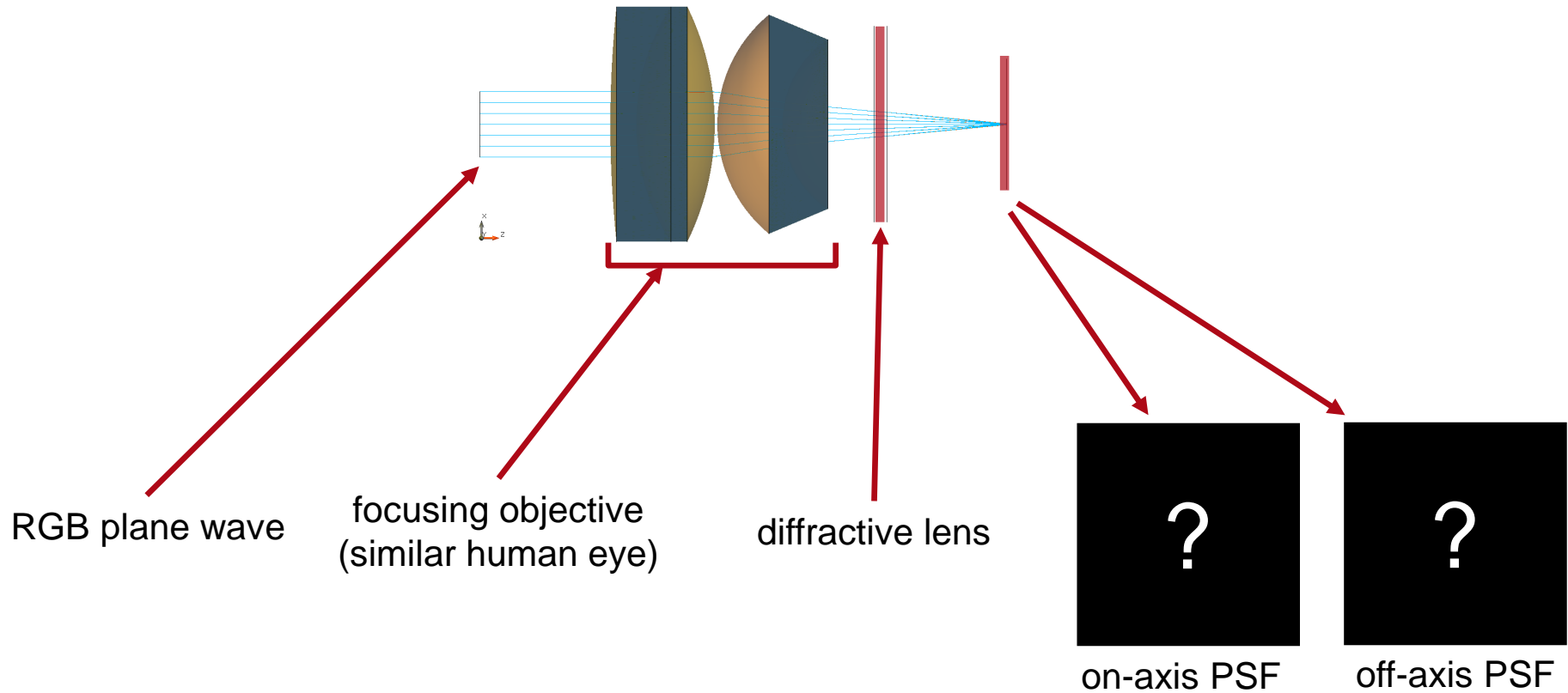Imaging Systems

Correction of Chromatic Aberration by using a Diffractive Lens

Task/System Illustration
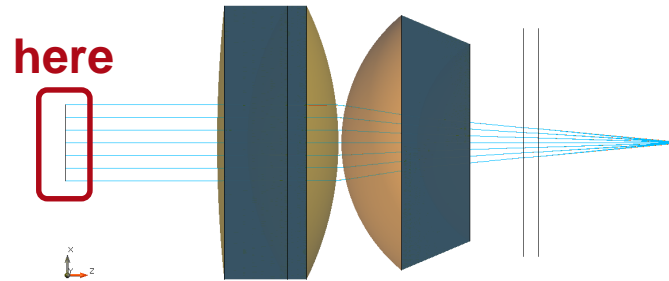

RGB plane wave

focusing objective
(similar human eye)

diffractive lens

on-axis PSF

off-axis PSF

Highlights
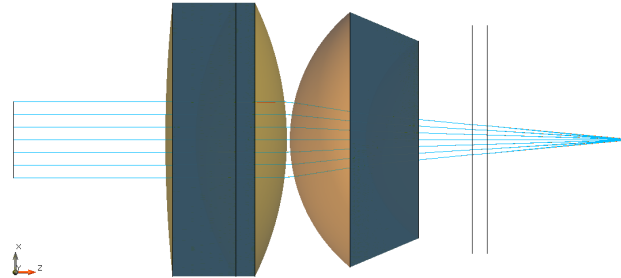
- inclusion of diffractive lenses in optical systems
- consideration of different diffraction orders with specific efficiencies
- evaluation of 2D PSF for not fully illuminated apertures
- calculation of off-axis 2D PSF

