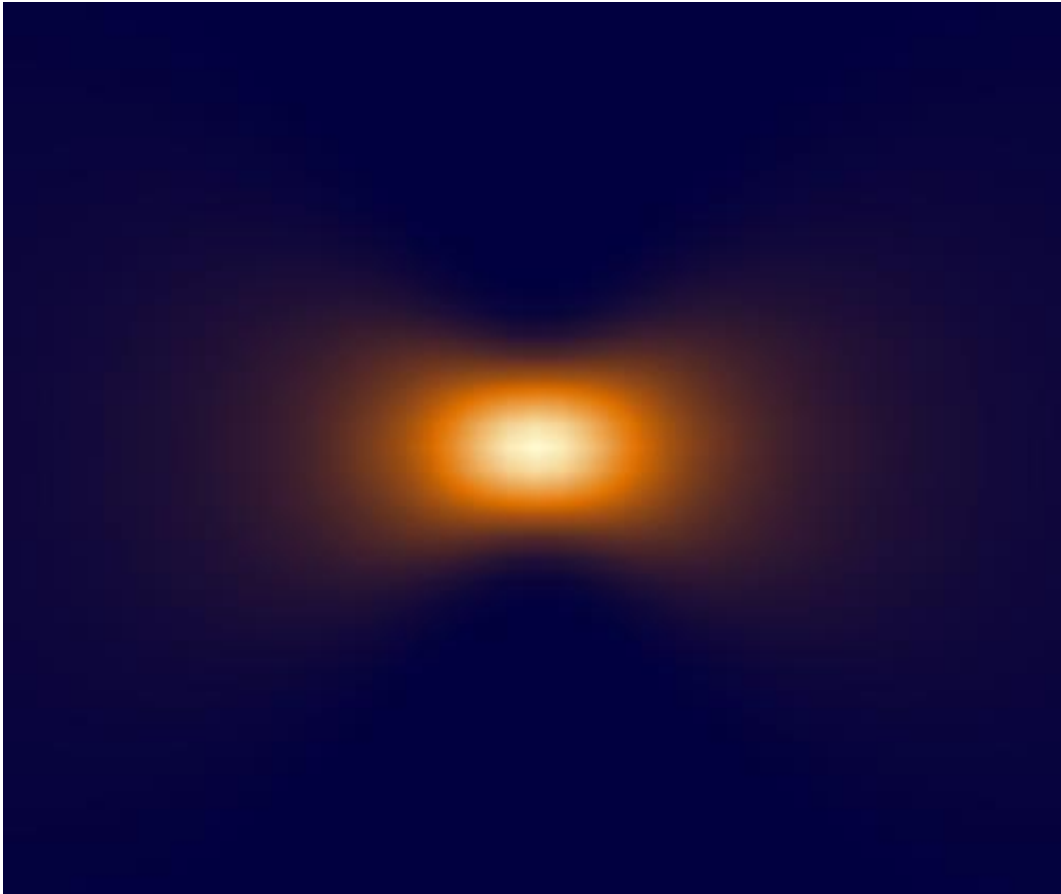


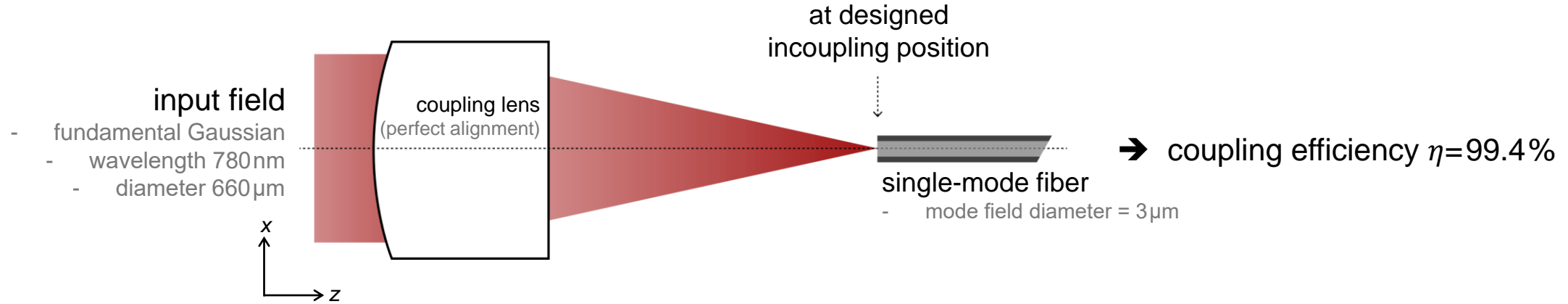
Tolerance Analysis of a Fiber Coupling Setup

