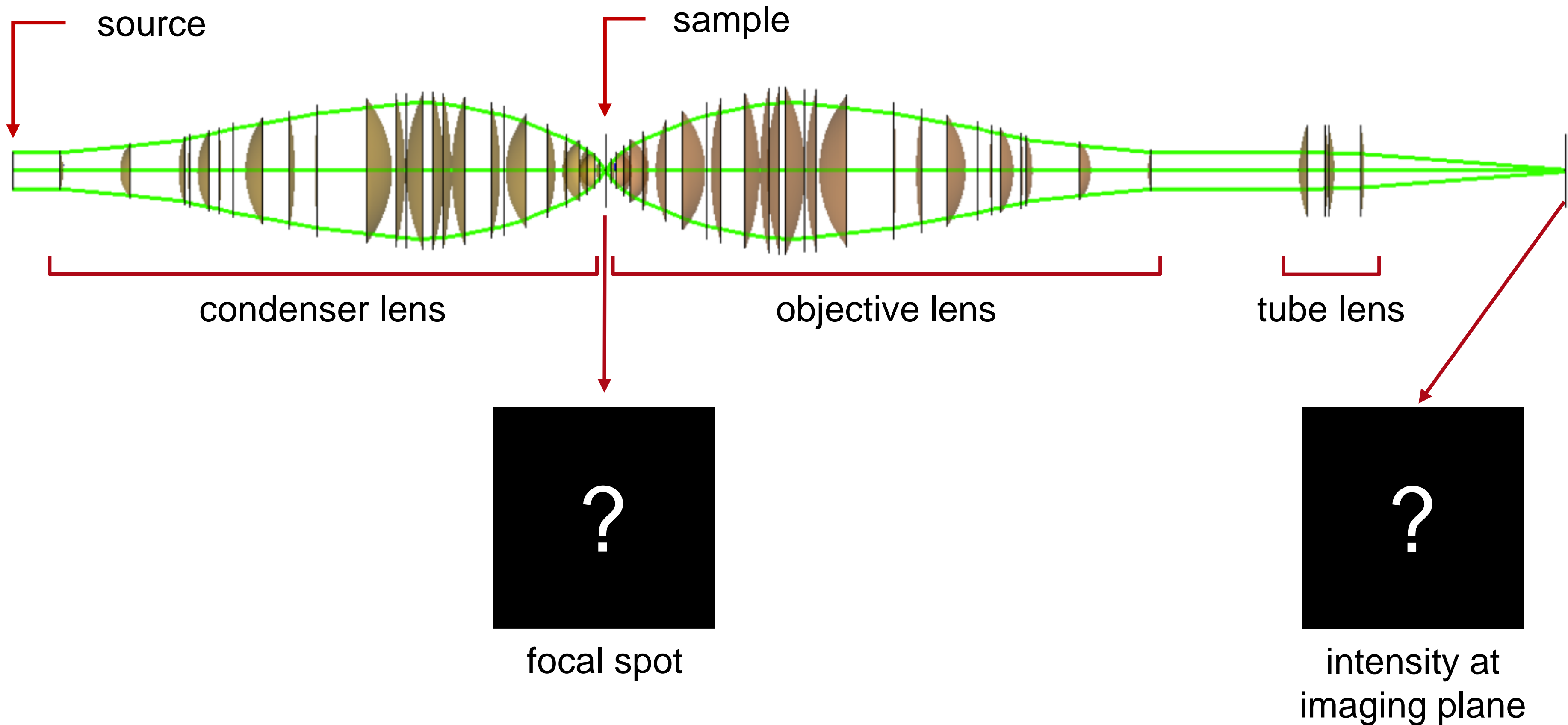
LightTrans

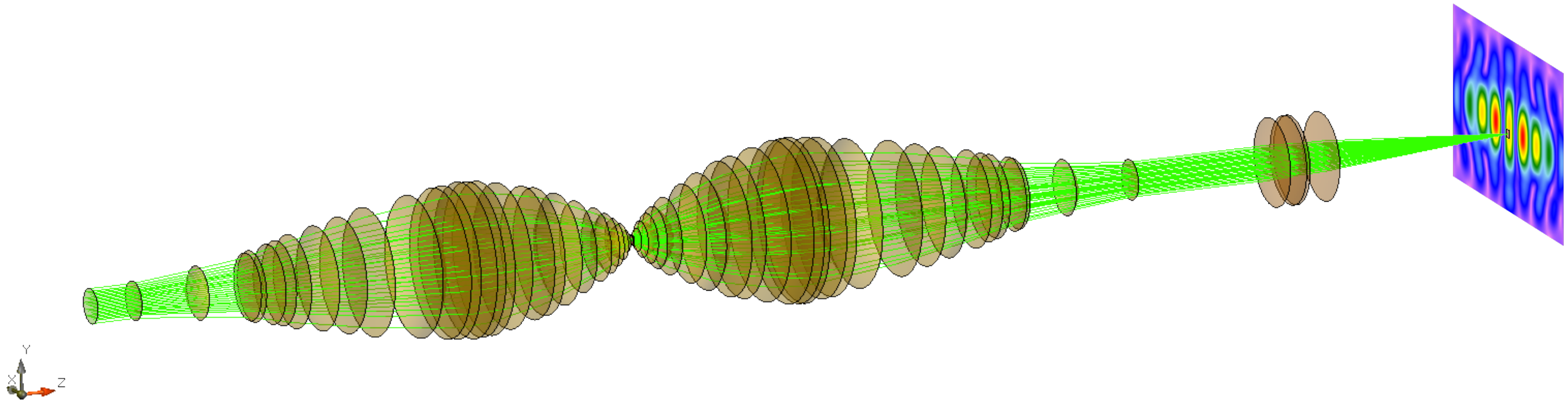
Optical Metrology > Microscopy

High-NA Microscope Investigation of Resolution Limit

Task/System Illustration

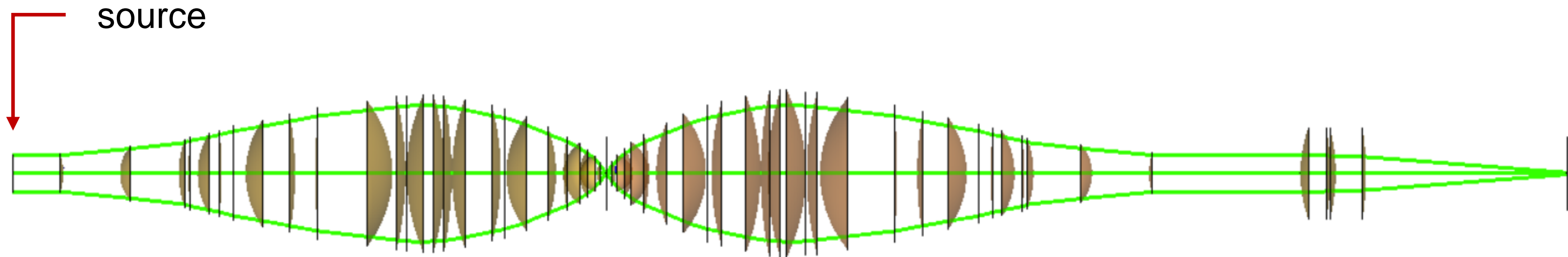


Highlights



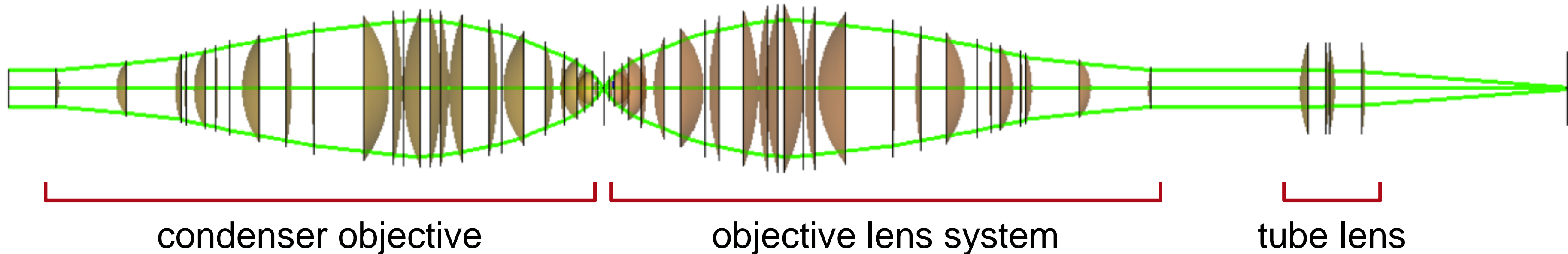
- full vectorial analysis of gratings within microscope systems
