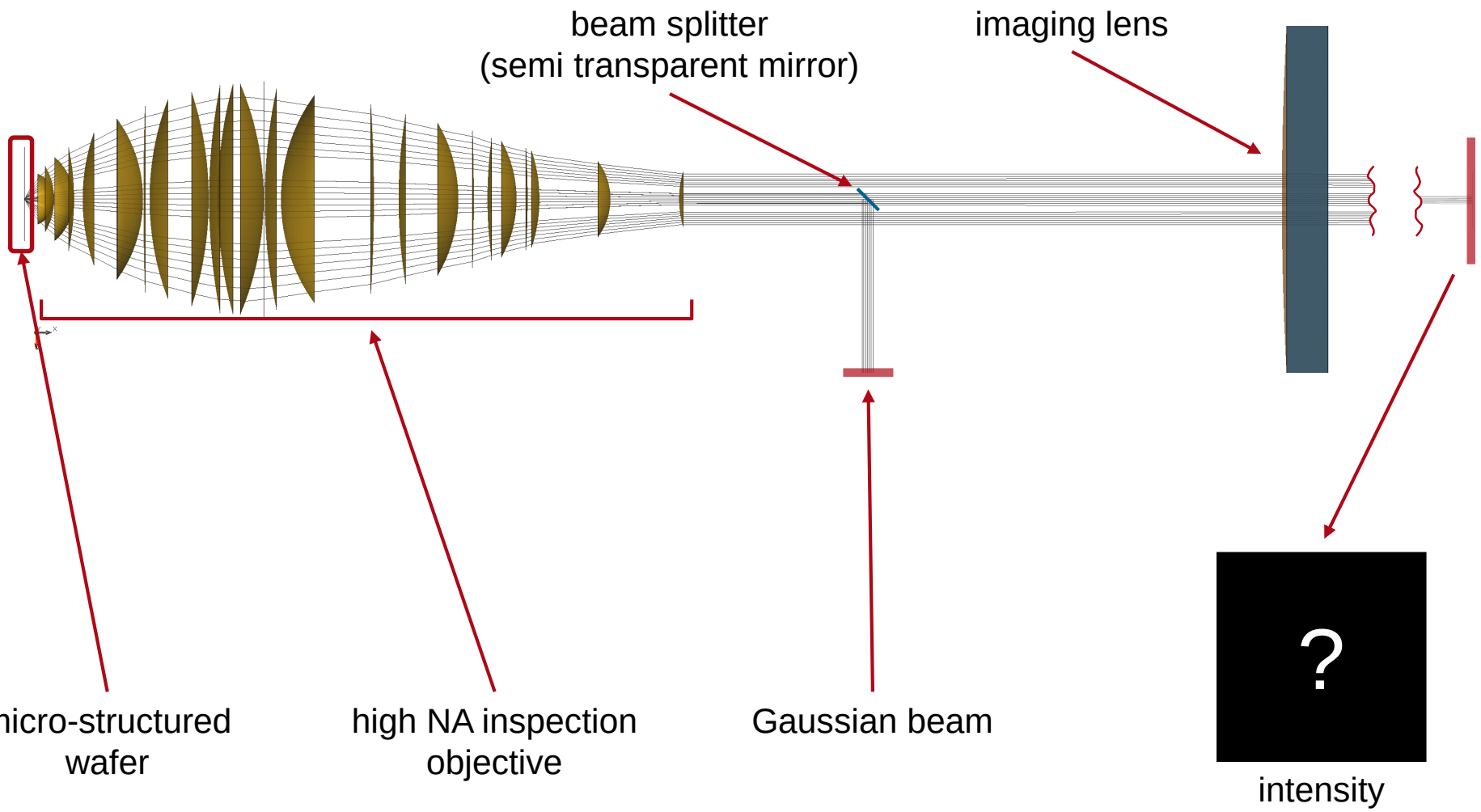
LightTrans

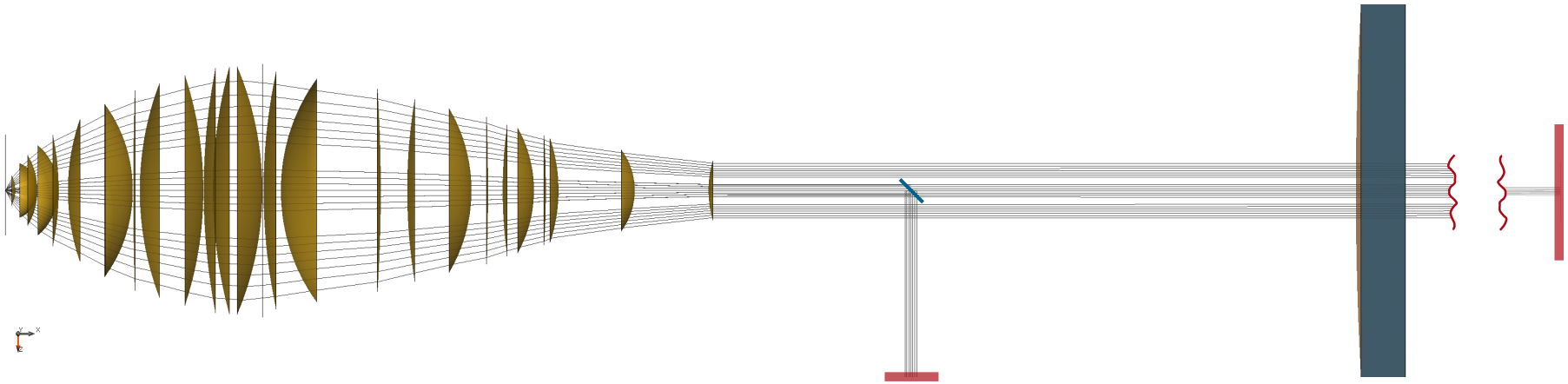
Imaging Systems > Inclusion of Gratings

Optical System for Inspection of Micro-Structured Wafer

Task/System Illustration

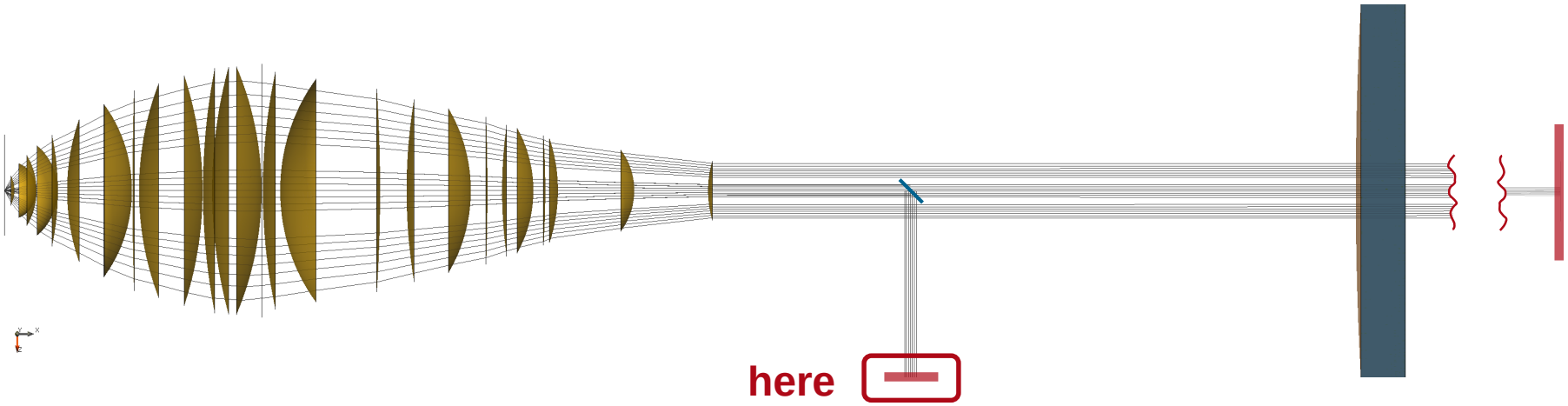


