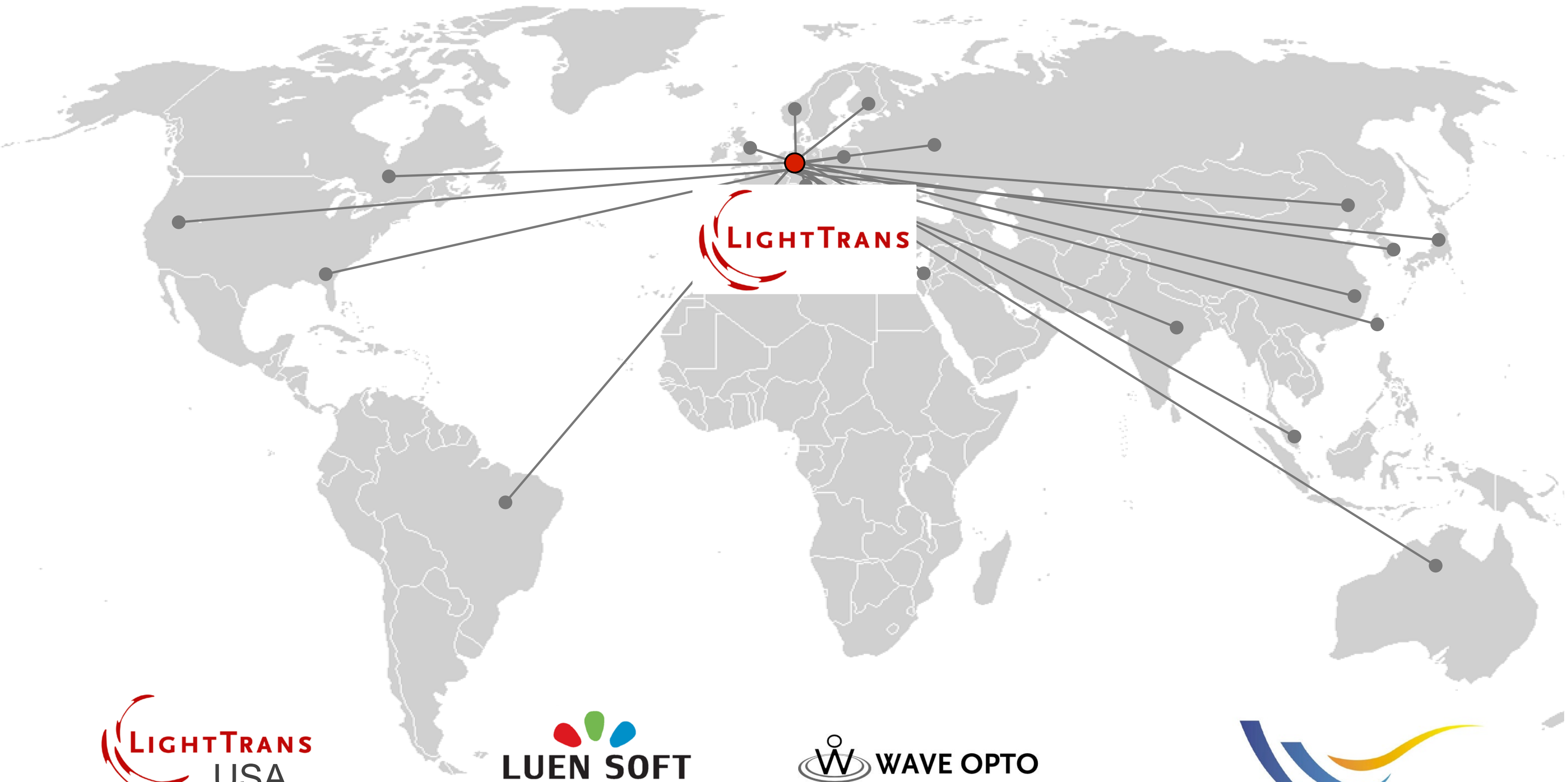
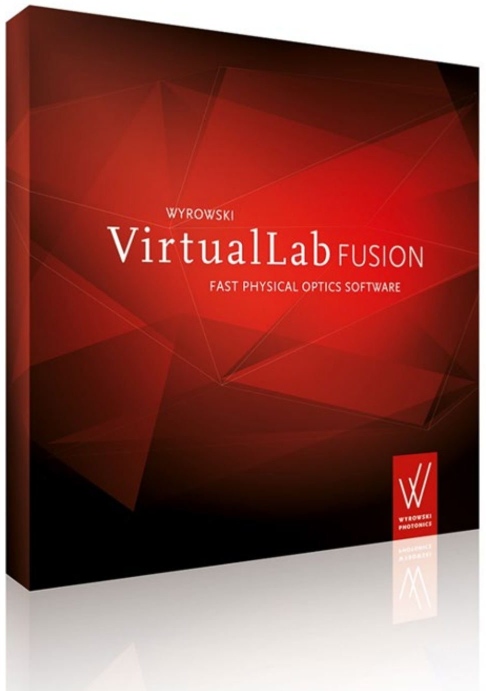

Tuesday, 17 May 2022, 16:00 CEST
EPIC Members New Product Release
Flexible Detector Modeling in VirtualLab Fusion
LightTrans
Supported by
EPIC
European Photonics Industry Consortium
Frank Wyrowski
President

Fast Physical Optics Modeling and Design Software





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LightTrans USA

LUEN SOFT

WAVE OPTO

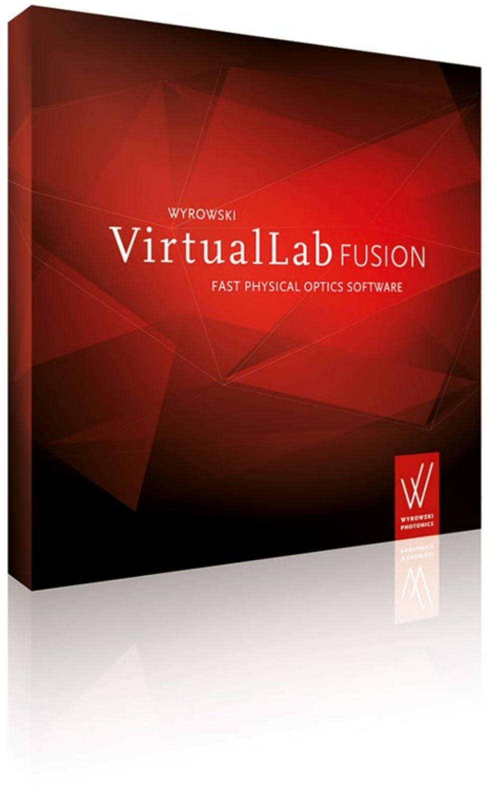
T.E.M. Incorporated

INFOTEK

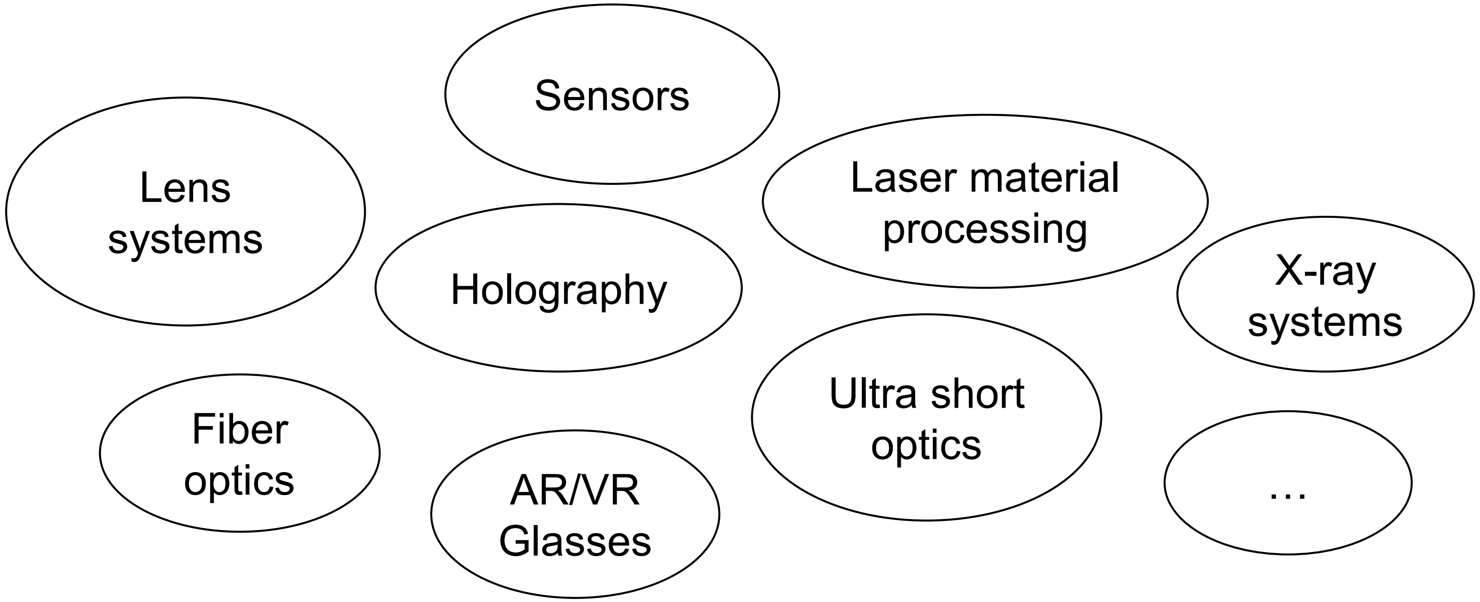
Fast Physical Optics Modeling and Design Software

VirtualLab FUSION

Physical Optics Software



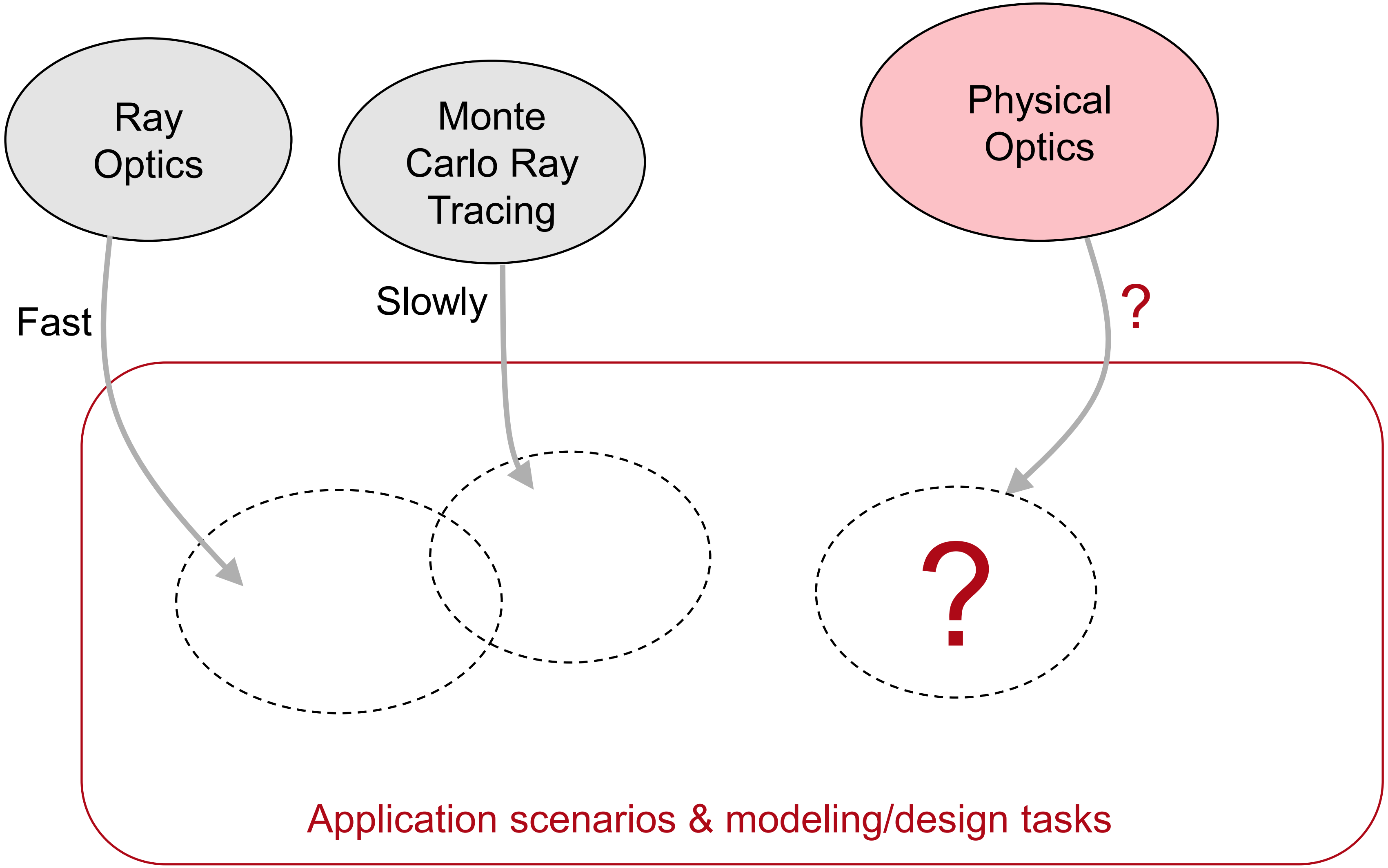
Huge Variety of Application Scenarios in Optics & Photonics



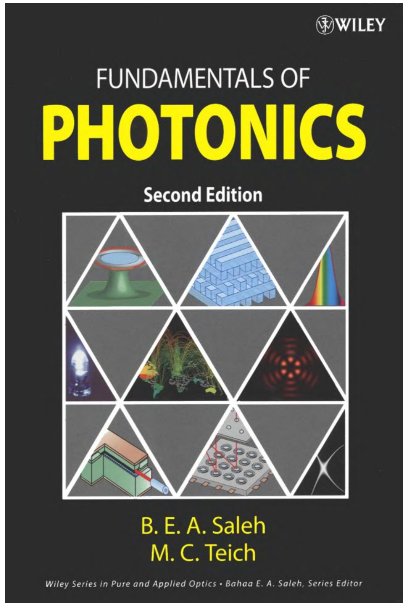
Huge Variety of Application Scenarios in Optics & Photonics

