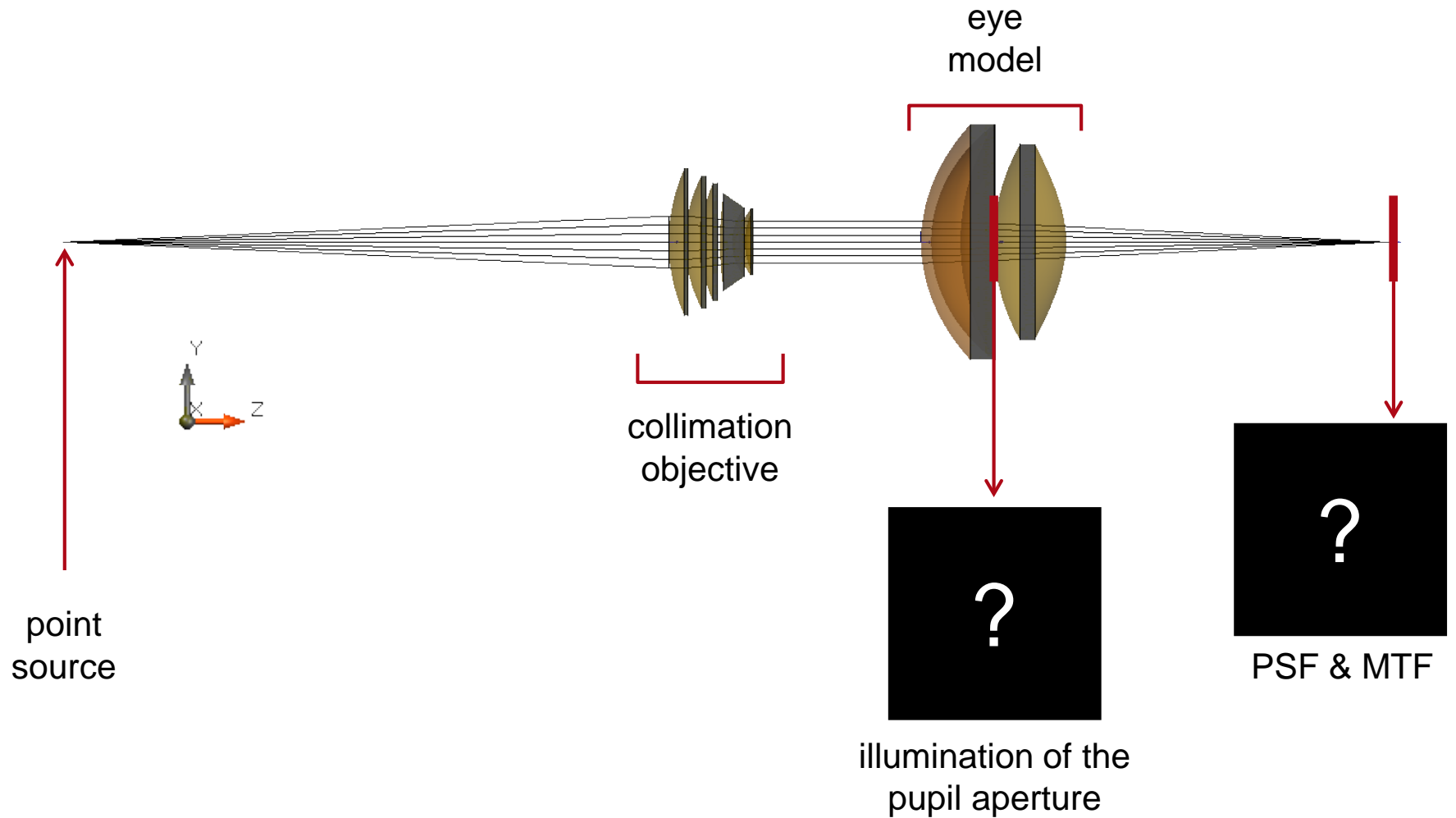


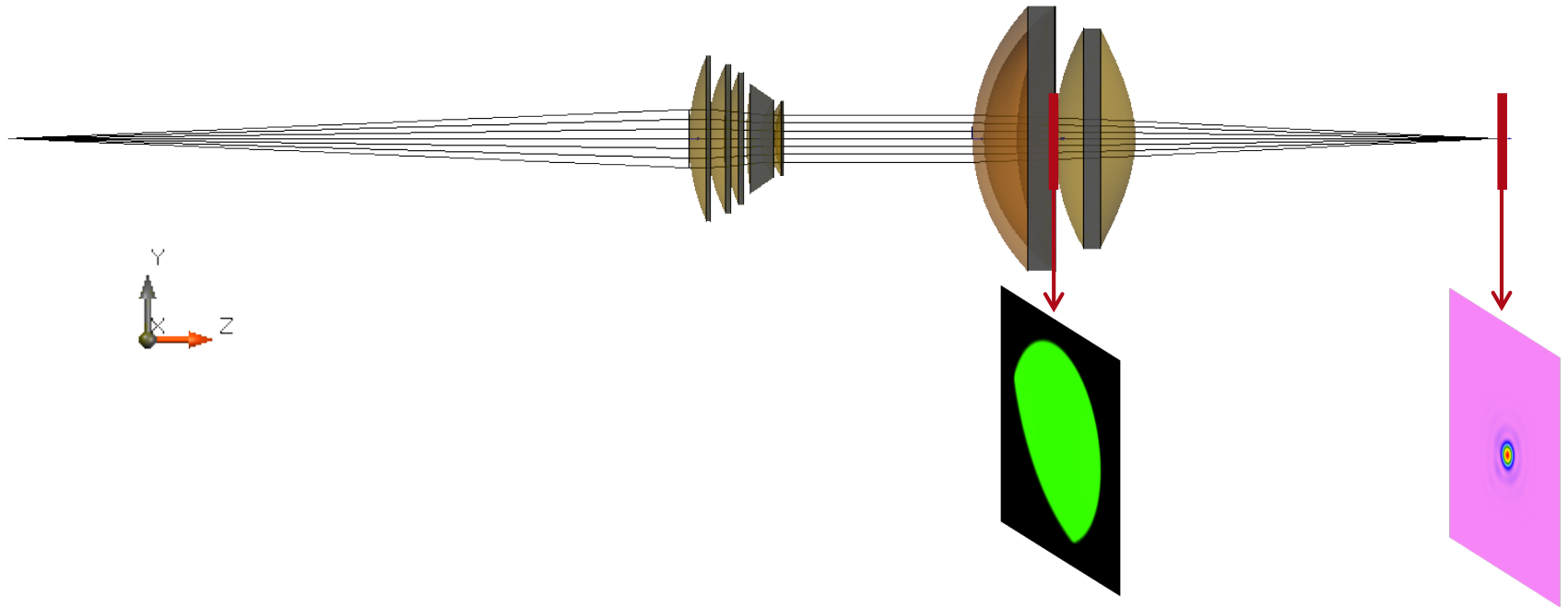
Virtual & Mixed Reality > Near-Eye Displays

Advanced PSF and MTF Calculation of Imaging System

