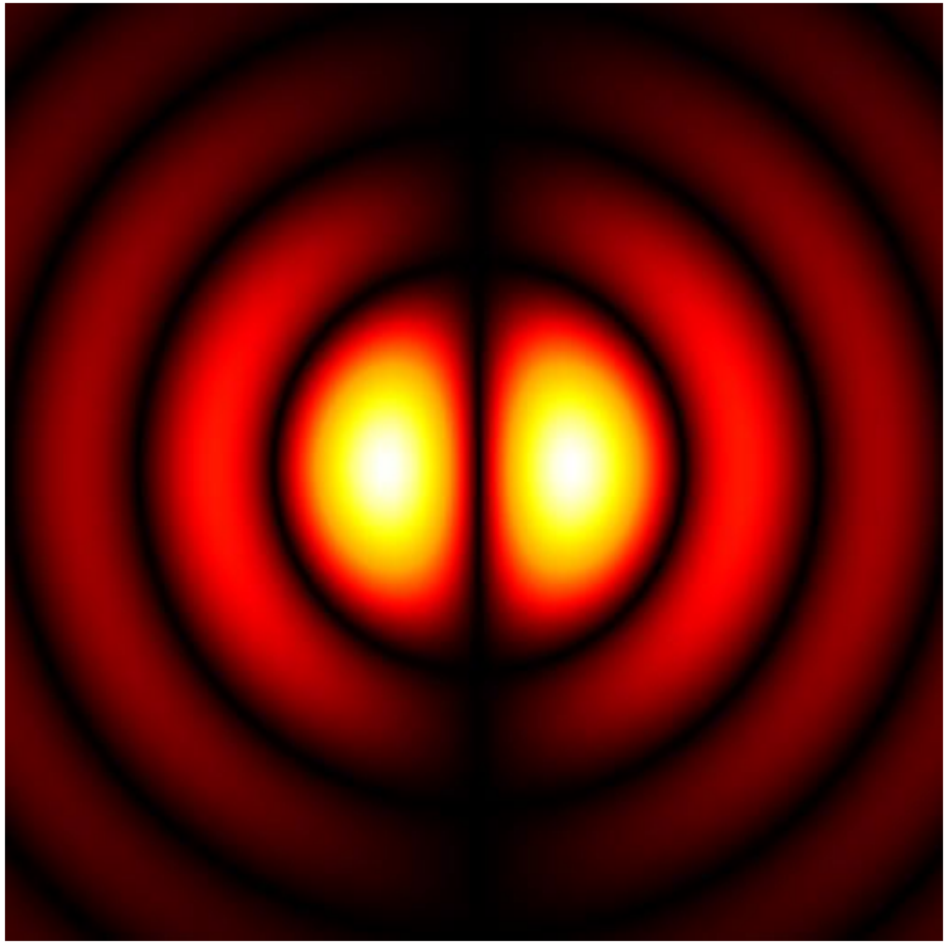
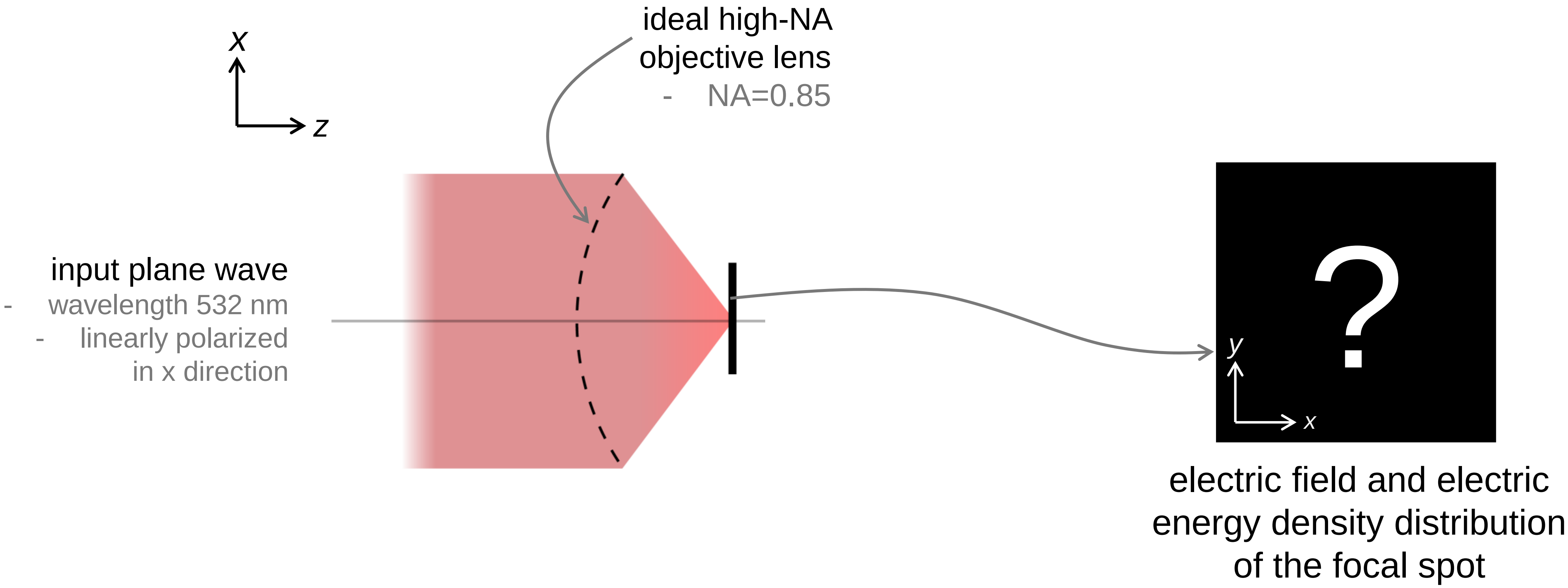
# Usage of Debye-Wolf Integral Calculator