- fast high-performance analysis for complex systems within seconds
- simple switching between ray tracing and physical optics modeling

Specification: Light Source



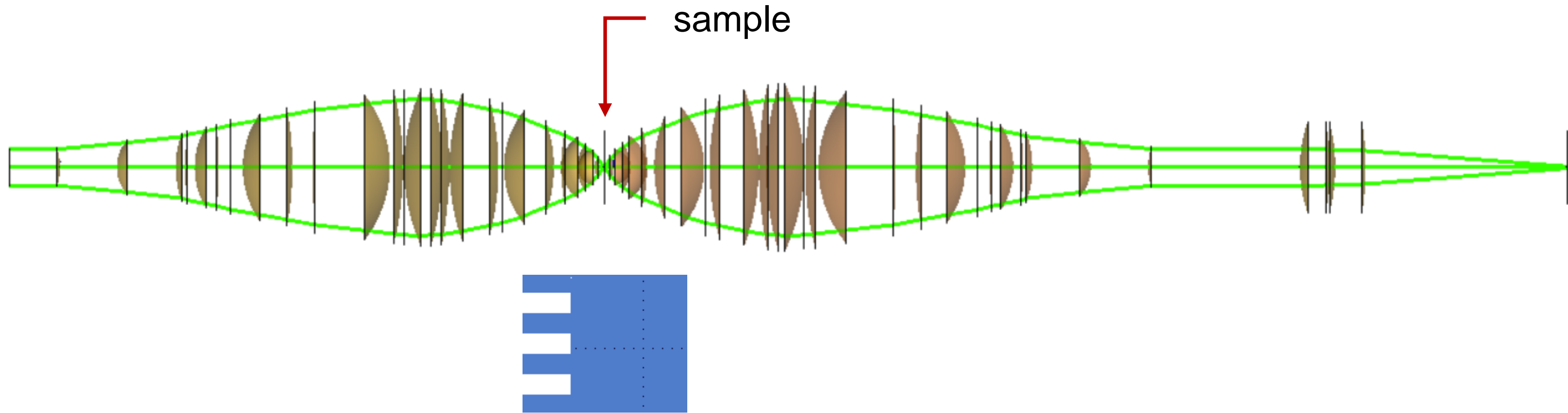
Parameter	Description / Value & Unit
type	plane wave
wavelength	532 nm
polarization	linear in y-direction