Task/System Illustration

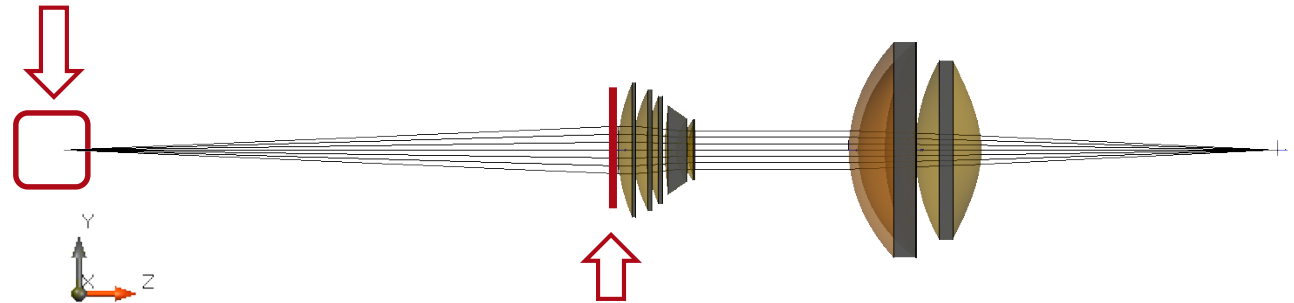


Highlights



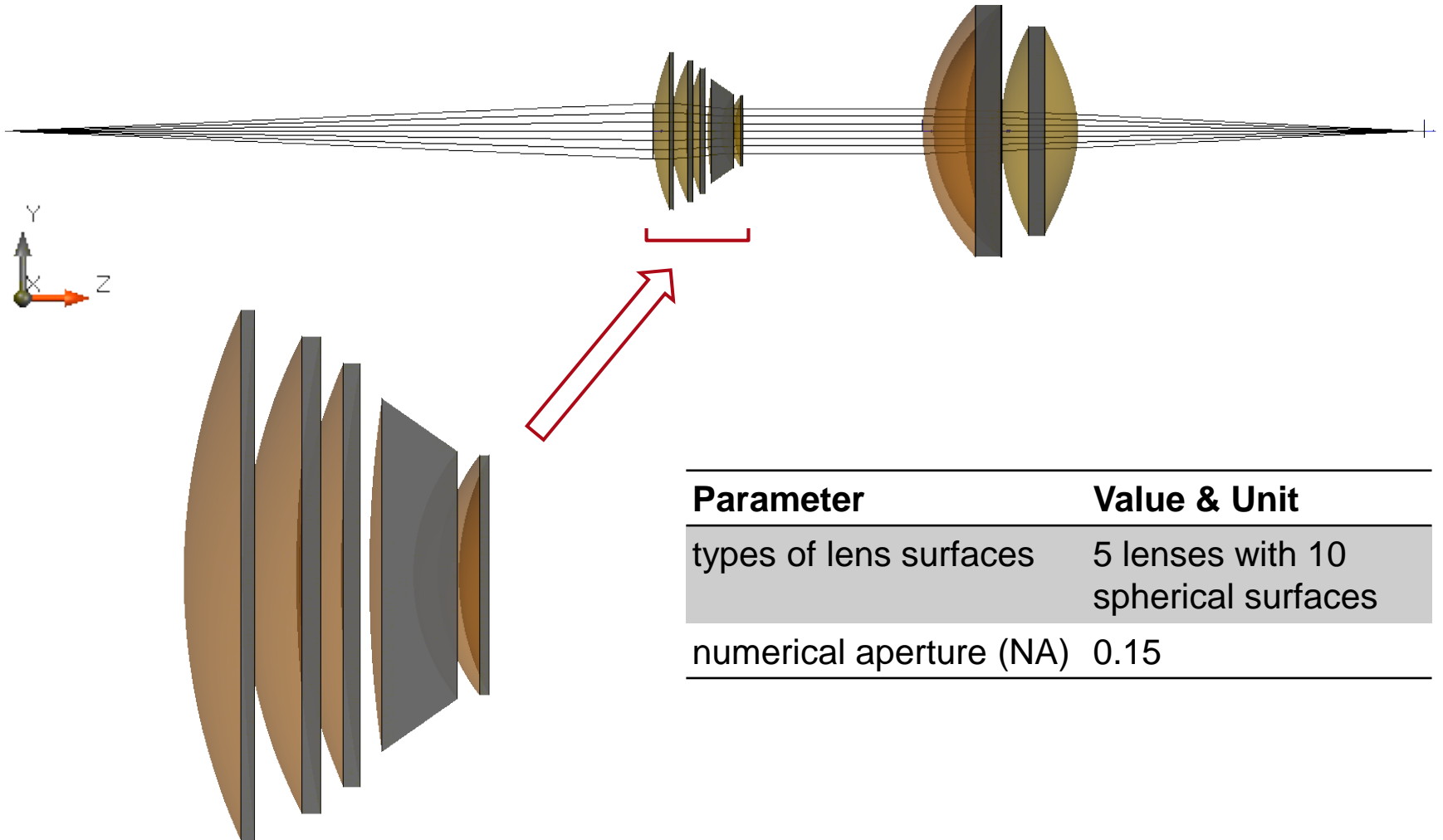
advanced PSF and MTF evaluation
of fully or partly illuminated apertures

