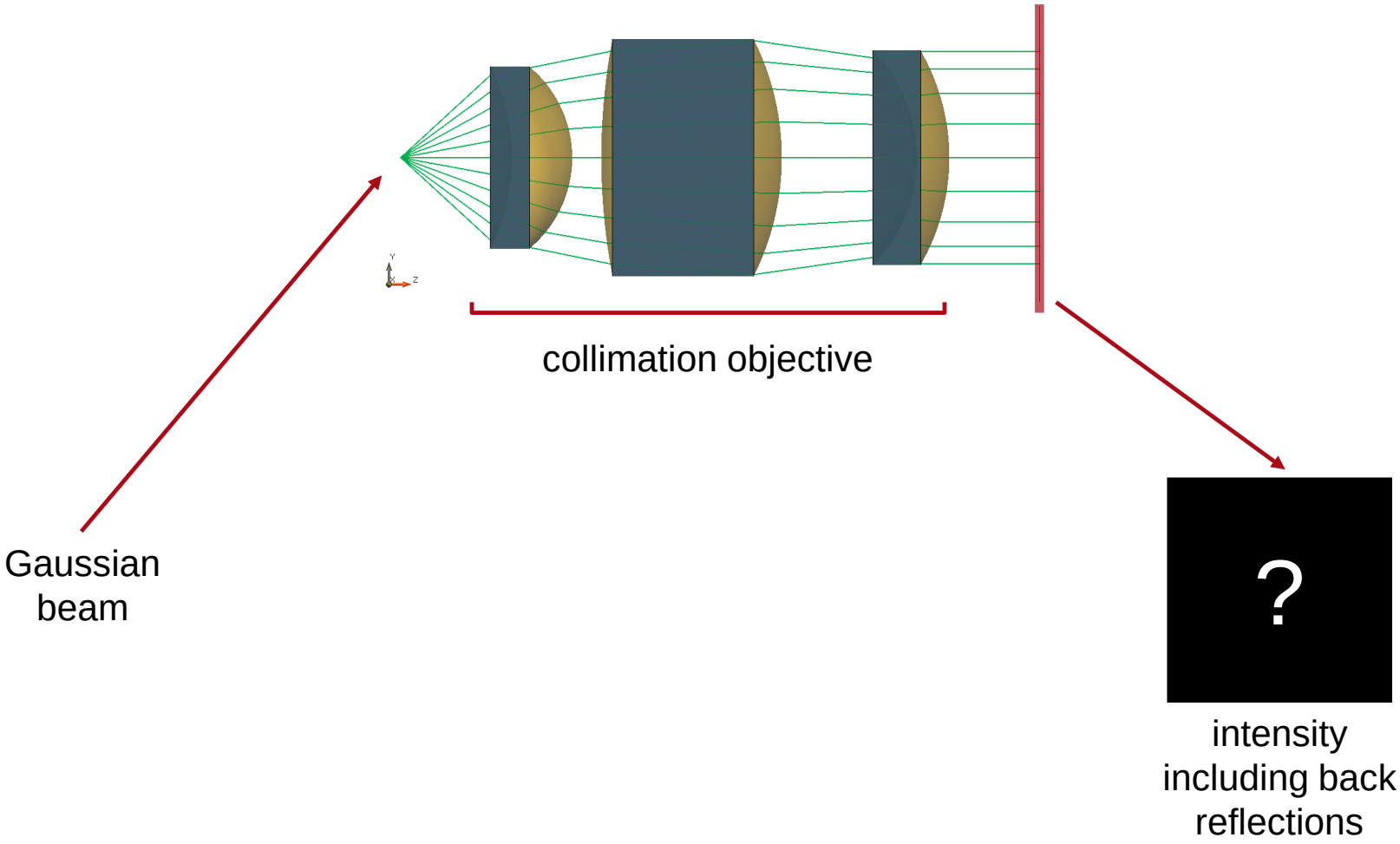
LightTrans

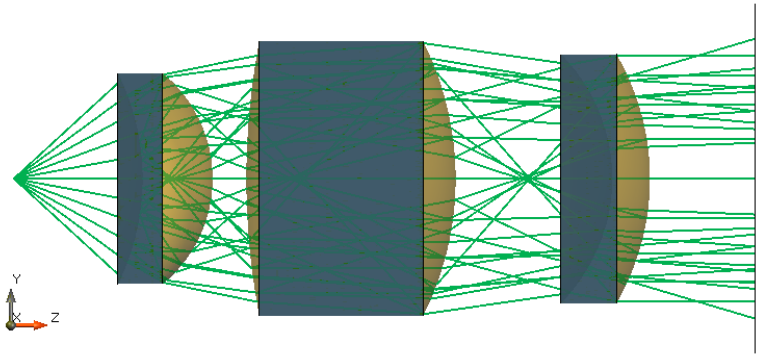
Imaging Systems > Ghost Imaging

Investigation of Ghost Imaging Effects in Collimation System

Task/System Illustration

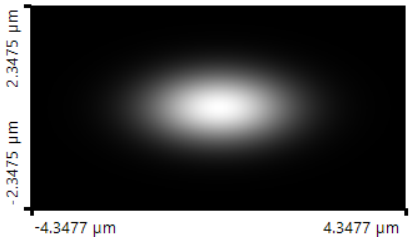


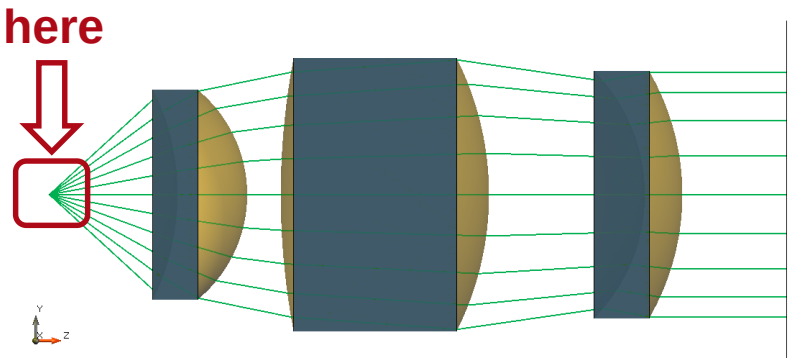
Highlights



- fast physical optics investigation of non-sequential systems
- control of non-sequential behavior by channel concept for each interface individually
- calculation of different non-sequential modes

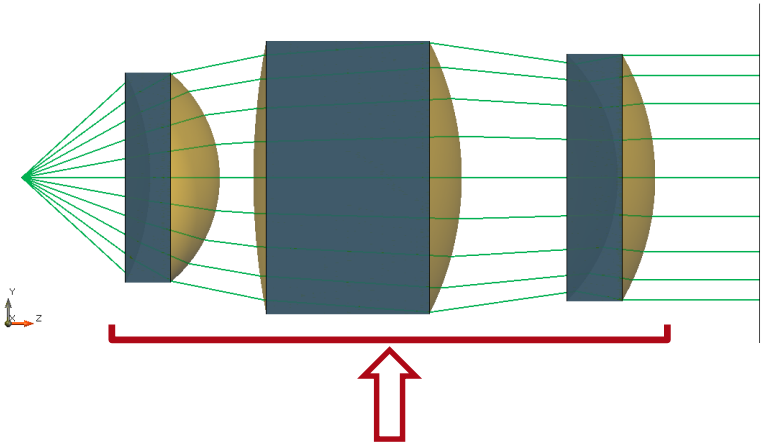
Specification: Light Source