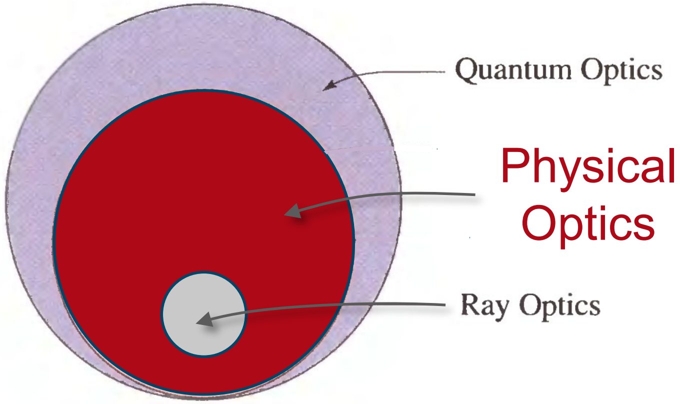
Application scenarios & modeling/design tasks

Modeling Techniques

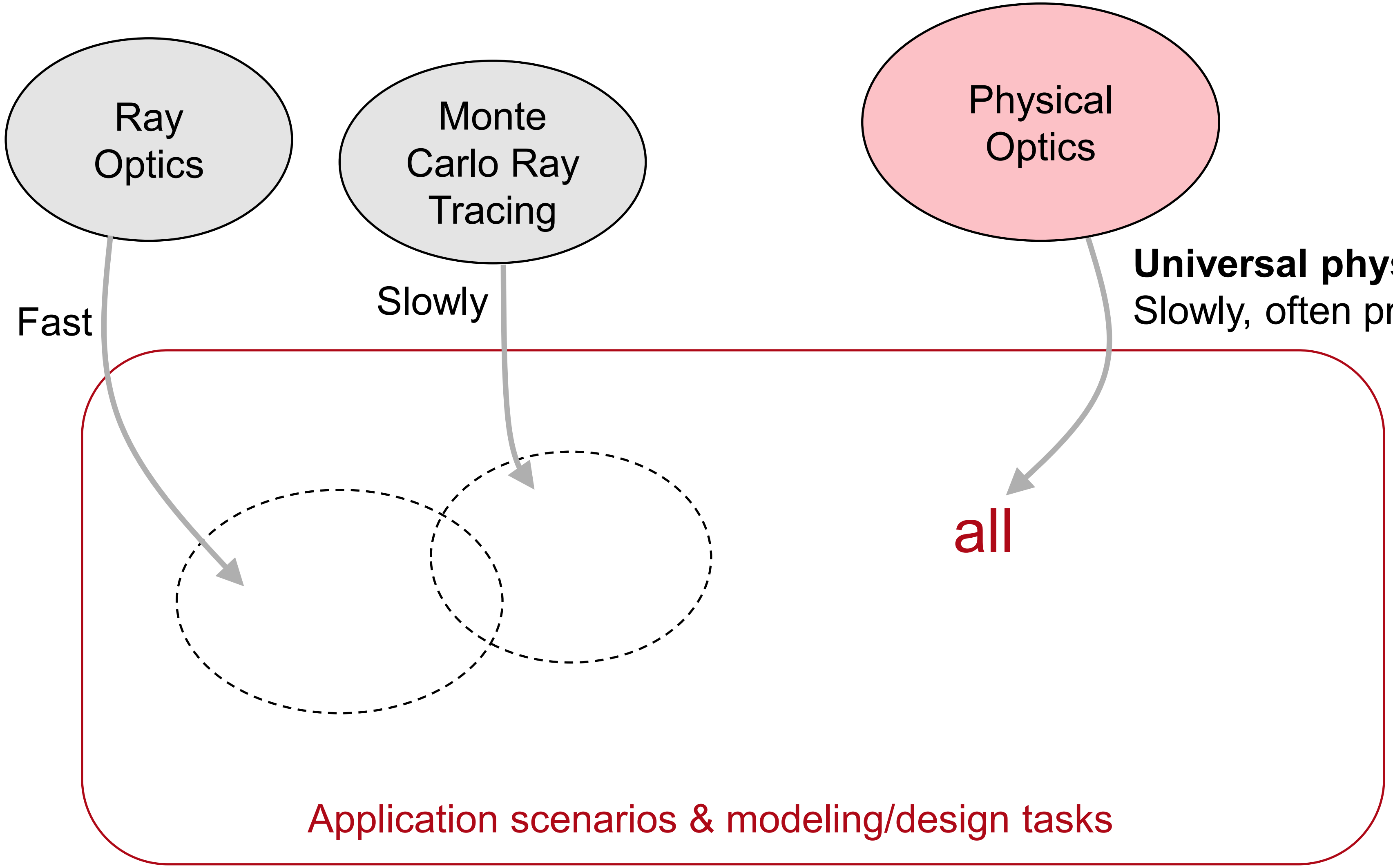


Physical Optics Includes Ray Optics

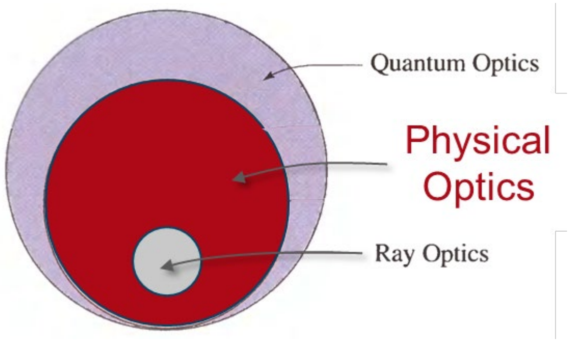




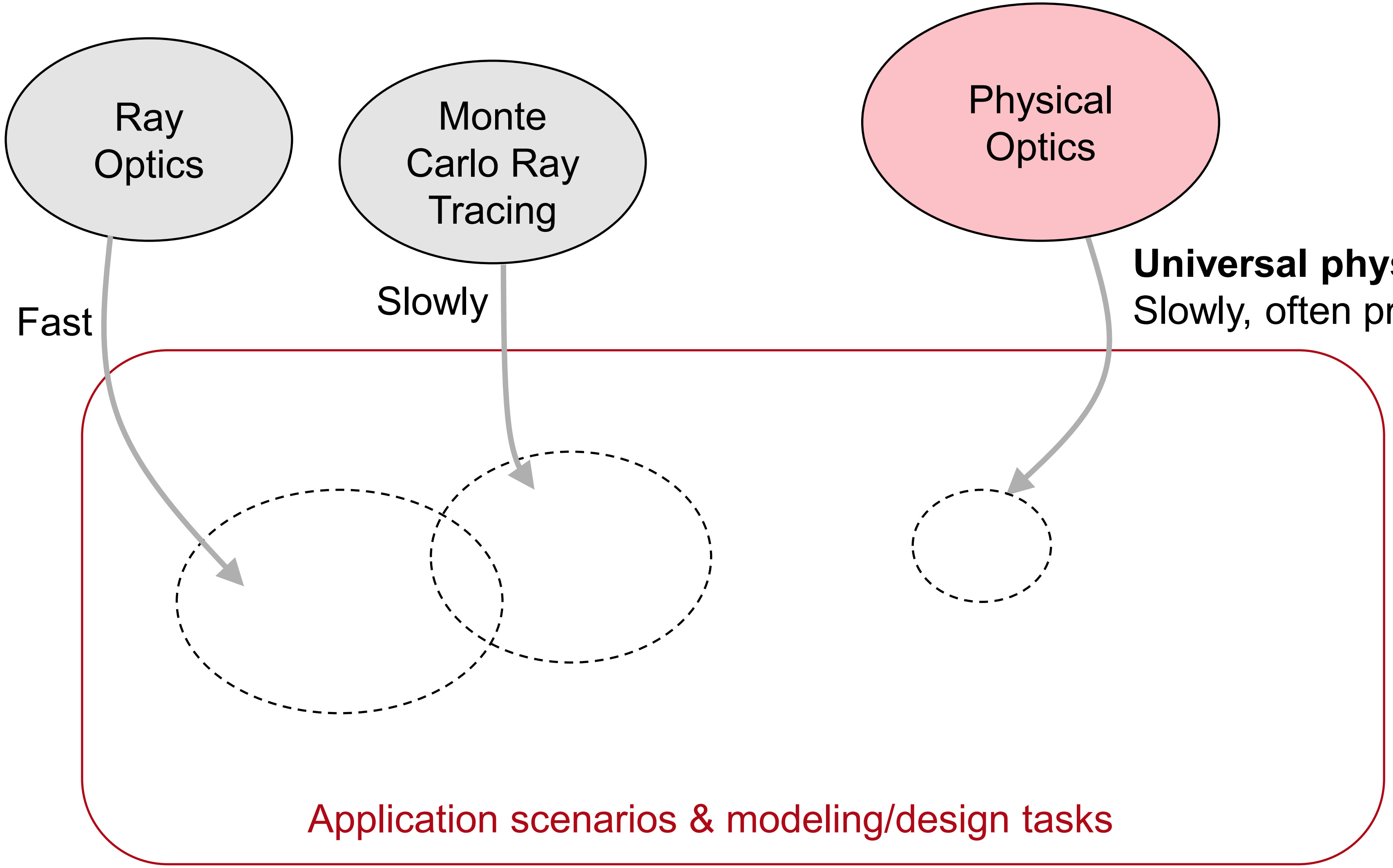
Physical Optics Modeling: One Universal Solver



Universal physical optics solver:
Slowly, often practically impossible



Physical Optics Modeling: One Universal Solver



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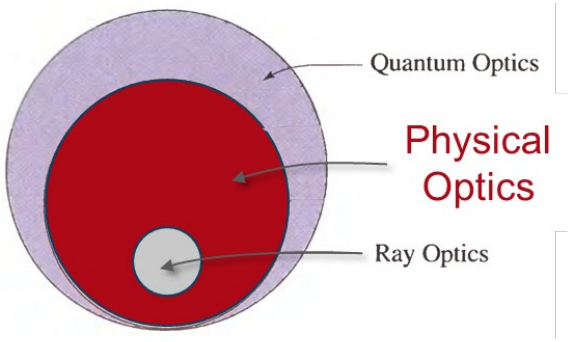
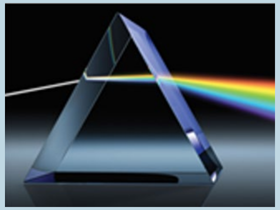
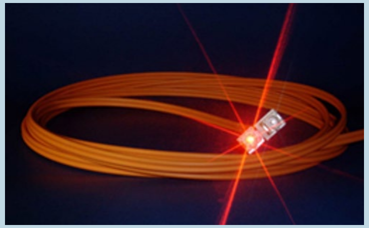