Specification: Light Source

Parameter	Description / Value & Unit
type	plane wave
wavelengths	486.1 nm, 587.6 nm, 656.3 nm
polarization	linear in x-direction (0°)
tilt angle	0°, 10°, 20°

Specification: Lens System
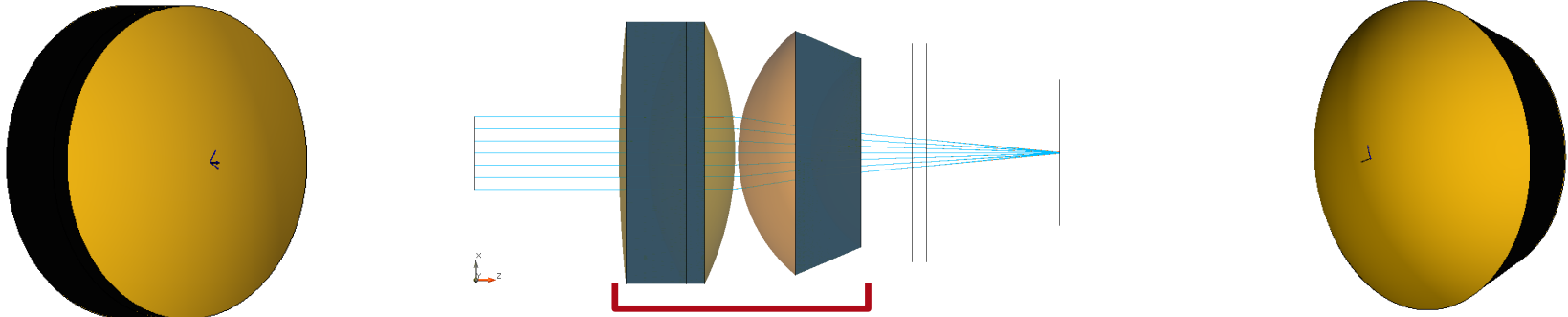
| Parameter	Description / Value & Unit
type	conical lenses
diameter 1st lens	18mm
diameter 2nd lens	16.8mm
material 1st lens	S-NPH2 / S-BAH28
material 2nd lens	S-LAH79

Specification: Diffractive Lens
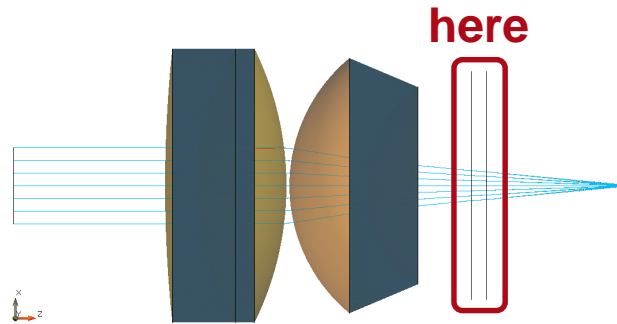
Parameter	Description / Value & Unit
type	polynomial phase function (radial symmetrical)
efficiency calculation	ideal
material	PMMA
thickness	1mm
working order	1st diffraction order
coefficient 1	-1050.1
coefficient 2	1133
coefficient 3	-878.2

Specification: Detectors
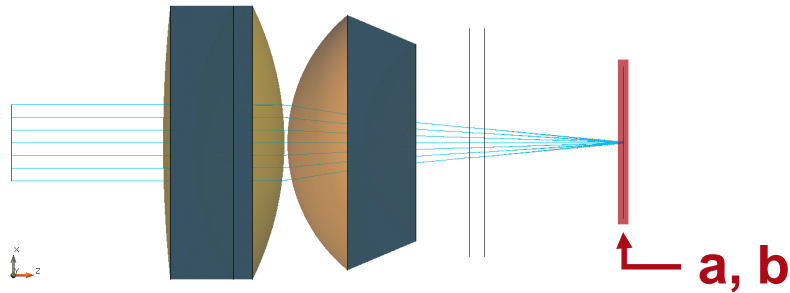
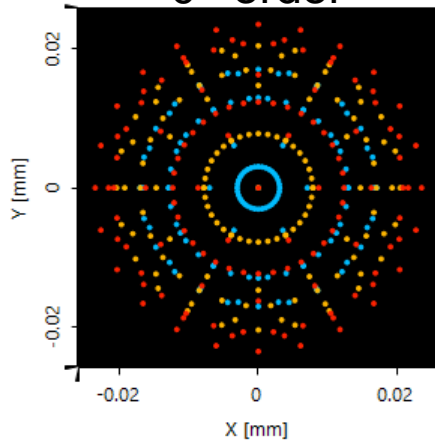| Position	Modeling Engine	Detector/Analyzer
full system	3D Ray Tracing	3D ray tracing system visualization
a	Ray Tracing	Ray Diagram
b	Field Tracing (2nd Gen.)	2D intensity evaluation / PSF calculation