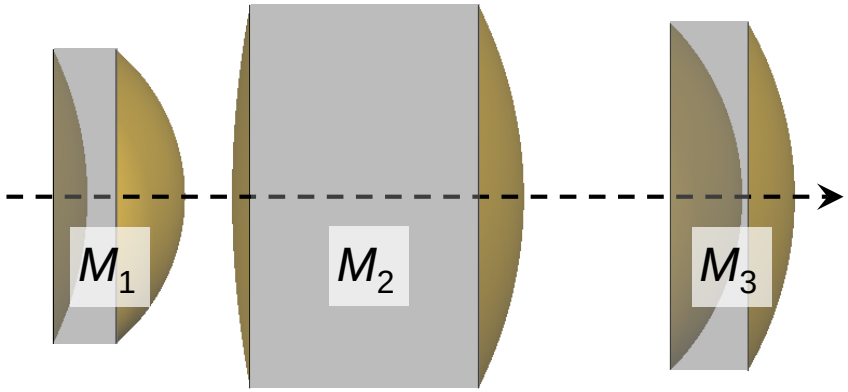




Parameter	Description / Value & Unit
type	single mode IR diode laser from Laser Components: WSLD-1064-050m-1-PD
mode/coherence	single Hermite Gaussian (0,0) mode
wavelength	1064 nm
polarization	linear in x-direction (0°)
FWHM of beam divergence	10° × 20° (i.e. 8.49° × 16.97° referring to $1/e^2$)
initial M^2 in x- and y-direction	1.0×1.0

Specification: Collimation Objective

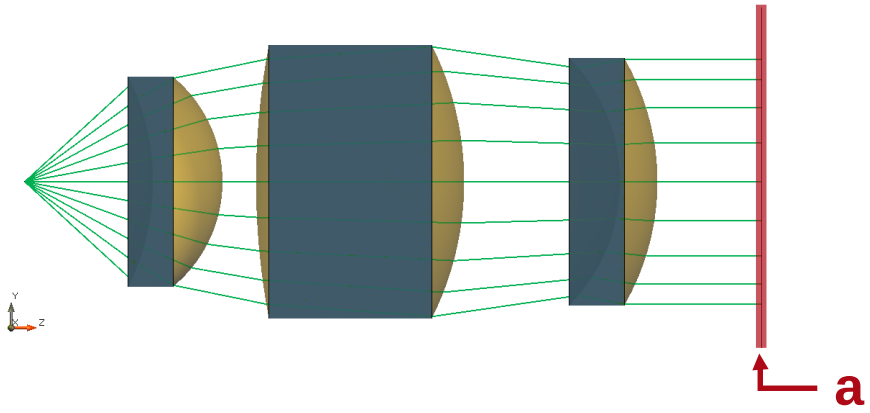




Parameter	Value & Unit
types of lens surfaces	3 lenses with 6 spherical surfaces
numerical aperture (NA)	0.63
materials	M_1: N-SF6* M_2,M_3: N-BK7*