Highlights



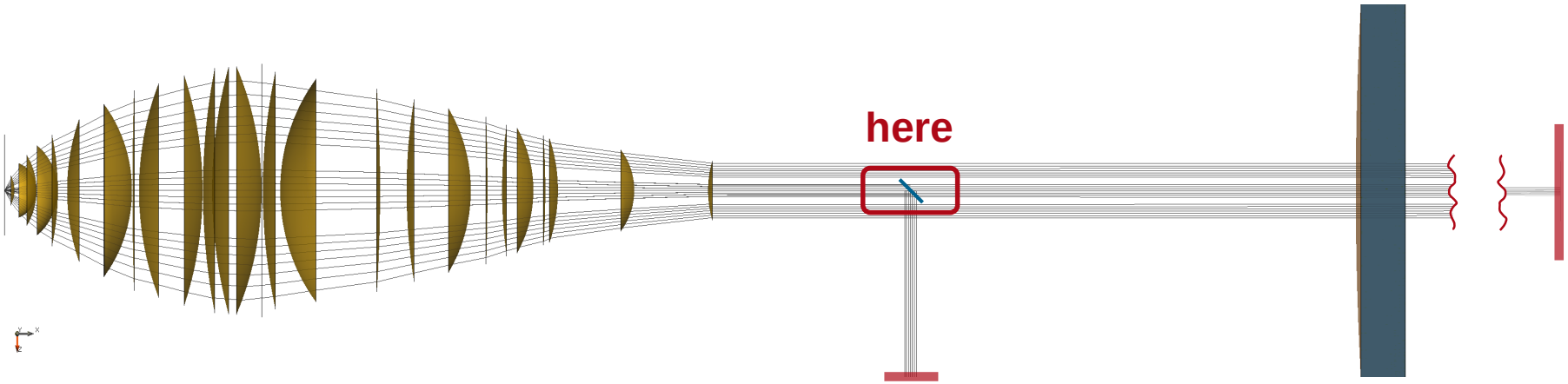
- inclusion of gratings in complex optical systems (e.g. with very high NA)
- rigorous analysis of grating diffraction efficiencies
- taking account of the directional distribution of the incident light

