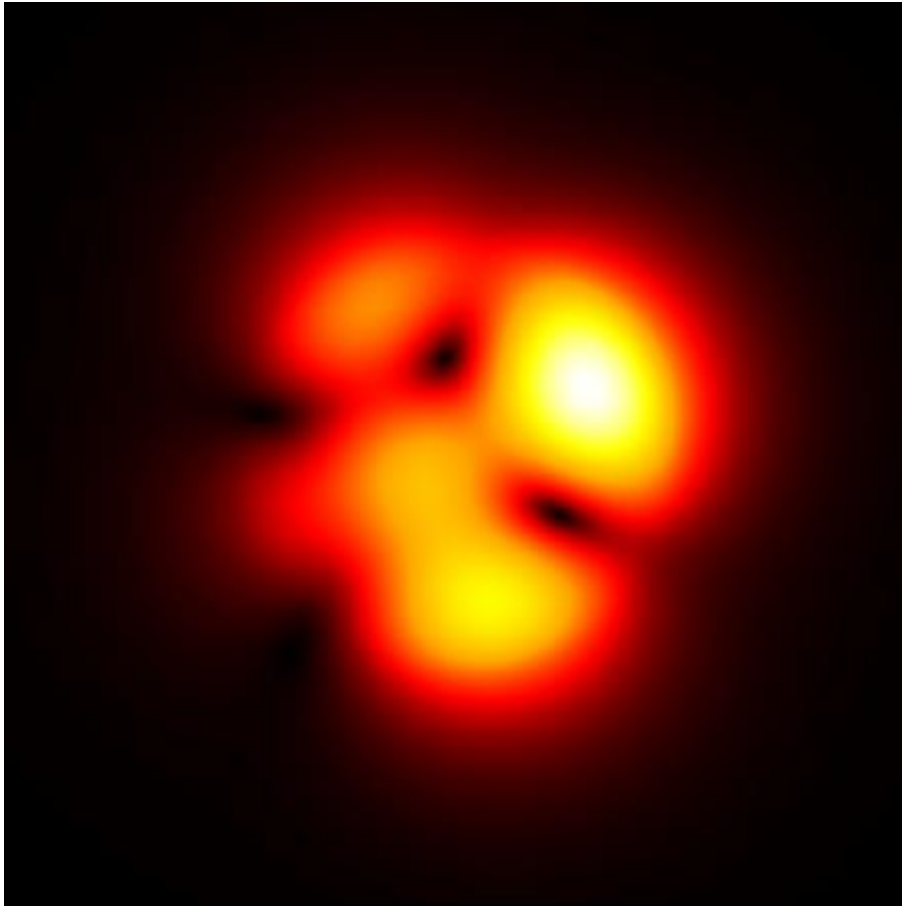


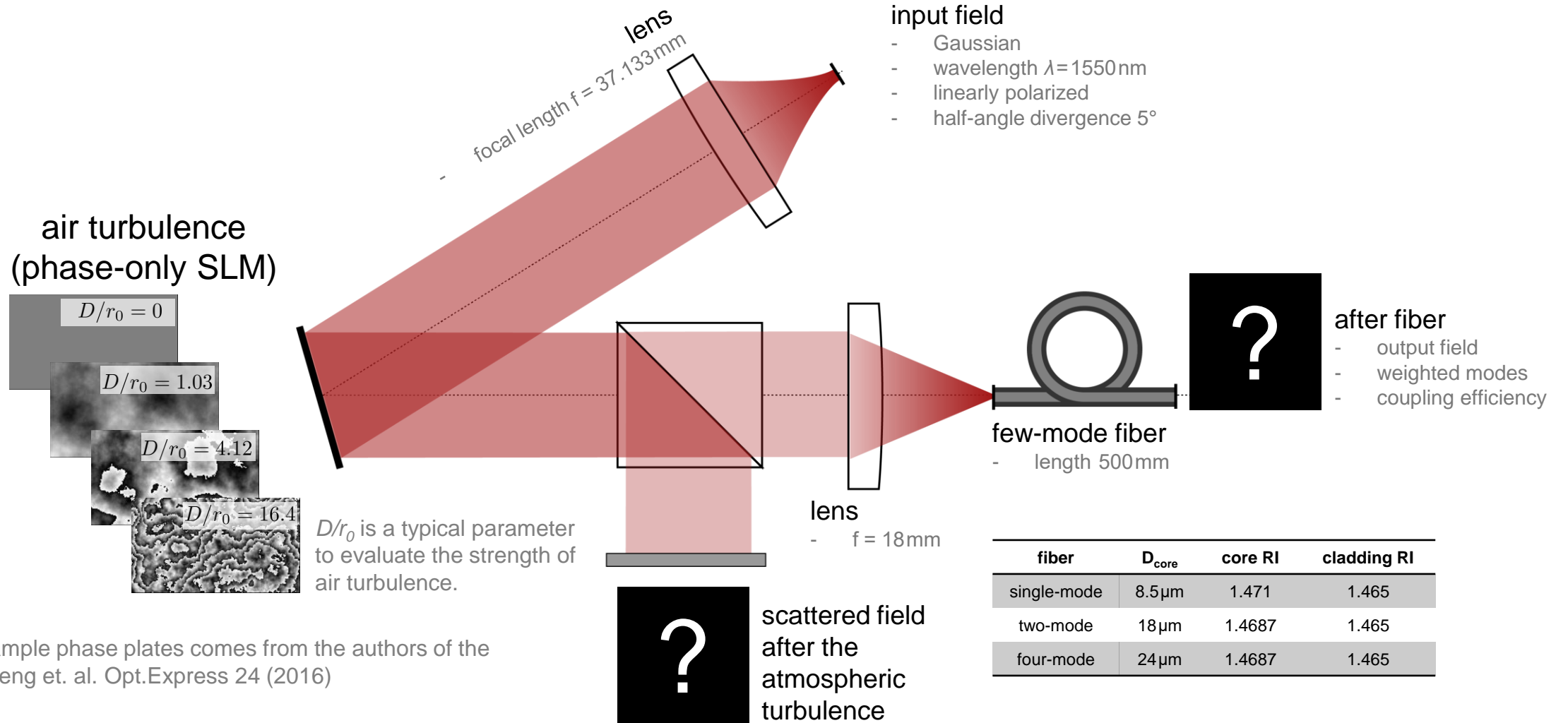
Few-Mode Fiber Coupling under Atmospheric Turbulence