# Abstract



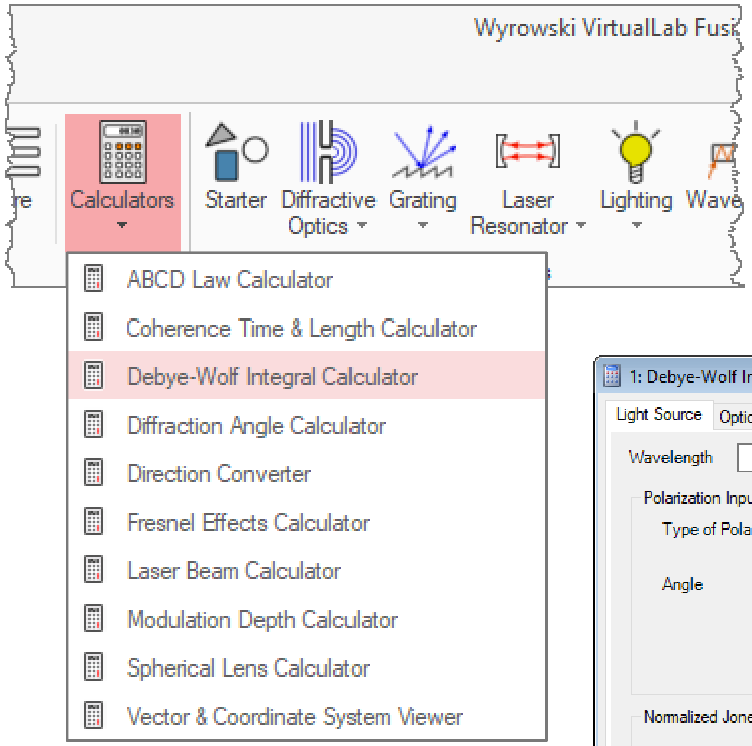

It is well known that the Debye-Wolf integral can be used to calculate the vectorial field near the focal plane in a semi-analytical manner. The Debye-Wolf integral is often used as the basic tool for the analysis of high-NA microscope imaging situations. It is based on an idealized model and therefore it does not require the knowledge on the exact lens specifications for the calculation. This use case will explain how to use the Debye-Wolf integral calculator in VirtualLab Fusion.

