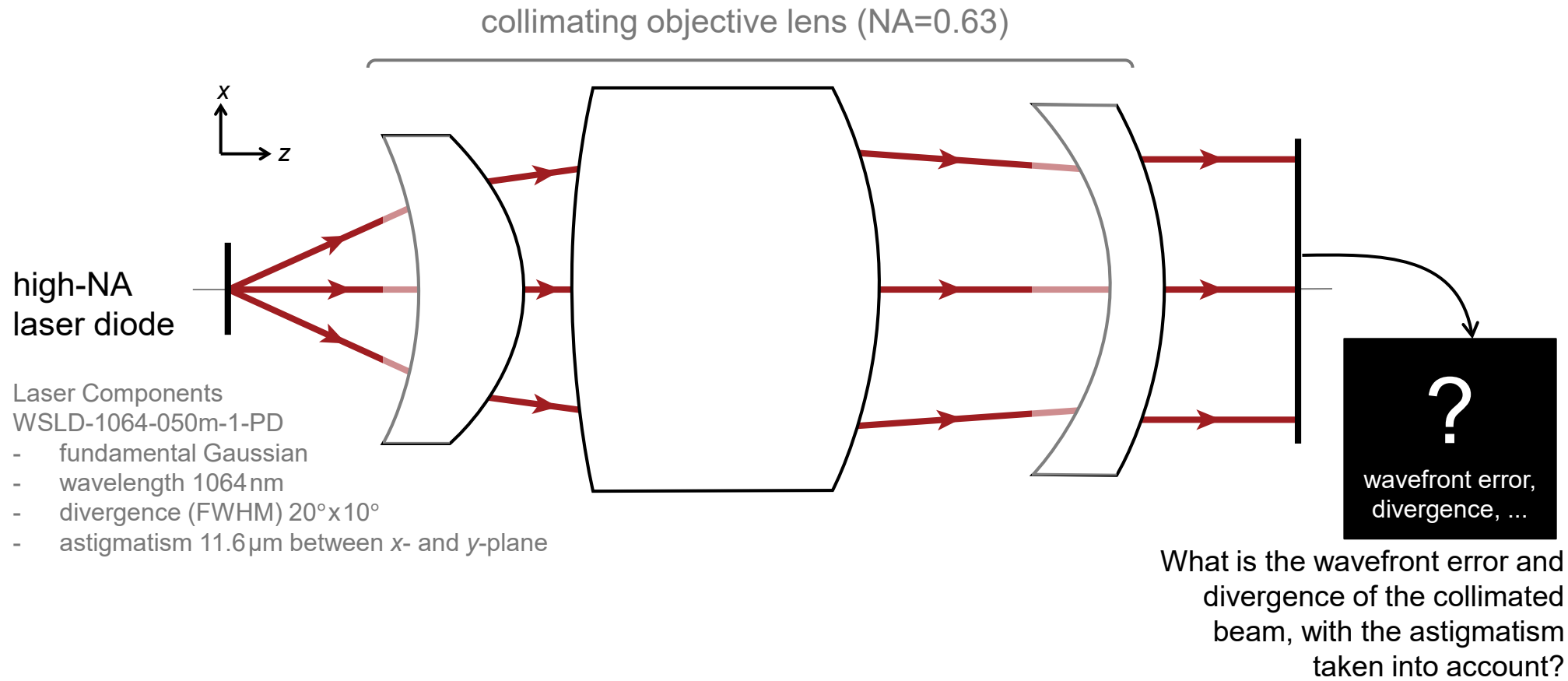# Collimation of Astigmatic Diode Laser Beam by Objective Lens
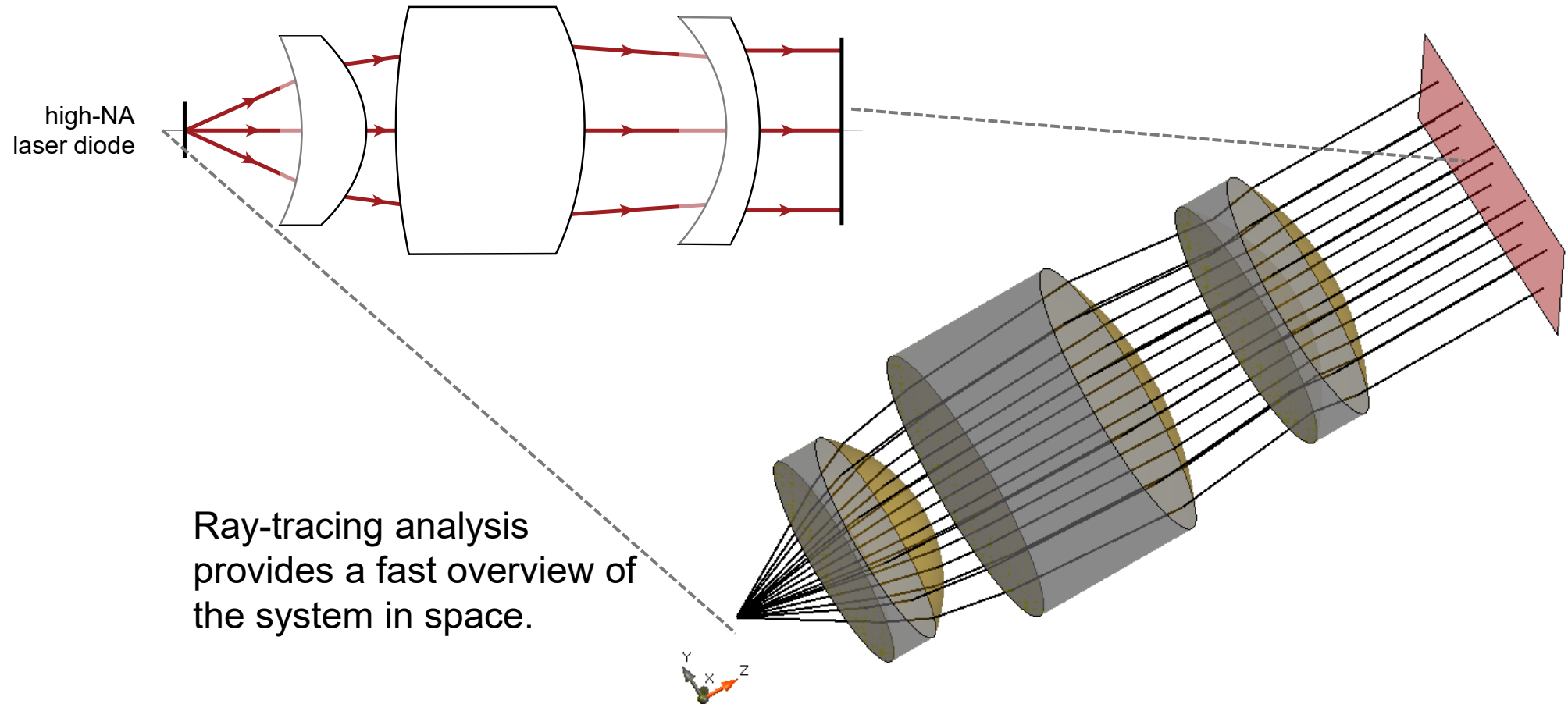
Abstract