Physical Optics Modeling by Universal Solver

Universal Solver

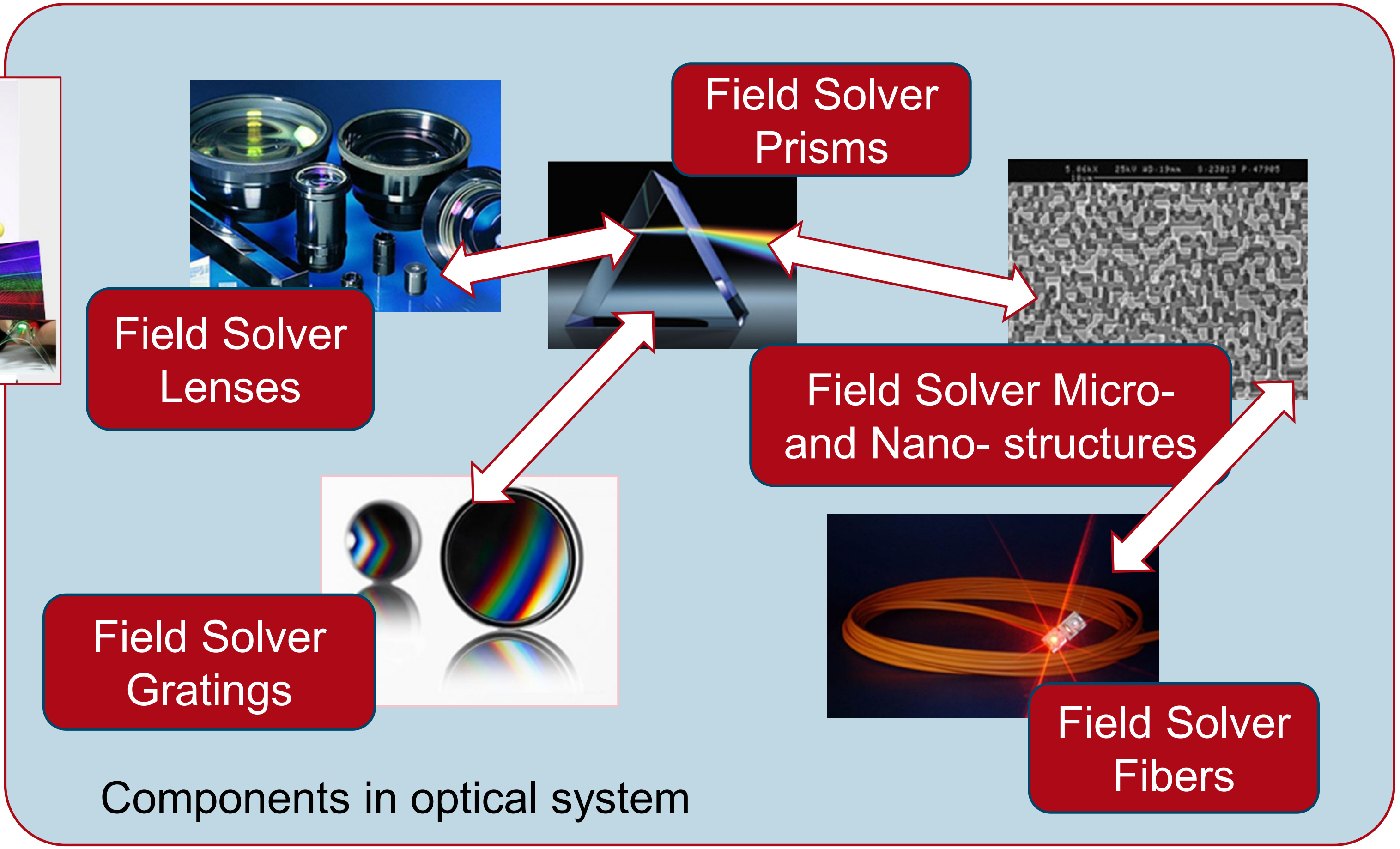




Components in optical system

One-size-fits-all physical-optics solver

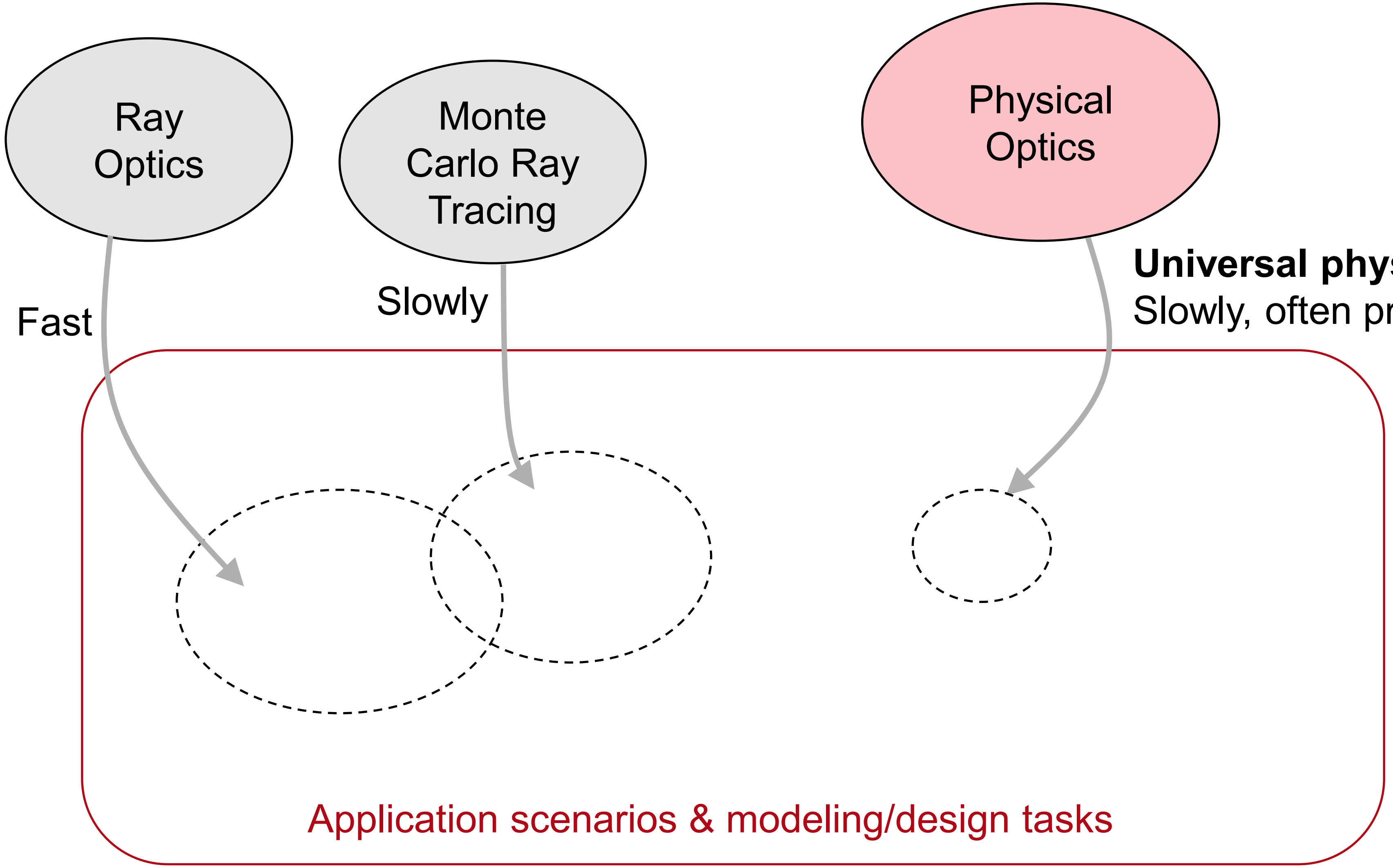
Fast Physical Optics: Connecting Solvers



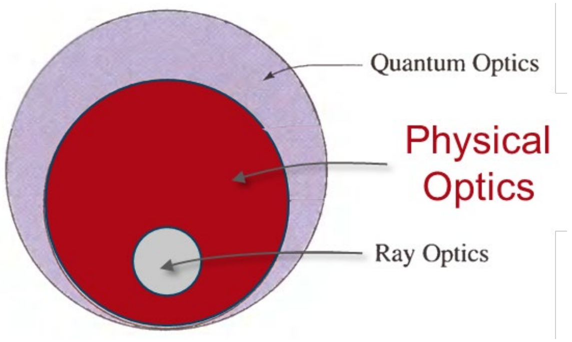
One-size-fits-all physical-optics solver

Various specialized physical-optics solvers

Fast Physical Optics Modeling: Connecting Solvers



Universal physical optics solver:
Slowly, often practically impossible



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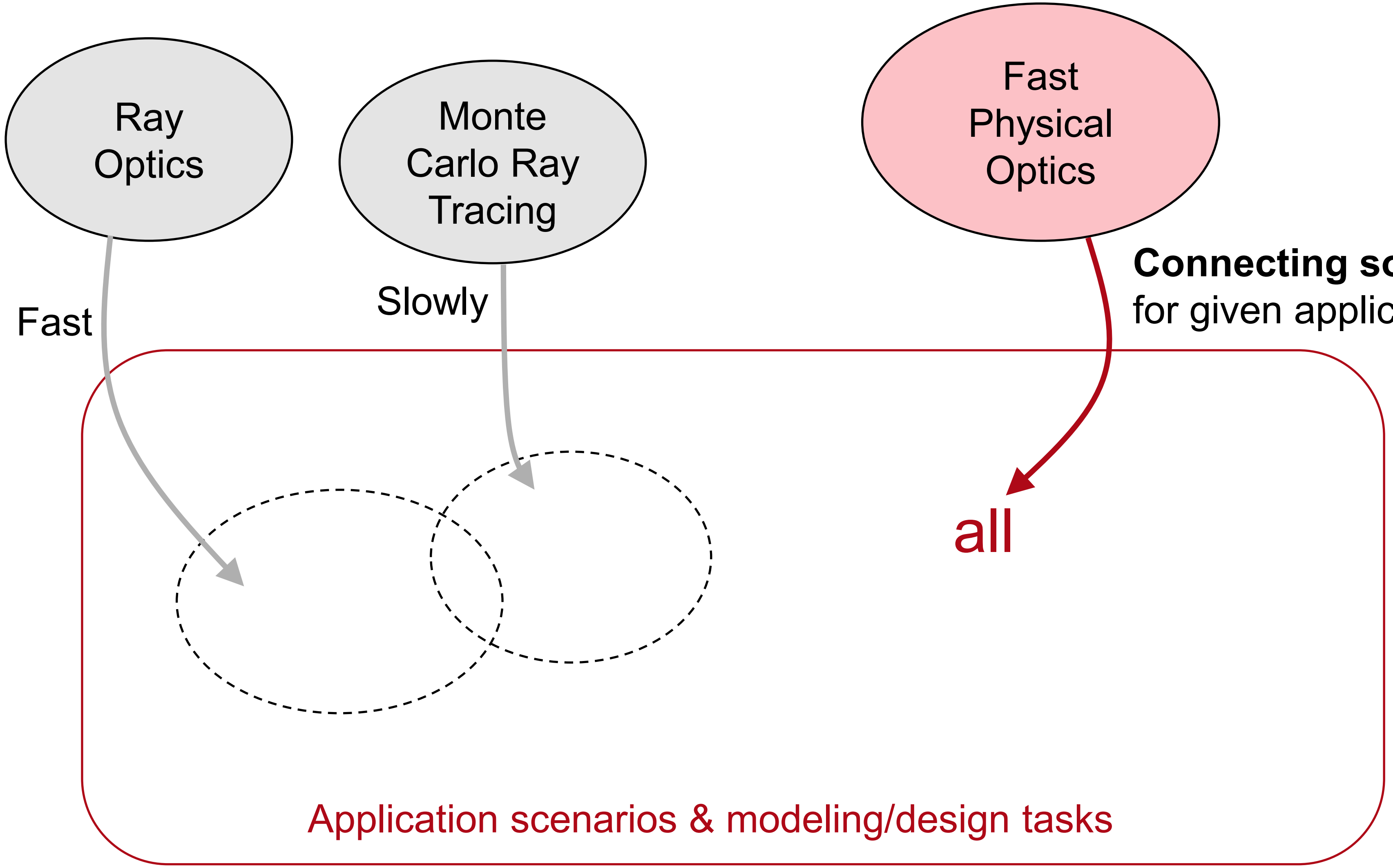
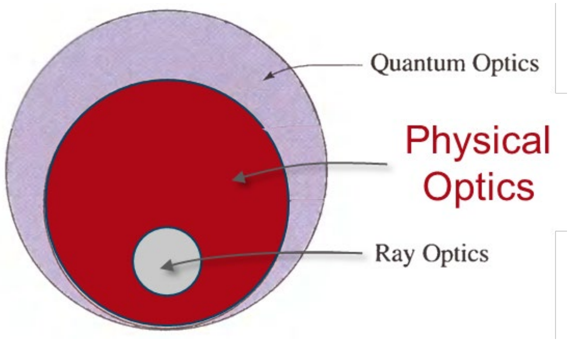


Connecting solvers: Optimized speed for given application scenario



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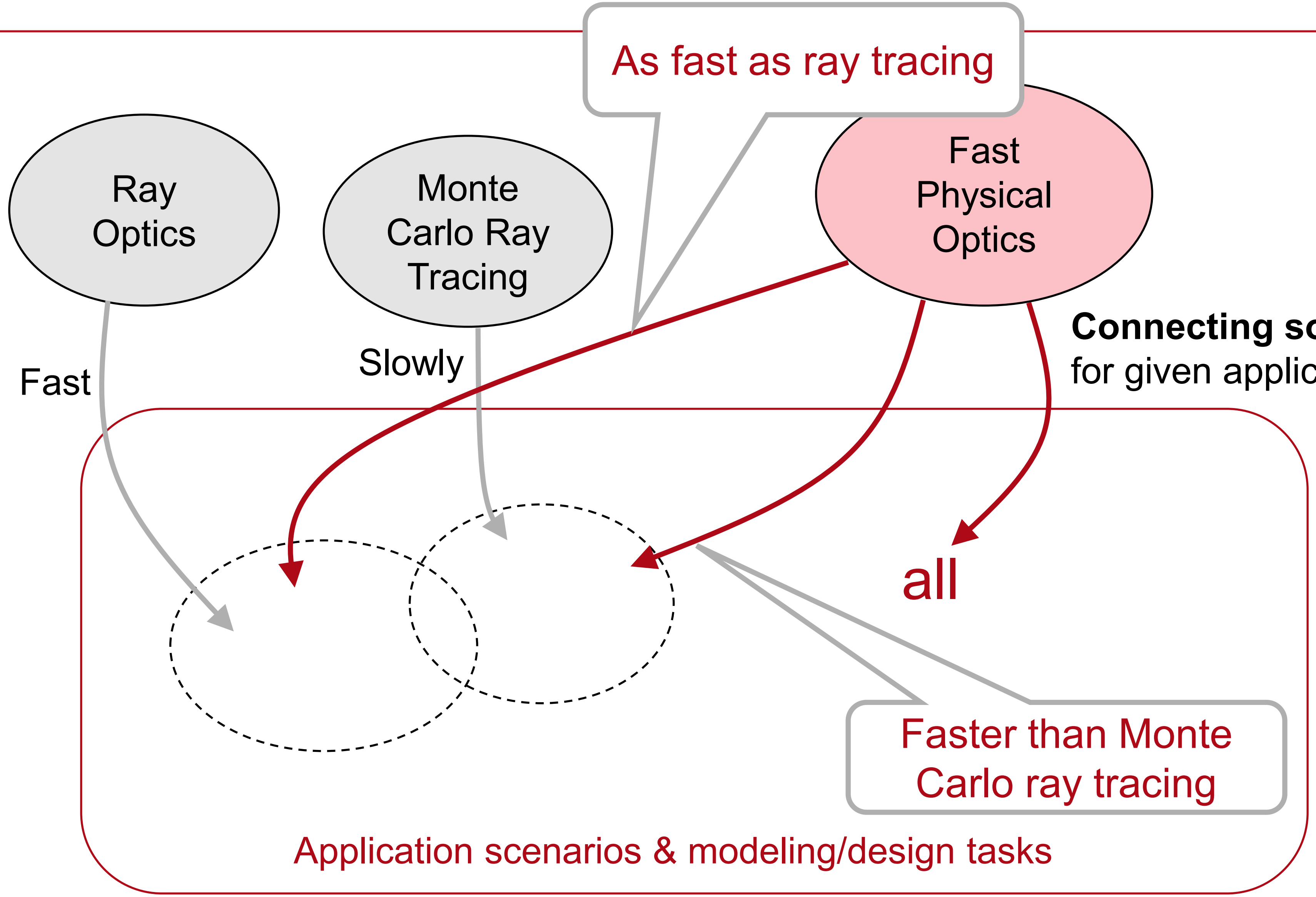
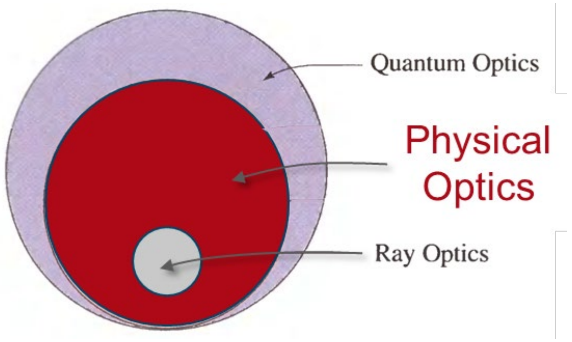


Connecting solvers: Optimized speed for given application scenario



Fast Physical Optics Modeling: Connecting Solvers

Physical optics modeling solvers can be seamlessly adapted to application scenario and design task.

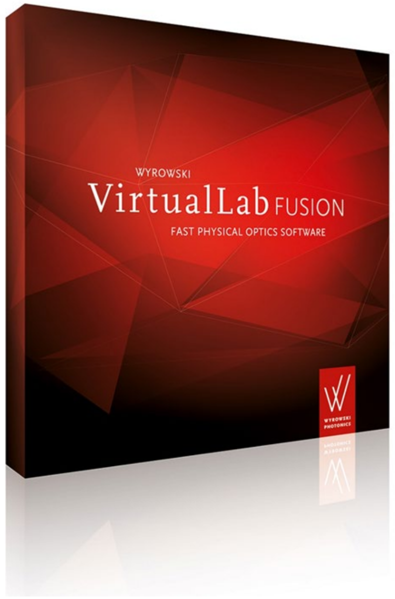
Fast Physical Optics

Connecting solvers: Optimized speed for given application scenario

New version 2022.1

Modeling editor and wizard for easy configuration to adapt physical optics modeling to application scenario

Application scenarios & modeling/design tasks



Fast Physical Optics Modeling: Detectors

Physical optics system modeling provides electromagnetic field: $\boldsymbol{E}$ and $\boldsymbol{H}$

→

All light quantities can be calculated from field without further system simulations.