** from catalog "Schott_2014"*

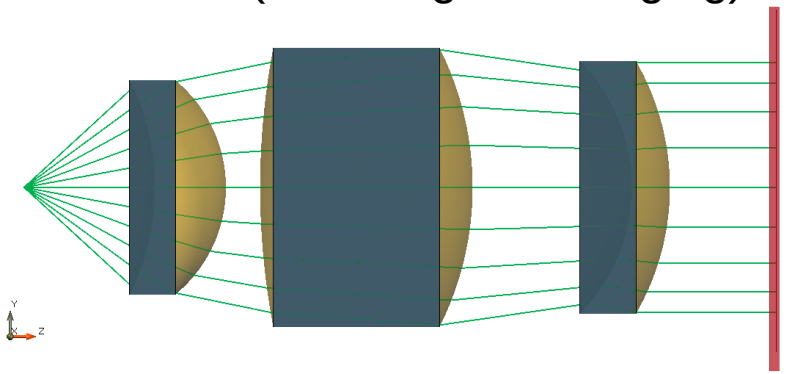
Specification: Detector



Position	Modeling Engine	Detector/Analyzer
full system	3D ray tracing	3D ray tracing system visualization
a	field tracing	calculation of 2D intensity

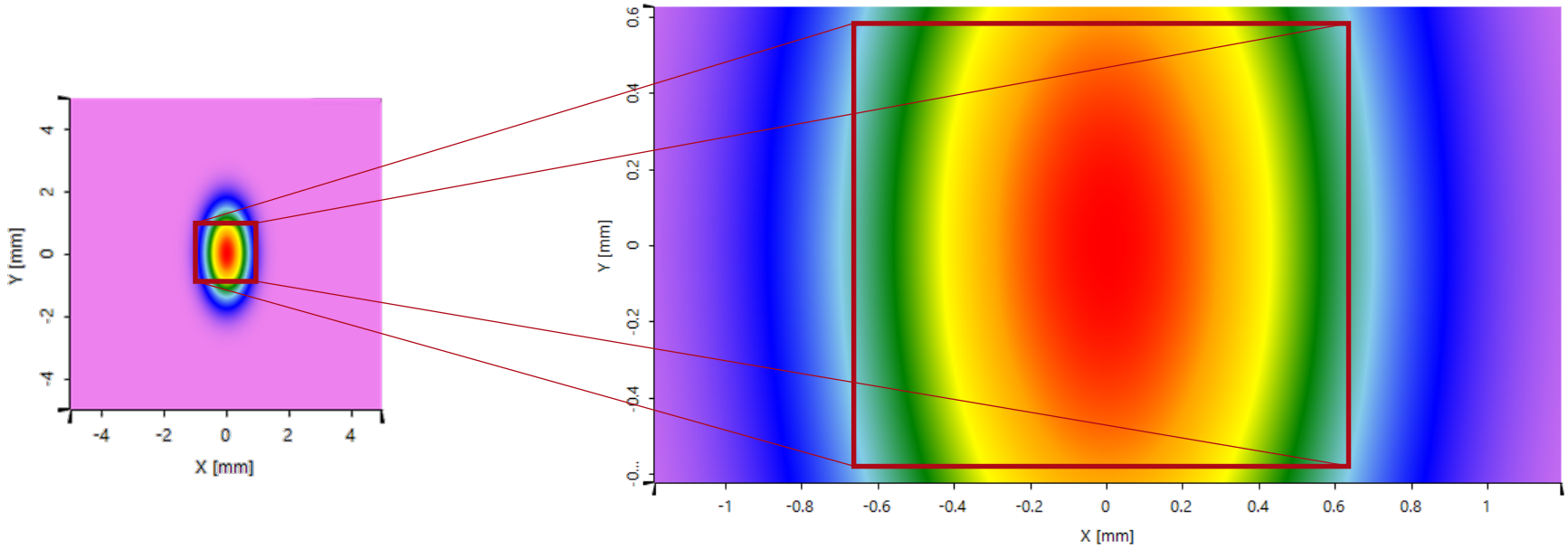
Result: Field Tracing Sequentially

sequential overview (without ghost imaging)