Laser diodes are one of the most commonly used sources nowadays. High-power laser diodes often exhibit asymmetric divergence in two directions. They must be collimated in most applications. In addition to the divergence, such sources may also show astigmatism between two directions. In this example, collimation of an astigmatic laser diode is investigated with both ray tracing and field tracing techniques, and it is compared with a reference case without astigmatism.
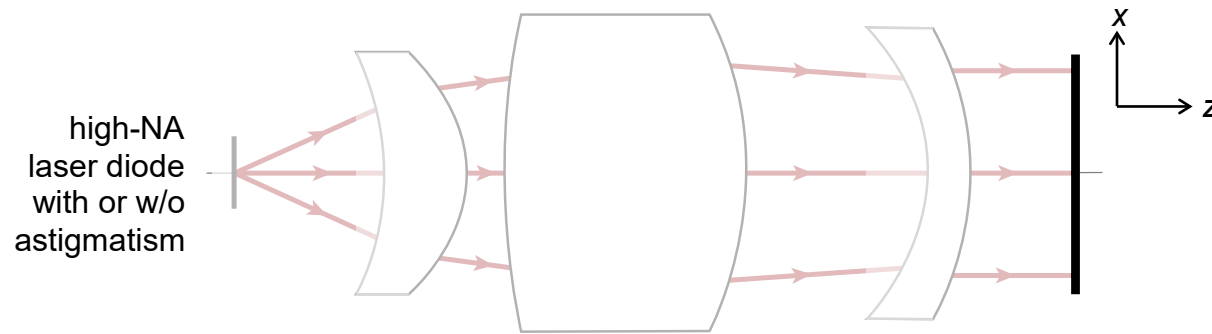
Modeling Task