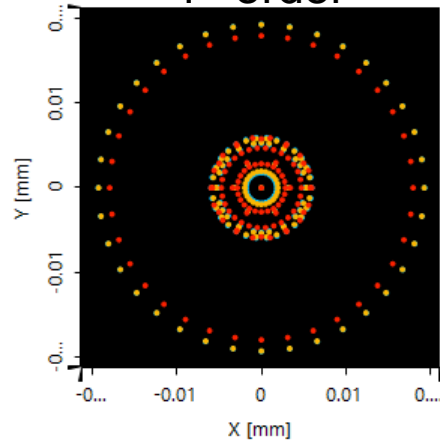lens system

source plane
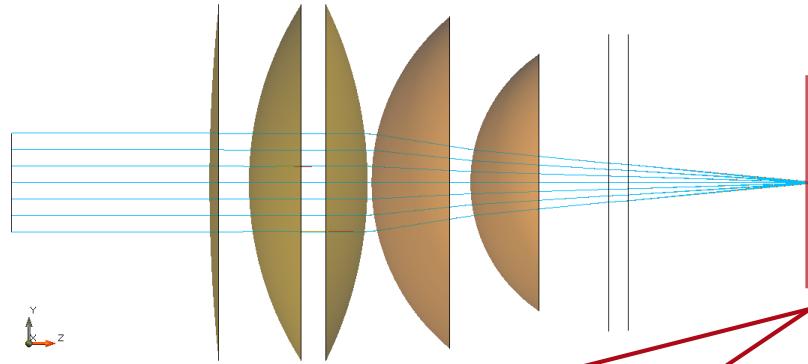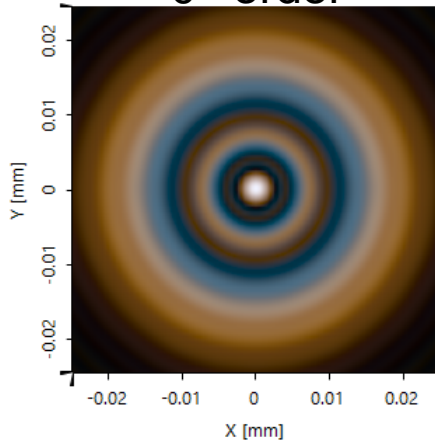
diffractive lens

