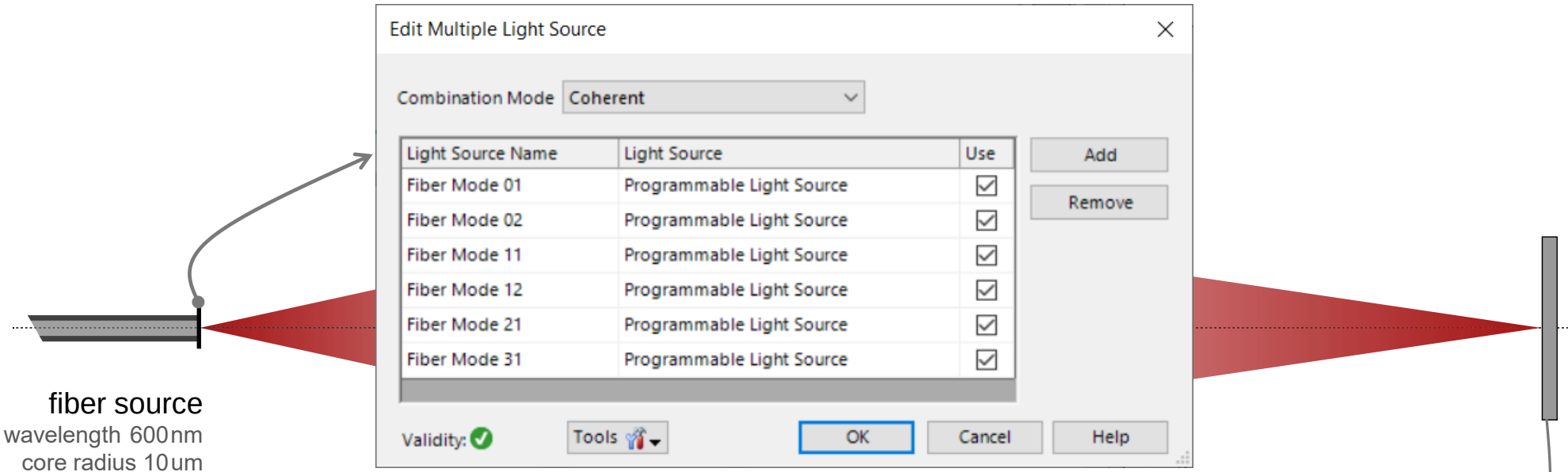
Setup from Appl. Opt. 59,6584-6592 (2020)

Diffraction Patterns

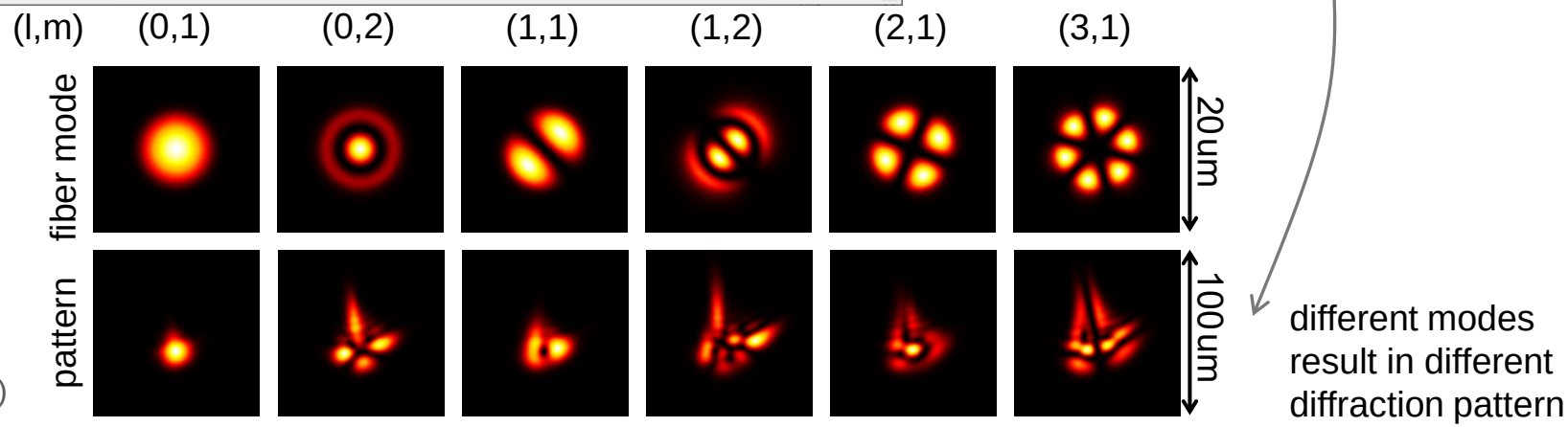


Setup from Appl. Opt. 59,6584-6592 (2020)