Fast Physical Optics Modeling: Detectors

Physical optics system modeling provides electromagnetic field: $\boldsymbol{E}$ and $\boldsymbol{H}$

→

- Aberrations
- Amplitude and Phase
- Polarization
- Coherence
- Radiometry
- Photometry
- Pulse length
- Etc.

Fast Physical Optics Modeling: Detectors

Physical optics system modeling provides electromagnetic field: $\boldsymbol{E}$ and $\boldsymbol{H}$

- Aberrations
- Amplitude and Phase
- Polarization
- Coherence
- **Radiometry**
- Photometry
- Pulse length
- Etc.

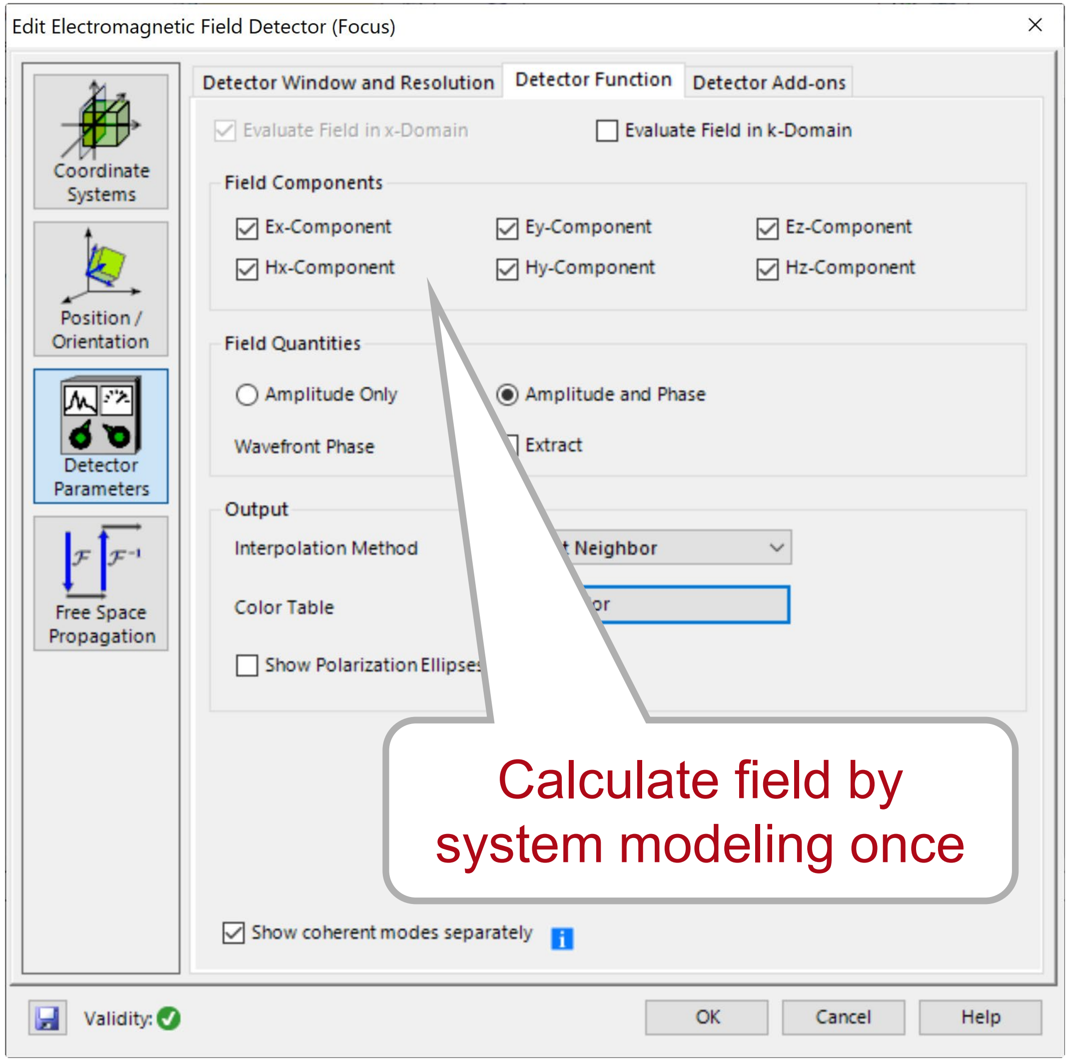
Fast Physical Optics Modeling: Radiometry Detectors

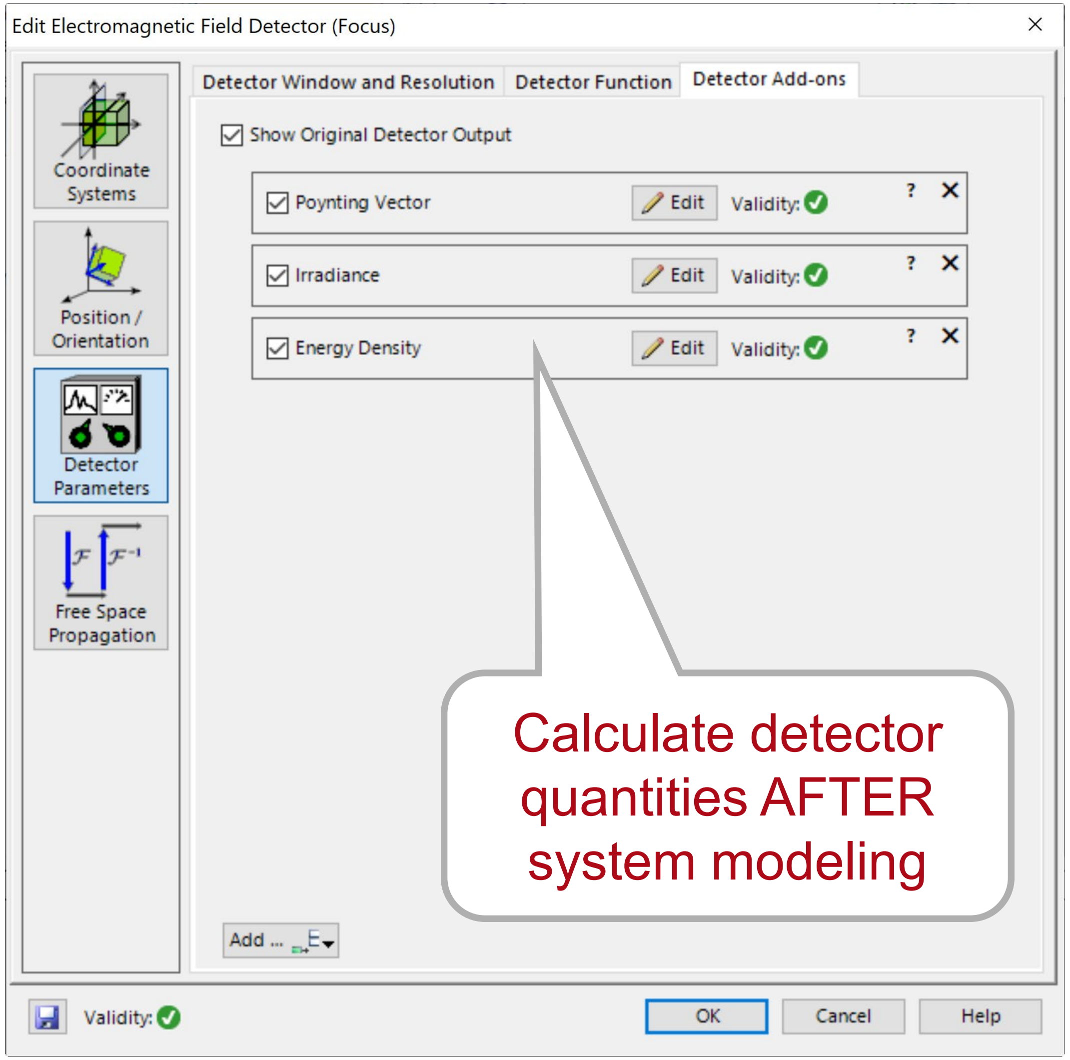
Physical optics system modeling provides electromagnetic field: $\boldsymbol{E}$ and $\boldsymbol{H}$

Poynting vector: $\boldsymbol{S} = (S_x, S_y, S_z)$

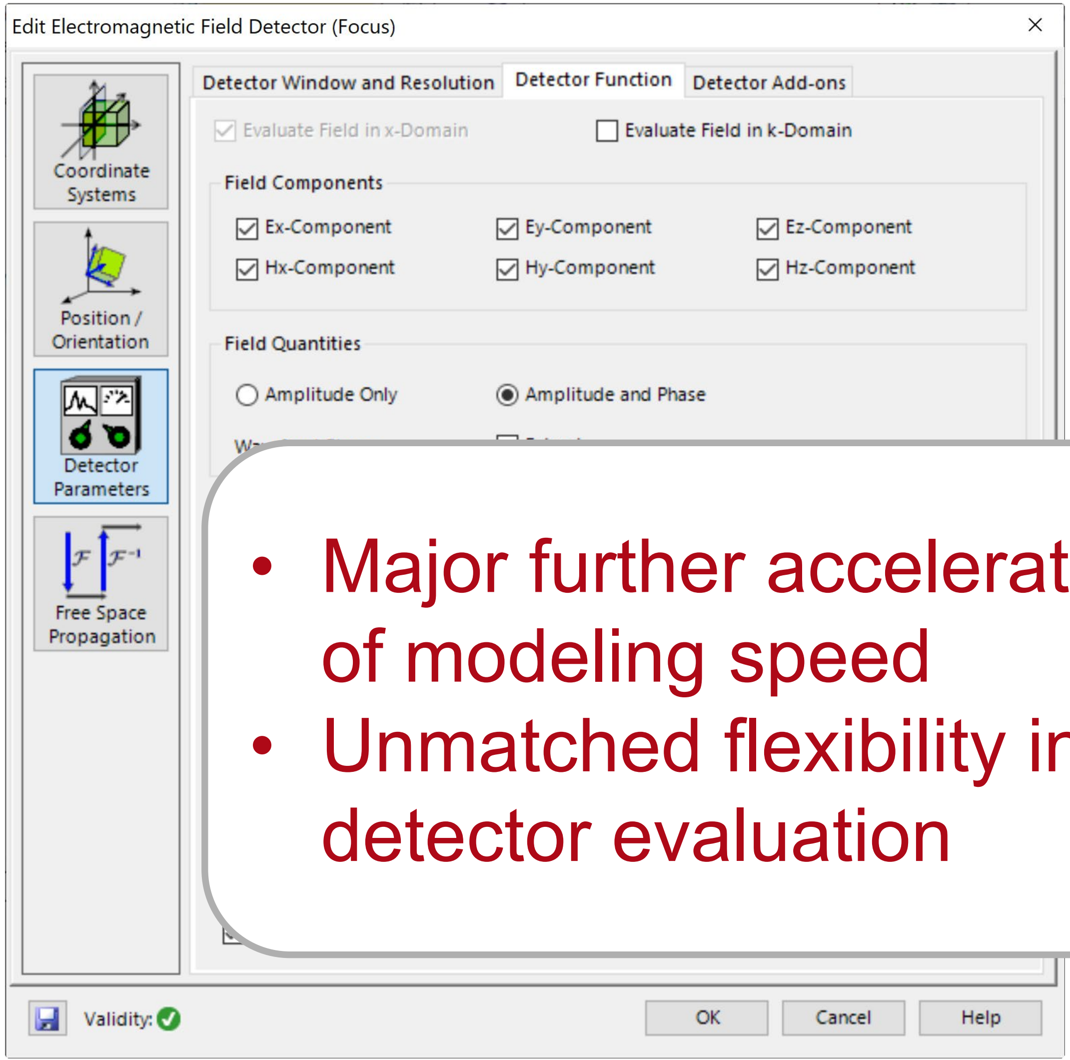
- Intensity
- Irradiance
- Energy density
- Radiant intensity
- Radiance
- Flux

VirtualLab Fusion: New in Version 2022.1

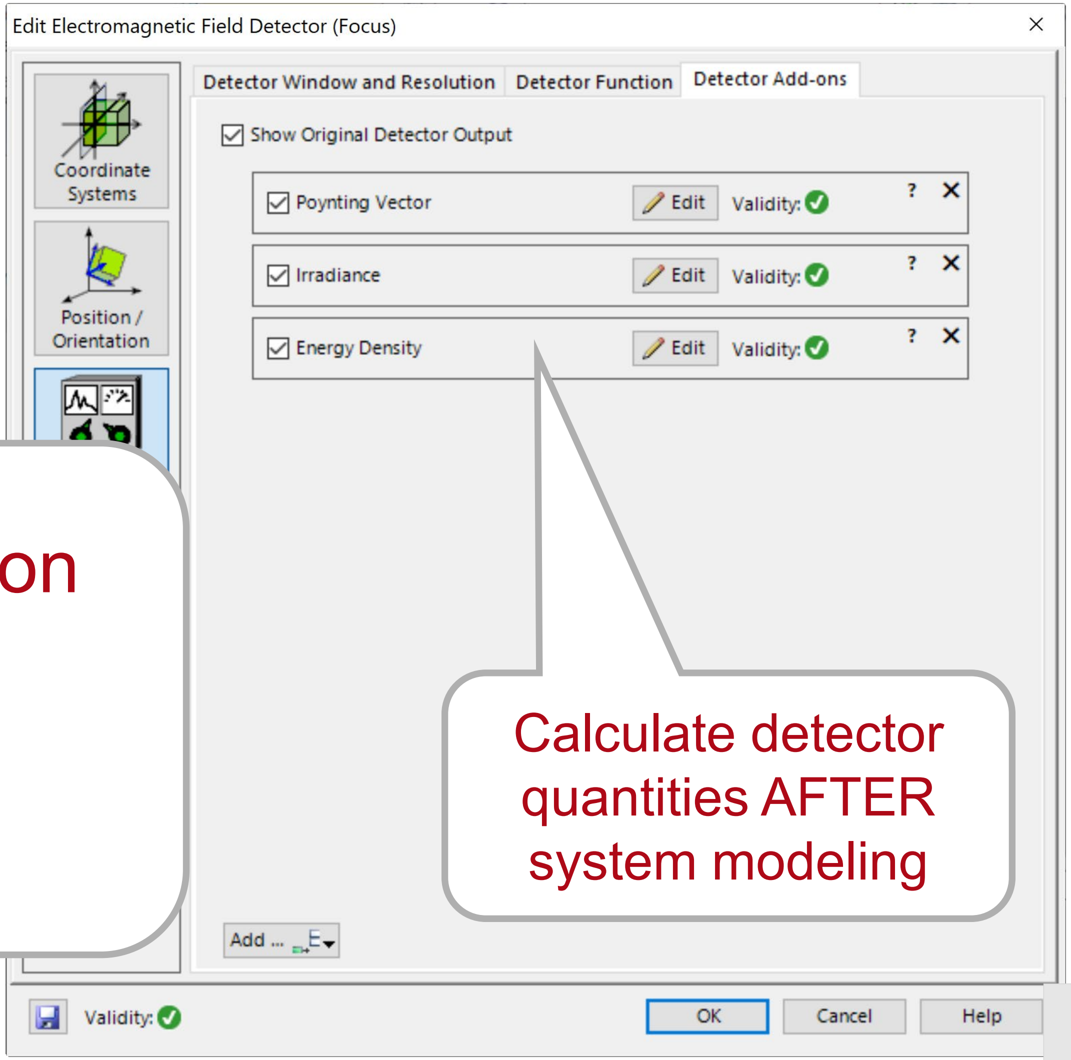




VirtualLab Fusion: New in Version 2022.1



- Major further acceleration of modeling speed
- Unmatched flexibility in detector evaluation