Specification: Light Source



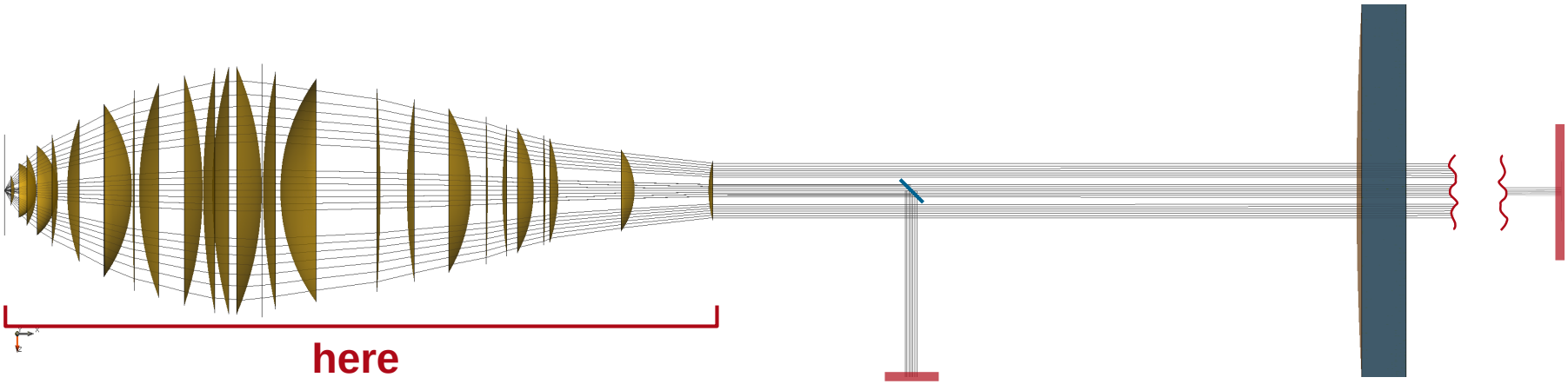
Parameter	Description / Value & Unit
mode/coherence	single Hermite Gaussian (0,0) mode
wavelength	266.08 nm
polarization	circular
full beam divergence	0.075° × 0.075° (referring to $1/e^2$)
initial M^2 in x- and y-direction	1.0 × 1.0

Specification: Beam Splitter



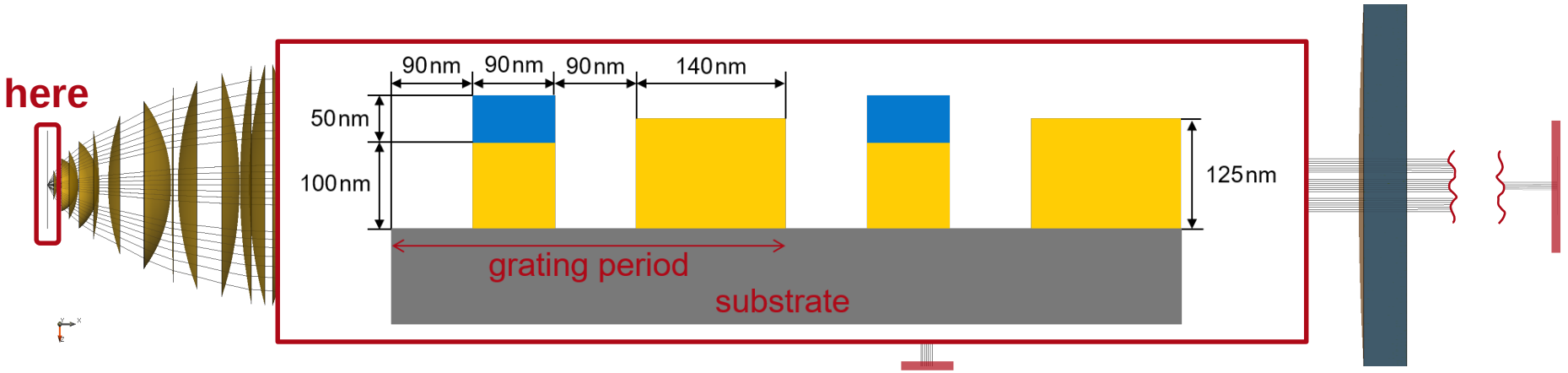
Parameter	Description / Value & Unit
type	ideal beam splitter / semi transparent mirror
splitting ratio	50% : 50%