Abstract



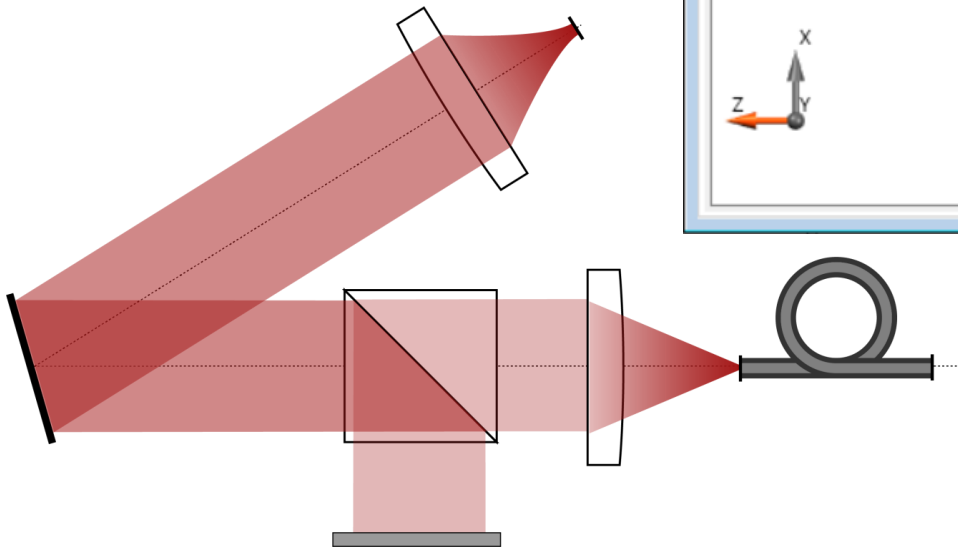
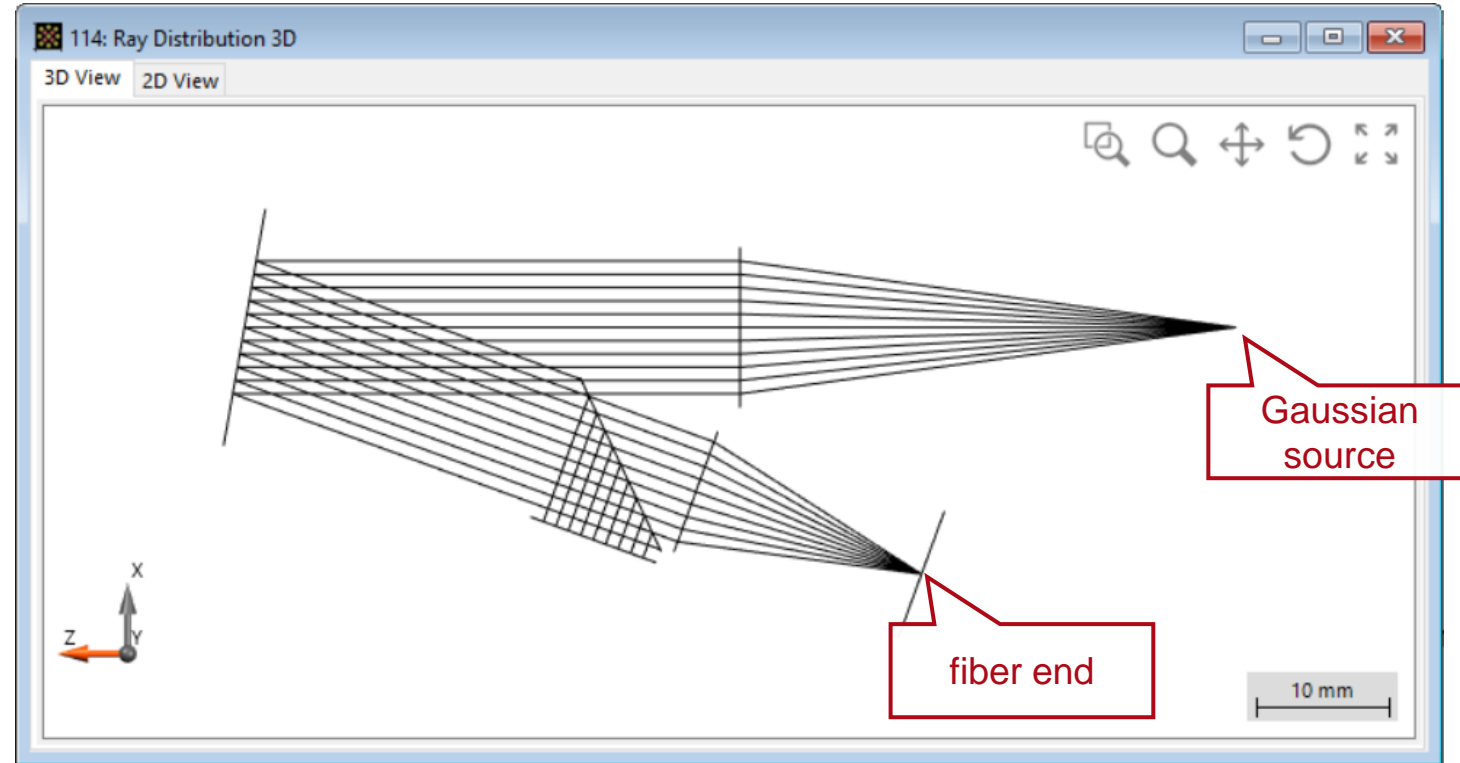
Free-space optical communication uses free space as a medium between transceivers, e.g., fibers. For longer propagation distances of the optical beam in free space, the atmospheric turbulence effects cannot be ignored. In this use case, we reproduce the experiments of Zheng et al. [Opt. Express 24 (2016)] to explore the atmospheric turbulence effects on the coupling efficiency between the free-space optical beam and few-mode fibers.