diameter	3 mm × 3 mm (round)

Specification: Lens Systems



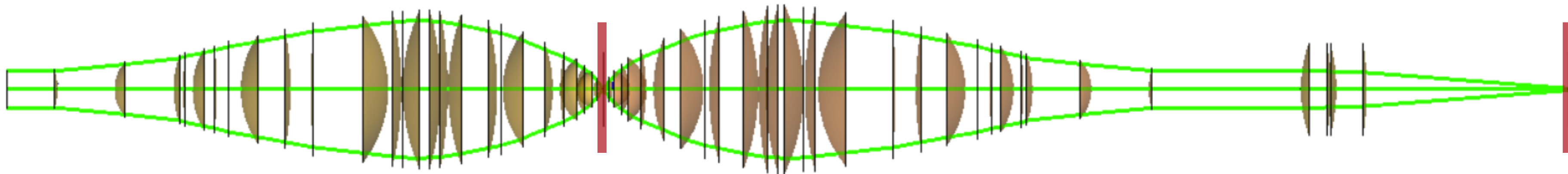
Components	Parameter	Description / Value & Unit
condenser objective	numerical aperture (NA)	0.76
	number of lenses	16
objective lens system	numerical aperture (NA)	0.76
	number of lenses	16
tube lens	numerical aperture (NA)	0.15
	number of lenses	2.2