Specification: Inspection Lens System



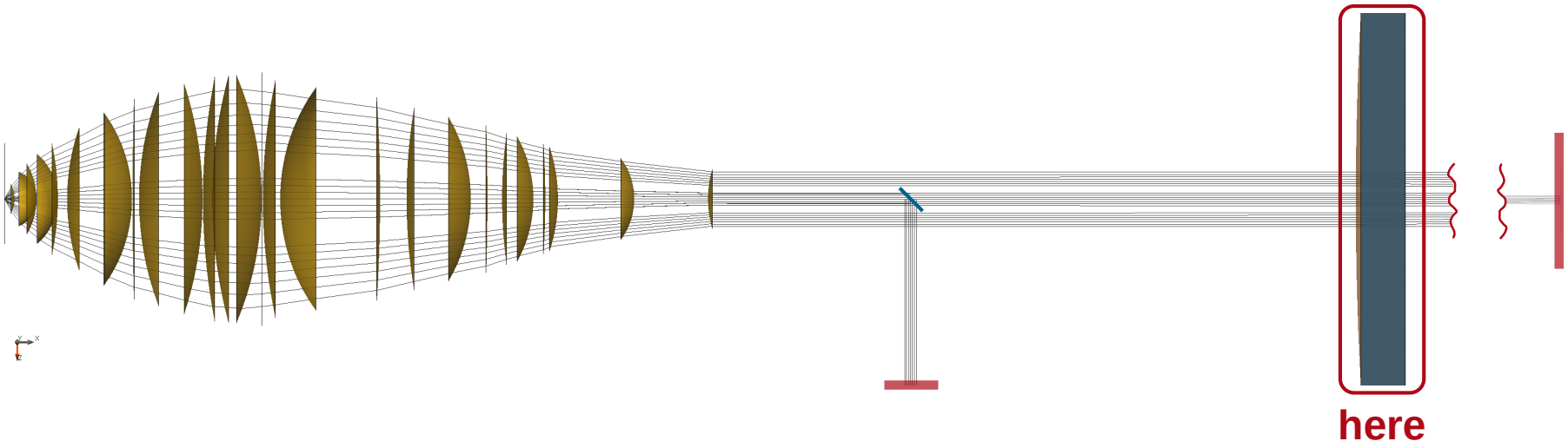
Parameter	Description / Value & Unit
number of lenses	16
numerical aperture (NA)	0.9
effective focal length	2 mm
back focal length	750 µm
wavefront error	0.05 λ PV / 0.006 λ RMS

Specification: Micro-Structured Wafer



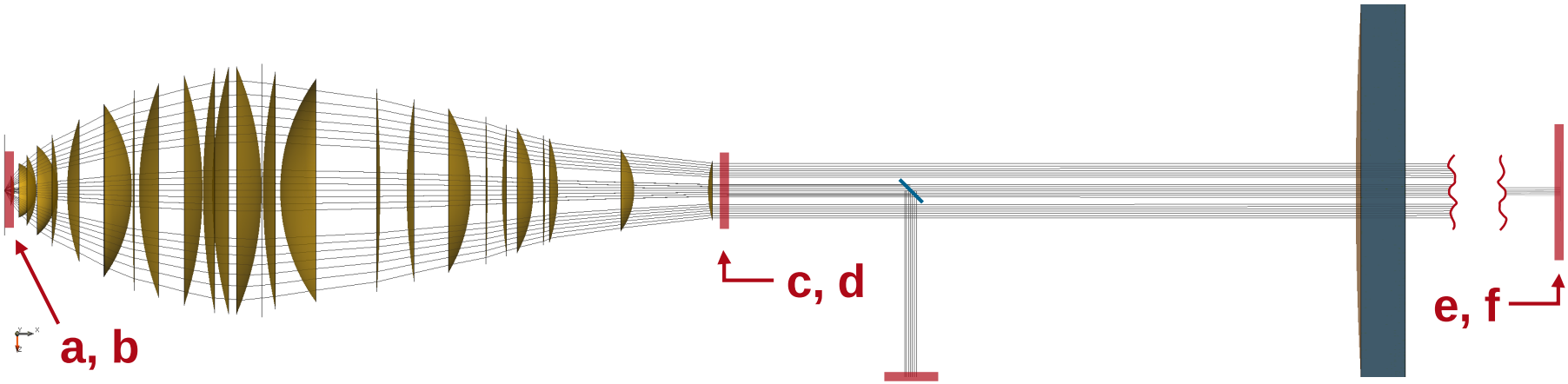
Parameter	Description / Value & Unit
type	periodic microstructured wafer
materials	gold, molybdenum
substrate	silicon (crystallin)
grating period	410nm
substrate thickness	1mm