Modeling Task with a Step-Index Fiber



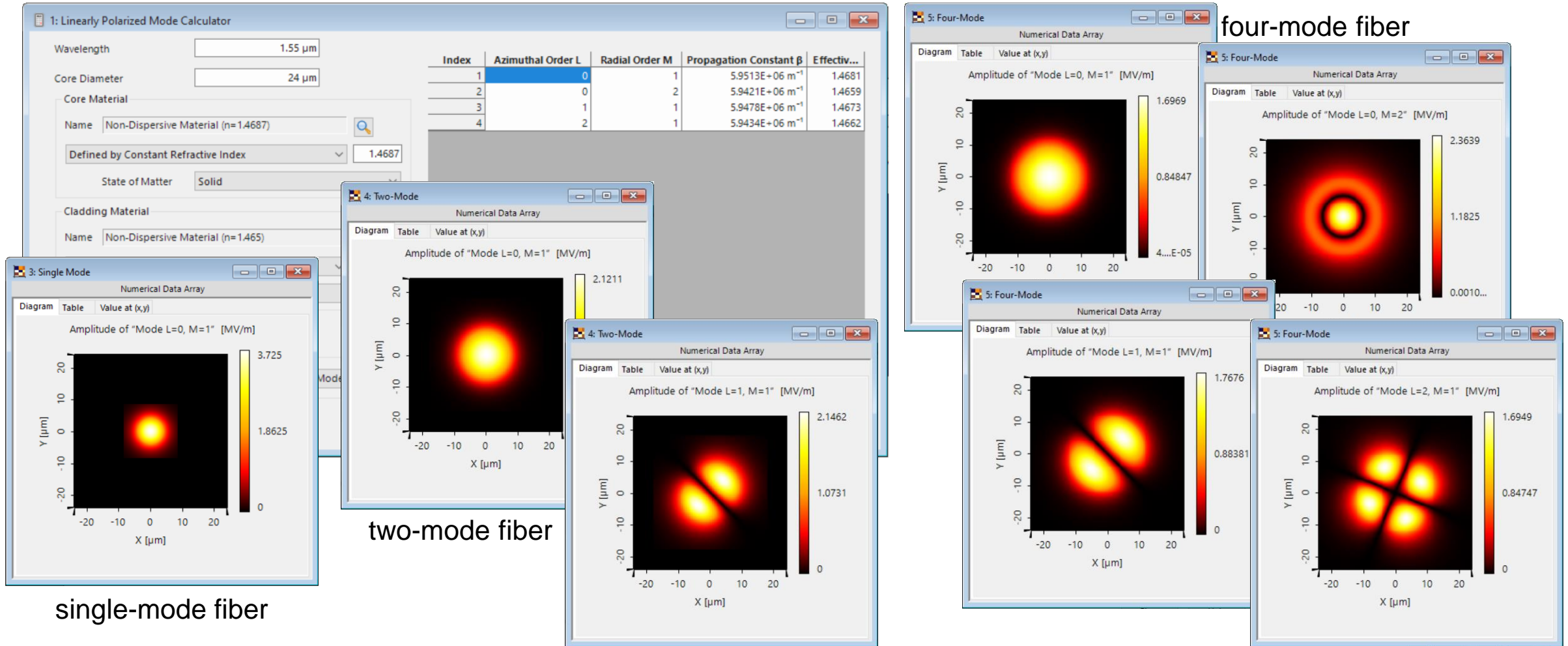
These sample phase plates comes from the authors of the paper Zheng et. al. Opt.Express 24 (2016)