Specification: Sample Structures



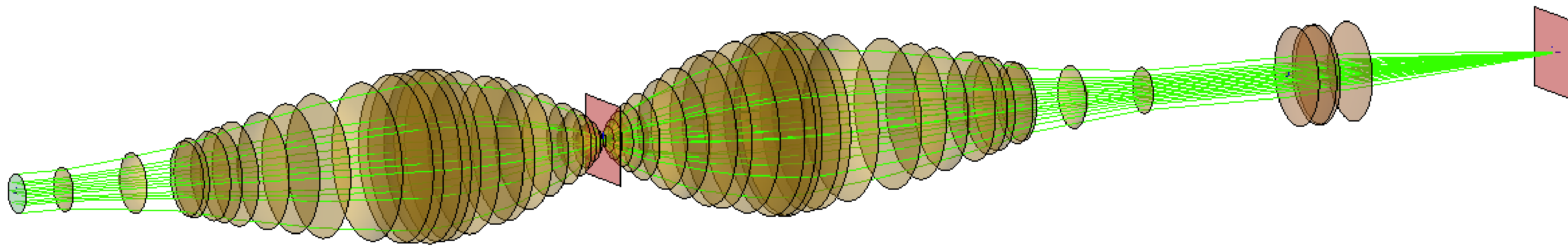
Parameter	Description / Value & Unit
type of grating profile	rectangular
grating periods	450 nm, 447.36 nm, 444.73 nm, 439.47 nm, 434.21 nm
duty cycle	0.5
grating height	610 nm
grating material	fused silica