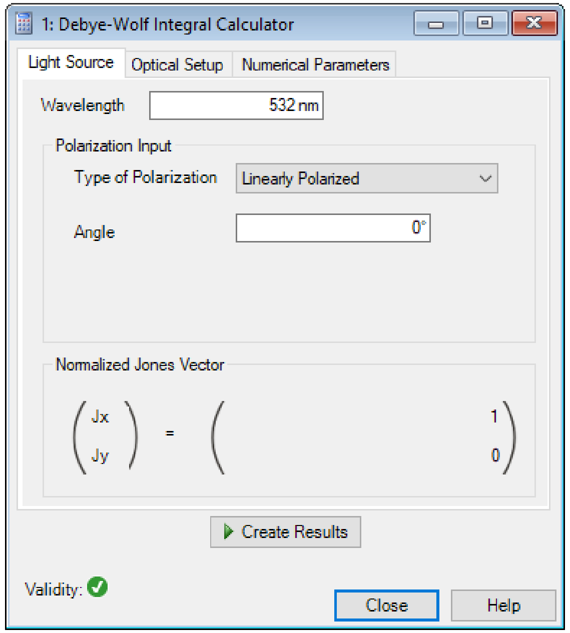
# Modeling Task



# Start the Debye-Wolf Integral Calculator

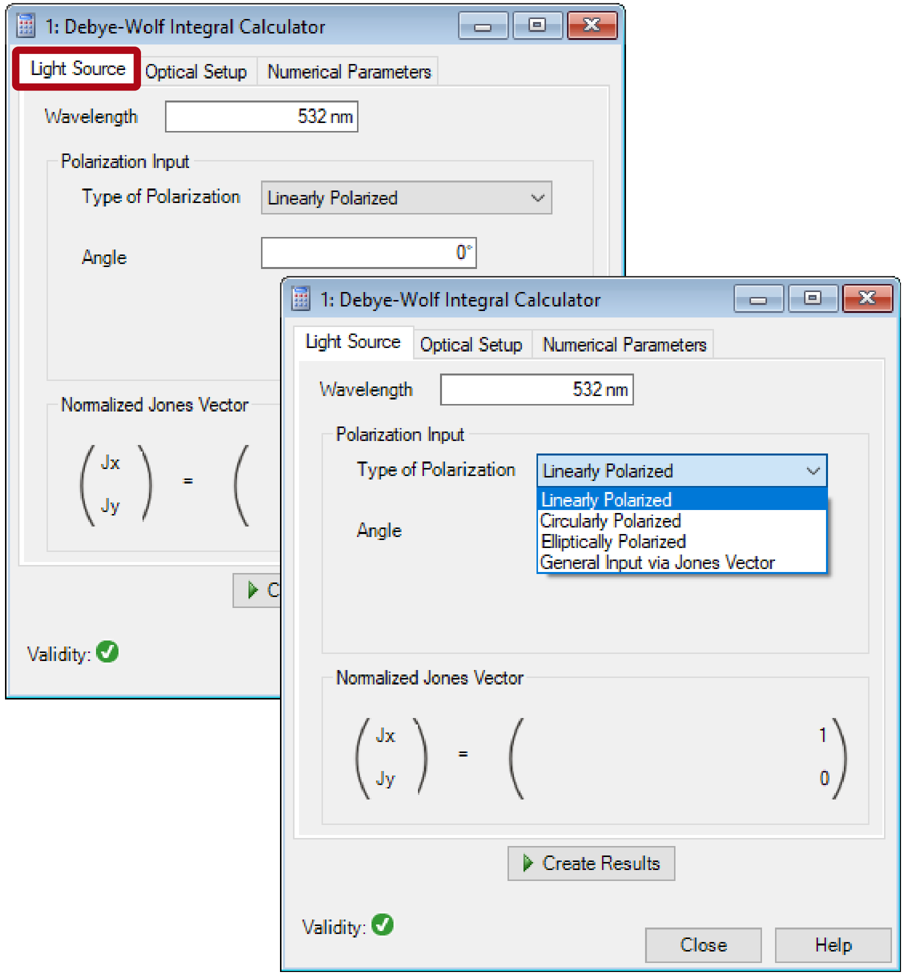
- We directly click Calculator and choose Debye-Wolf Integral Calculator.
- Next, we set the Light Source, Optical Setup and Numerical Parameters separately.