focal plane
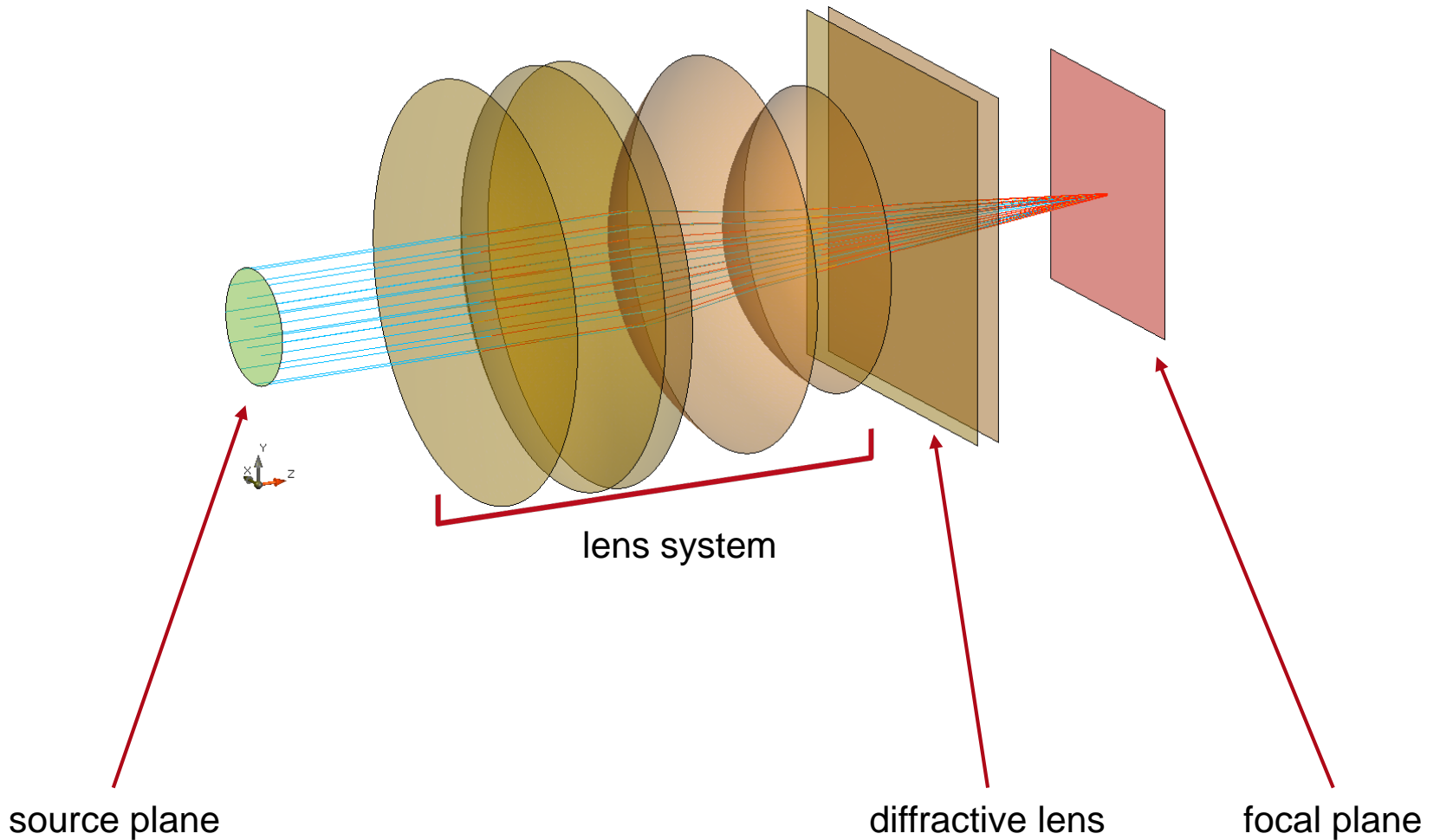
Result: Ray Tracing On-axis
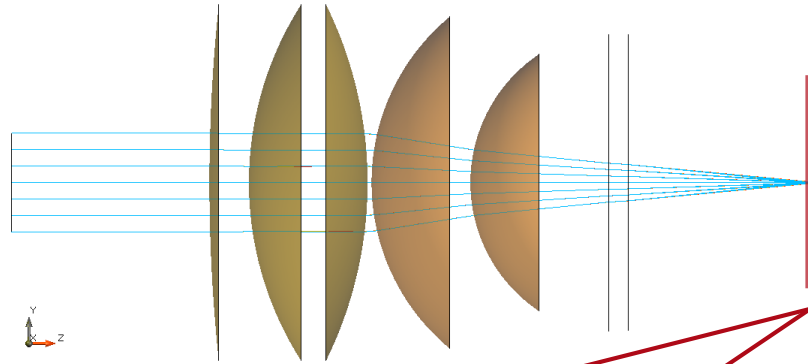
0th order