Specification: Light Source



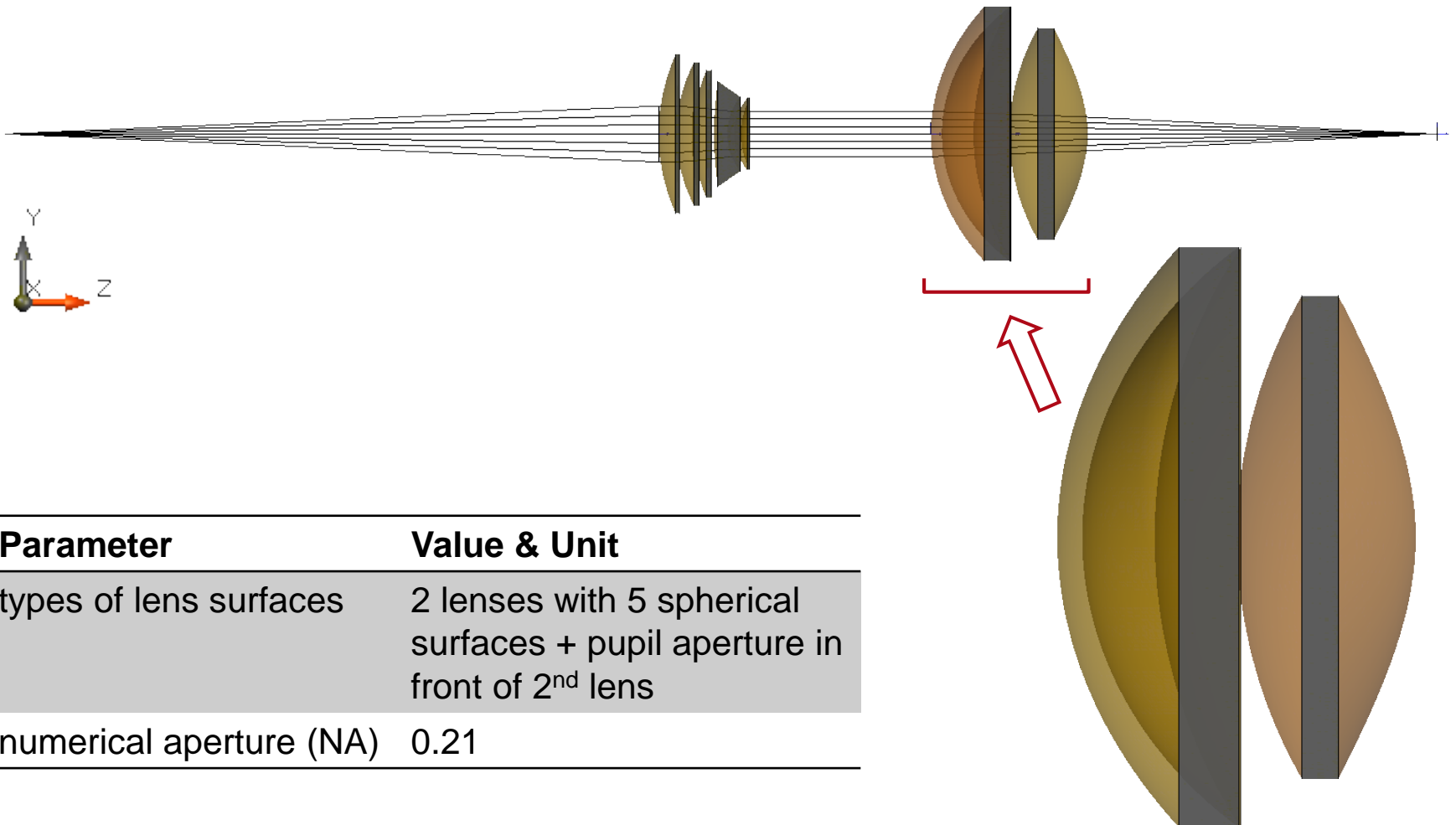
Parameter	Description / Value & Unit
type/number	spherical wave (point source)
wavelength	532nm
polarization	linear in x-direction (0°)
distance to next surface	30.955mm
aperture shape & dimension at next surface	round; 2.5mm × 2.5mm