Specification: Inspection Objective



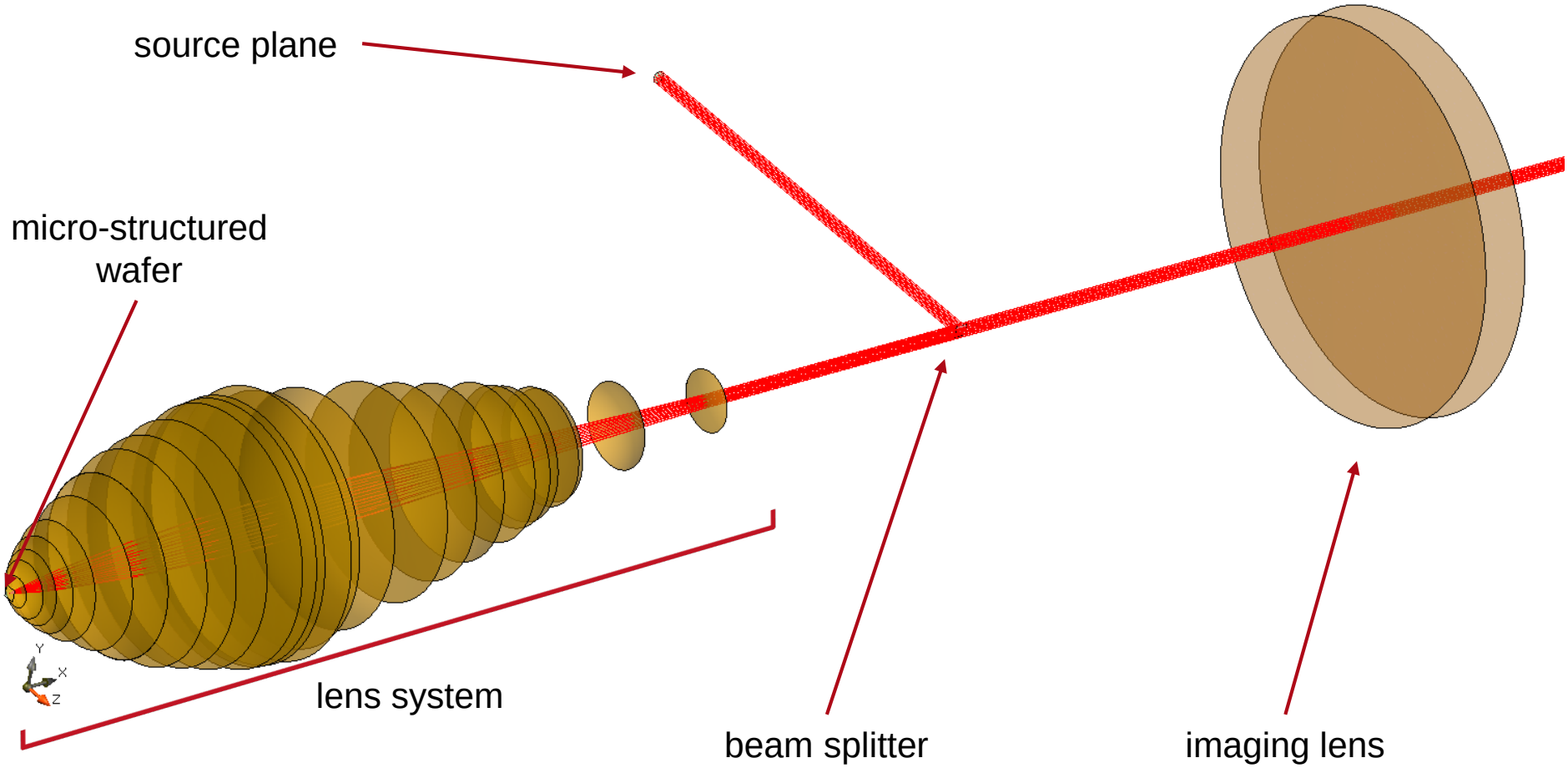
Parameter	Description / Value & Unit
type	spherical lens (plano-convex)
model	Newport SPX031AR.10
effective focal length	500 mm
back focal length	459 mm
material	fused silica