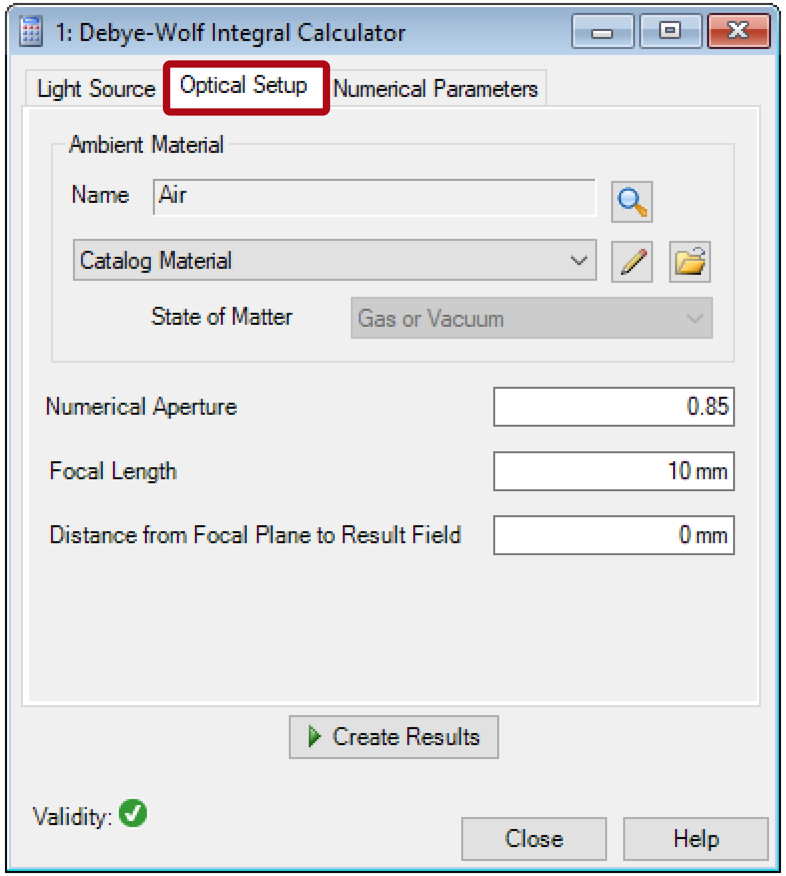
# Light Source – the Input Field

- The wavelength is set here to be 532 nm.
- The global polarization is set to be linearly polarized. The angle 0° means the field vector is on *x*-axis.
- One can also choose other type of polarization, e.g. Circularly Polarized, Elliptically Polarized and General Input via Jones Vector.
- The shape of the input field is circular as defined in the Debye-Wolf integral.



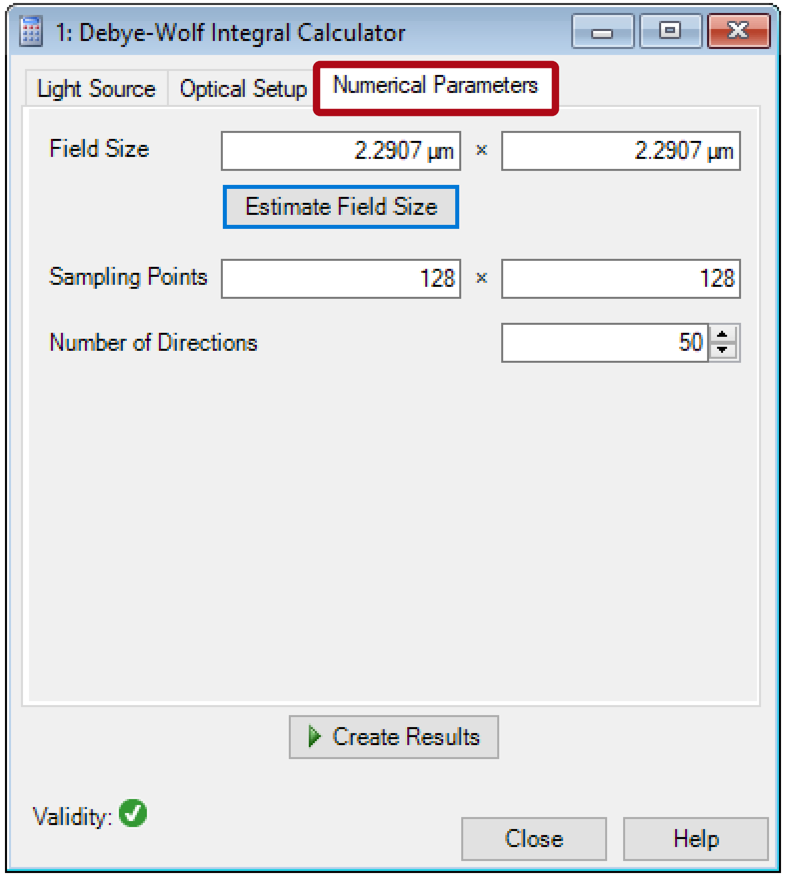
# Parameters of the Optical Setup

- The refractive index of the focusing region is taken by the real part of the complex refractive index of the materials. Therefore, absorption is not considered.
- The Numerical Aperture is set to be 0.85.
- The Focal Length is set to be 10 mm.
- The Distance from Focal Plane to Result Field is set to be 0 μm.