Ray Tracing System Analyzer

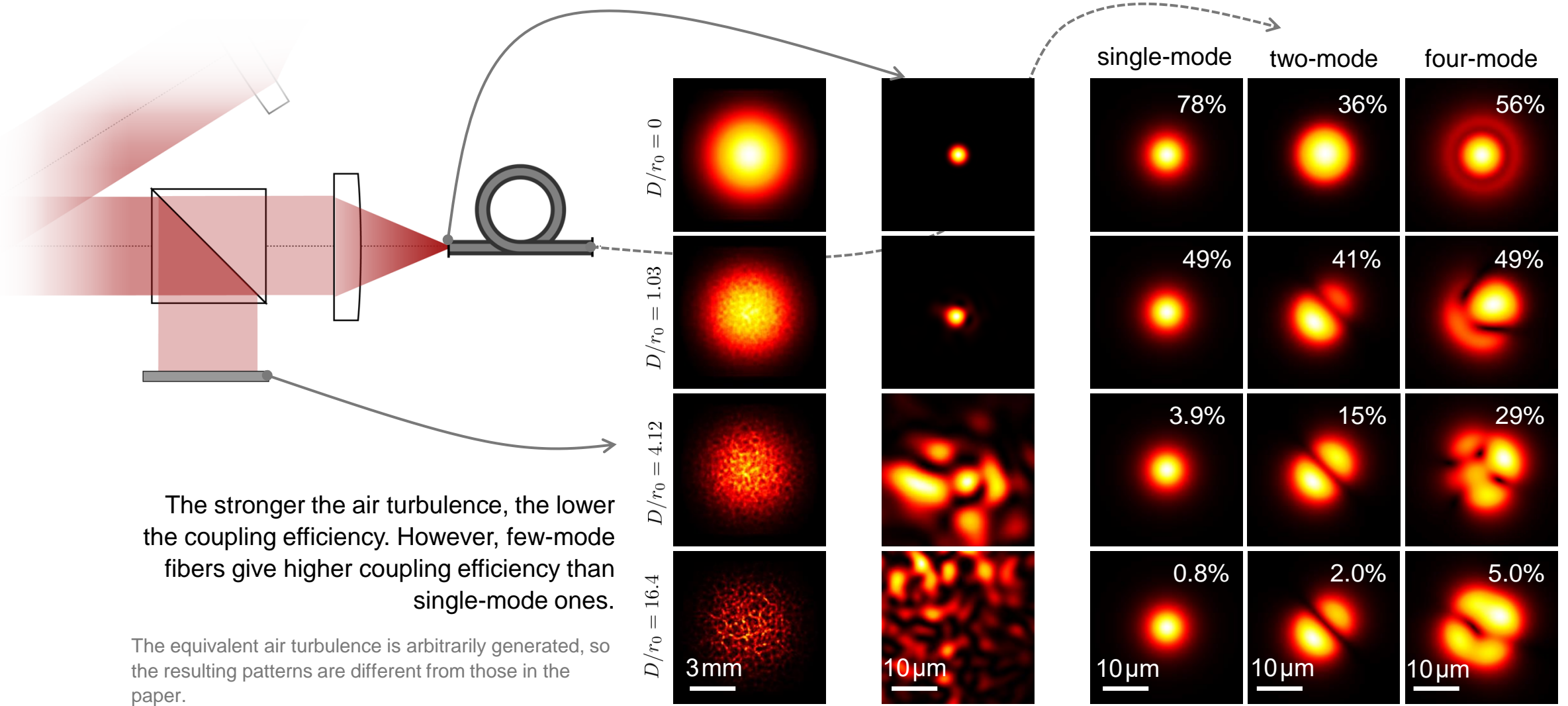


Ray tracing result gives us a brief idea if the optical system is correctly set.