collimating objective lens (NA=0.63)

x

z

high-NA
laser diode

Laser Components
WSLD-1064-050m-1-PD
- fundamental Gaussian
- wavelength 1064 nm
- divergence (FWHM) 20°x10°
- astigmatism 11.6 µm between *x*- and *y*-plane

?

wavefront error,
divergence, ...

What is the wavefront error and
divergence of the collimated
beam, with the astigmatism
taken into account?

Results

- Ray tracing – system in 3D space

high-NA
laser diode

Ray-tracing analysis
provides a fast overview of
the system in space.

Results

- Ray tracing – wavefront analysis

high-NA laser diode with or w/o astigmatism
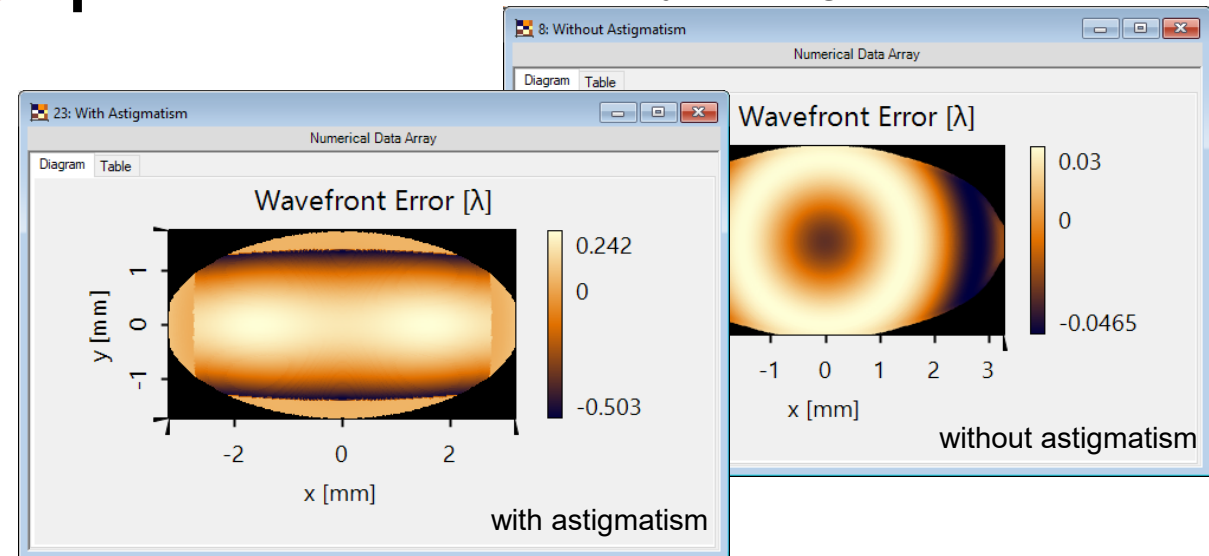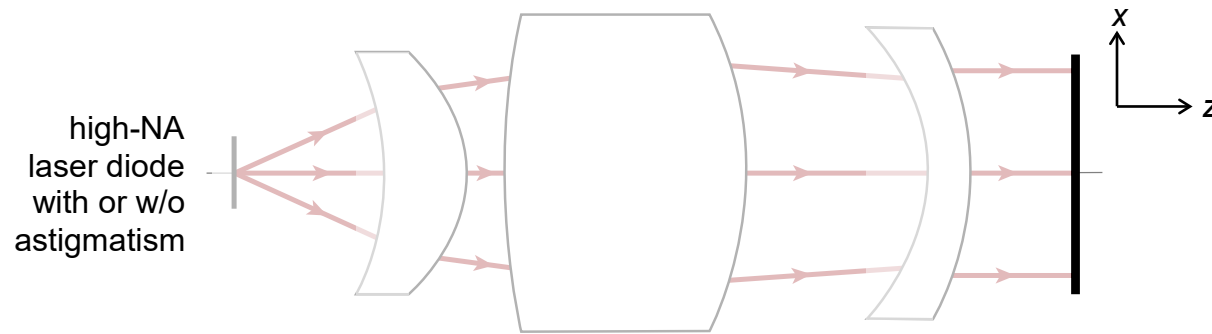
Laser diode properties, including astigmatism, are taken into account for the ray-tracing simulation.