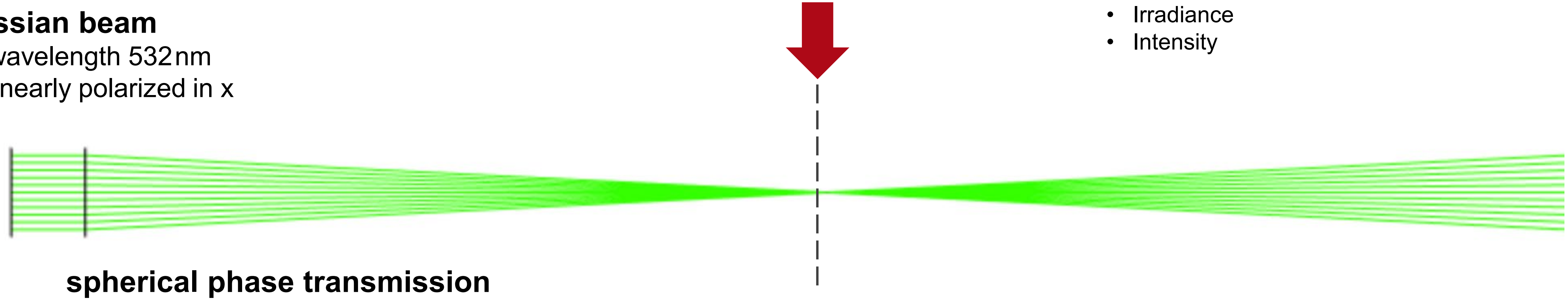


Calculate detector quantities AFTER system modeling

Setup for Demonstrations: Focusing Gaussian Beam

detector
- E Field
- Poynting Vector
- Energy Density
- Irradiance
- Intensity

Gaussian beam
- wavelength 532 nm
- linearly polarized in x

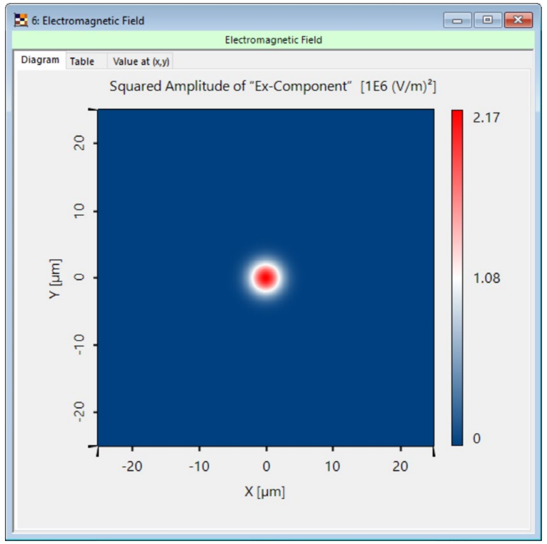


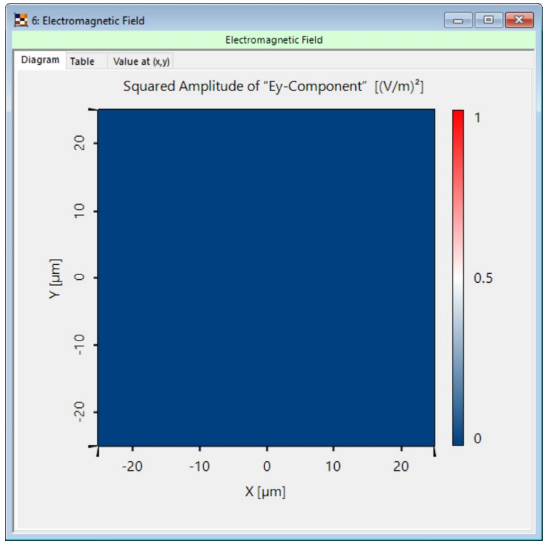
spherical phase transmission

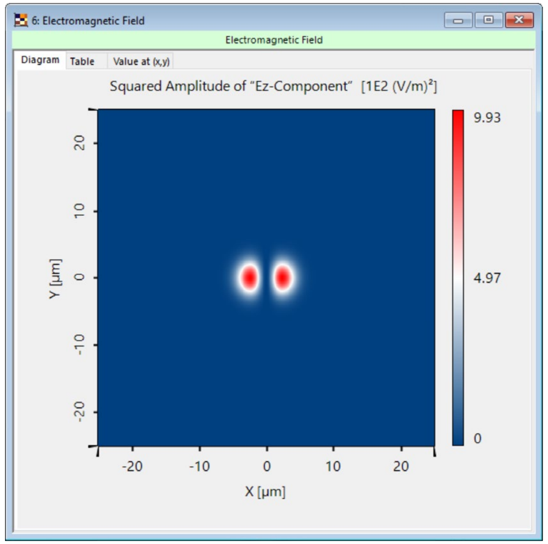
Example #1 with NA = 0.025
Example #2 with NA = 0.93

Focal Plane: NA= 0.025 (Scaling per Component)

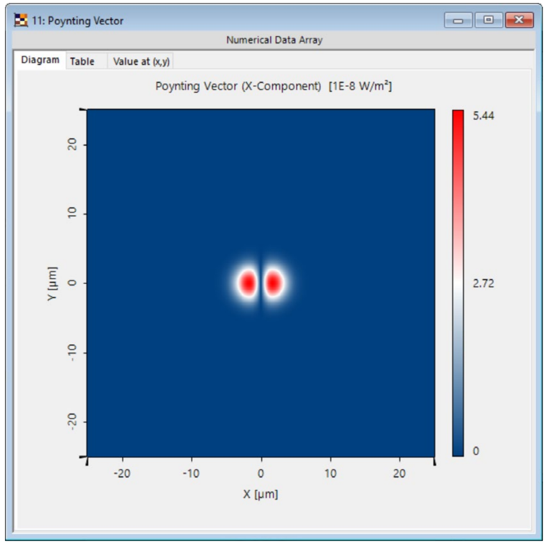
Electric field square amplitudes:
$(|E_x|^2, |E_y|^2, |E_z|^2)$

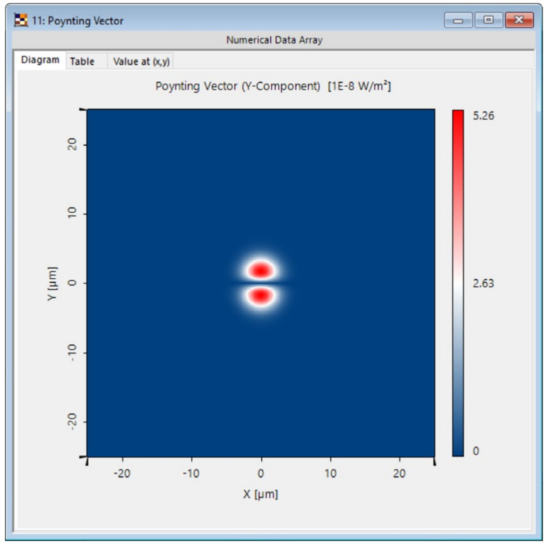


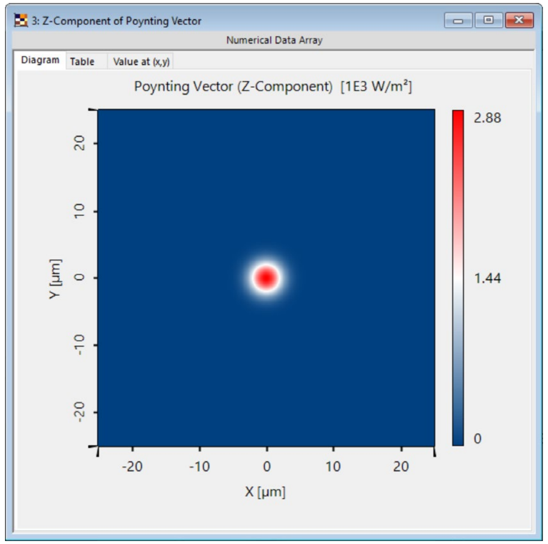




Amplitudes Poynting vector:
$(|S_x|, |S_y|, |S_z|)$

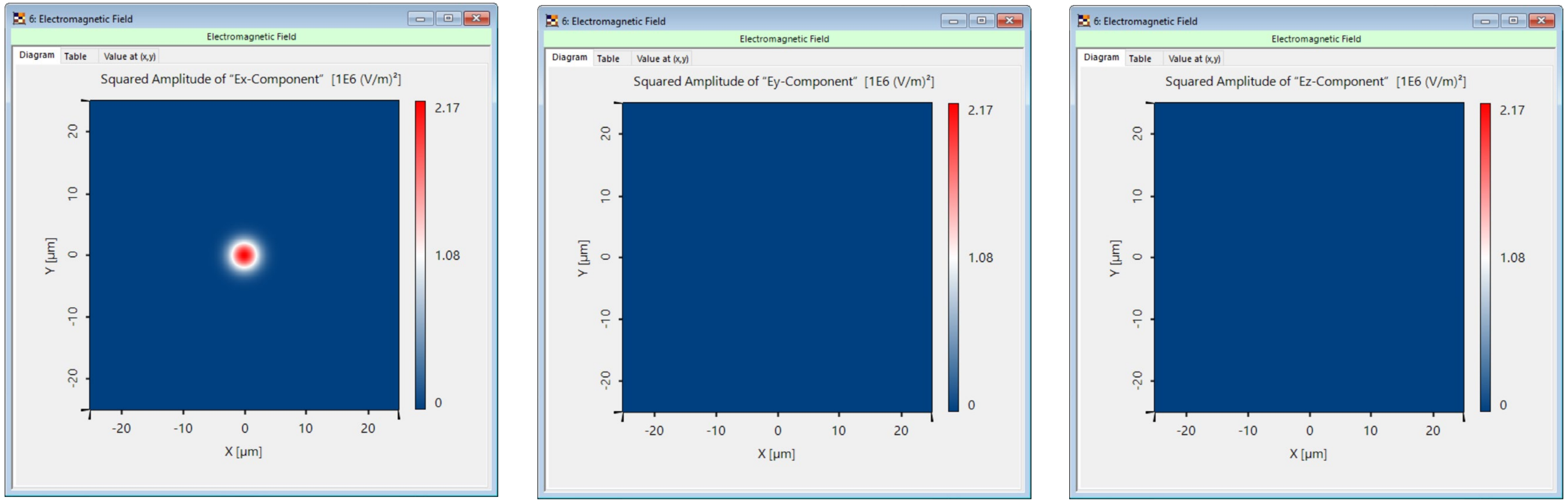






Focal Plane: NA= 0.025 (Unified Scaling)

Electric field square amplitudes:
$(|E_x|^2, |E_y|^2, |E_z|^2)$



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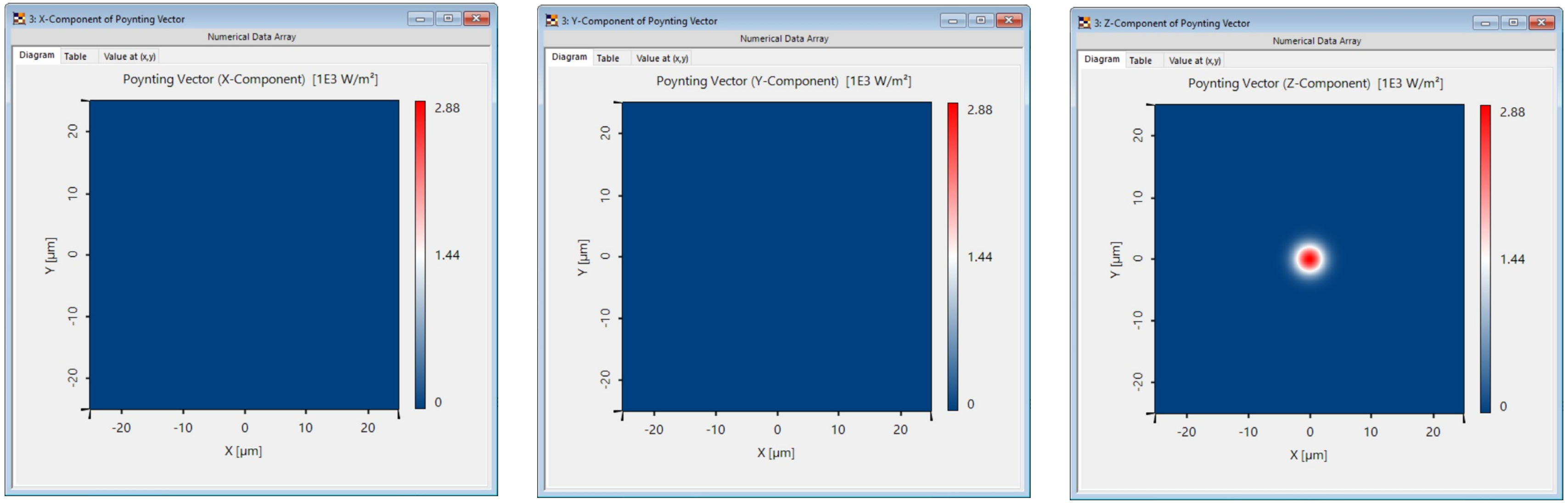