Linearly Polarized Fiber Modes



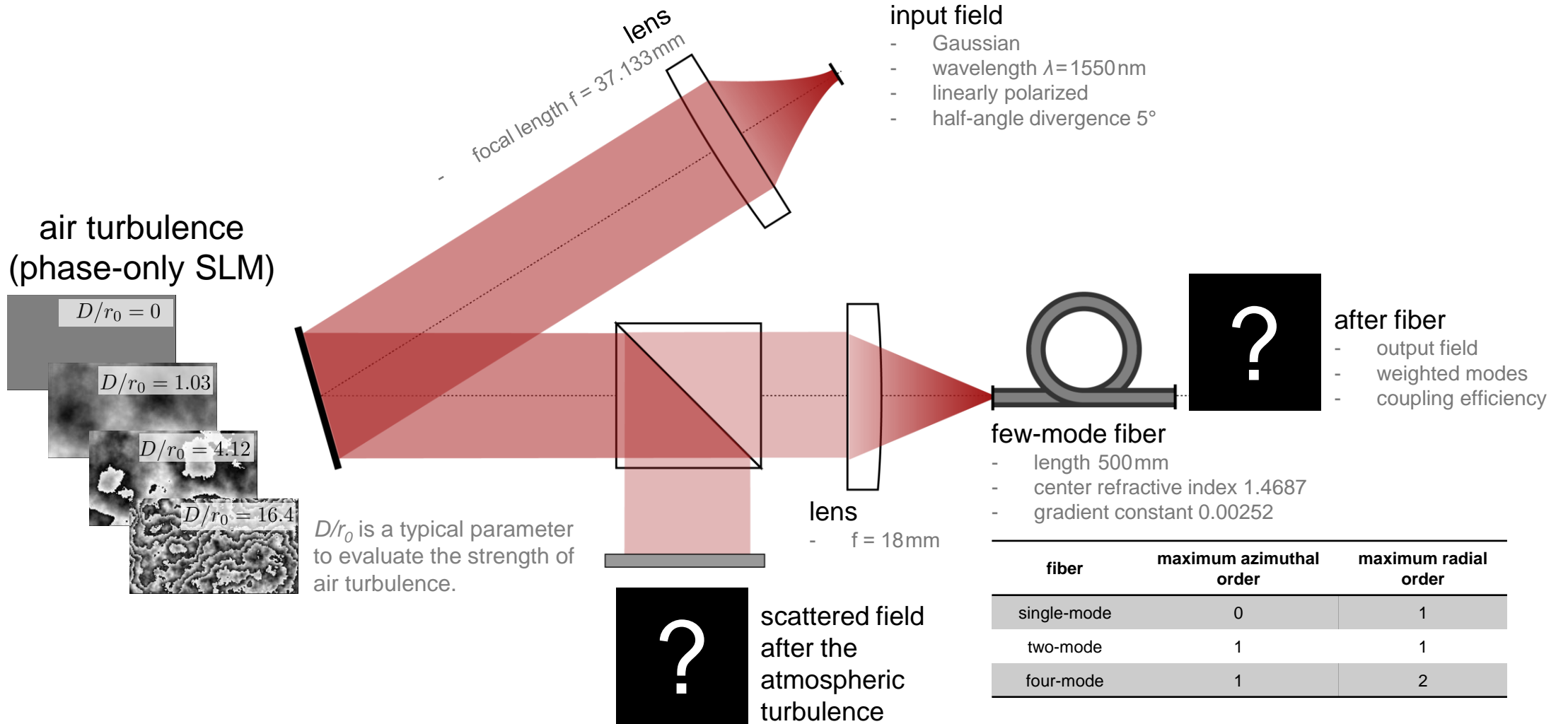
Field Tracing Results: Energy Density



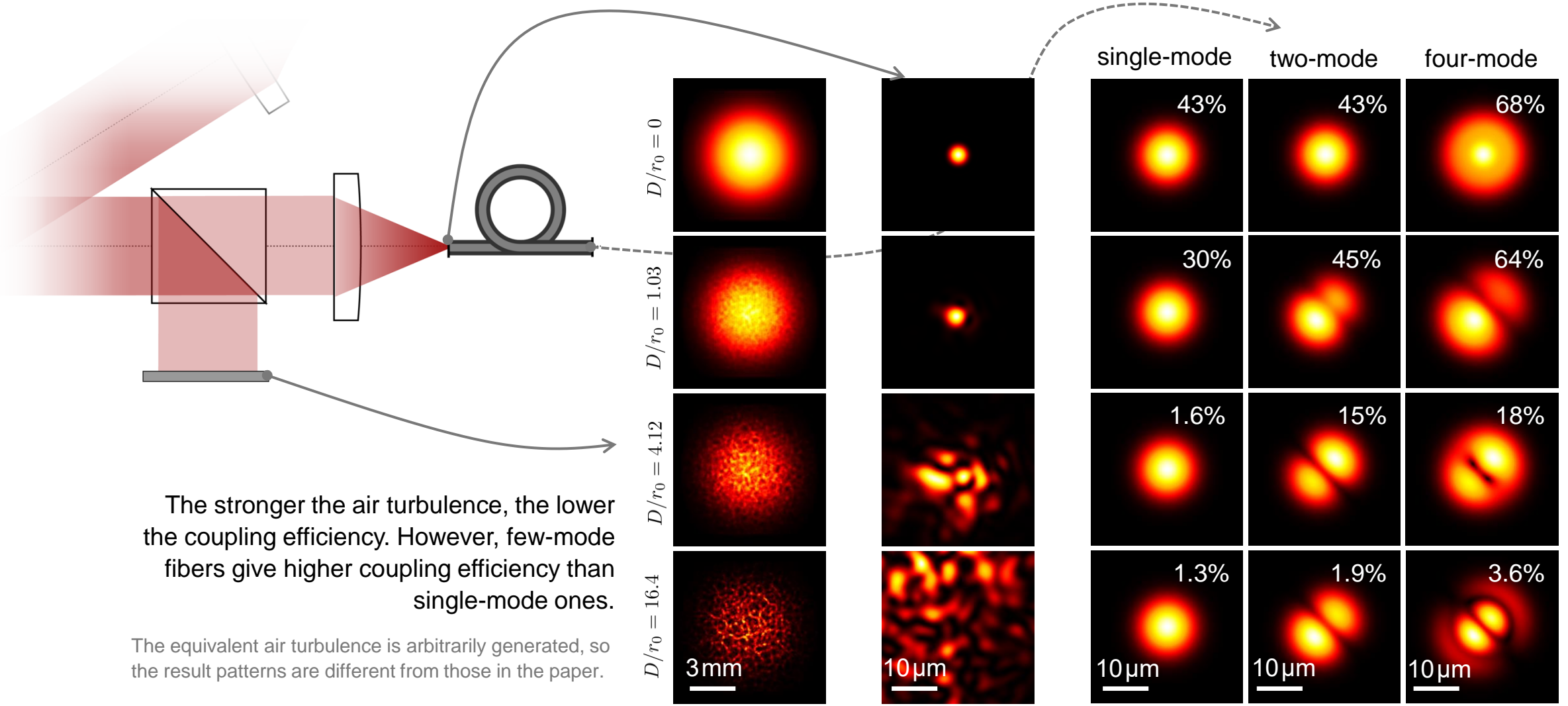
The stronger the air turbulence, the lower the coupling efficiency. However, few-mode fibers give higher coupling efficiency than single-mode ones.

The equivalent air turbulence is arbitrarily generated, so the resulting patterns are different from those in the paper.