Abstract

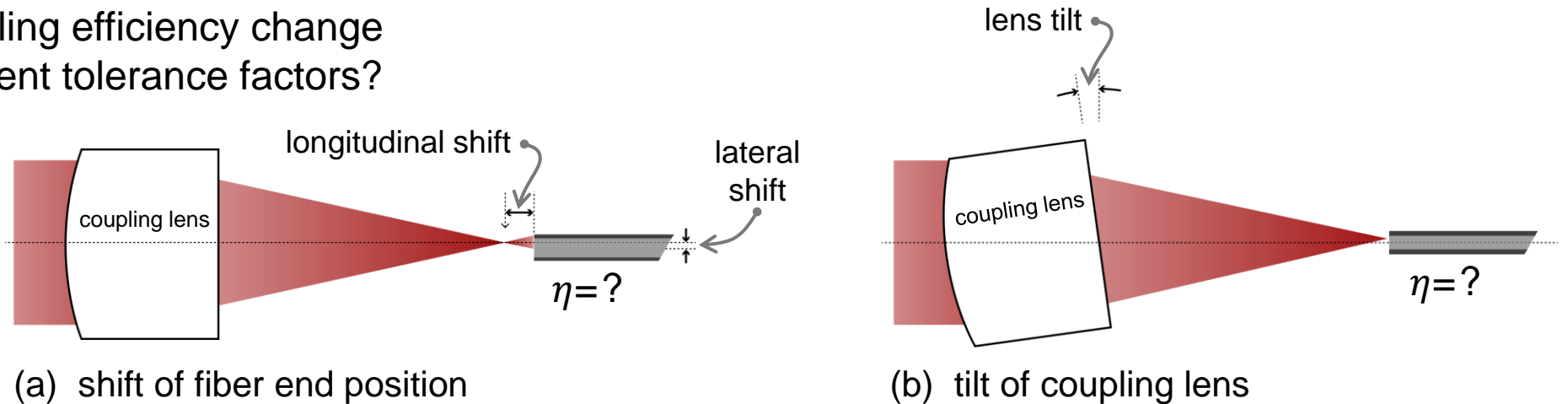


In modern optics, fibers can be found in various optical system, and it is usually of concern how much light can be coupled into fibers. The coupling efficiency can be sensitive to the system alignment, especially for single-mode fibers with relatively small core diameters. In this example, a well-designed fiber coupling lens is selected and the coupling efficiency is evaluated with respect to different tolerance factors, such as the shift of fiber end position and the tilt of coupling lens.

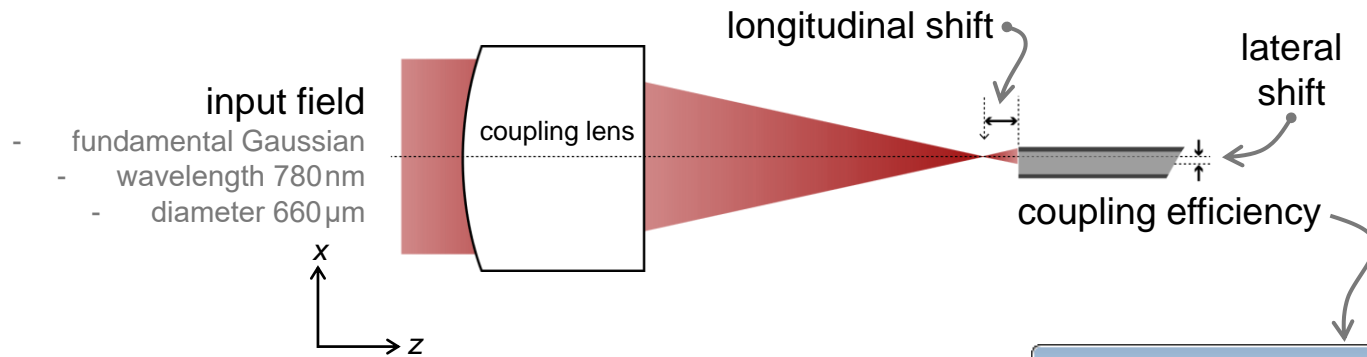
Modeling Task



How does the coupling efficiency change with respect to alignment tolerance factors?

