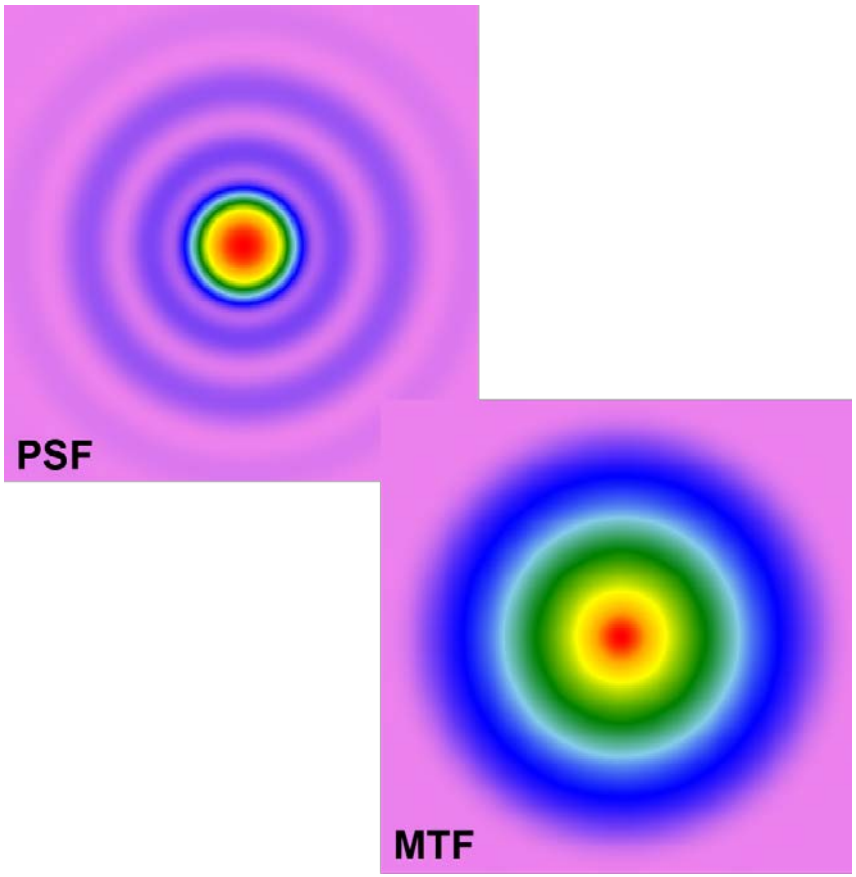
Usage of PSF & MTF Detector

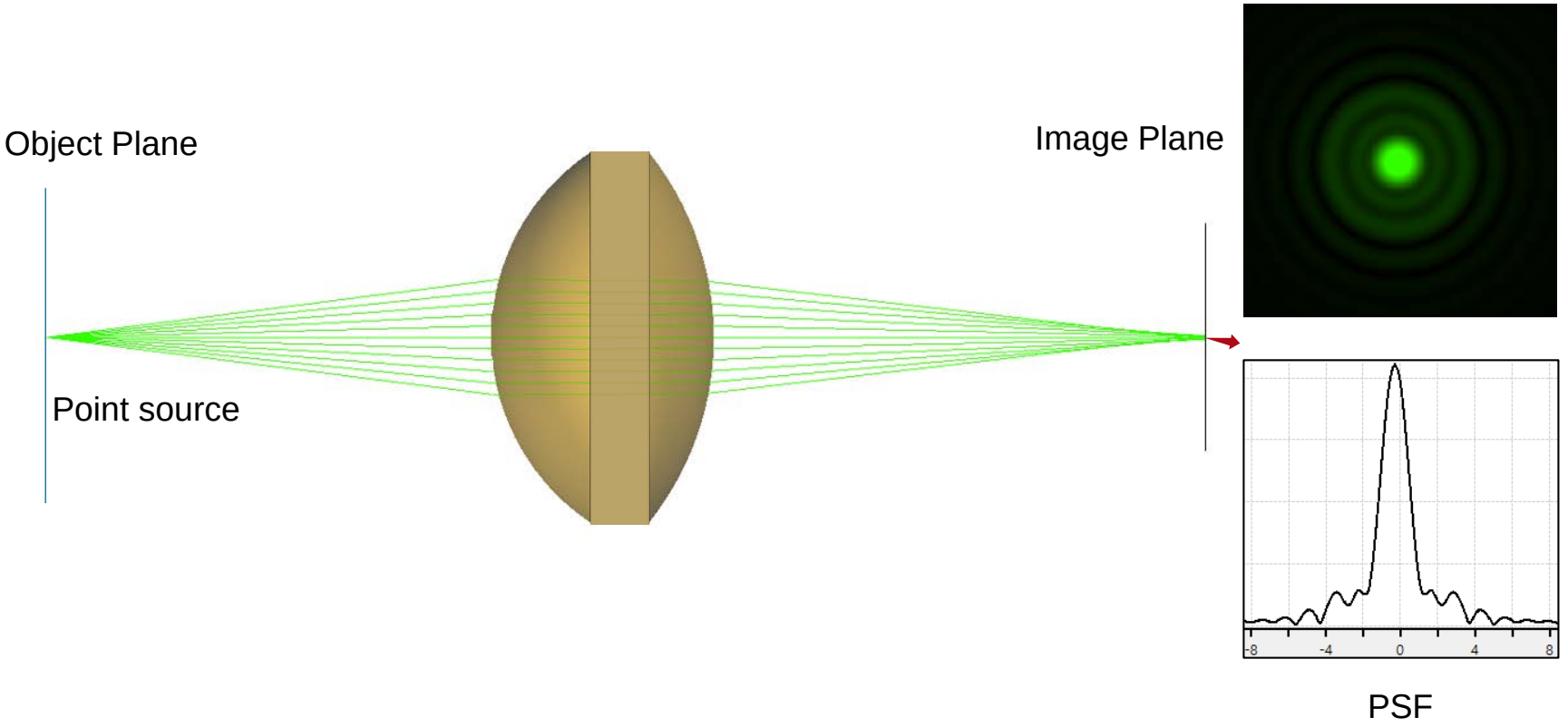
Abstract



Point spread function (PSF) and modulation transfer function (MTF) are important optical quantities to evaluate the quality of an imaging system. Two-dimensional (2D) PSF and MTF are highly required for optical systems of high NA or non-symmetry. In VirtualLab Fusion, PSF and MTF (both 