Modeling Task with a Graded-Index Fiber



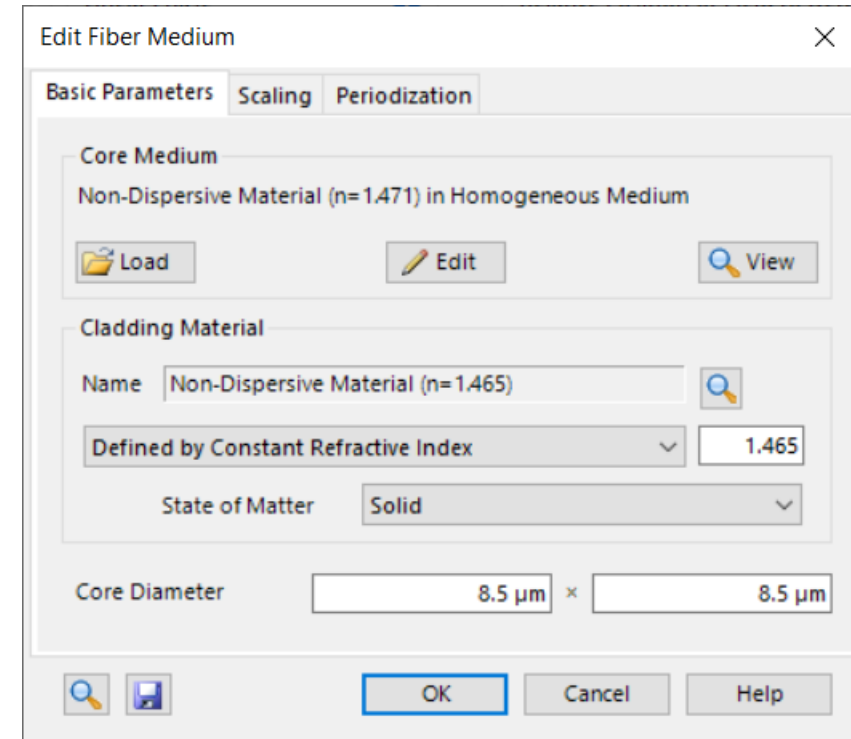
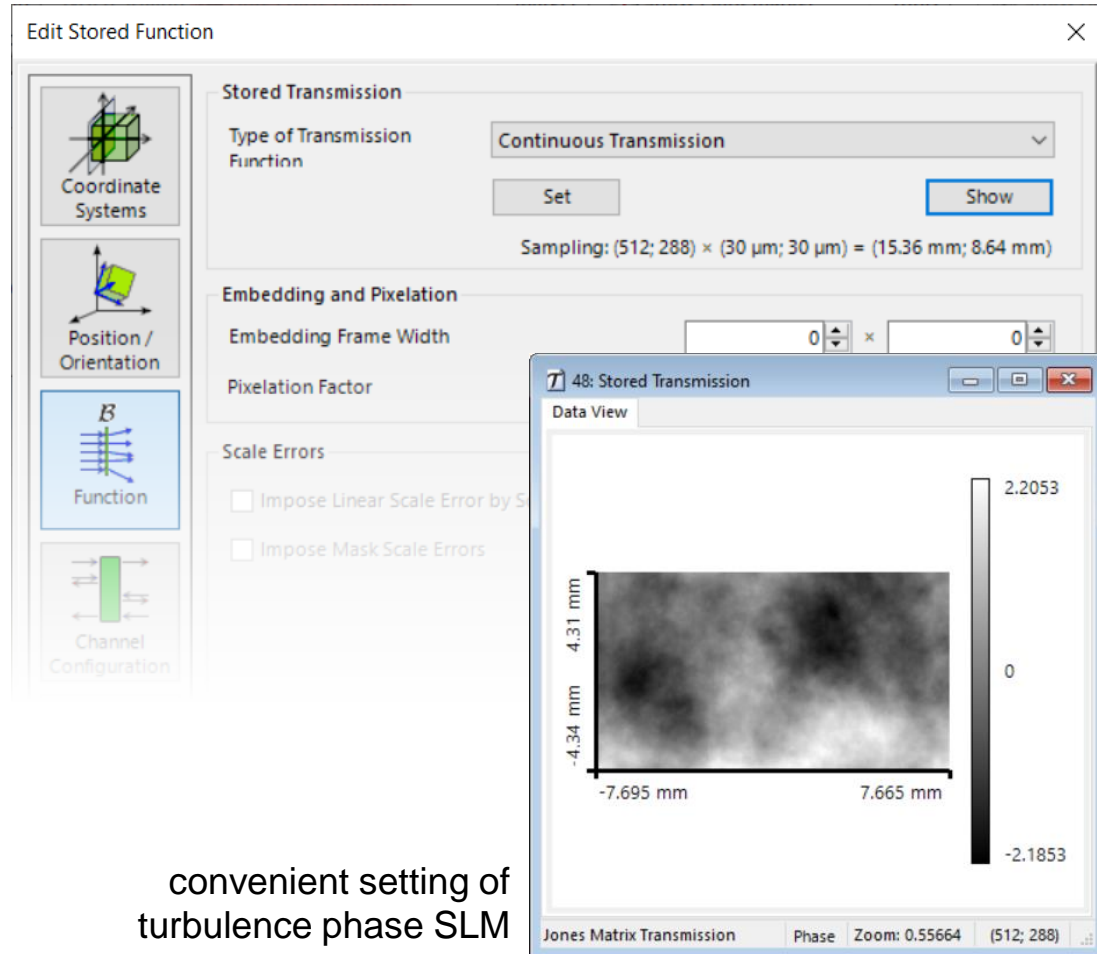
Field Tracing Results: Energy Density



The stronger the air turbulence, the lower the coupling efficiency. However, few-mode