Specification: Collimating Lens

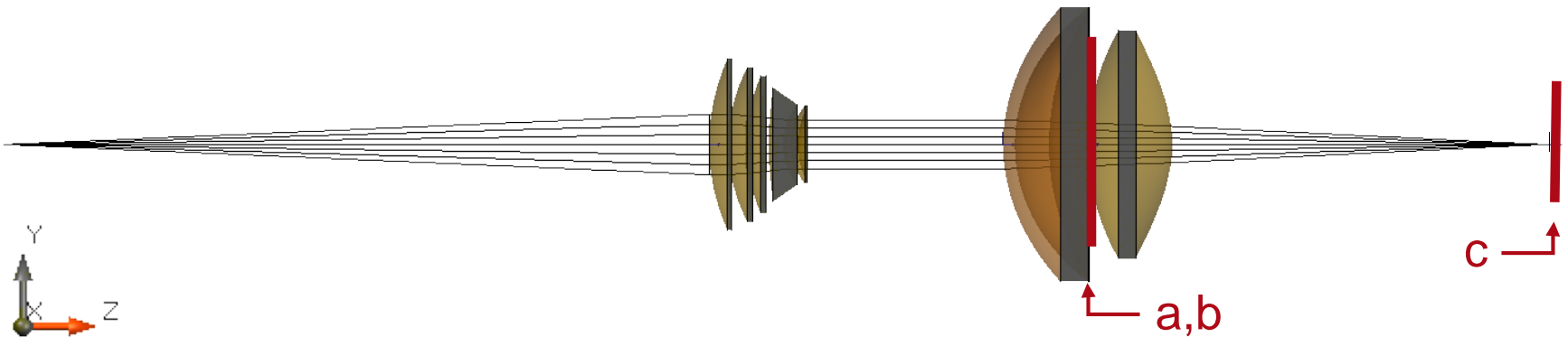


Parameter	Value & Unit
types of lens surfaces	5 lenses with 10 spherical surfaces
numerical aperture (NA)	0.15