1st order

Result: Field Tracing On-axis

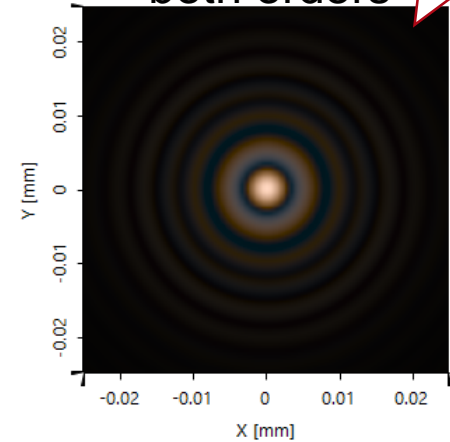assumed diffraction efficiencies:
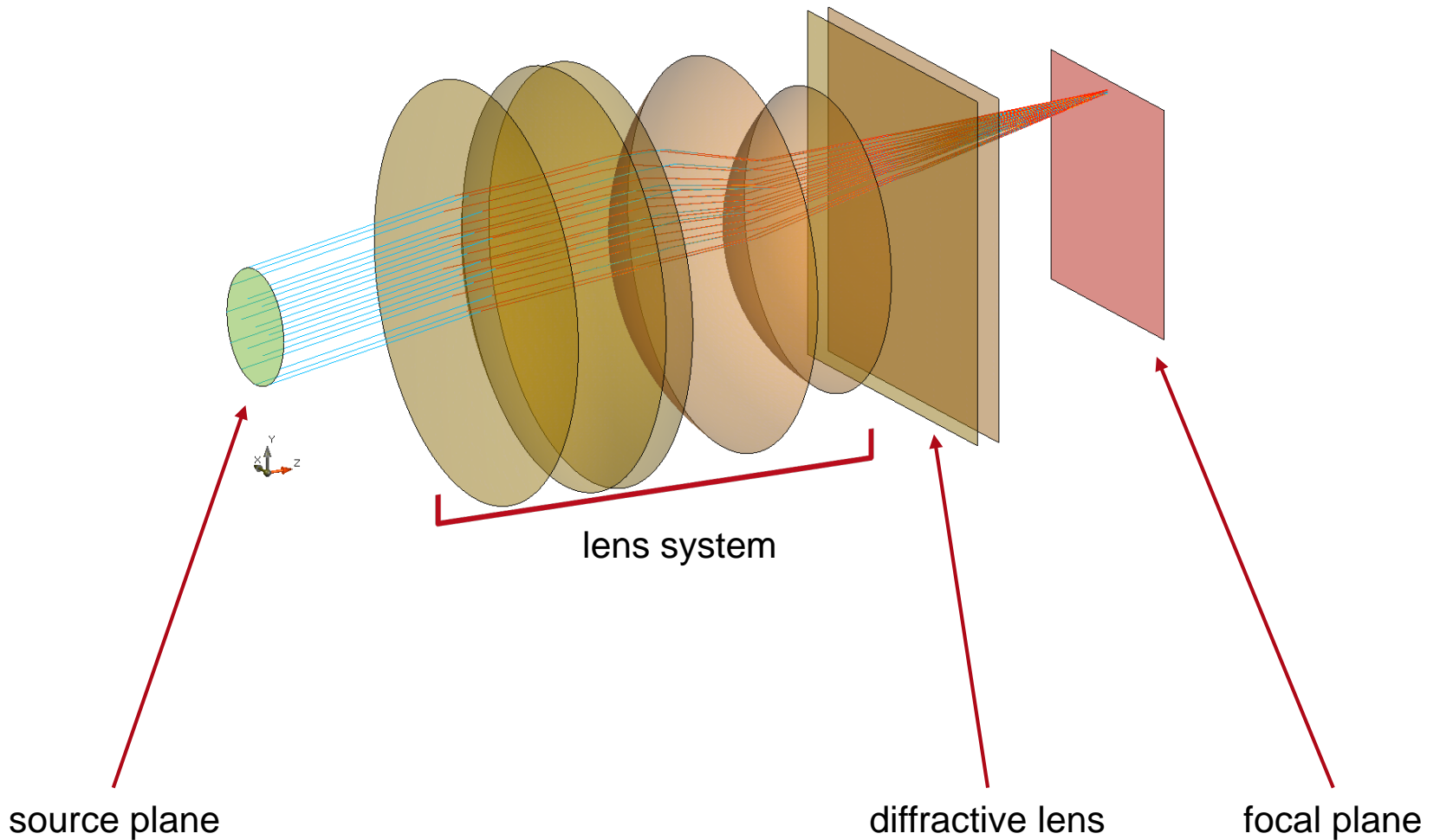0th order: 0.2
1st order: 0.8
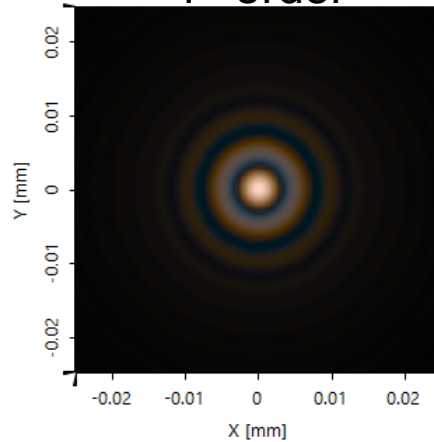
0th order