1D and 2D evaluations) for an imaging system can be calculated fast and accurately by using the PSF & MTF detector.

Modeling Task

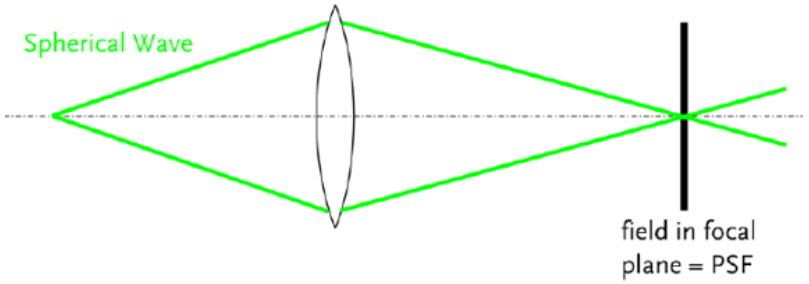
- how to set PSF & MTF detector in VirtualLab Fusion.



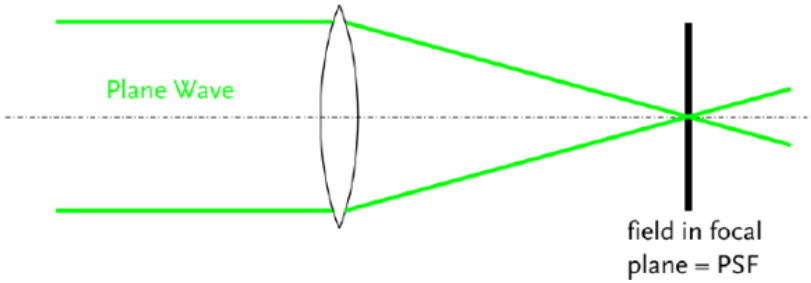
What is PSF and MTF?

- PSF: the **point spread function** is the field in focal / imaging plane of an optical system with a point source.