Specification: Focusing Lens

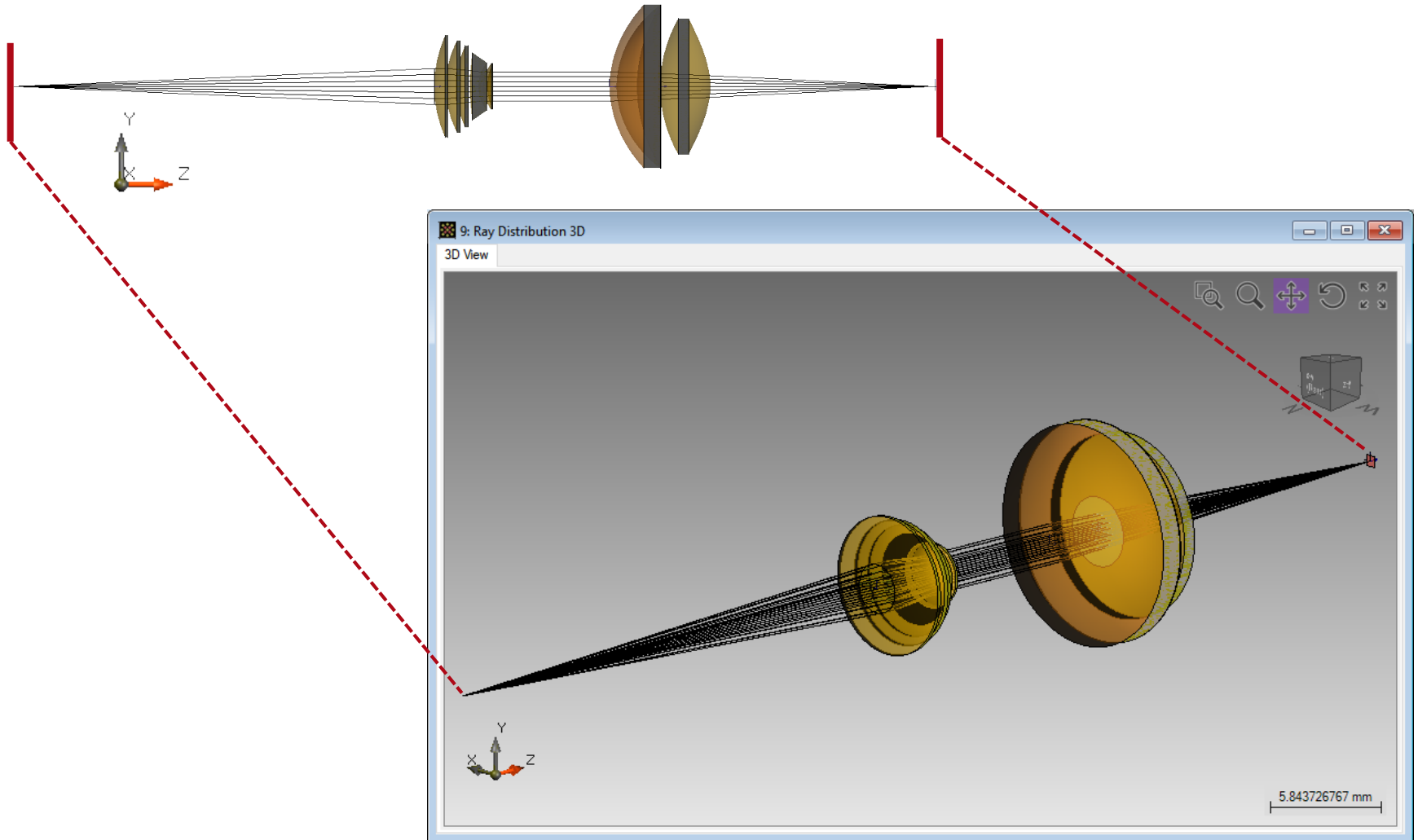


Specification: Detectors

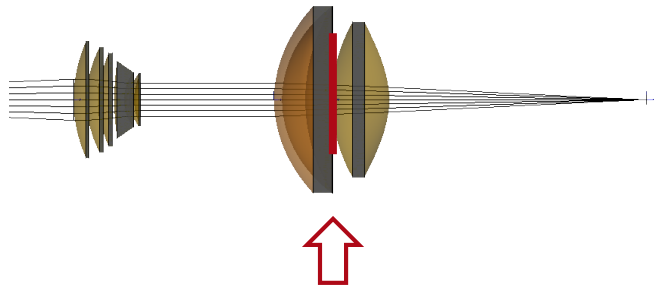


Position	Modeling Technique	Detector/Analyzer
full system	3D ray tracing system analyzer	general overview of light behavior in system
a	ray tracing	dot diagram at pupil
b	field tracing	intensity pattern at pupil
c	field tracing	evaluation of points spread function (PSF) and modulation transfer function (MTF)