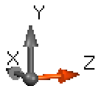
Specification: Detectors



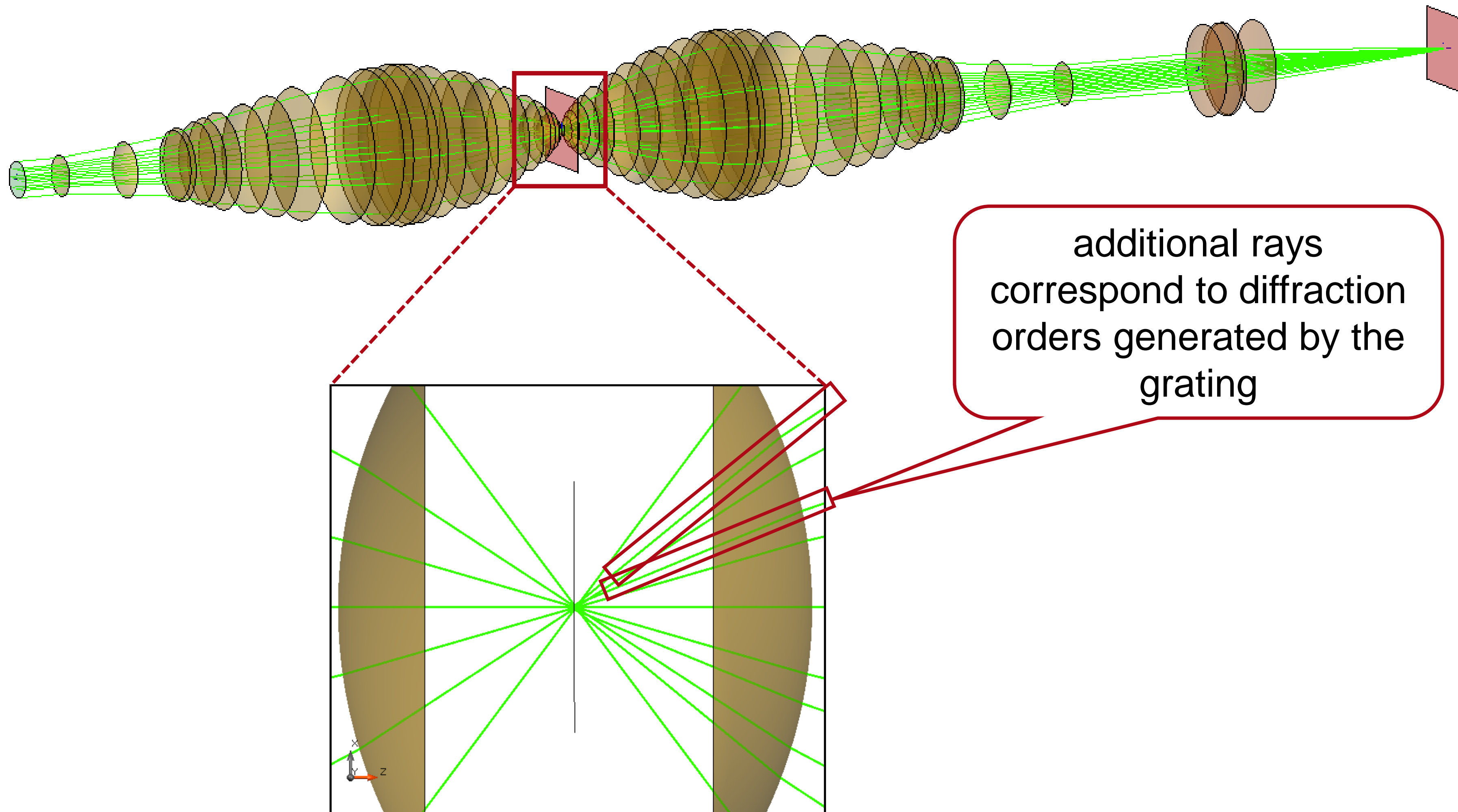
Position	Modeling Technique	Detector/Analyzer
full system	3D ray tracing	3D ray tracing system visualization
a	ray tracing	2D ray tracing dot diagram
	field tracing	2D field amplitude and intensity
b	ray tracing	2D ray tracing dot diagram
	field tracing	2D field amplitude and intensity