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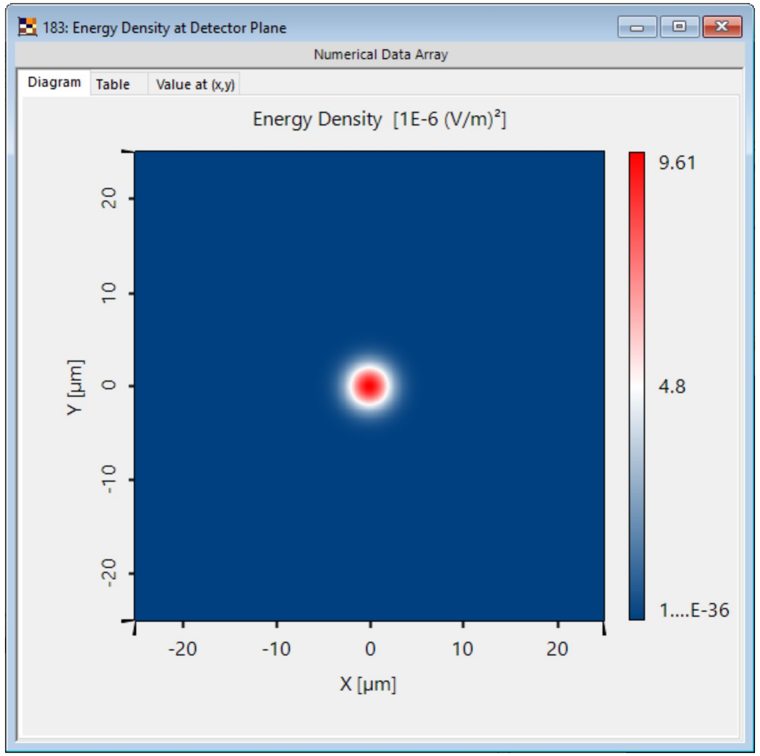
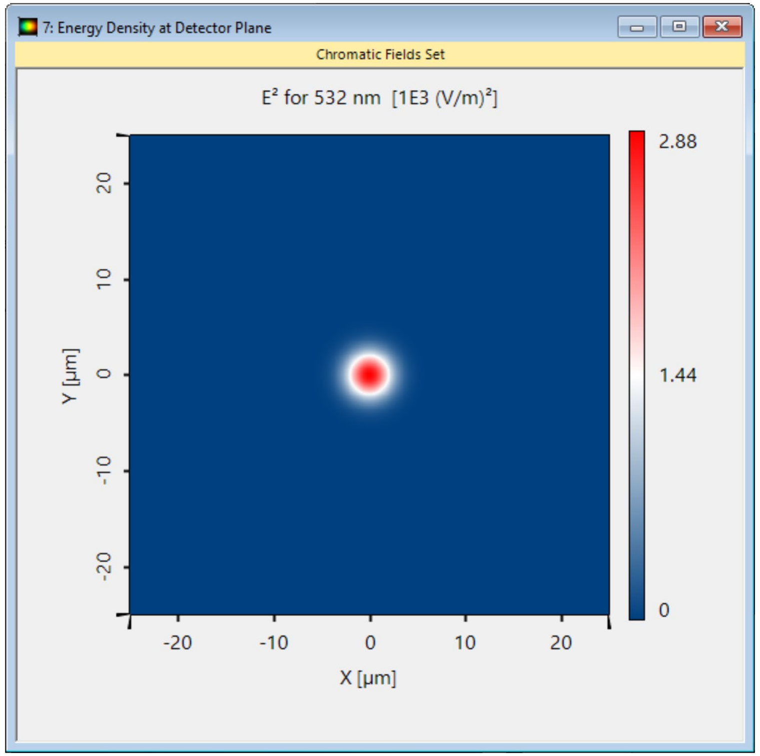


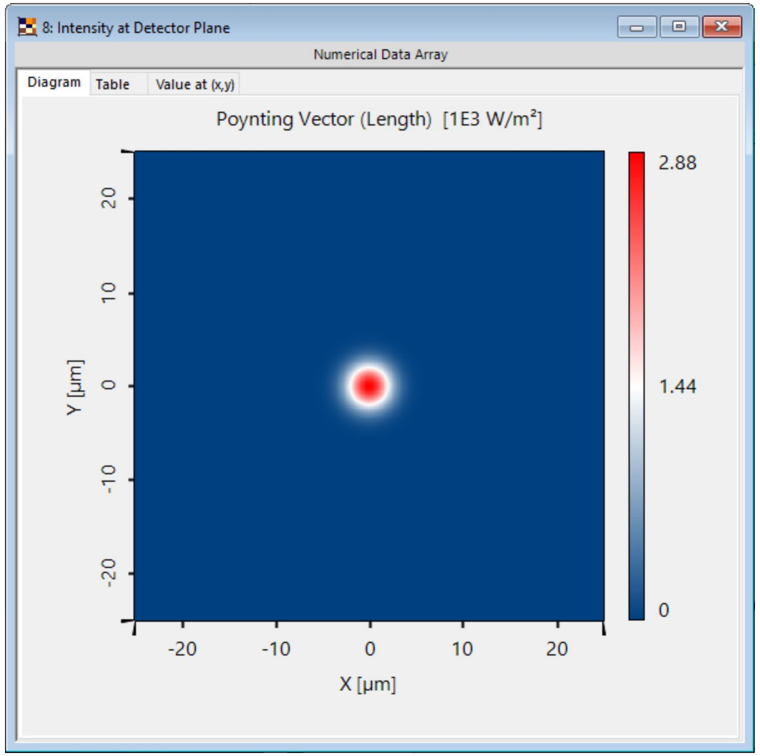
Energy Density

$$w_e \propto |E_x|^2 + |E_y|^2 + |E_z|^2$$



Irradiance

$$E_e = S_z$$



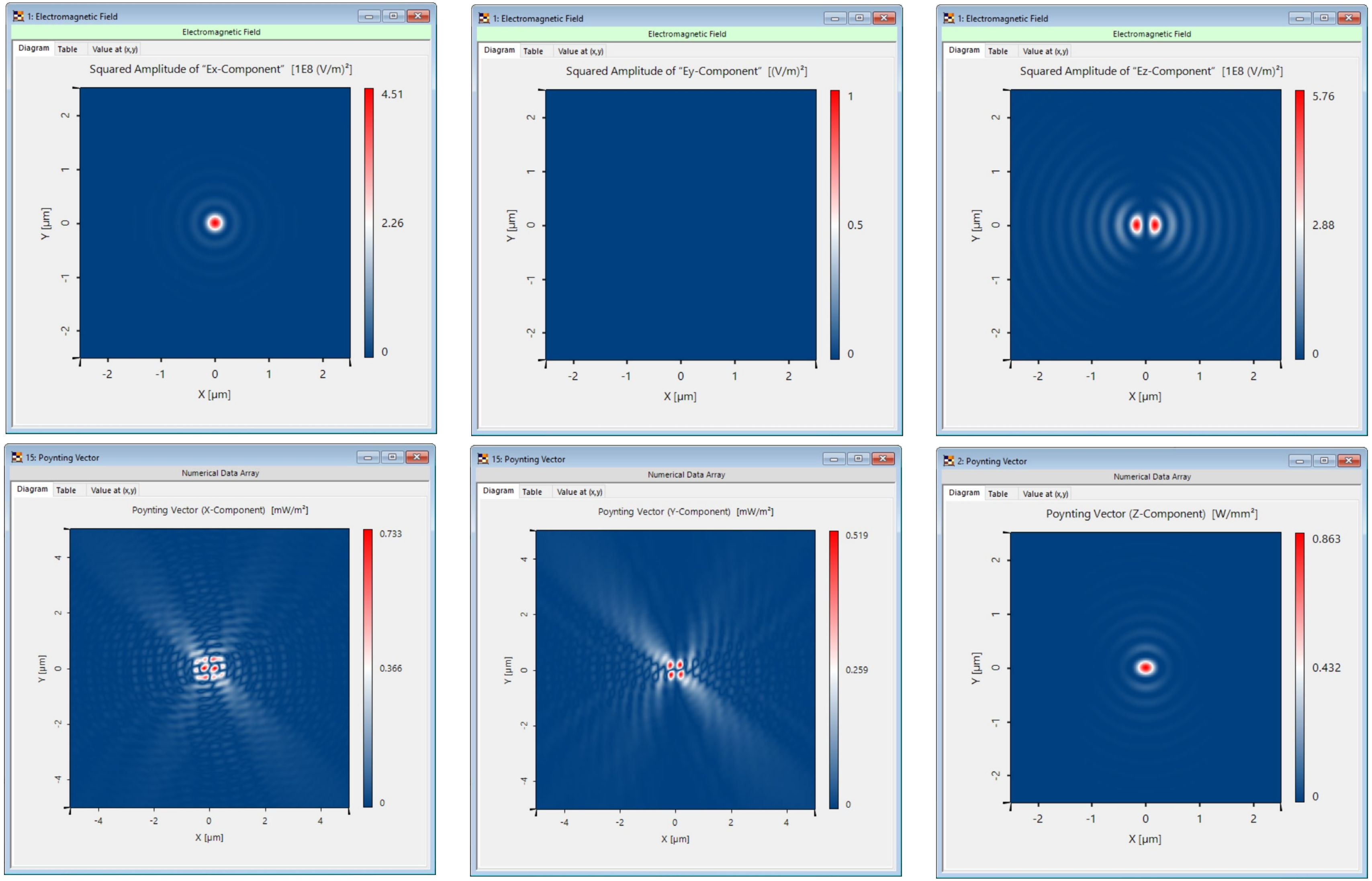
Intensity

$$I_{\text{Wolf}} = \|\boldsymbol{S}\|$$

Focal Plane: NA= 0.93 (Scaling per Component)

Electric field square amplitudes:
$(|E_x|^2, |E_y|^2, |E_z|^2)$

Amplitudes Poynting vector:
$(|S_x|, |S_y|, |S_z|)$



Focal Plane: NA= 0.93 (Unified Scaling)

Electric field square amplitudes:
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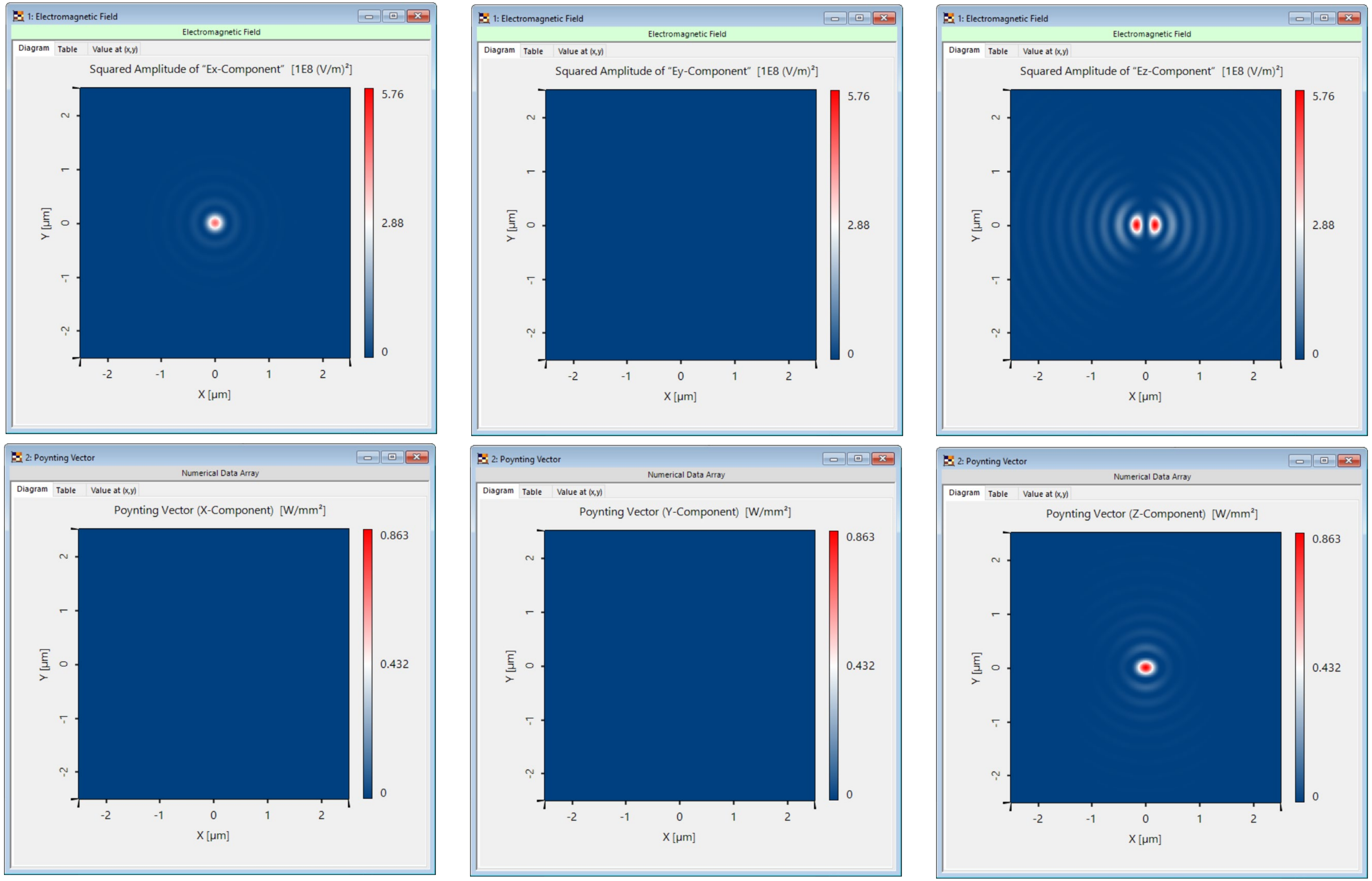