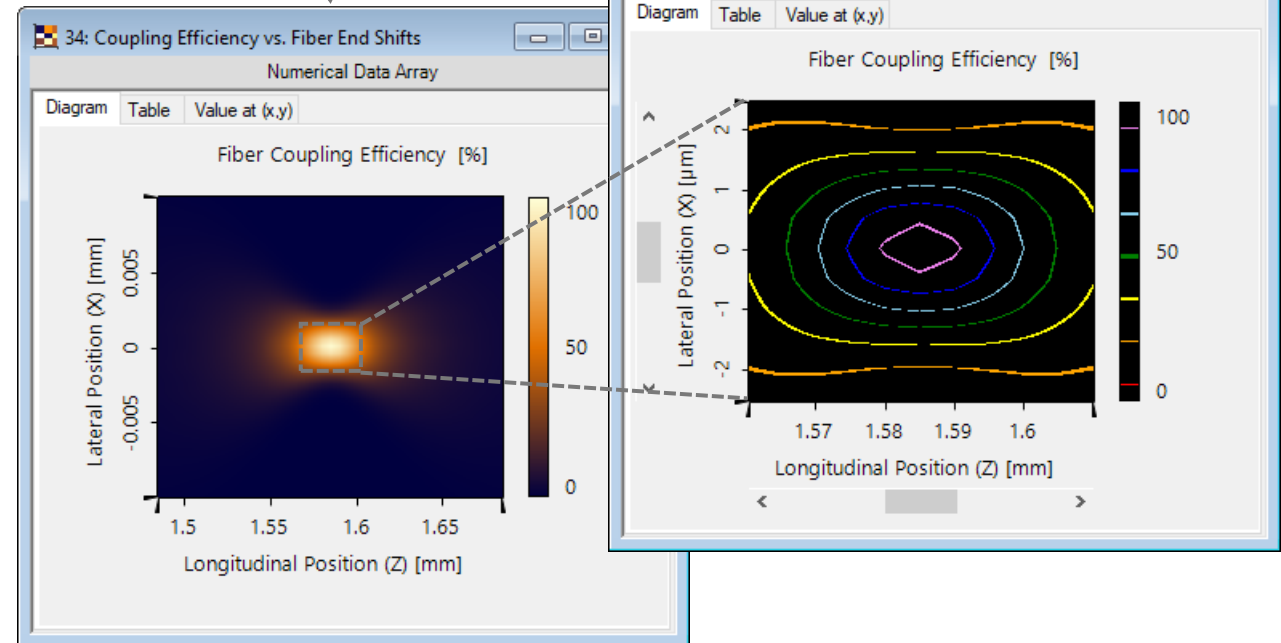


Coupling Efficiency vs. Fiber End Position Shift

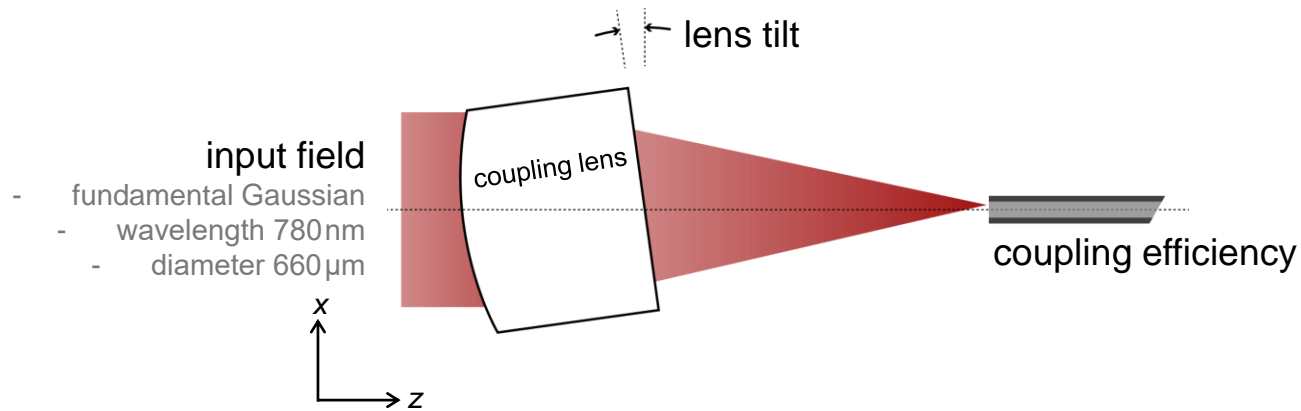


Contour plot helps with the identification of the parameter range for desired coupling efficiency threshold.