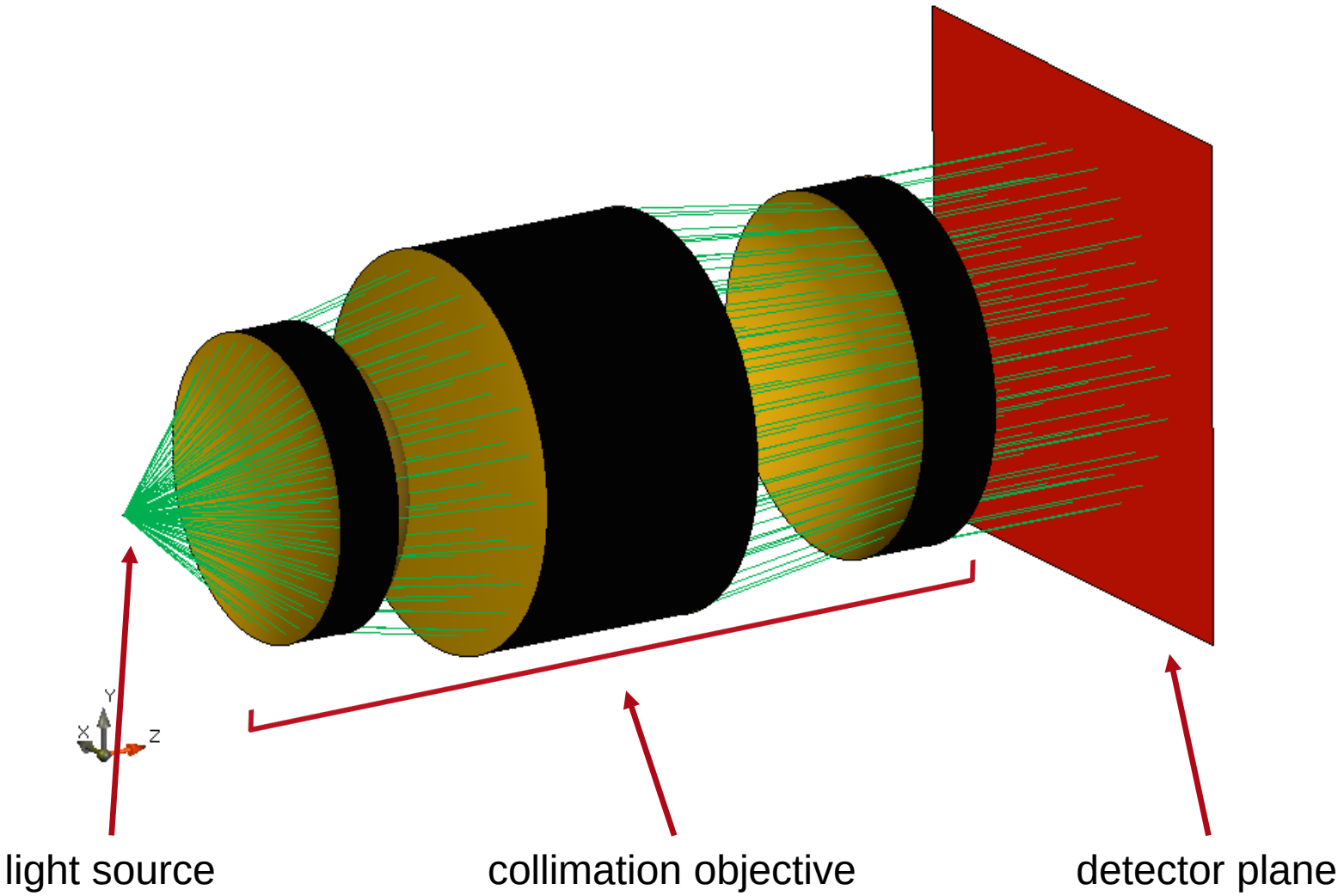


non-sequential
channel settings

Interface	+/+	+/-	-/-	-/+
	☑	☐	☐	☐
Interface #1 (Conical Interface)	☑	☐	☐	☐
Interface #2 (Conical Interface)	☑	☐	☐	☐
Interface #3 (Conical Interface)	☑	☐	☐	☐
Interface #4 (Conical Interface)	☑	☐	☐	☐
Interface #5 (Conical Interface)	☑	☐	☐	☐
Interface #6 (Conical Interface)	☑	☐	☐	☐