1st order

both orders

Result: 3D Ray Tracing Off-axis 10°

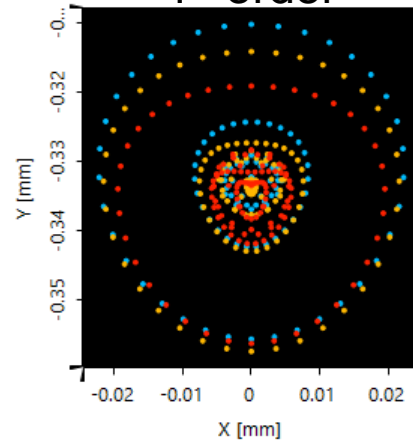source plane

lens system

diffractive lens

focal plane

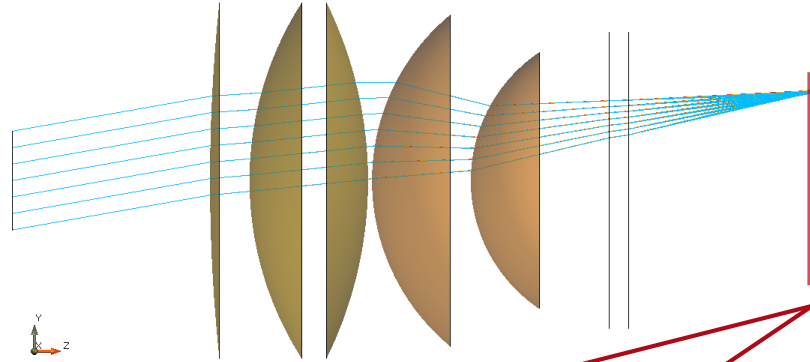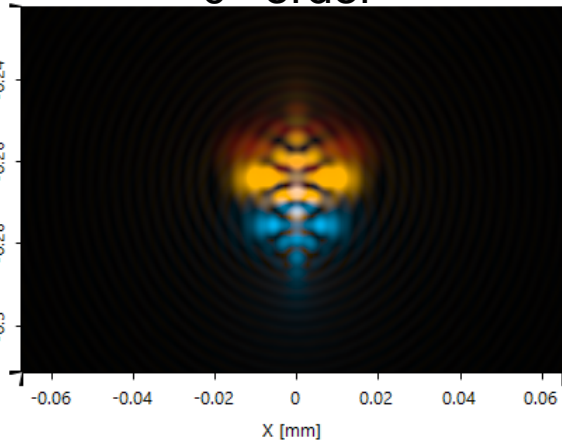# Result: Ray Tracing Off-axis 10°
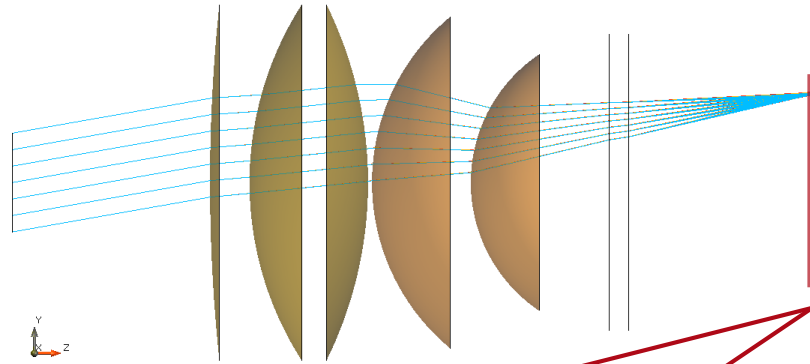
0th order
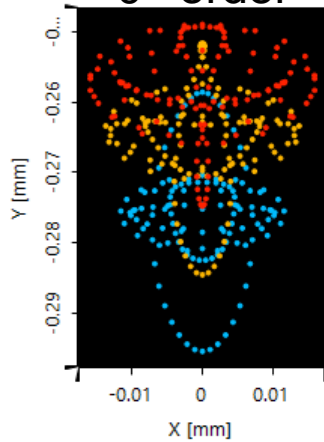
1st order

Result: Field Tracing Off-axis 10°

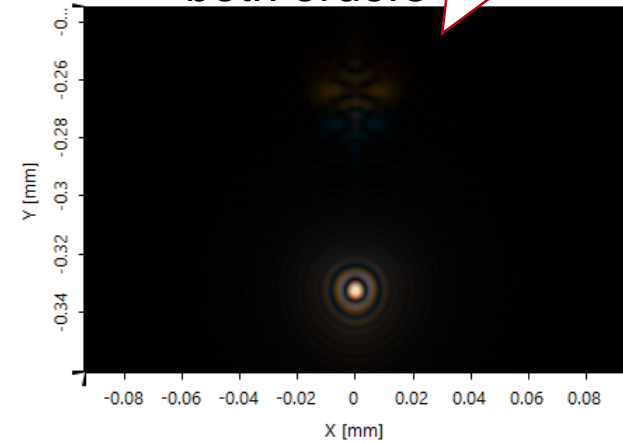assumed diffraction efficiencies:
0th order: 0.2
1st order: 0.8