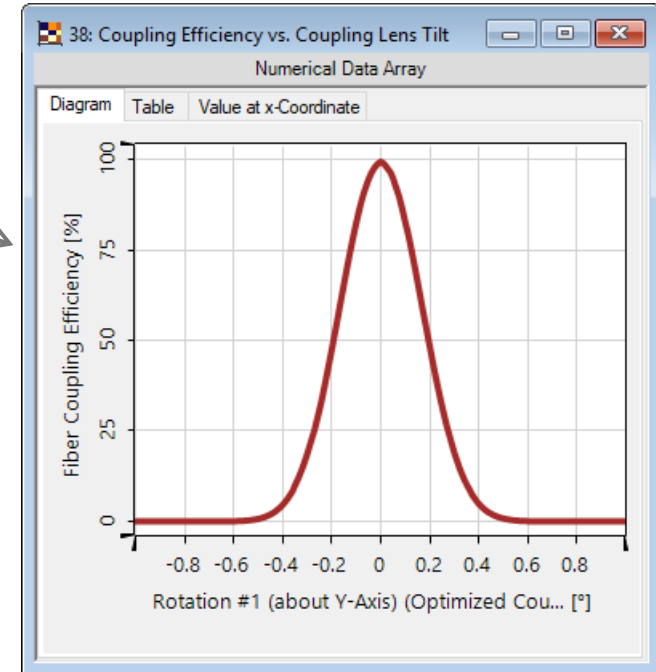
The coupling efficiency is scanned with respect to the fiber position shifts along both axial and lateral directions.



Coupling Efficiency vs. Coupling Lens Tilt



Physical-optics analysis of the coupling efficiency with respect to lens tilt, over 200 angles, takes only 50 seconds.



Peek into VirtualLab

multi-dimensional scanning of system parameters

Parameter Specification

Set up the parameter(s) to be varied.

You can select one or more parameters which shall be varied as well as the resulting number of iterations. Several [modes](#) are available specifying how the parameters are varied per iteration.

Usage Mode: Scanning Number of Iterations: 1681

Filter by... Show Only Varied Parameters

1 2 +	Object	Category	Parameter	Vary	From	To	Steps	Step Size	Original Value
	Fiber End #3	Basal Positioning (Relative)	Distance Be...	<input checked="" type="checkbox"/>	1.485 mm	1.685 mm	41	5 μ m	1.585 mm
			Lateral Shift...	<input checked="" type="checkbox"/>	-10 μ m	10 μ m	41	500 nm	0 m

Edit Fiber Coupling Efficiency

Detector Window and Resolution | Detector Function

Specify Gaussian Mode Field

Fiber NA: 0.002

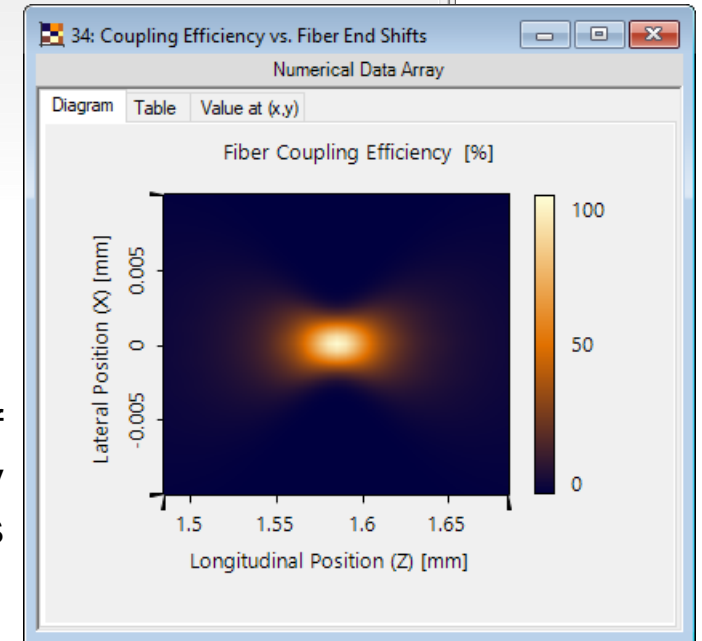
Mode Field Diameter (1/e²): 3 μ m

Specify Customized Mode Field

Mode Field: [Set] [Show]