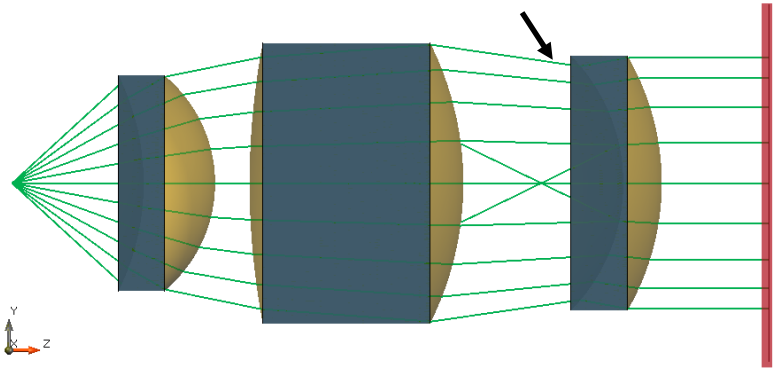


Result: 3D Ray Tracing Sequentially



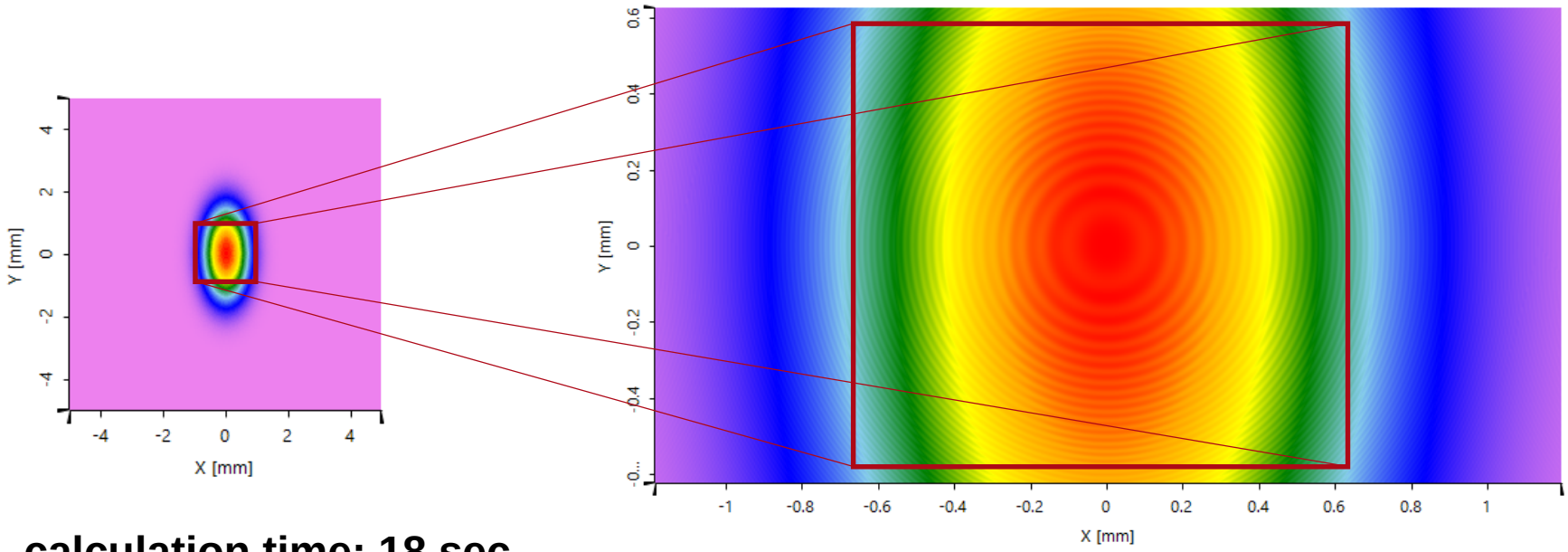
Result: Field Tracing Non-Sequentially

allowing reflection at first surface of last lens



non-sequential channel settings

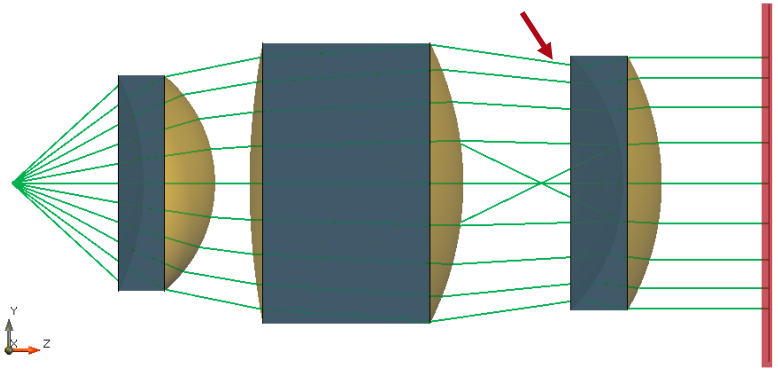
Interface	+/+	+/-	-/-	-/+
	☑	■	☐	■
Interface #1 (Conical Interface)	☑	☐	☐	☐
Interface #2 (Conical Interface)	☑	☐	☐	☐
Interface #3 (Conical Interface)	☑	☐	☐	☐
Interface #4 (Conical Interface)	☑	☐	☐	☑
Interface #5 (Conical Interface)	☑	☑	☐	☐
Interface #6 (Conical Interface)	☑	☐	☐	☐



calculation time: 18 sec

Result: Ray Tracing Non-Sequentially

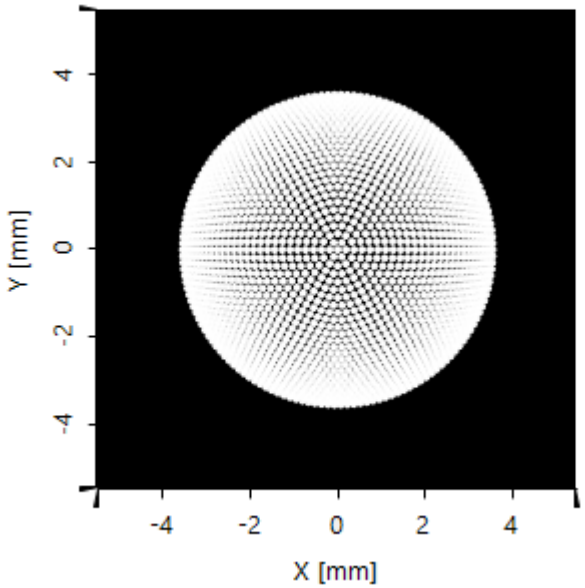
allowing reflection at first surface of last lens