Specification: Detectors

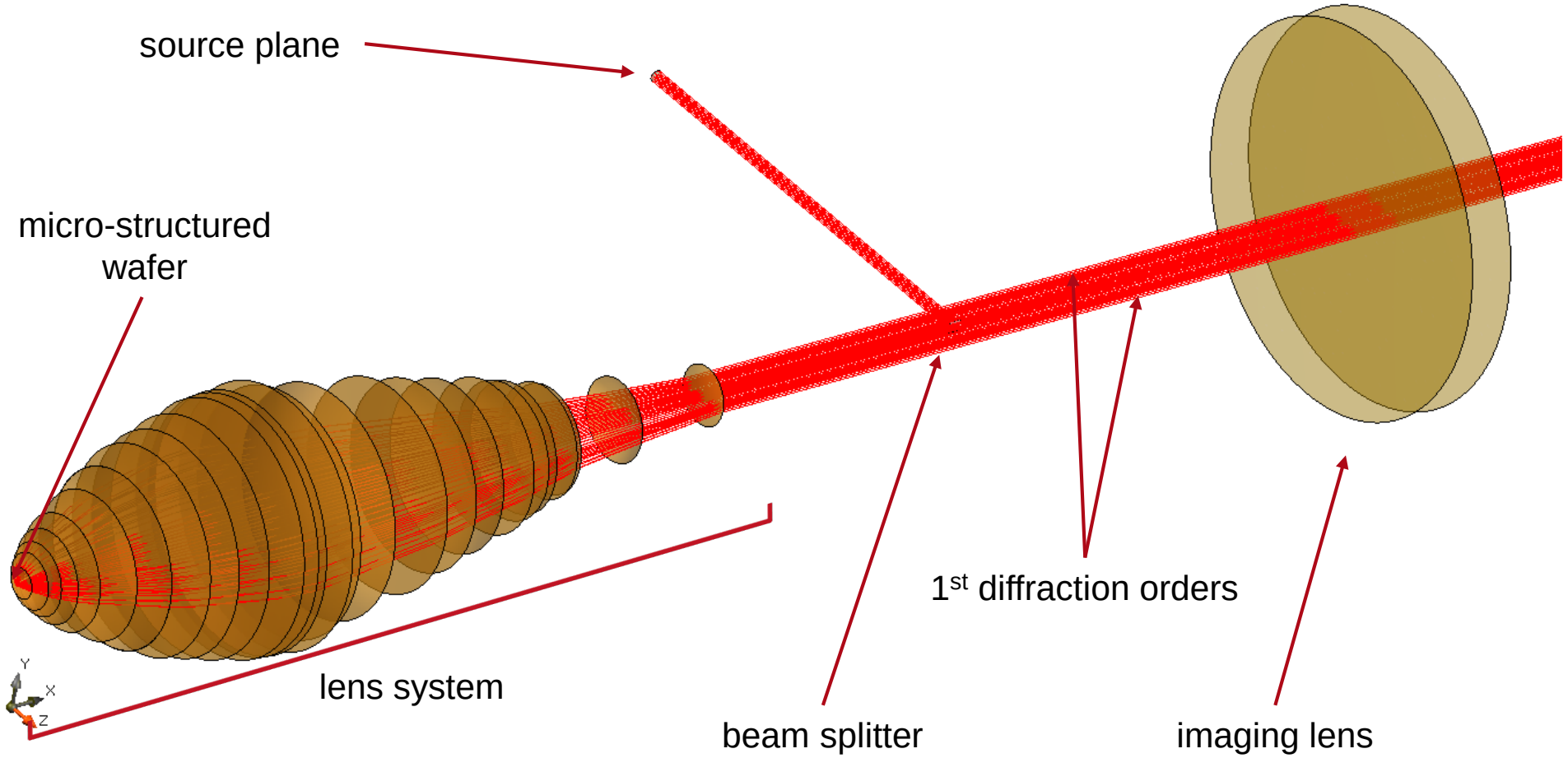


Position	Modeling Technique	Detector/Analyzer
full system	3D ray tracing	3D ray tracing system visualization
a	ray tracing	dot diagram in front of objective (behind grating)
b	field tracing	intensity in front of objective (behind grating)
c	ray tracing	dot diagram behind objective
d	field tracing	intensity behind objective
e	ray tracing	dot diagram in imaging plane
f	field tracing	intensity in imaging plane

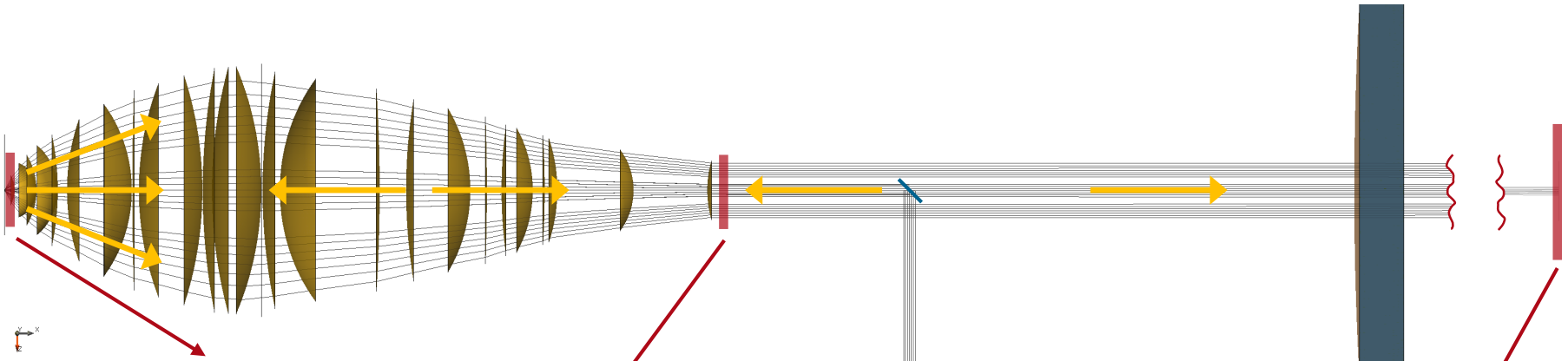
Result: 3D Ray Tracing (Only 0th Order)



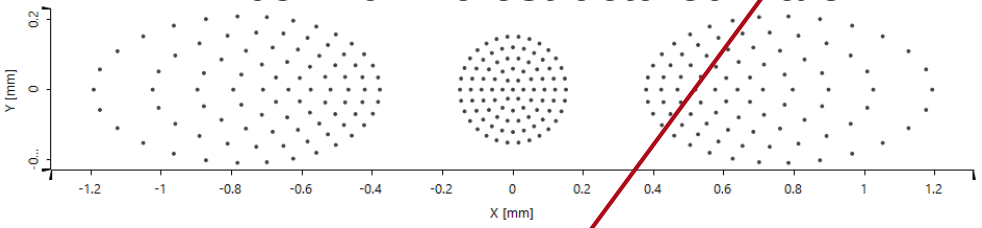
Result: 3D Ray Tracing (All Orders)