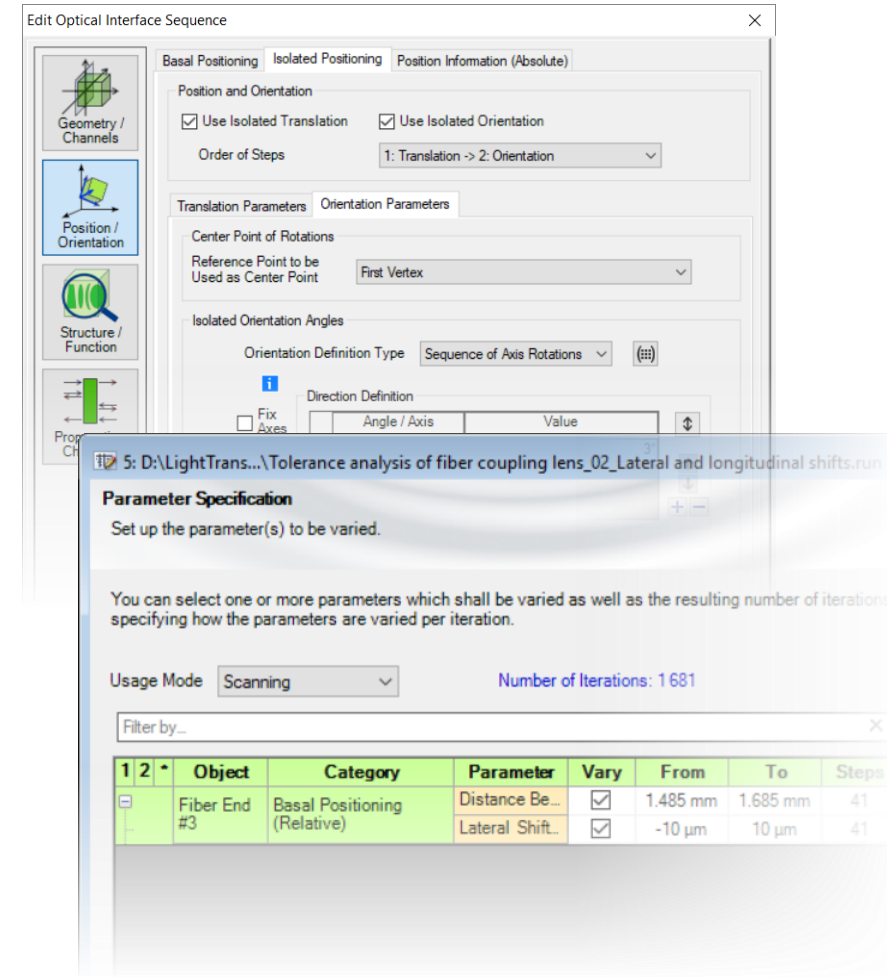
Efficiency Related to Incident Field of Optical System