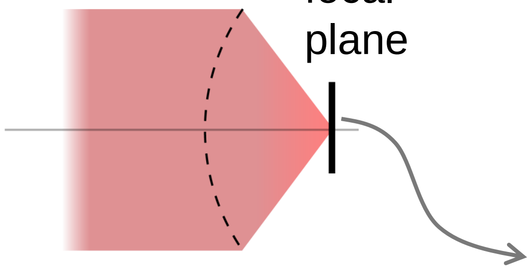
# Numerical Settings

- The Field Size is set directly, or by clicking Estimate Field Size button, VirtualLab will make an estimation.
- Sampling Points means the sampling of the resulting fields in spatial domain.
- Number of Directions means the sampling points of the full numerical aperture in angular domain.
- Click Create Results, the electric fields and the energy density is shown.

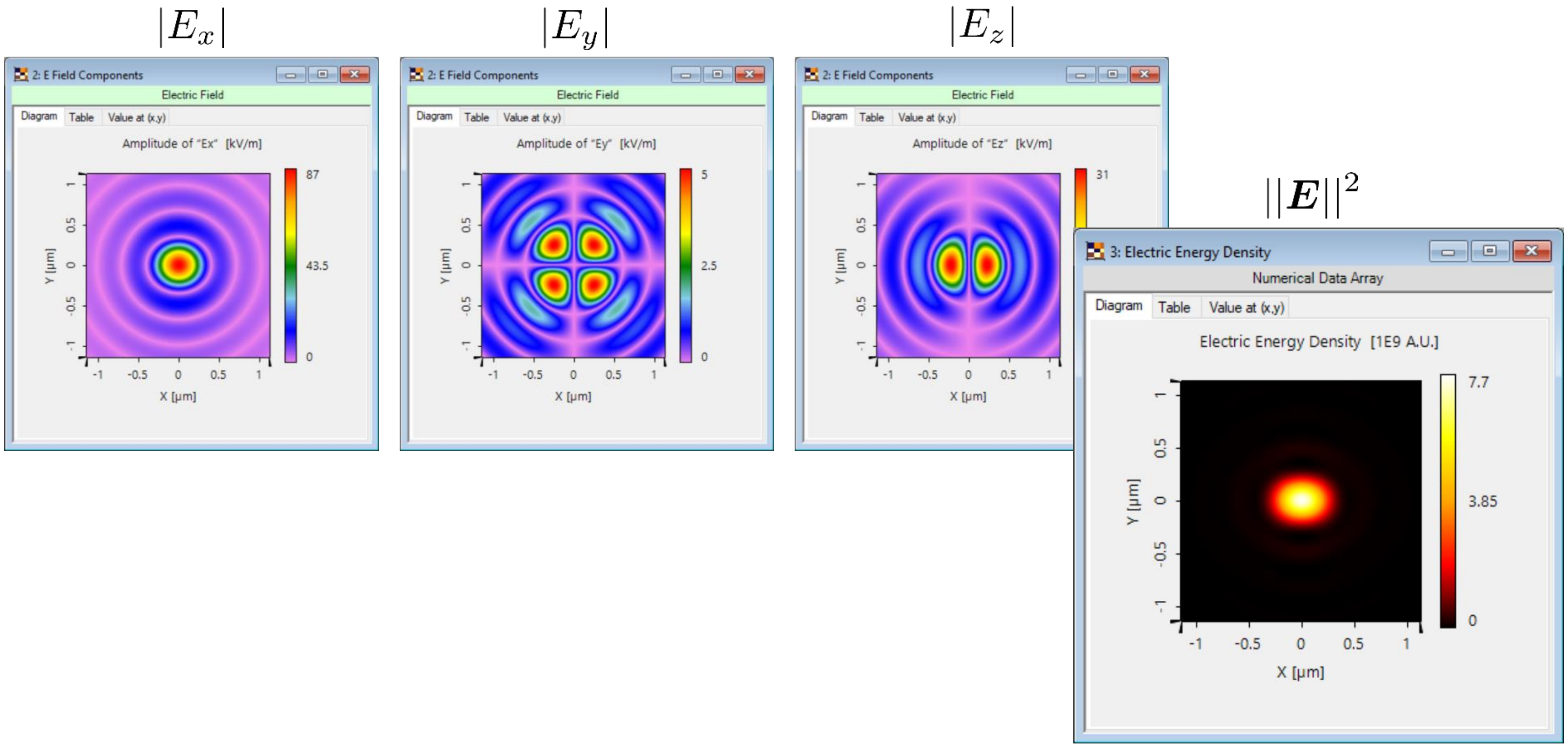


# Field and Energy Density Near Focal Plane

focal plane



- wavelength: 532 nm
- linearly polarized in *x* direction
- NA=0.85



# Document Information

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|---|---|
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