0th order

1st order

both orders

lens system

source plane

diffractive lens

focal plane
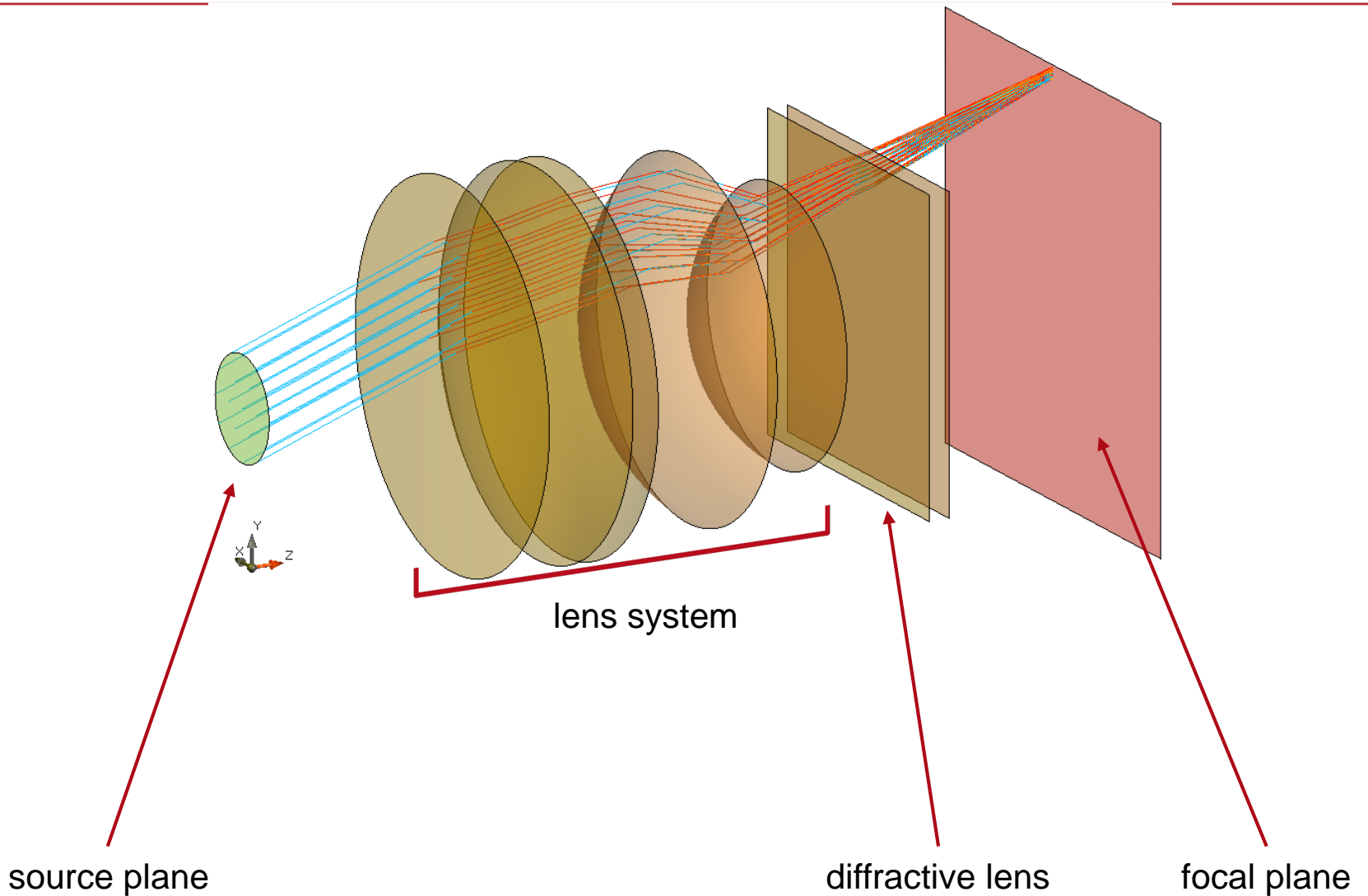
Result: Ray Tracing Off-axis 20°
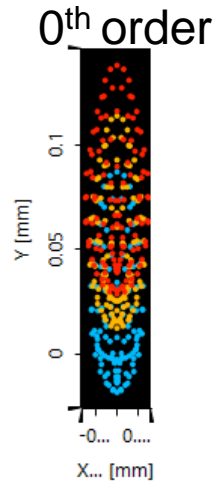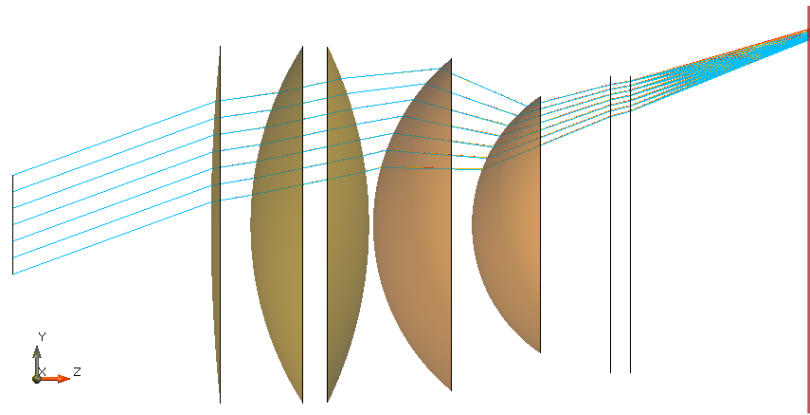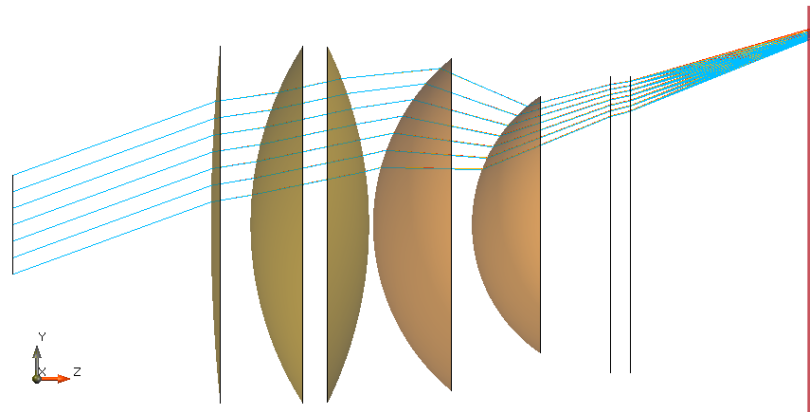
0th order