Switch from Single Mode Source to Multiple Light Source



fiber source
- wavelength 600nm
- core radius 10um
- n_{core} = 1.455
- $n_{cladding}$ = 1.45

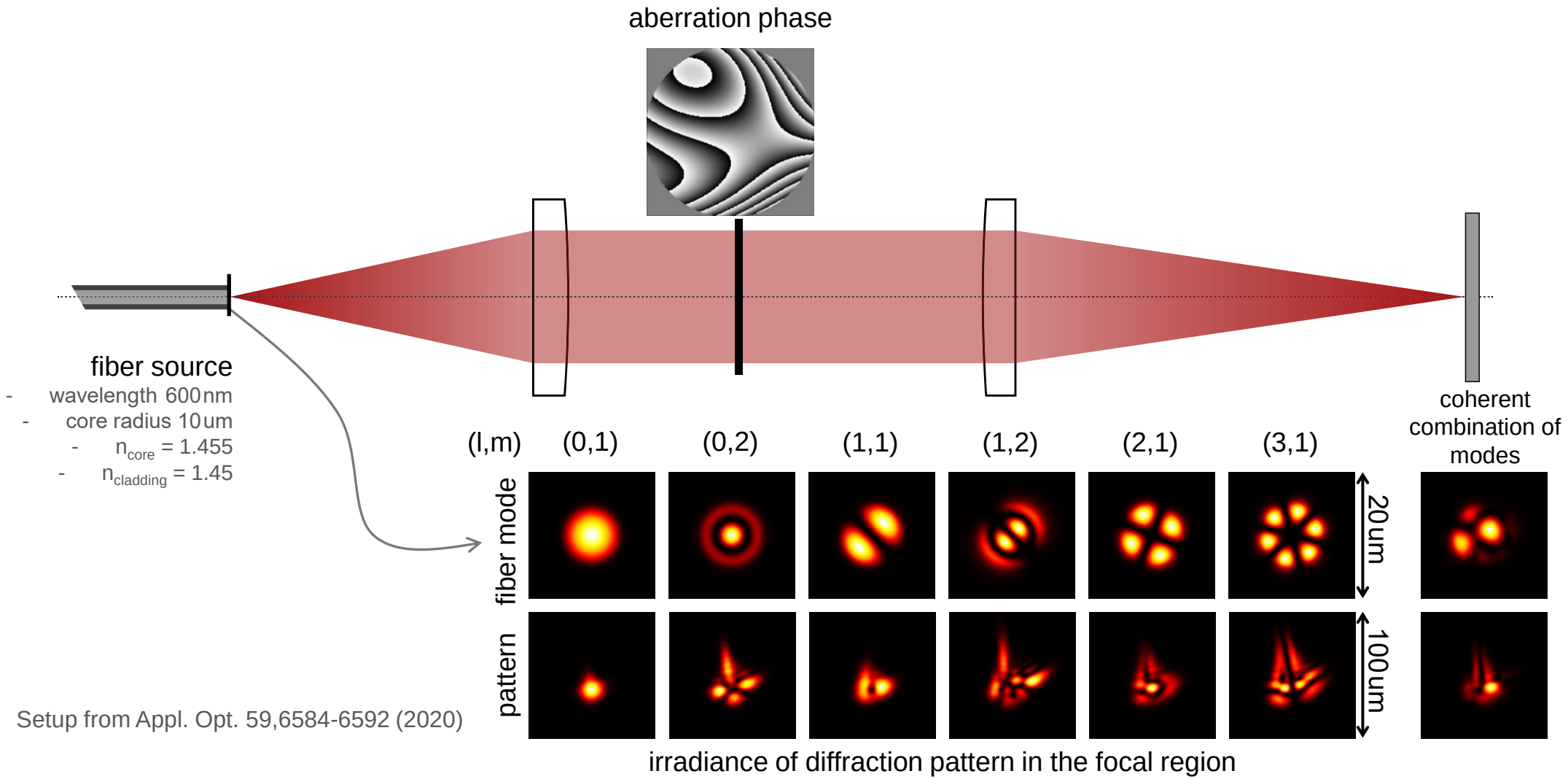


irradiance of diffraction pattern in the focal region

different modes result in different diffraction pattern

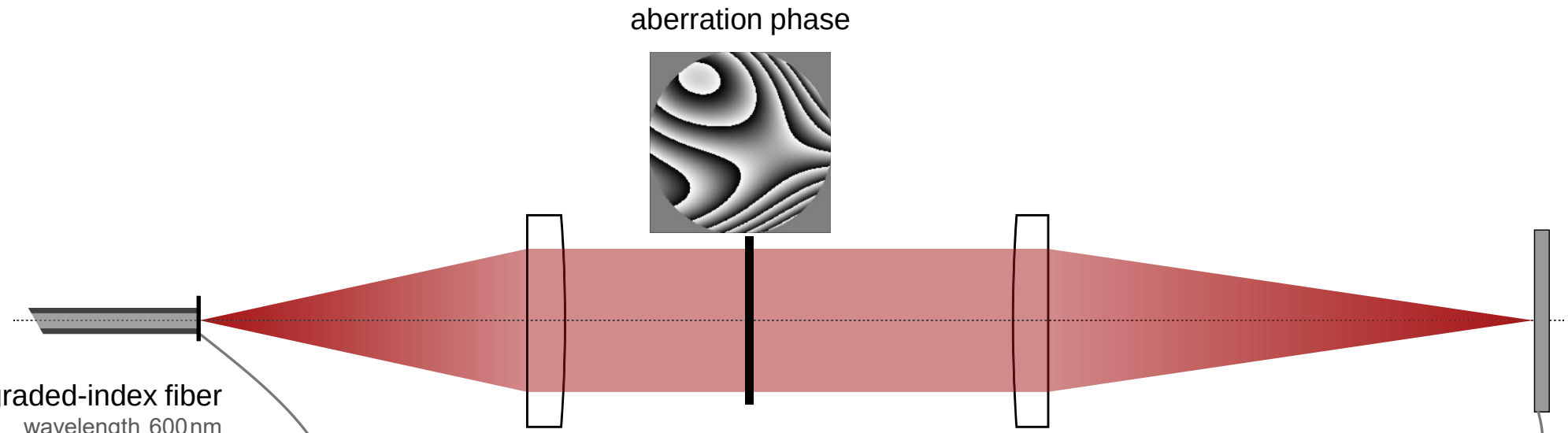
Setup from Appl. Opt. 59,6584-6592 (2020)

Switch from Single Mode Source to Multiple Light Source



Setup from Appl. Opt. 59,6584-6592 (2020)

Modeling Task with a Graded-Index Fiber



graded-index fiber
- wavelength 600nm
- core diameter 10um
- n_{center} = 1.455
- gradient constant 0.00343