visualization of coupling efficiency vs. tolerance factors

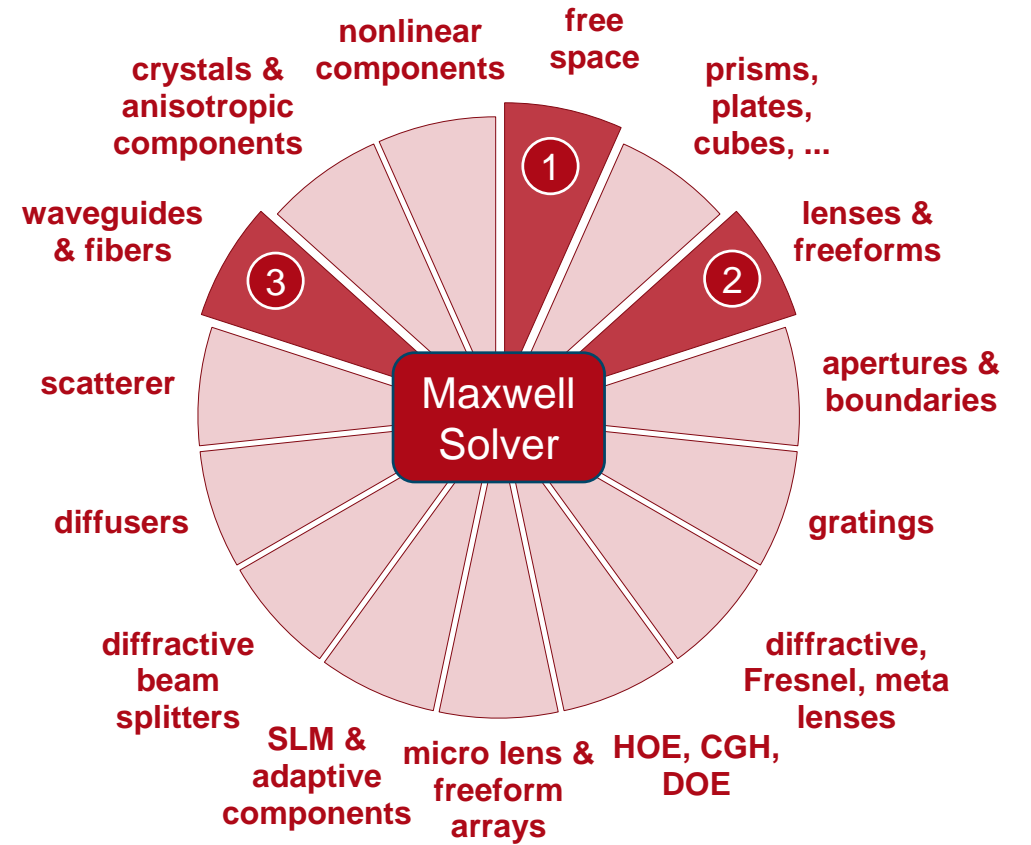
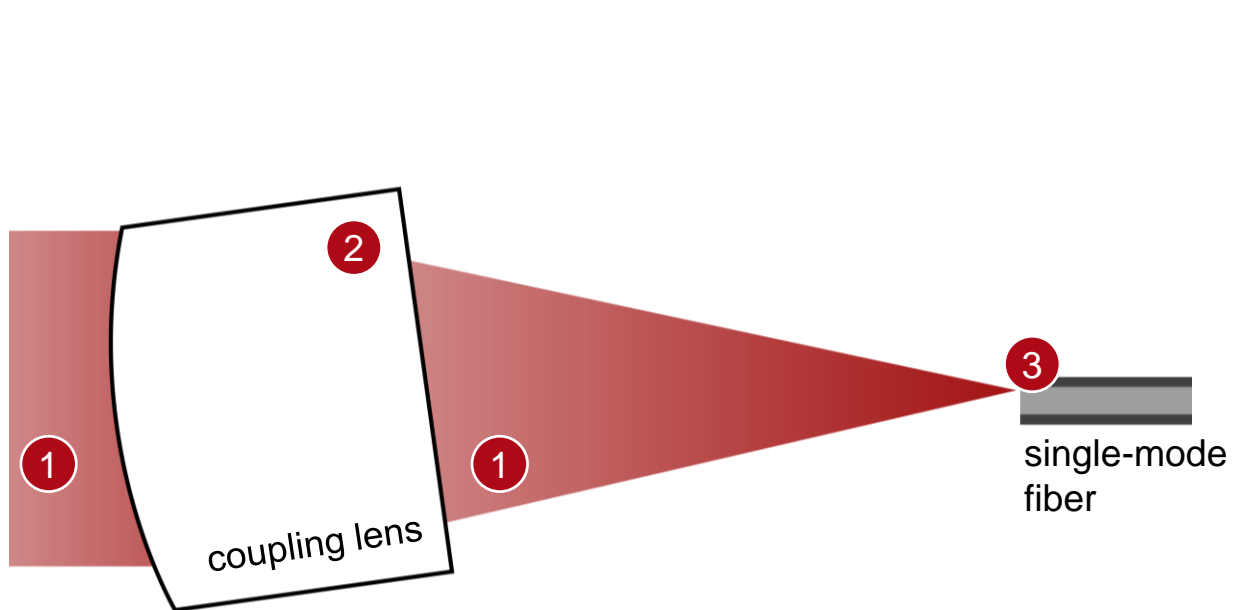


Workflow in VirtualLab

- Set up input Gaussian field
 - [Basic Source Models](#)
 - Load fiber coupling lens e.g. from Zemax file
 - [Import Optical Systems from Zemax](#)
 - [Optimal Working Distance for Coupling Light into Single-Mode Fibers](#)
- or optimize your own lens in VirtualLab
- [Parametric Optimization of Fiber Coupling Lenses](#)
- Use Parameter Run to scan over tolerance factors of concern



VirtualLab Technologies



Document Information

title	Tolerance Analysis of a Fiber Coupling Setup
document code	FCP.0004
version	1.0
toolbox(es)	Starter Toolbox
VL version used for simulations	7.4.0.49
category	Application Use Case
further reading	<ul style="list-style-type: none">- Comparison of Different Lenses for Fiber Coupling- Parametric Optimization of Fiber Coupling Lens