fibers give higher coupling efficiency than single-mode ones.

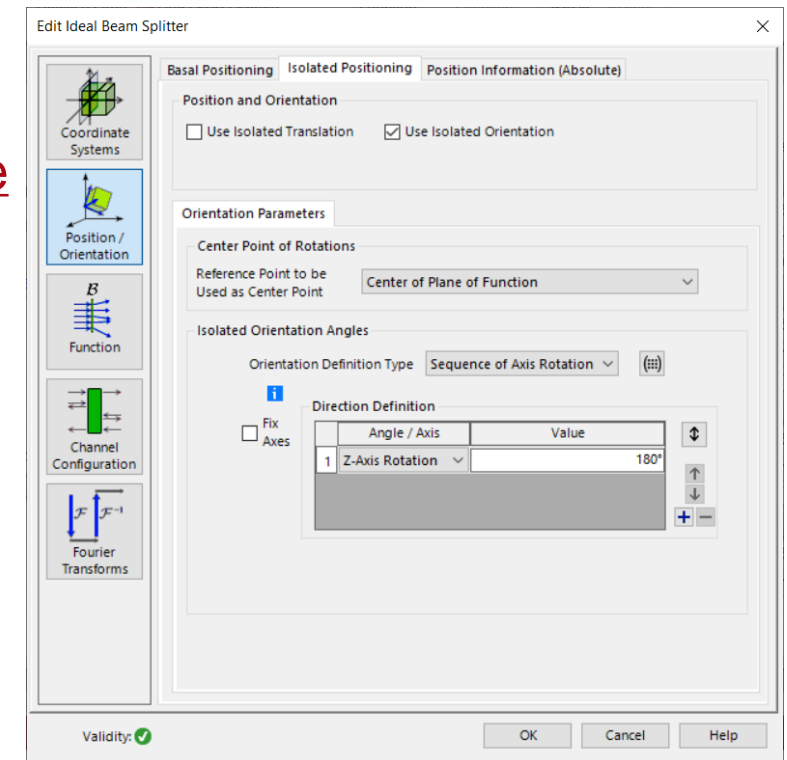
The equivalent air turbulence is arbitrarily generated, so the result patterns are different from those in the paper.