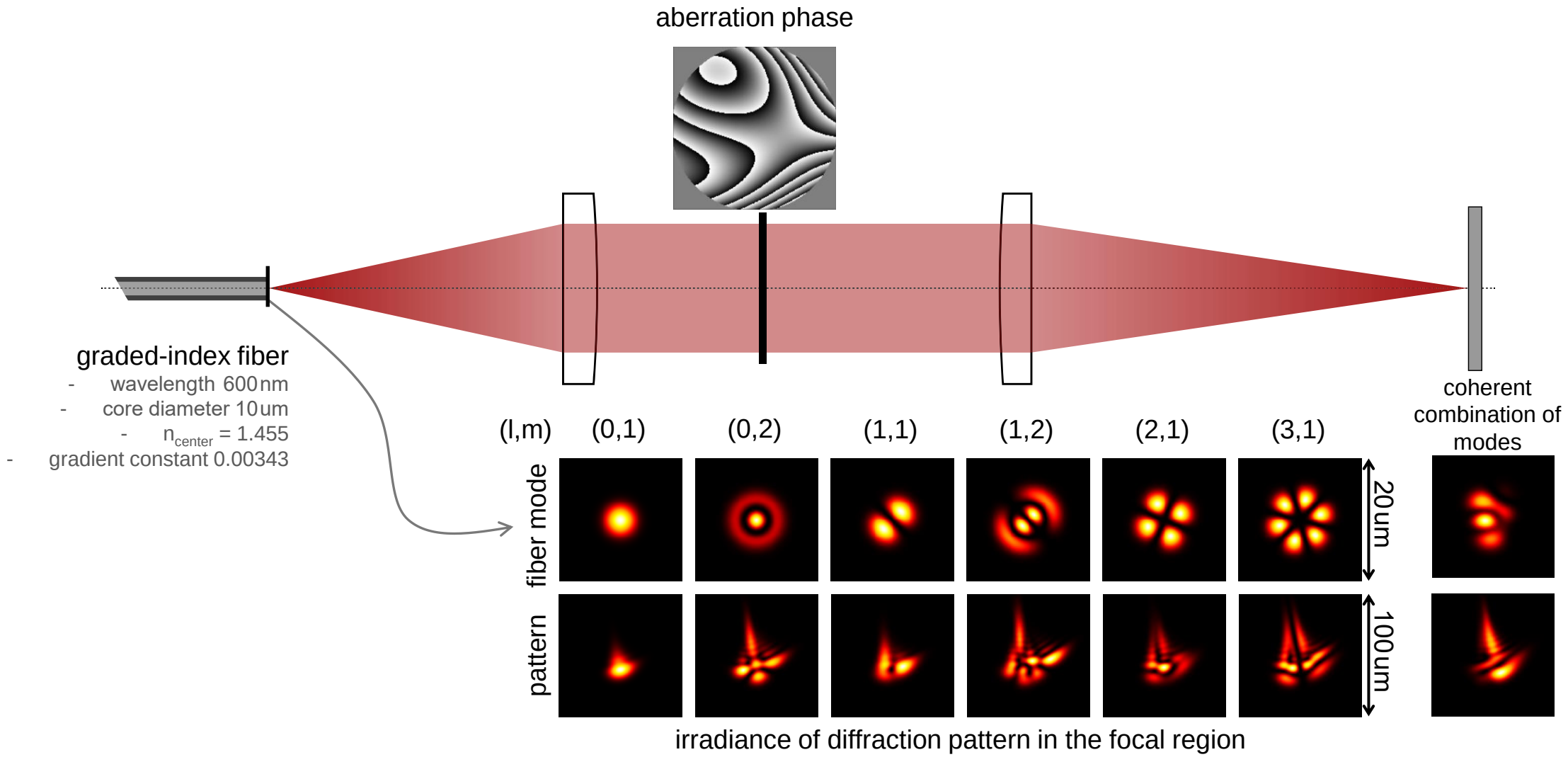
?

In the fiber source, what is the propagation modes?