Results: 3D System Ray Tracing

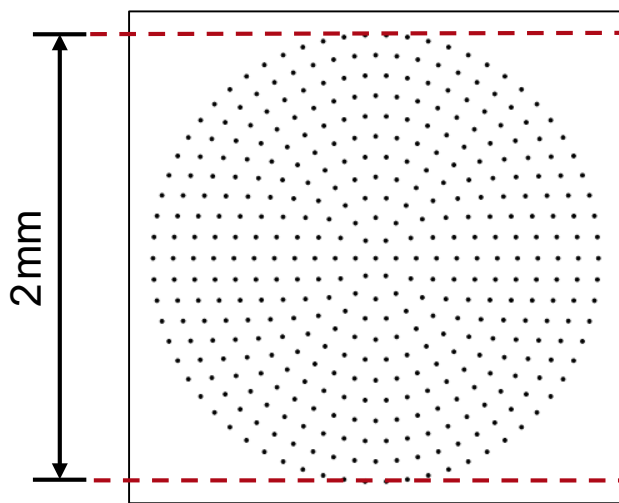


Results: Illumination of Pupil

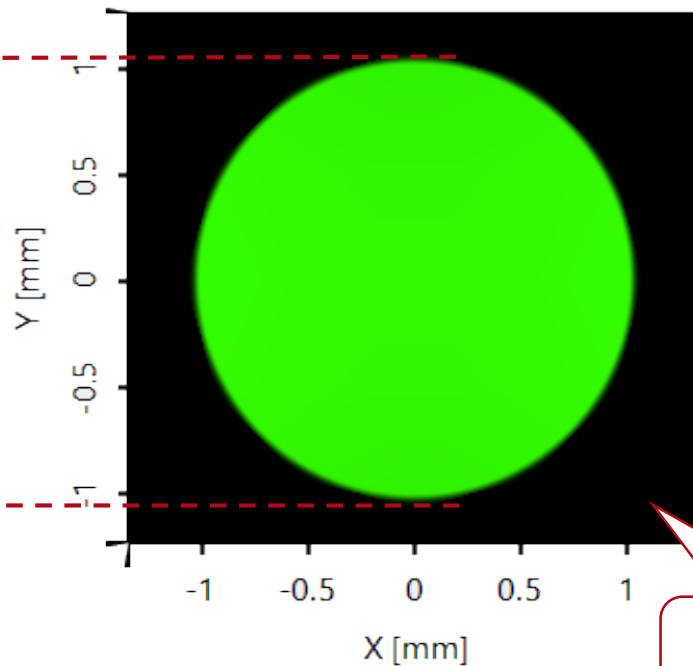


Highlight

advanced PSF and MTF evaluation of fully or partly illuminated apertures



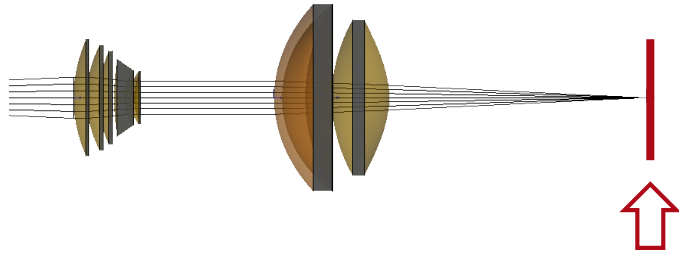
dot diagram of ray positions



intensity

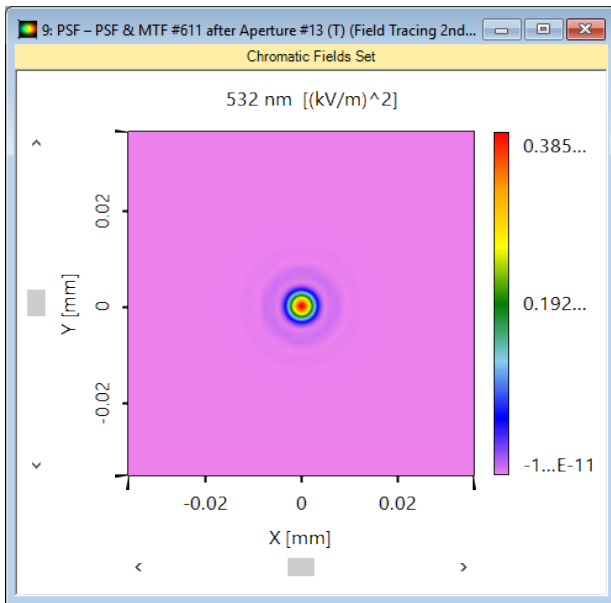
fully illuminated aperture

Results: PSF & MTF

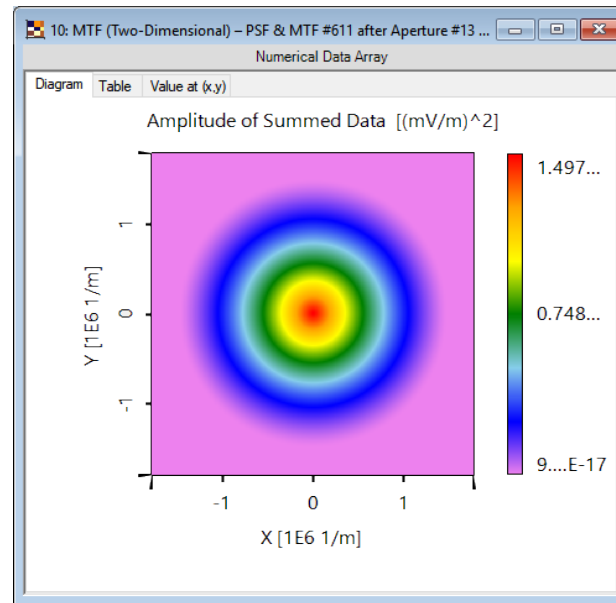


Highlight

advanced PSF and MTF evaluation
of fully or partly illuminated apertures



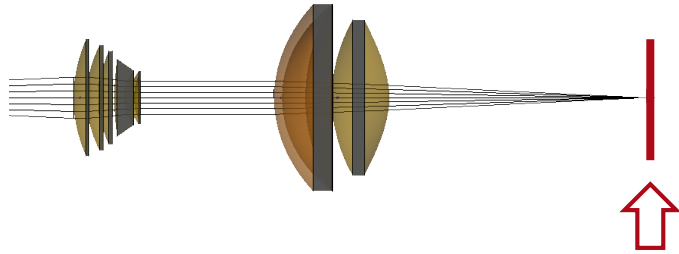
PSF



2D MTF

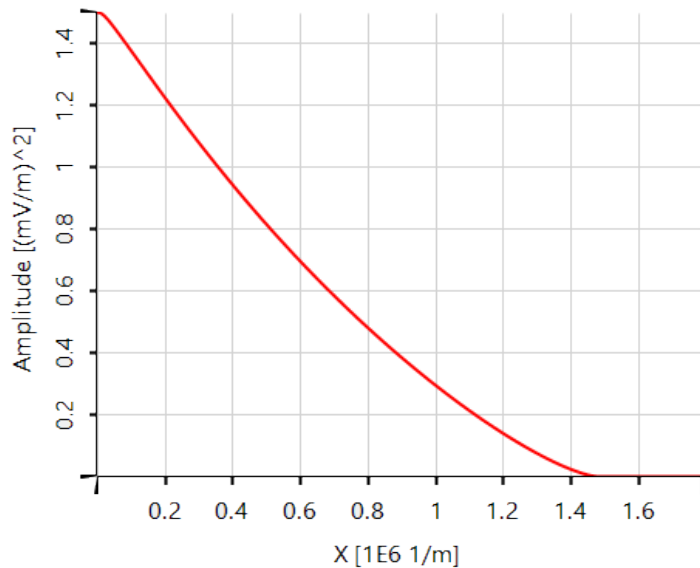
Simulation
Time ~6s