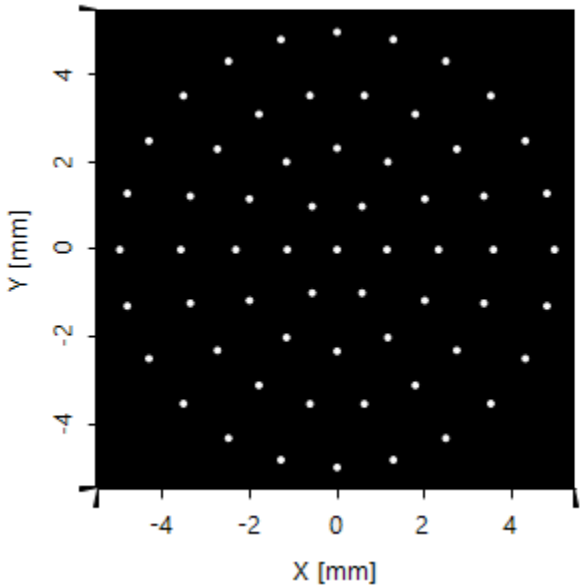
non-sequential
channel settings

Interface	+/+	+/-	-/-	-/+
	☑	■	☐	■
Interface #1 (Conical Interface)	☑	☐	☐	☐
Interface #2 (Conical Interface)	☑	☐	☐	☐
Interface #3 (Conical Interface)	☑	☐	☐	☐
Interface #4 (Conical Interface)	☑	☐	☐	☑
Interface #5 (Conical Interface)	☑	☑	☐	☐
Interface #6 (Conical Interface)	☑	☐	☐	☐

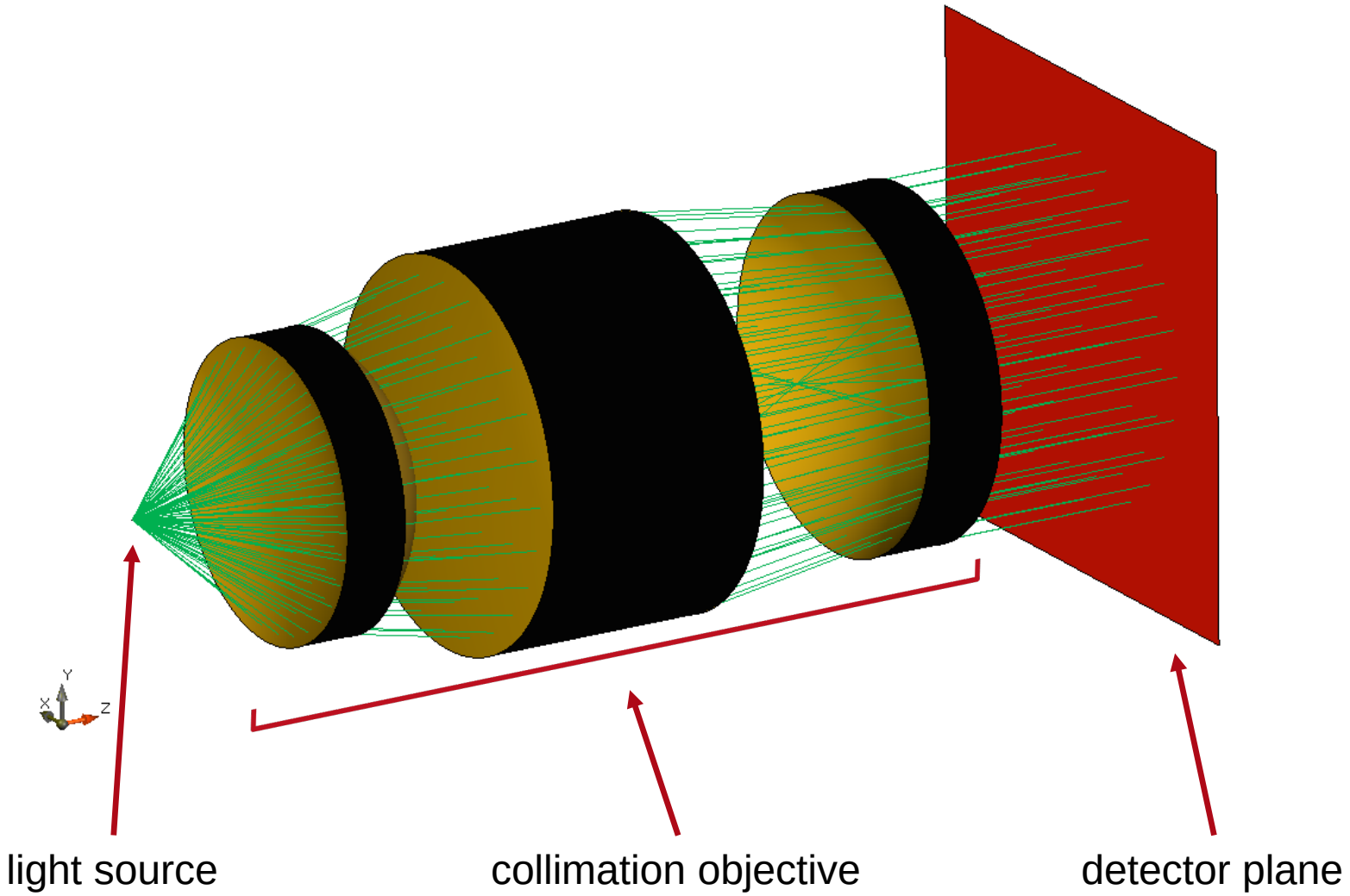
mode 1: “sequential part”