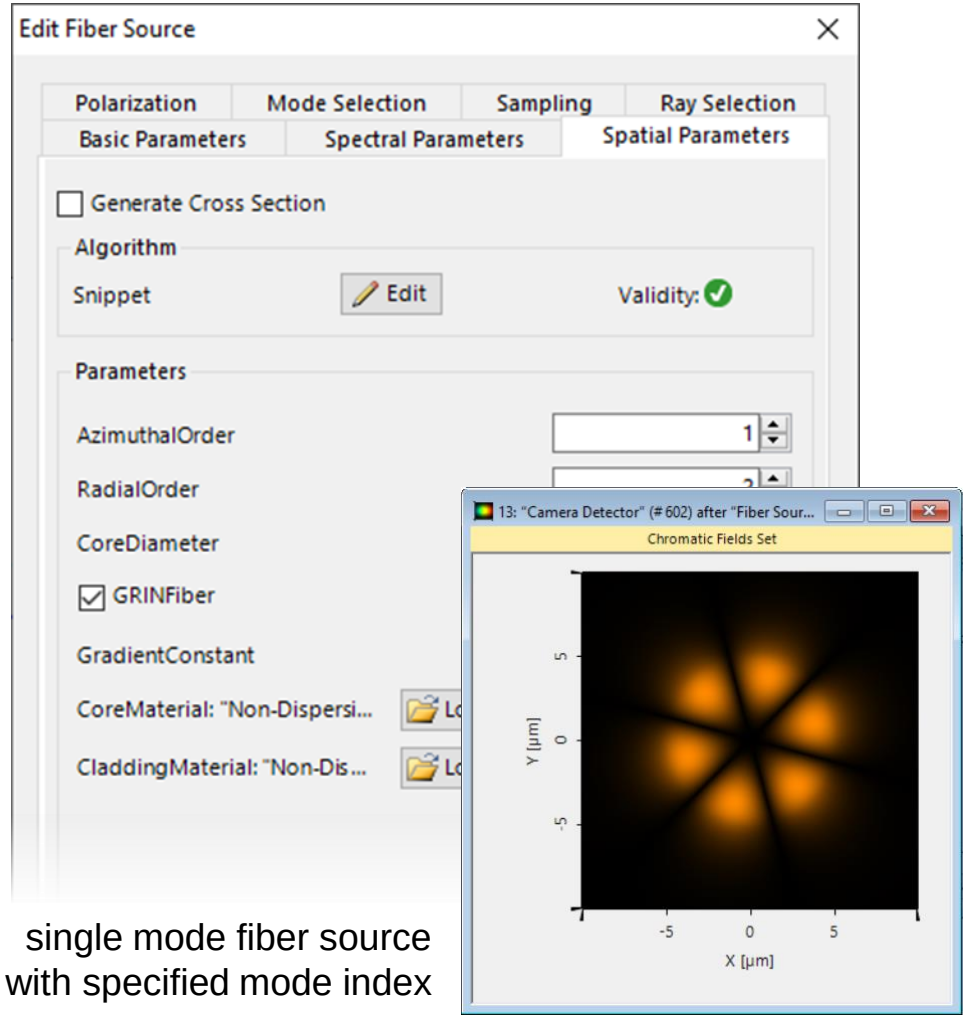
?

What is the diffraction pattern in the focal region?