1st order

Result: Field Tracing Off-axis 20°

assumed diffraction efficiencies:
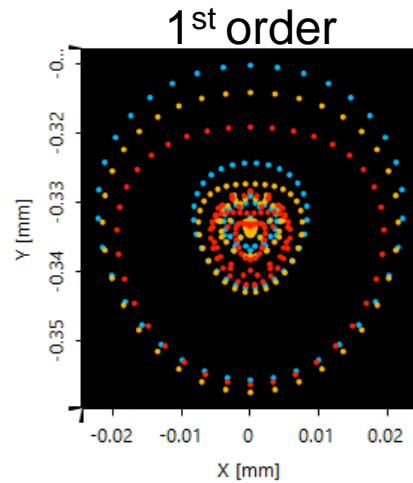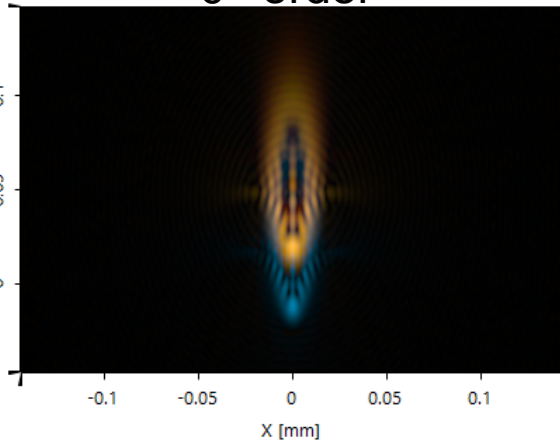0th order: 0.2
1st order: 0.8

0th order

1st order
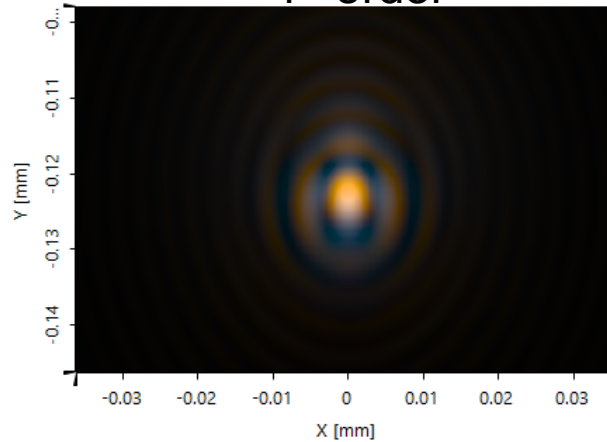
both orders
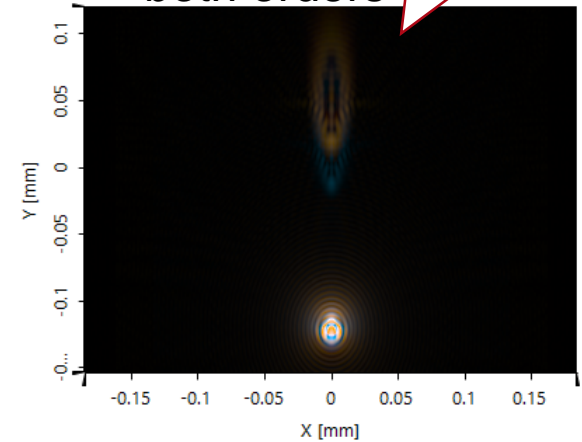
Document & Technical Info

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version of document	1.0
title	Correction of Chromatic Aberration by using a Diffractive Lens
category	Imaging Systems
created by	Stefan Steiner / LightTrans International UG
VL version used for simulations	7.0.0.29 (sample file will be available soon)

Specifications of PC Used for Simulation

Processor	i7-49010MQ (4 CPU cores)
RAM	32 GB
Operating System	Windows 10