mode 2: “ghost image”

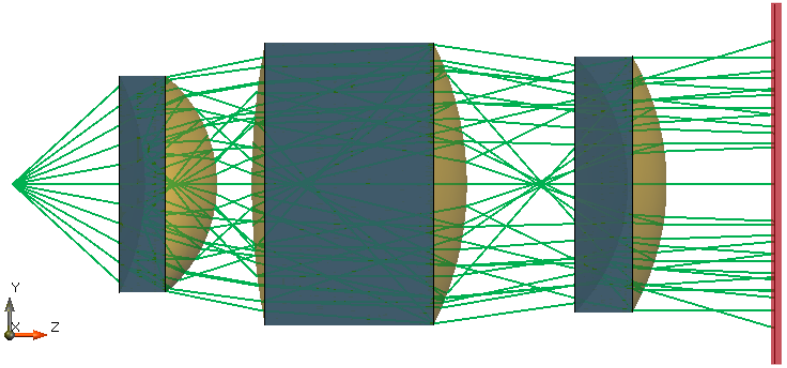


Result: 3D Ray Tracing Non-Sequentially

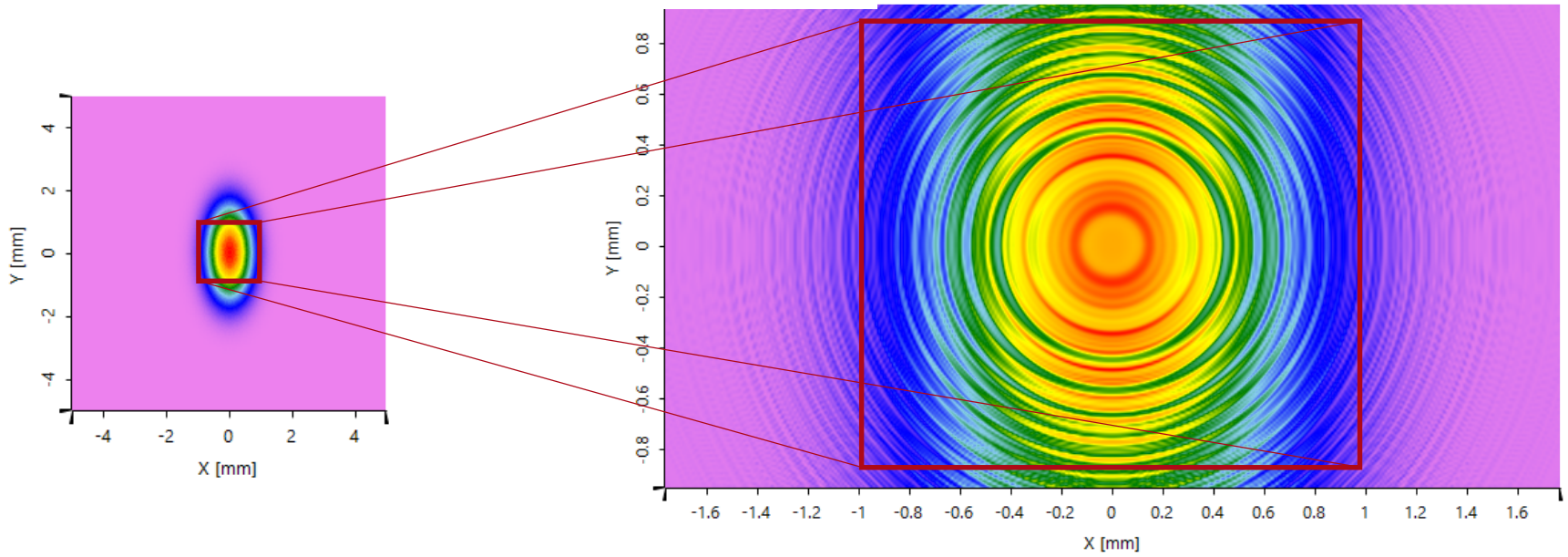


Result: Field Tracing Fully Non-sequentially

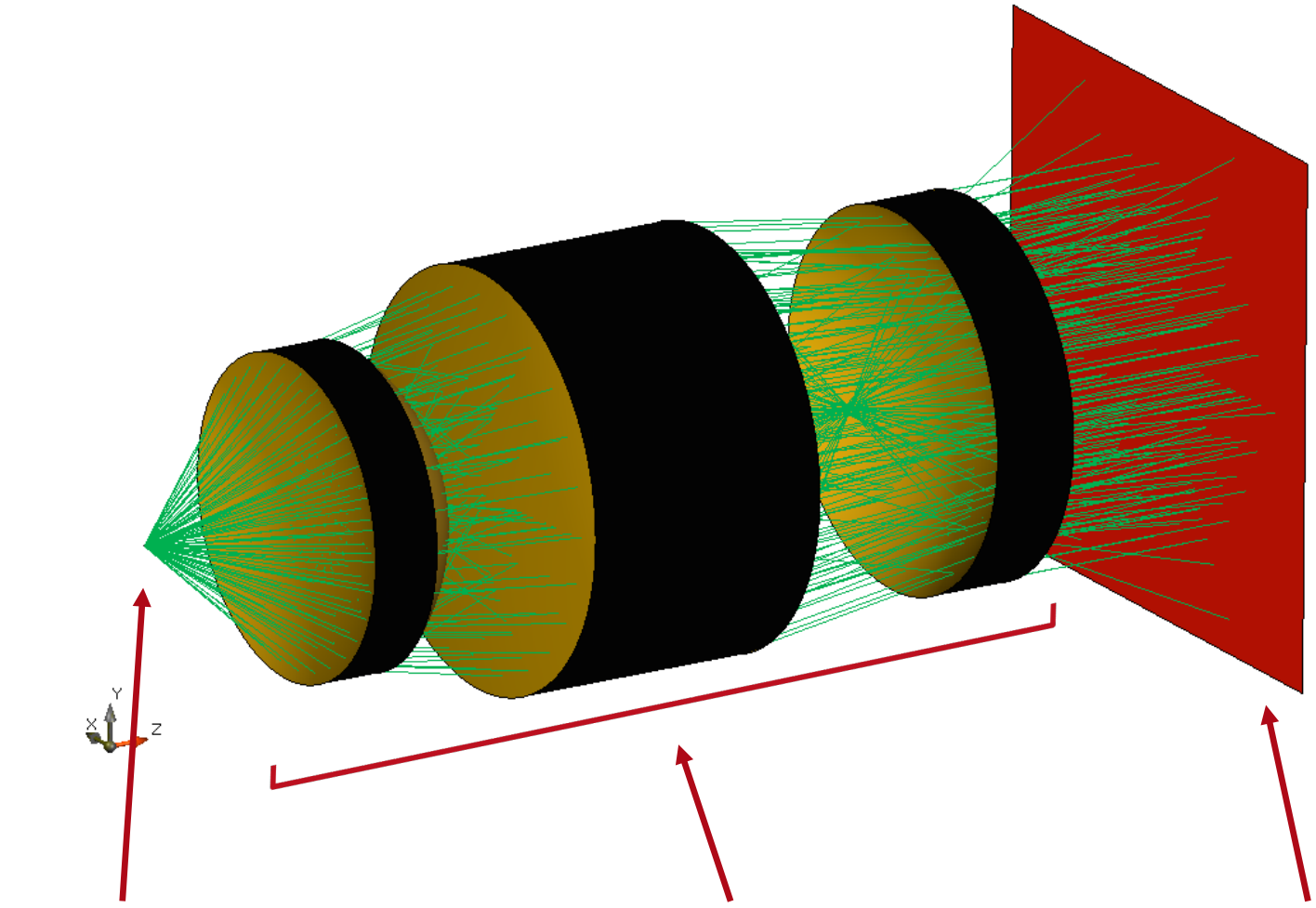
allowing reflection at all surfaces at all lenses (full non-sequential)



Interface	+/+	+/-	-/-	-/+
	☑	☑	☑	☑
Interface #1 (Conical Interface)	☑	☑	☑	☑
Interface #2 (Conical Interface)	☑	☑	☑	☑
Interface #3 (Conical Interface)	☑	☑	☑	☑
Interface #4 (Conical Interface)	☑	☑	☑	☑
Interface #5 (Conical Interface)	☑	☑	☑	☑
Interface #6 (Conical Interface)	☑	☑	☑	☑



Result: 3D Ray Tracing Fully Non-Sequentially



Document & Technical Info

code	GI.0001
version of document	1.0
title	Investigation of Ghost Imaging Effect in Collimation System
category	Imaging Systems > Ghost Imaging (GI)
author	Stefan Steiner (LightTrans)
VL version used for simulations	The sample files for this use case will be available with the release of non-sequential extension of VirtualLab.

Specifications of PC Used for Simulation	
Processor	i7-4910MQ (4 CPU cores)
RAM	32 GB
Operating System	Windows 10