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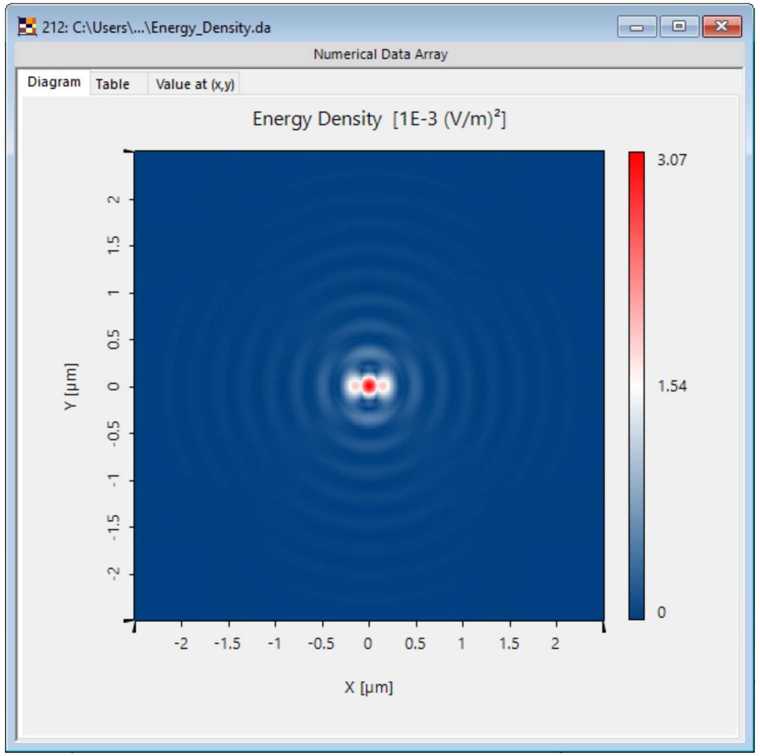
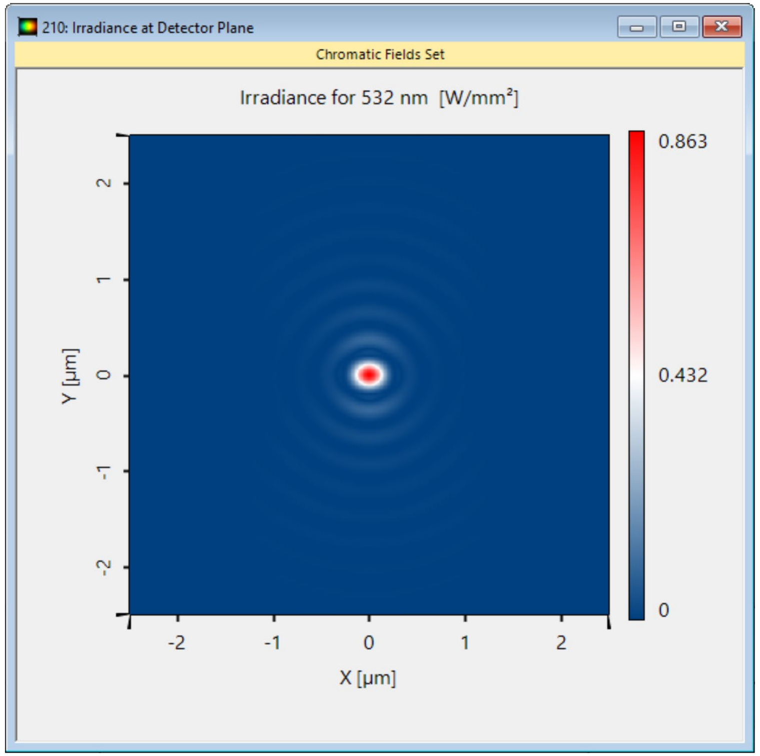


Energy Density

$$w_{\mathrm{e}} \propto |E_x|^2 + |E_y|^2 + |E_z|^2$$



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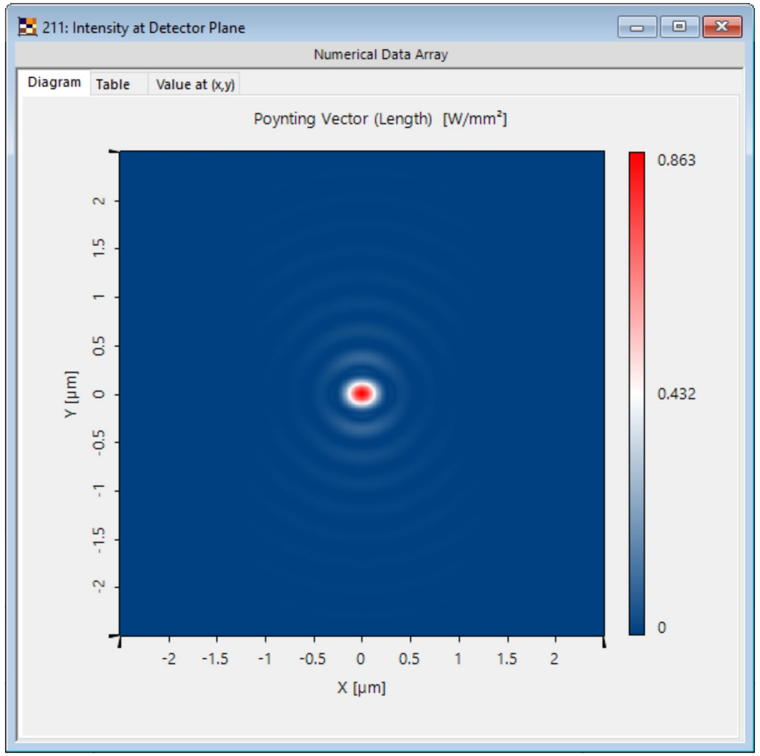


Intensity

$$I_{\mathrm{Wolf}} = \|\boldsymbol{S}\|$$

Setup for Demonstrations: Divergent Gaussian Beam

detector
- E Field
- Poynting Vector
- Energy Density
- Irradiance
- Intensity

Gaussian beam
- wavelength 532 nm
- linearly polarized in x

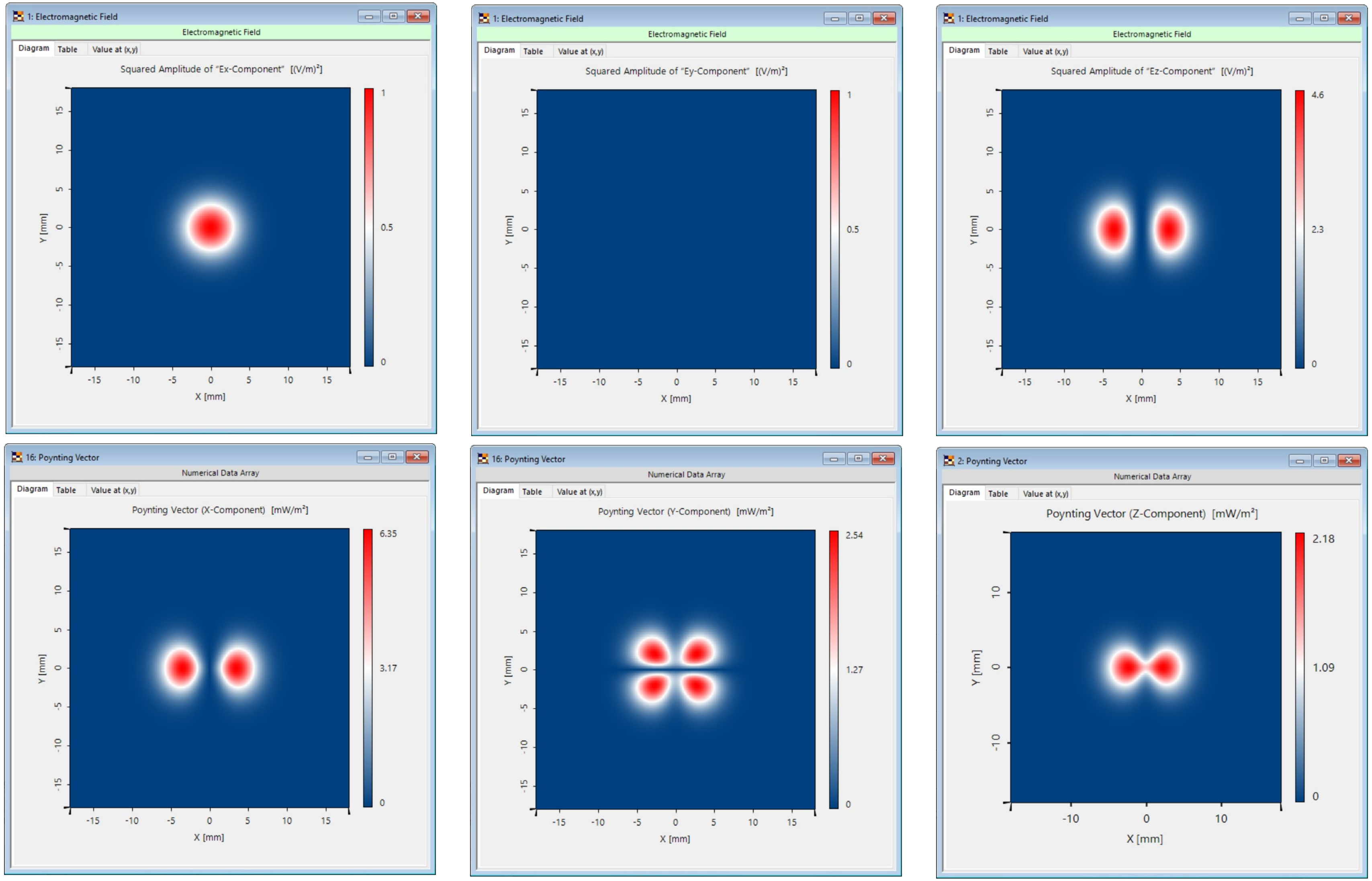
spherical phase transmission

Example #1 with NA = 0.025
Example #2 with NA = 0.93

Behind Focal Plane: NA= 0.93 (Scaling per Component)

Electric field square amplitudes:
$(|E_x|^2, |E_y|^2, |E_z|^2)$

Amplitudes Poynting vector:
$(|S_x|, |S_y|, |S_z|)$



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Electric field square amplitudes:
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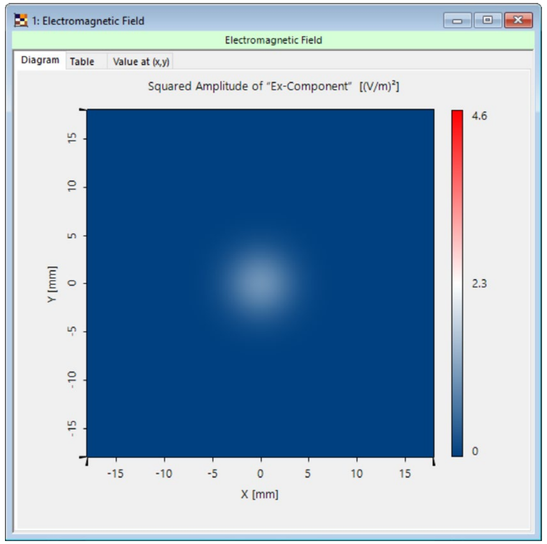

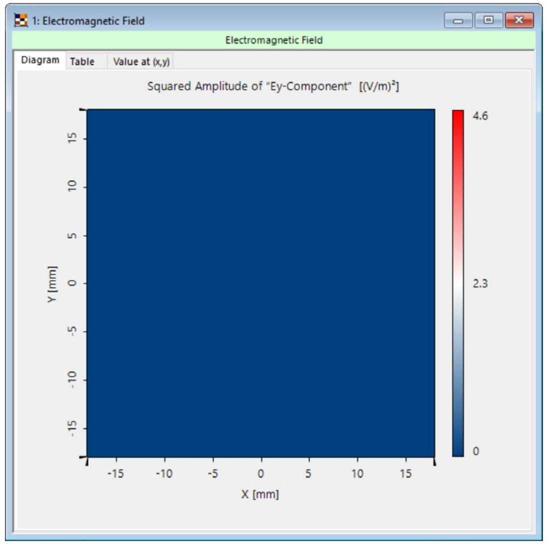

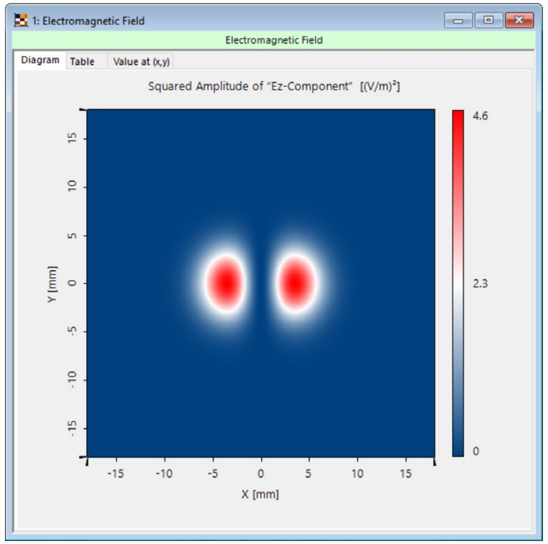

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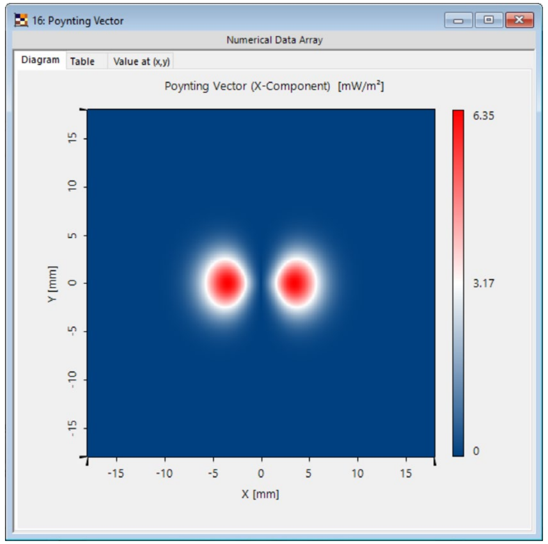