Result: 3D Ray Tracing



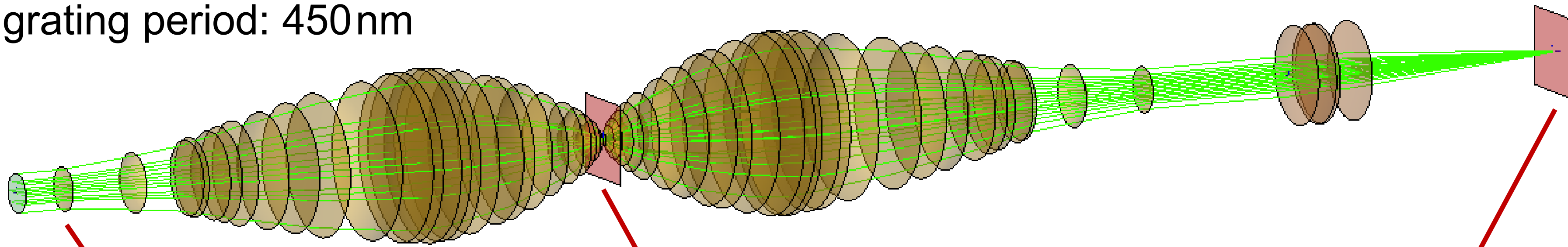


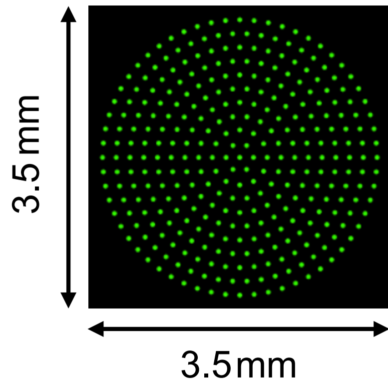
Result: 3D Ray Tracing

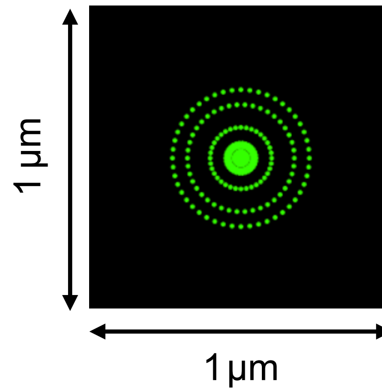


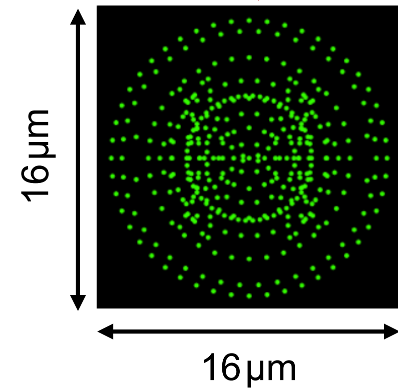
Result: Ray Tracing

grating period: 450 nm