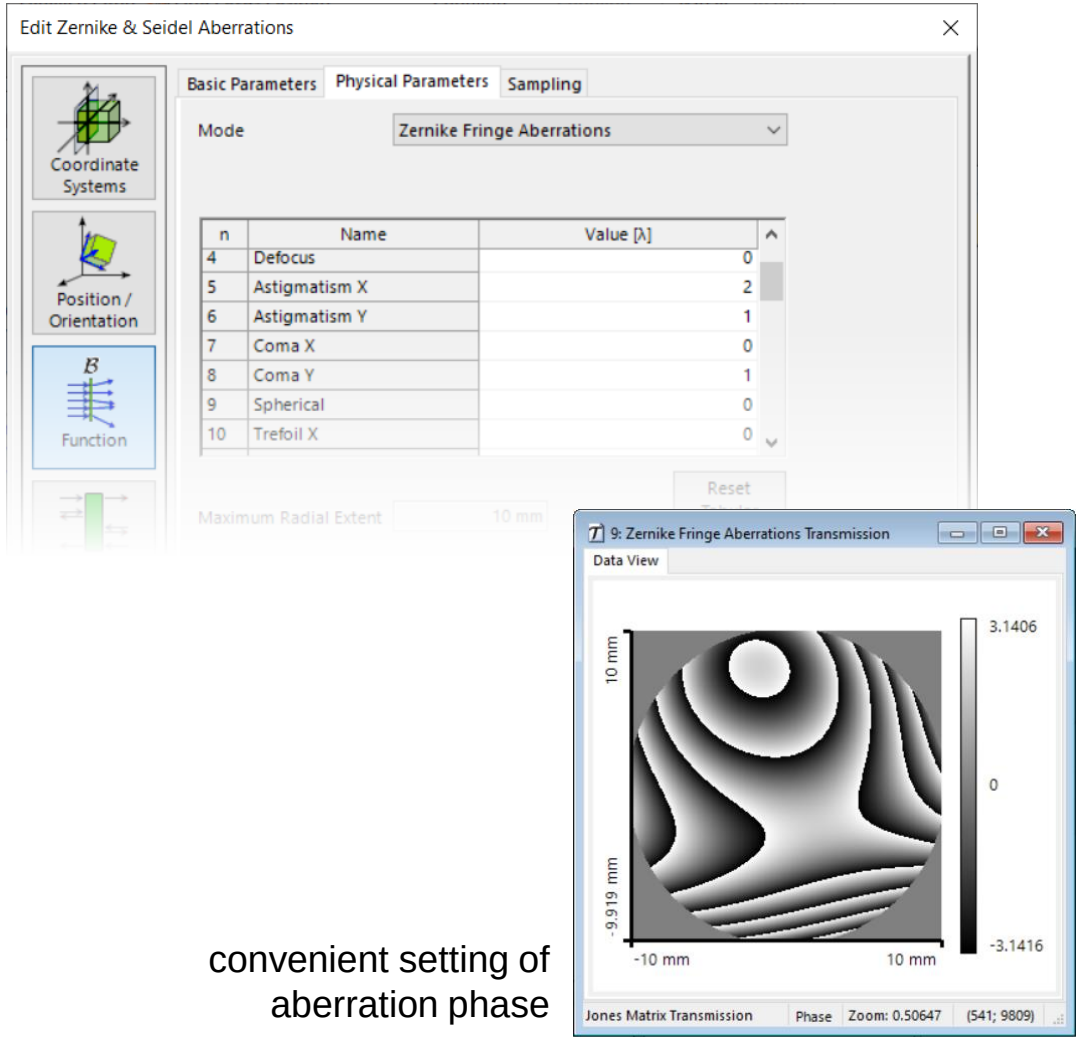
Source Modes and Diffraction Patterns



Peek into VirtualLab Fusion



single mode fiber source with specified mode index

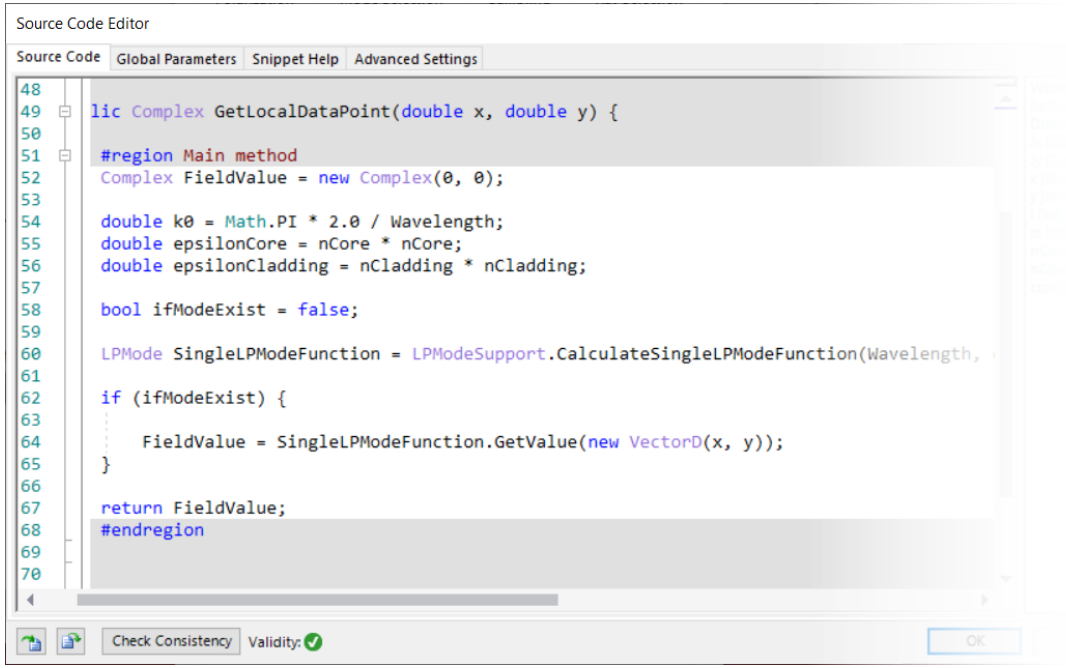


convenient setting of aberration phase

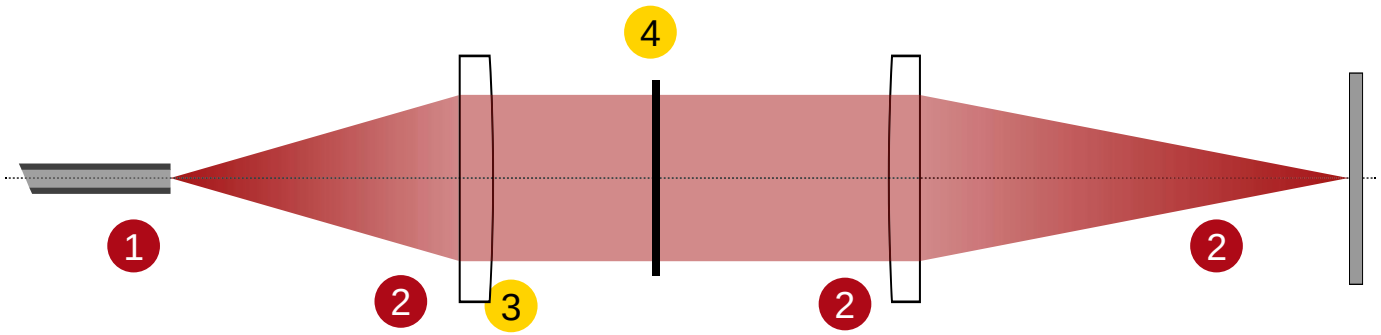
Workflow in VirtualLab Fusion