Results: PSF & MTF

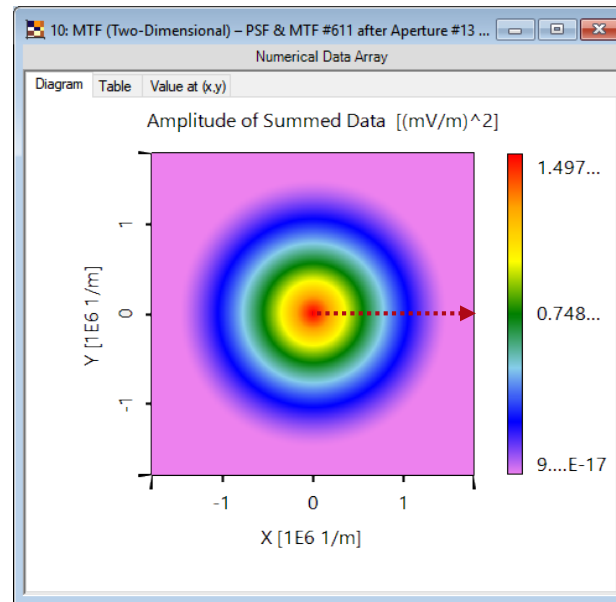


Highlight

advanced PSF and MTF evaluation of fully or partly illuminated apertures



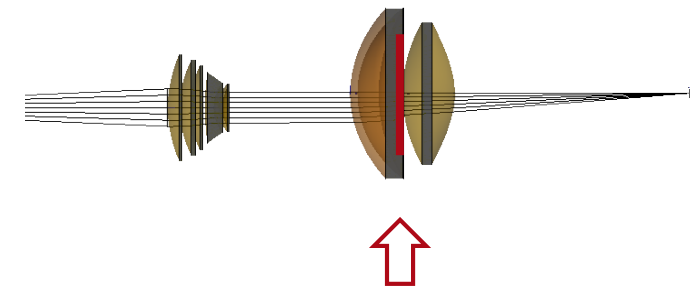
1D MTF extracted according to marker line from 2D MTF



2D MTF

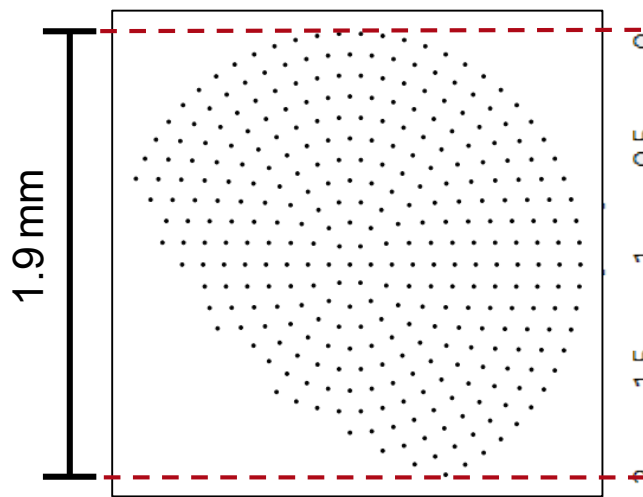
Simulation Time ~6s

Results: Illumination of Pupil

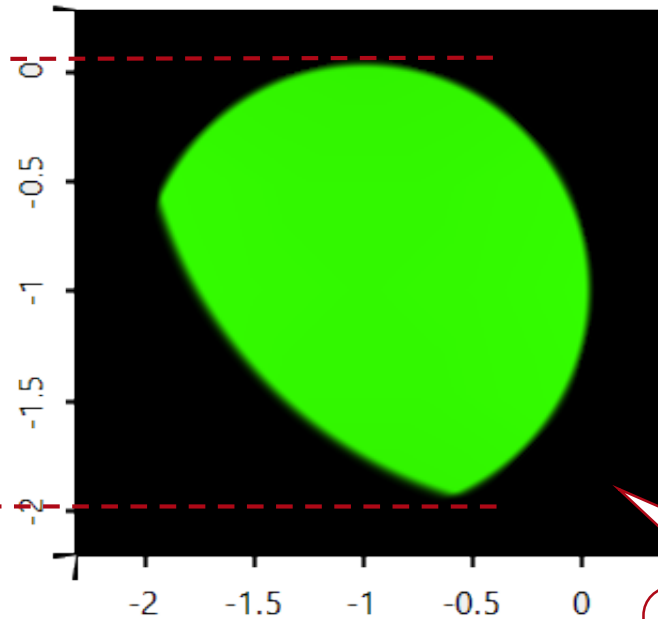


Highlight

advanced PSF and MTF evaluation
of fully or partly illuminated apertures



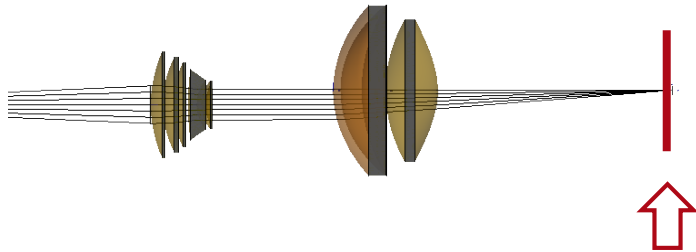
dot diagram of ray positions



intensity

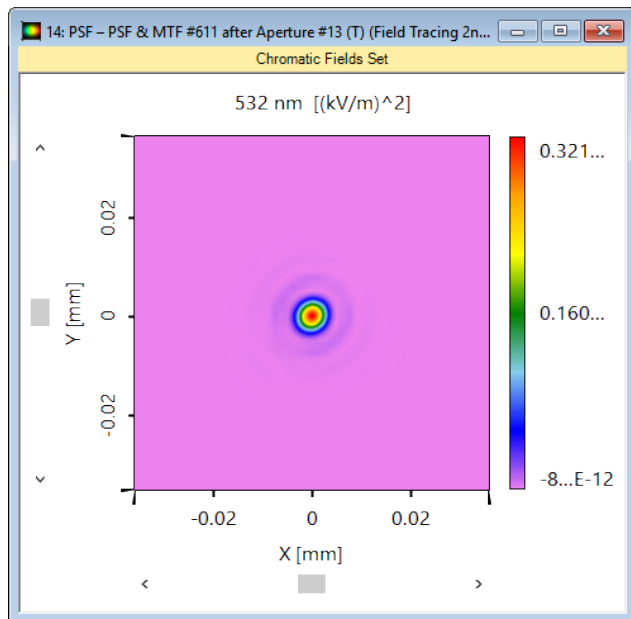
partly illuminated
aperture by shifting eye
to (1, 1)mm