Peek into VirtualLab Fusion

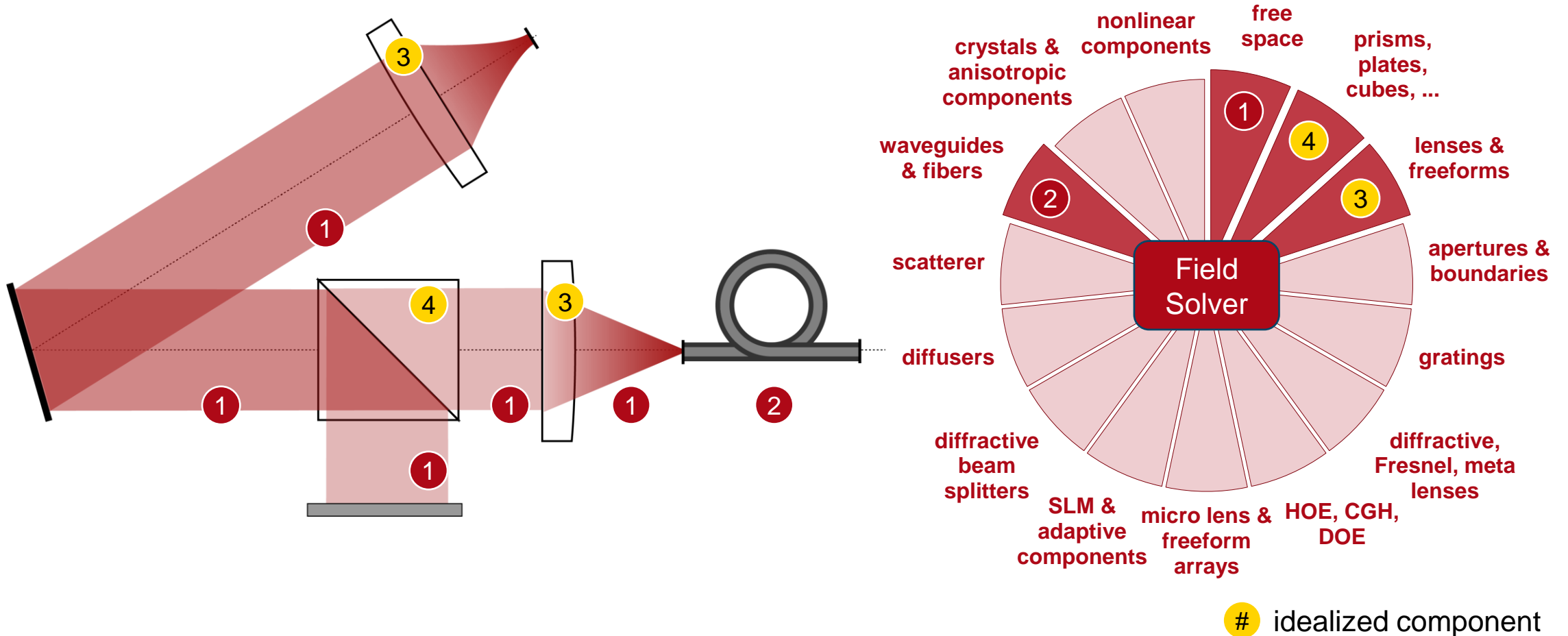


Workflow in VirtualLab Fusion

- Set the position and orientation of components
 - [Position and Orientation](#) [Video]
- Set the programmable detector
 - [How to Work with the Programmable Detector and Example \(Minimum and Maximum Wavelengths\)](#) [Use Case]
- Set the Fourier transforms properly
 - [Fourier Transform Settings – Discussion at Examples](#) [Use Case]



VirtualLab Fusion Technologies



Document Information

title	Few-Mode Fiber Coupling under Atmospheric Turbulence
document code	FCP.0007
version	1.0
edition	VirtualLab Fusion Basic
software version	2021.1 (Build 1.118)
category	Application Use Case
further reading	<ul style="list-style-type: none">- Fiber Mode Calculator- Investigation the Aberration Effects on the Fiber Modes