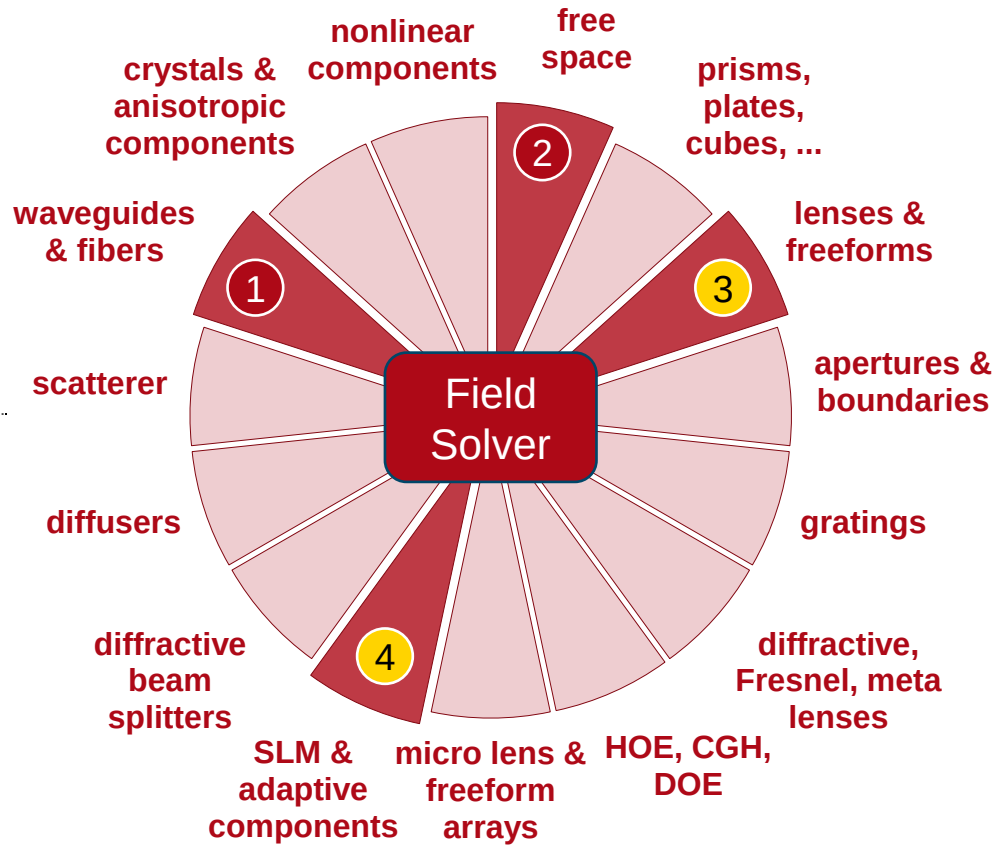
- Set the programmable light source
  - How to work with the programmable light source in VirtualLab Fusion and Example (Gaussian Beam) [Use Case]

- Set the position and orientation of components
  - Position and Orientation [Video]



VirtualLab Fusion Technologies





idealized component

Document Information

title	Investigation of Aberration Effects on Fiber Modes in the Focal Region
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software version	2021.1 (Build 1.176)
category	Application Use Case
further reading	- Fiber Mode Calculator - Linearly-Polarized (LP) Mode Solver - Few-Mode Fiber Coupling under Atmospheric Turbulence