Results: PSF & MTF

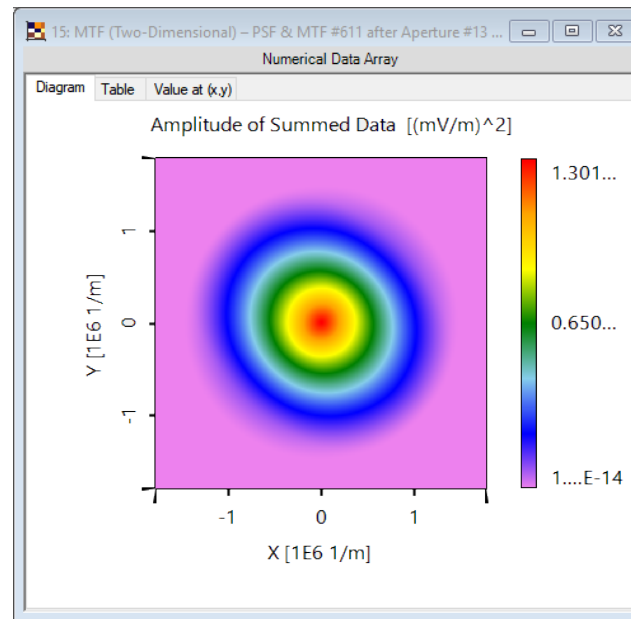


Highlight

advanced PSF and MTF evaluation of fully or partly illuminated apertures



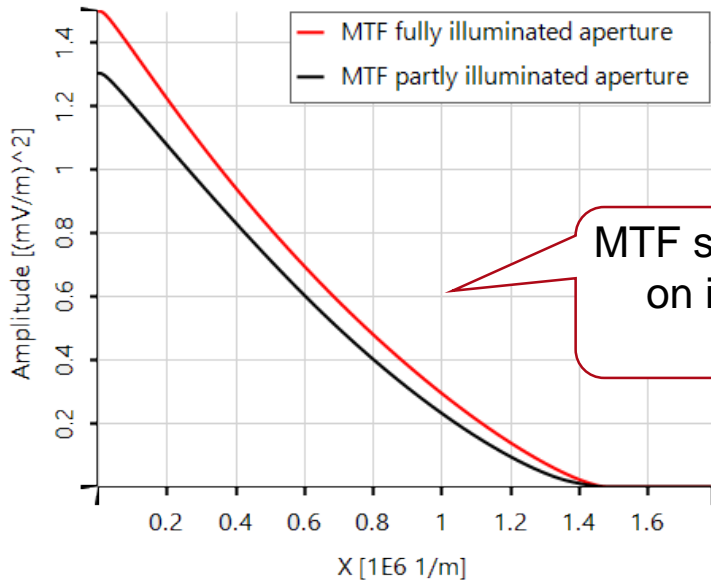
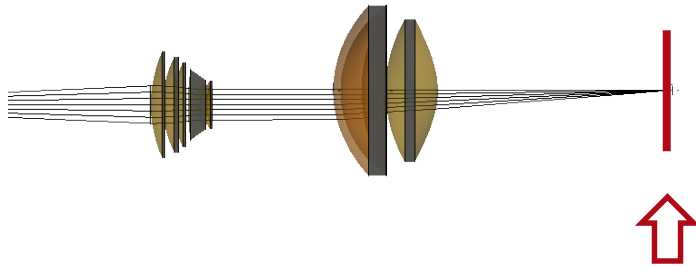
PSF



2D MTF

Simulation Time ~6s

Results: PSF & MTF – Comparison



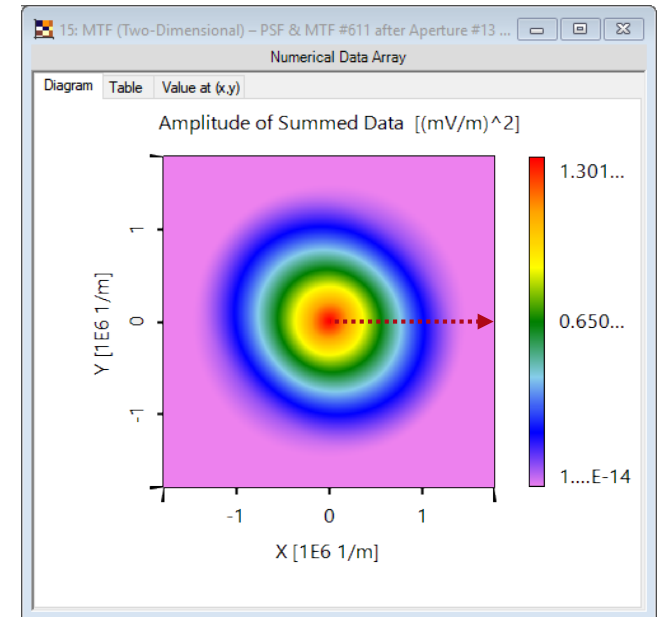
MTF strongly depends on illumination of aperture

MTF profile line

Simulation Time ~6s

Highlight

advanced PSF and MTF evaluation of fully or partly illuminated apertures



2D MTF

(from system with partly illuminated aperture)

Document & Technical Info

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category	Virtual & Mixed Reality > Near-Eye Displays (NED)
author	Roberto Knoth (LightTrans)
used VL version	7.0.0.29

Specifications of PC Used for Simulation

Processor	i7-4910MQ (4 CPU cores)
RAM	32 GB
Operating System	Windows 10