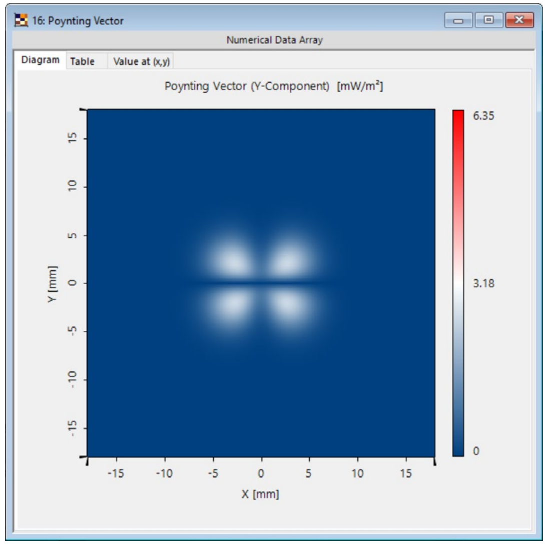

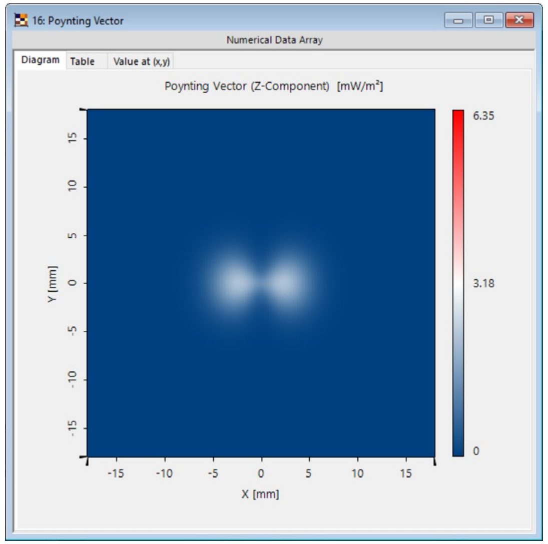

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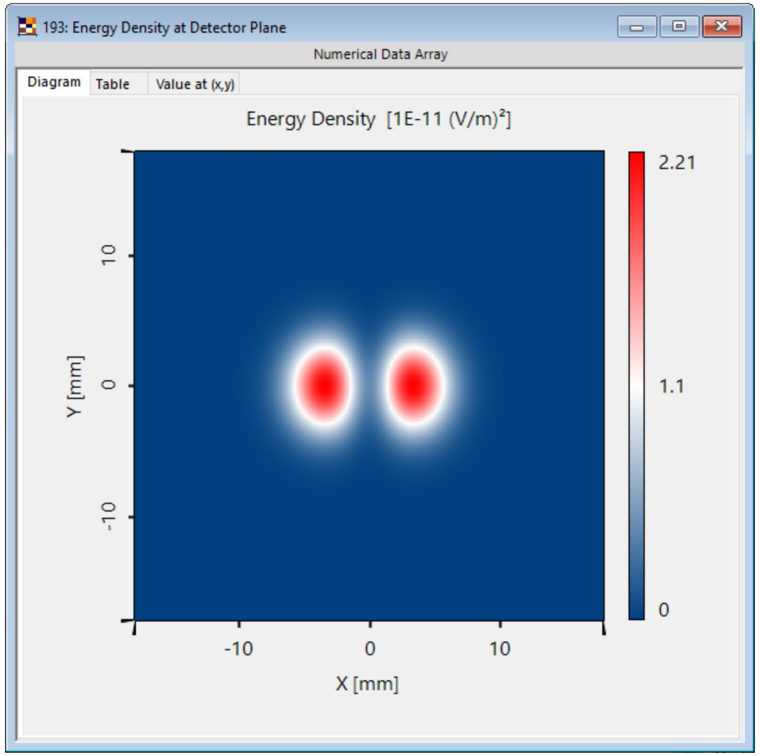

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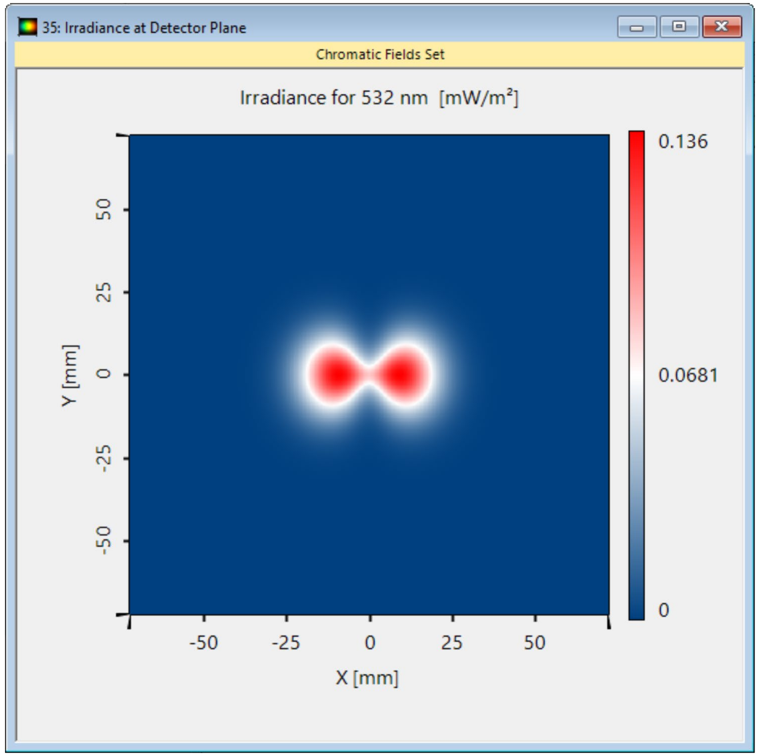

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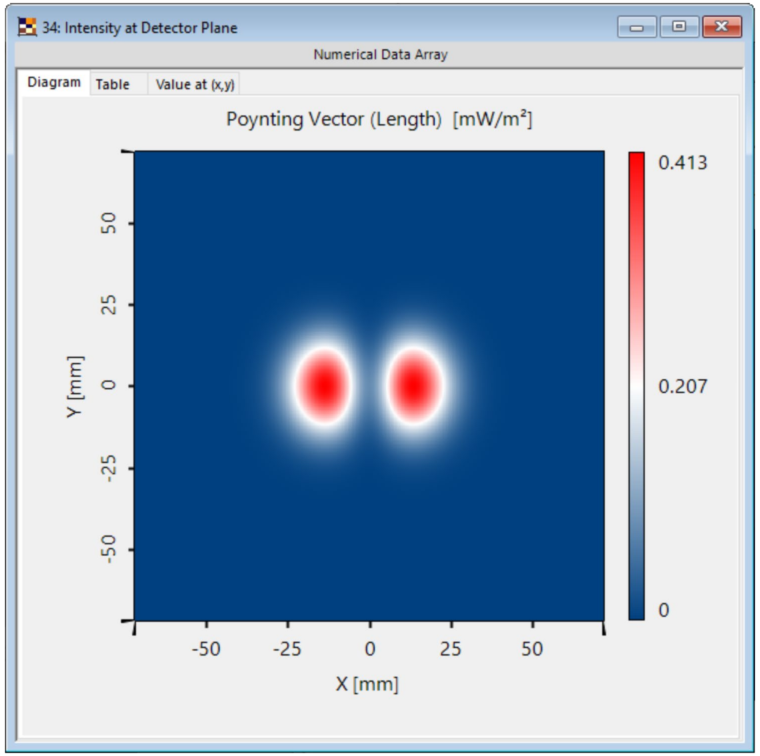
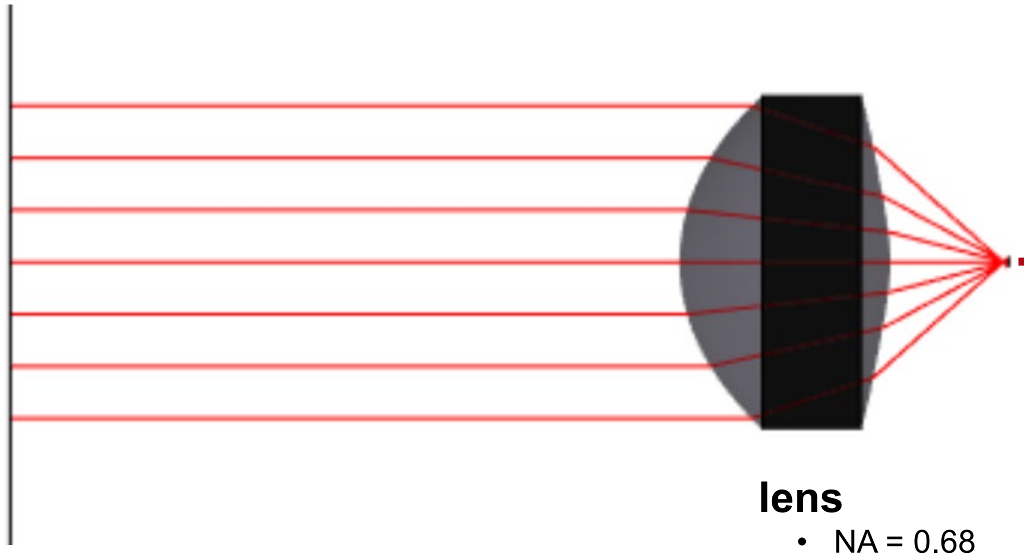


Intensity

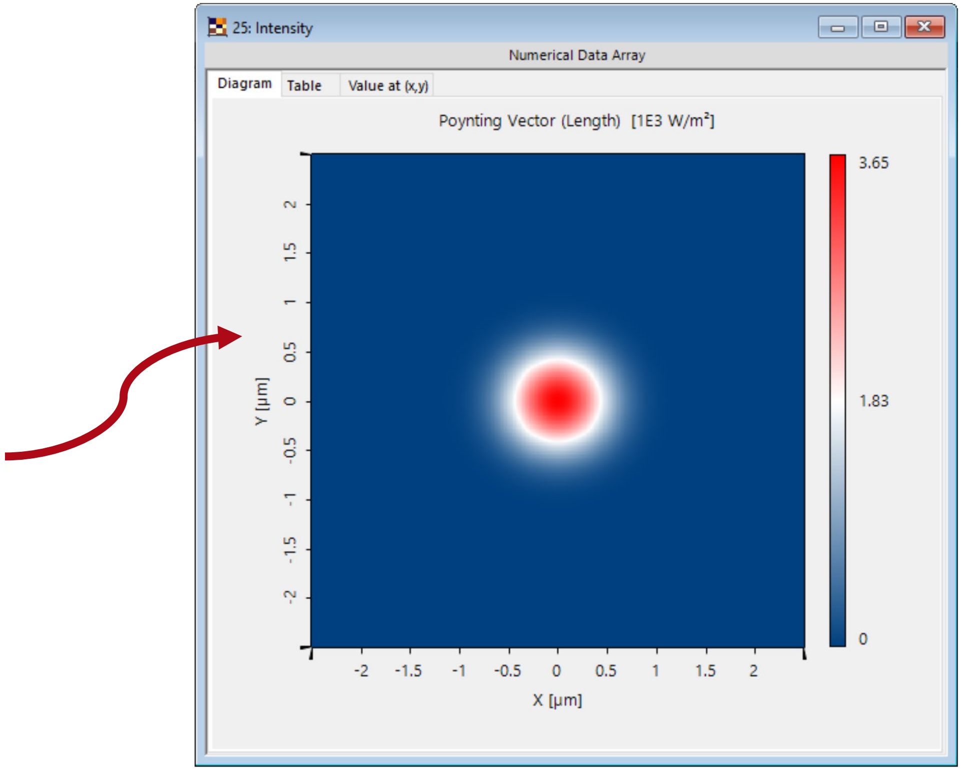
$$I_{Wolf} = \|\boldsymbol{S}\|$$

High-NA Pulse Focusing

gaussian pulse
- center-wavelength 800 nm
- 5 mm × 5 mm
- 5 fs pulse duration
- linearly polarized in x

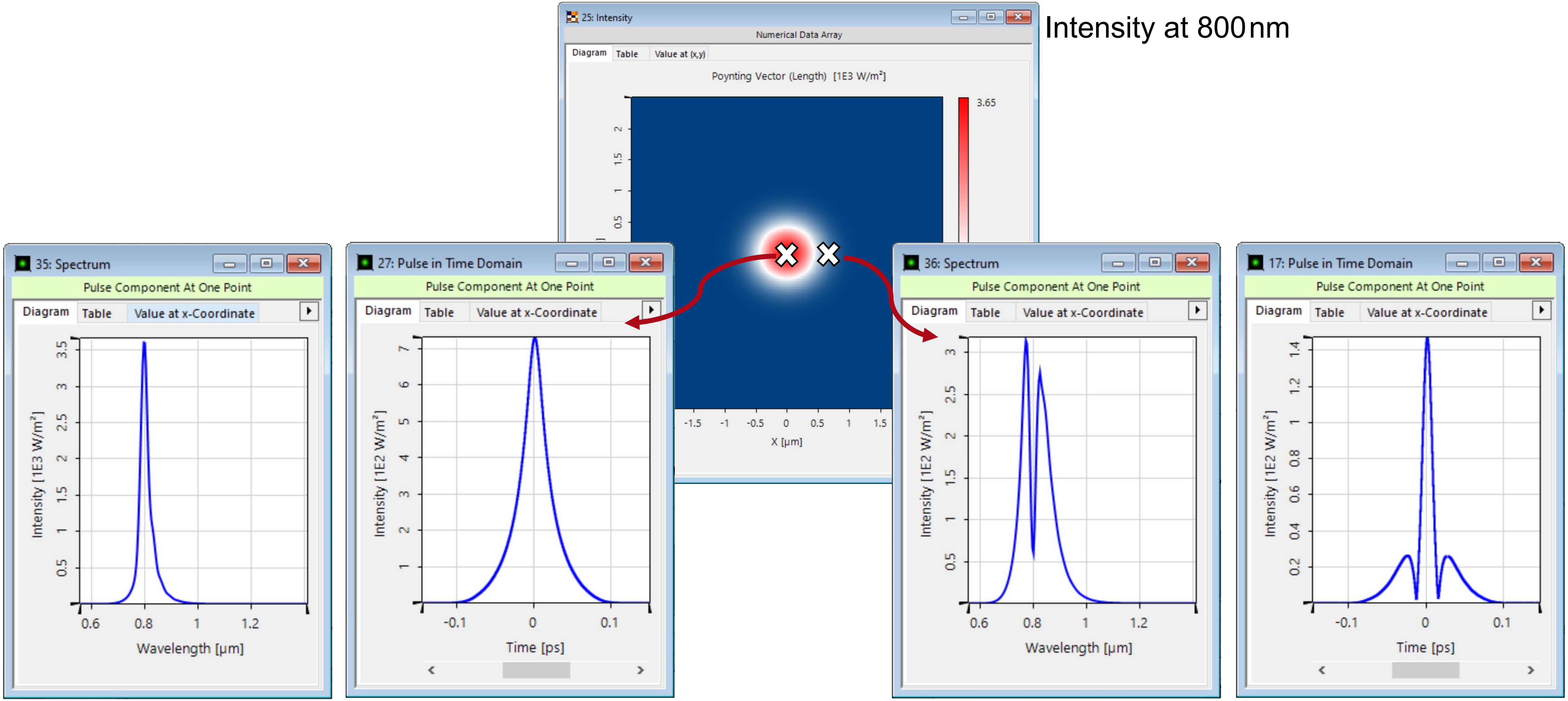


lens
- NA = 0.68



Intensity for central wavelength

Point Extraction



Summary

- Fast physical optics software most flexible in modeling and design.
- Example of flexibility: Any detector function can be calculated from one system modeling in a postprocessing step!
- New in VirtualLab Fusion version 2022.1

Coming in summer 2022