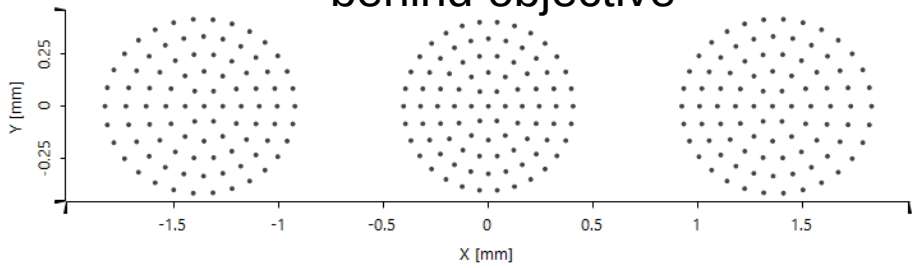
Result: Ray Tracing



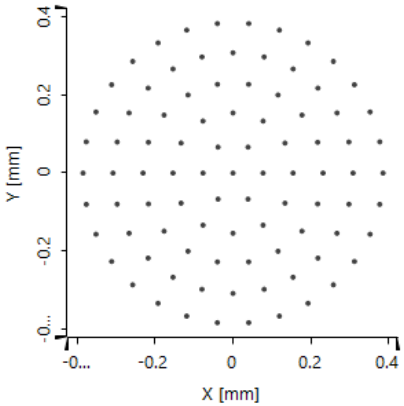
behind microstructured wafer



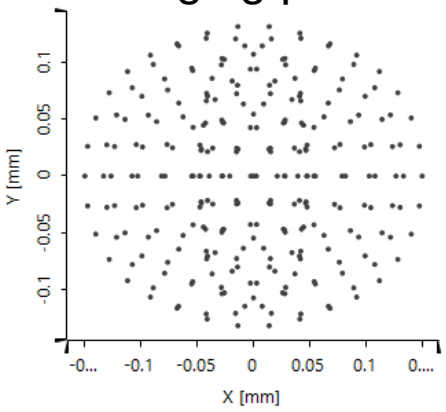
behind objective



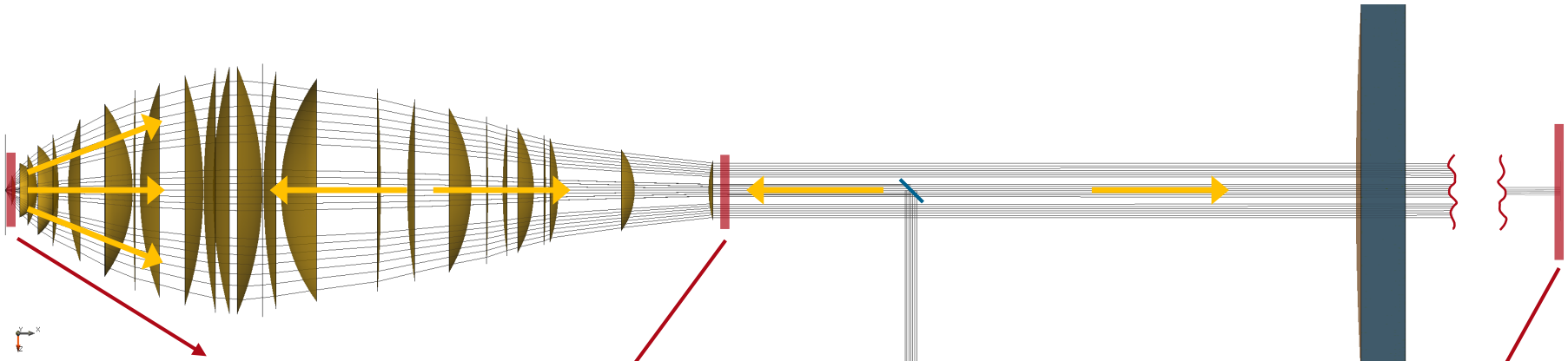
incident beam



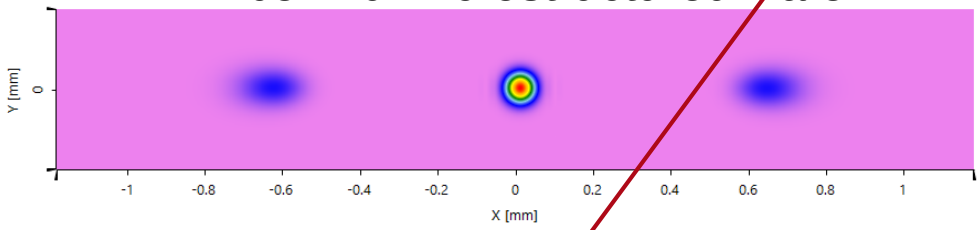
imaging plane



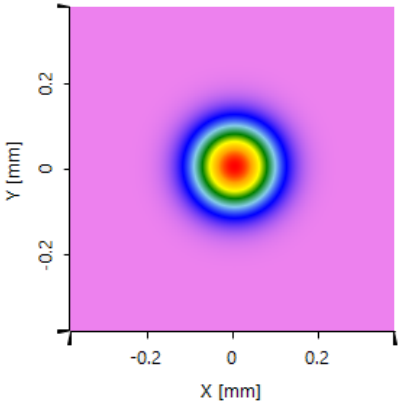
Result: Field Tracing



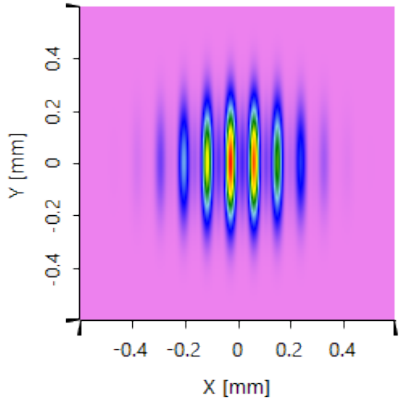
behind microstructured wafer



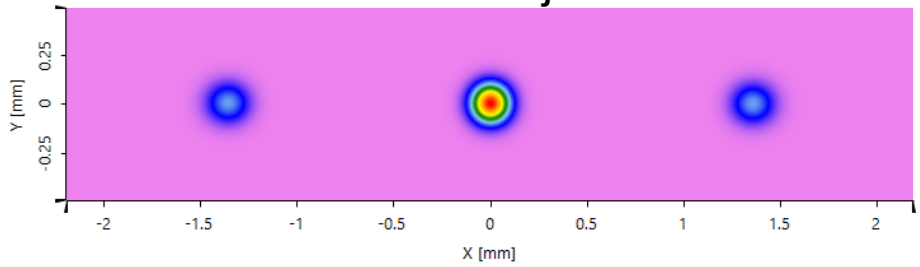
incident beam



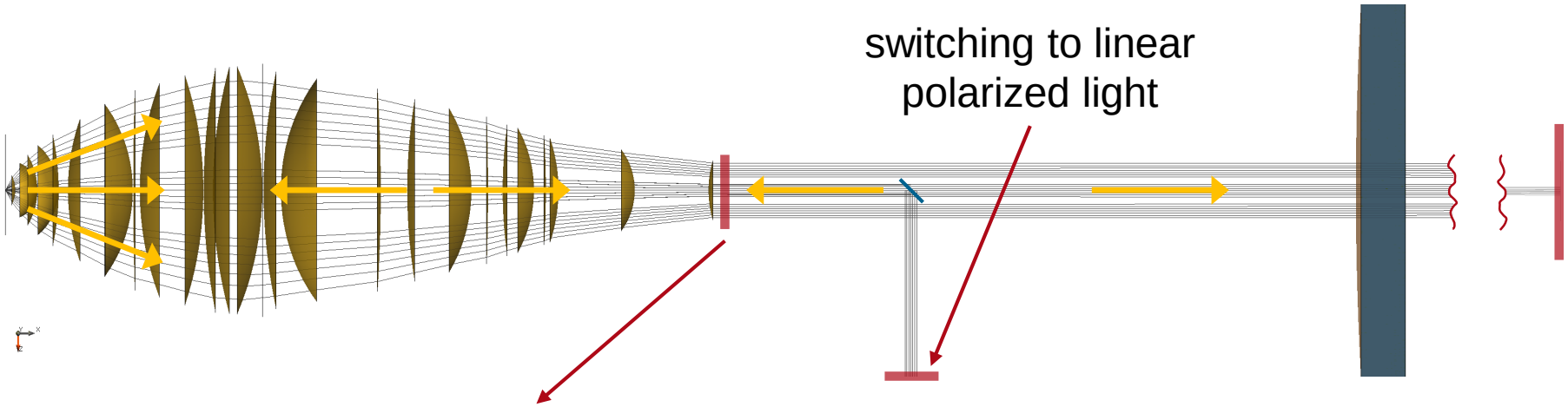
imaging plane