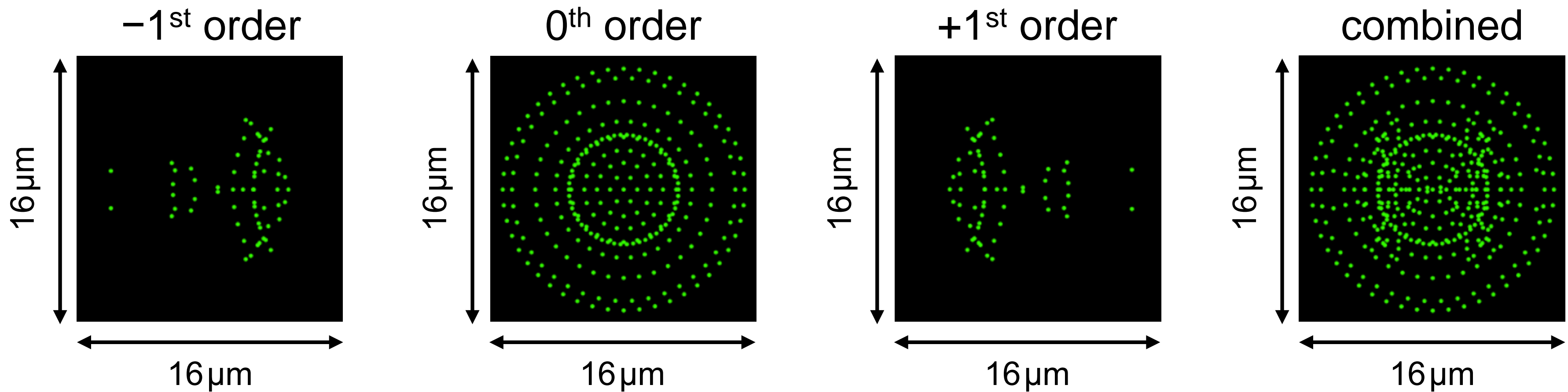




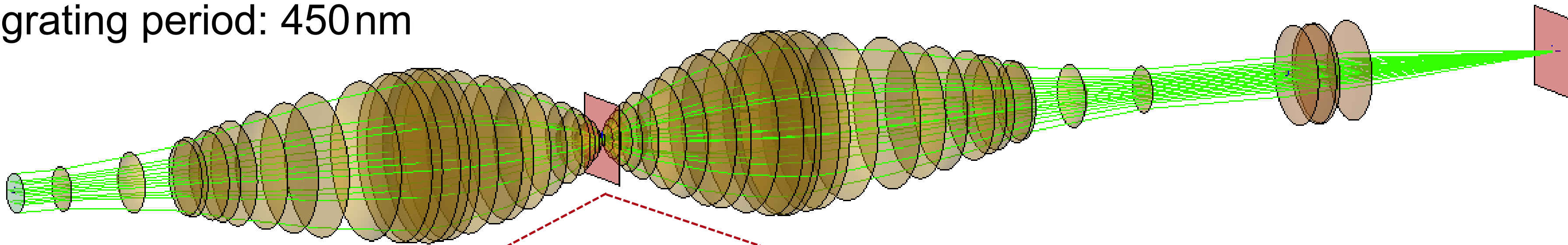
Result: Ray Tracing Diffraction Orders

grating period: 450 nm

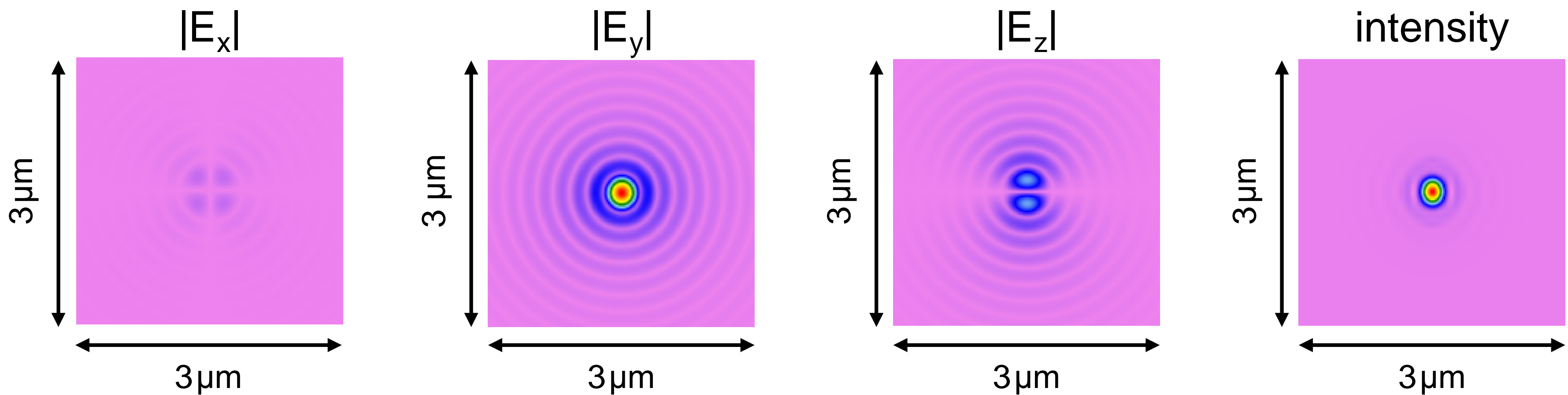
different diffraction orders are treated separately