| Wavefront error	With astigmatism	Without astigmatism
P-V	0.747λ	0.0765λ
RMS	0.18λ	0.0265λ

Results

- Field tracing – divergence and beam quality

Physical-optics simulation of whole collimation system takes less than 2 seconds!

Multiple physical parameters are available for quantitative evaluations.

Parameters	With astigmatism	Without astigmatism
div. angle (x)	0.023°	0.023°
div. angle (y)	0.05°	0.042°
$M^2 (x)$	1.11	1.11
$M^2 (y)$	1.01	1.01

with astigmatism

without astigmatism
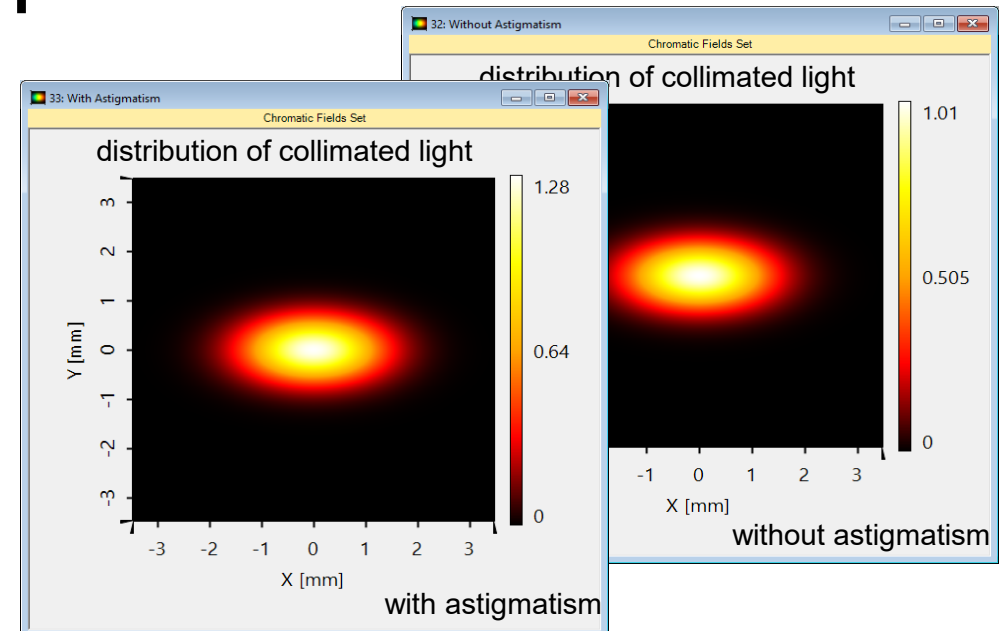
Document Information

title	Collimation of Astigmatic Diode Laser Beam by Objective Lens
version	2.0
toolbox(es)	Starter Toolbox
VL version used for simulations	2020.2 (Build 1.116)
category	Application Use Case