behind objective

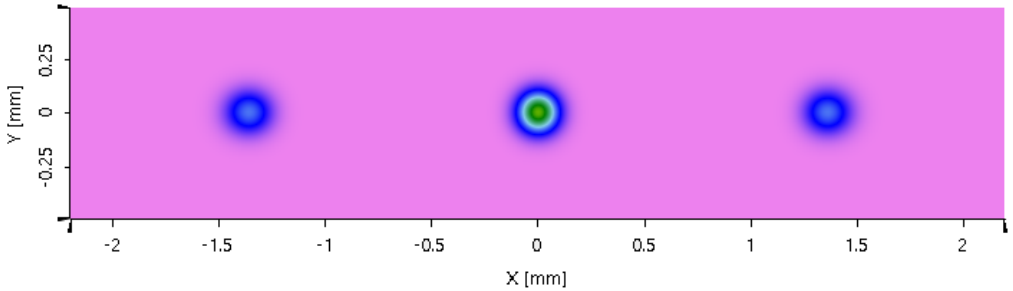


Result: Field Tracing of Linear Polarized Light

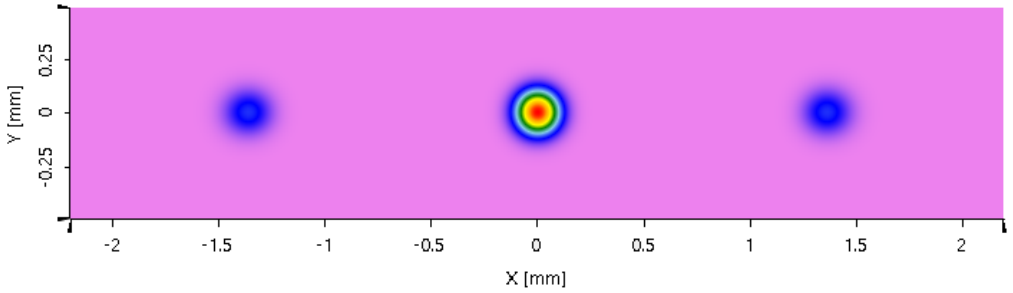


behind objective

E_x



E_y



polarization depending diffraction efficiency (taken into account by rigorous grating analysis)

Document & Technical Info

code	IOG.0001
version of document	1.0
title	Optical System for Inspection of Micro-Structured Wafer
category	Imaging Systems
author	Stefan Steiner (LightTrans)
VL version used for simulations	7.0.0.28

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