Result: Field Tracing Sample Plane

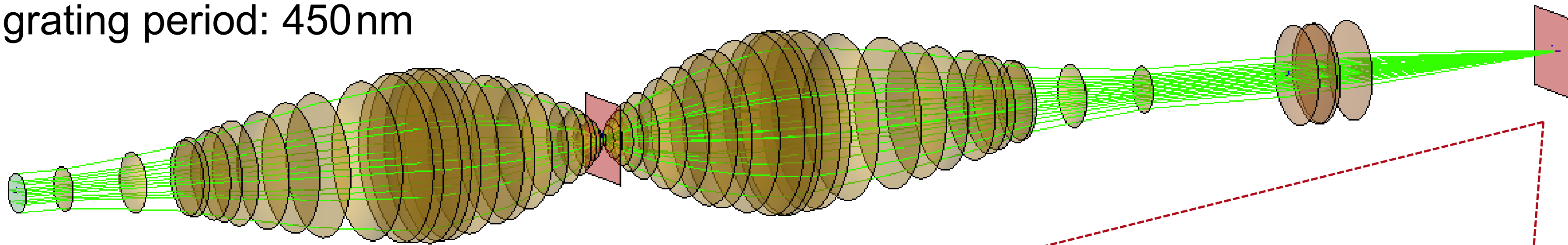


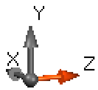
simulation time: ~3 s



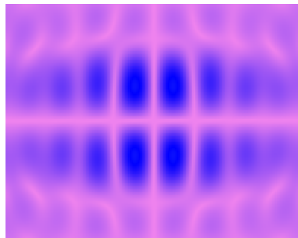
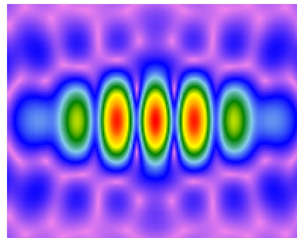
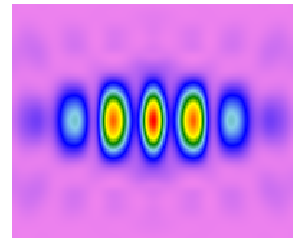
Result: Field Tracing Focal Plane

grating period: 450 nm



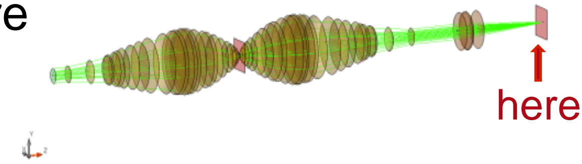


simulation time: ~5 s

$\lvert E_x \rvert$	$\lvert E_y \rvert$	$\lvert E_z \rvert$	intensity
			

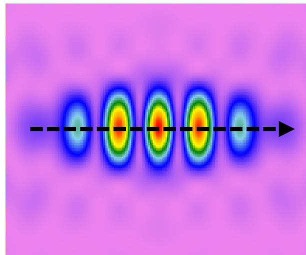
Result: Decreasing of Grating Period

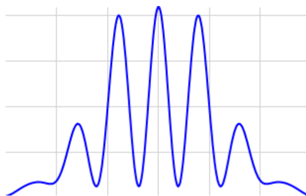
With decreasing of the grating period, the grating structure cannot be resolved anymore.



450 nm

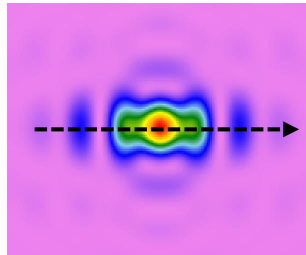
intensity

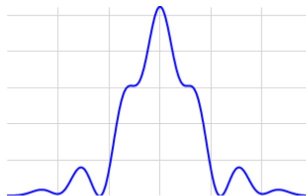




447 nm

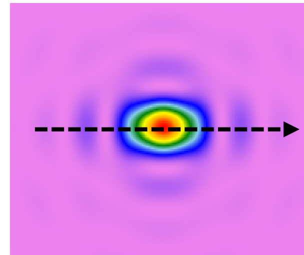
intensity

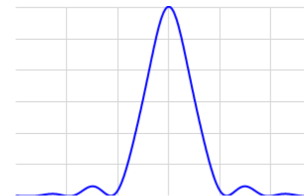




444 nm

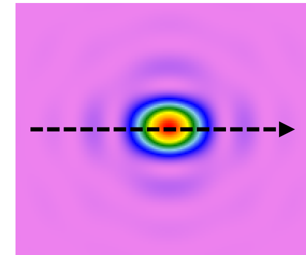
intensity

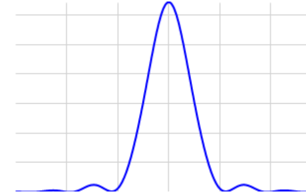




441 nm

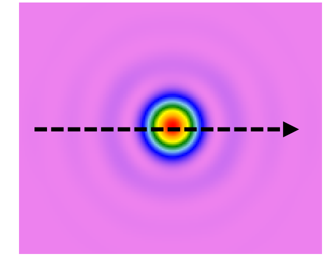
intensity

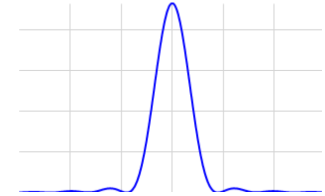




435 nm

intensity





Document & Technical Info

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Specifications of PC Used for Simulation	
Processor	i7-4700MQ (4 CPU cores)
RAM	16 GB
Operating System	Windows 8