Optical System for Divergent Light



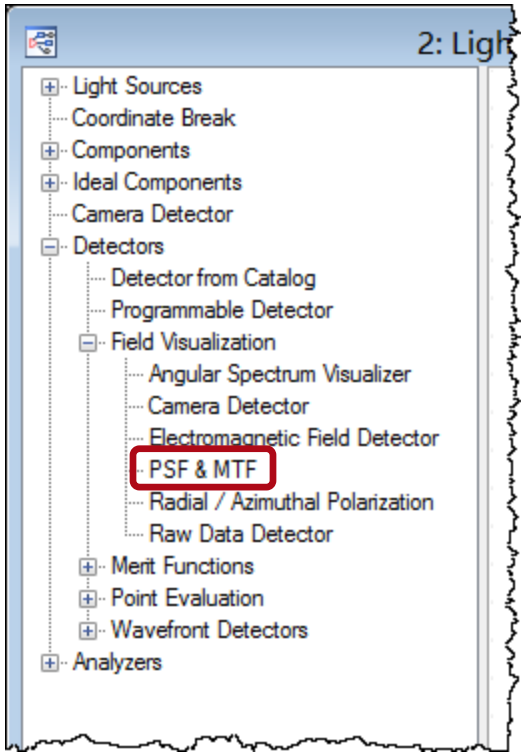
Optical System for Collimated Light



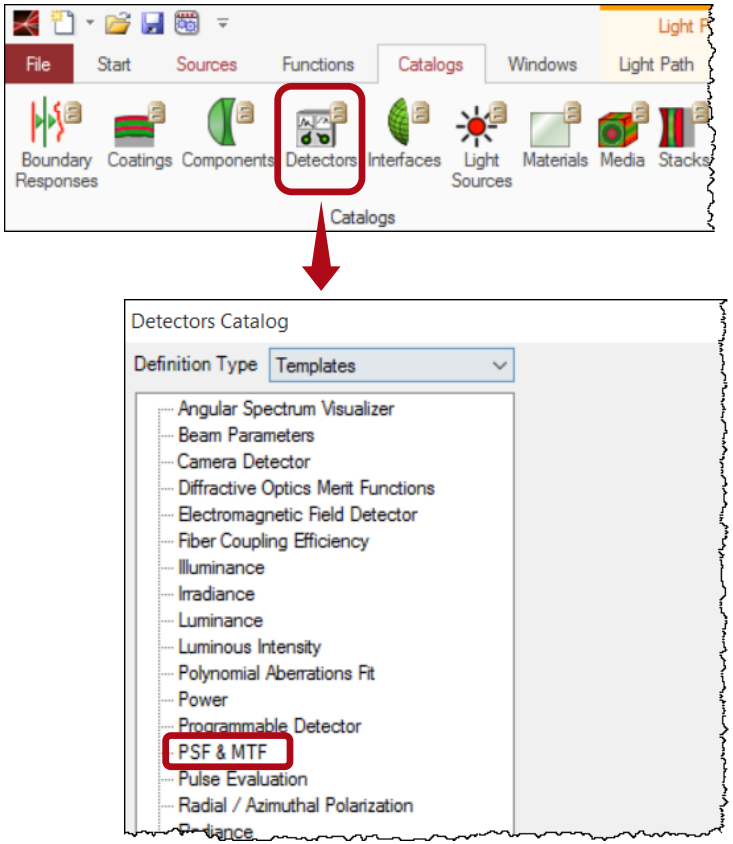
- MTF: the **modulation transfer function**, is defined as the Fourier transform of the point spread function.

Where to find PSF/MTF Detector?

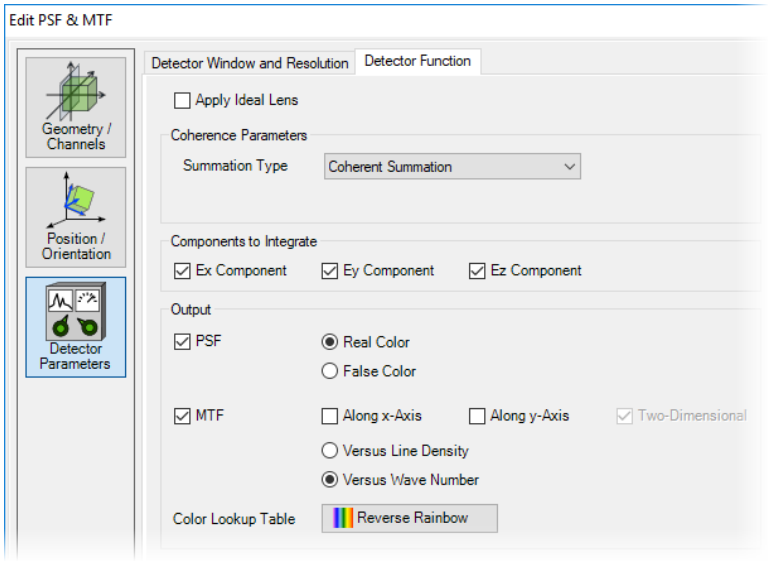
Light Path Diagram



Catalogs ➔ Detectors



Settings of PSF/ MTF Detector



Description

Apply Ideal Lens is an option to calculate the PSF & MTF at the focal plane of an ideal lens (at current position), with a customized focal length.

Coherence Parameters determines how different modes shall be handled.

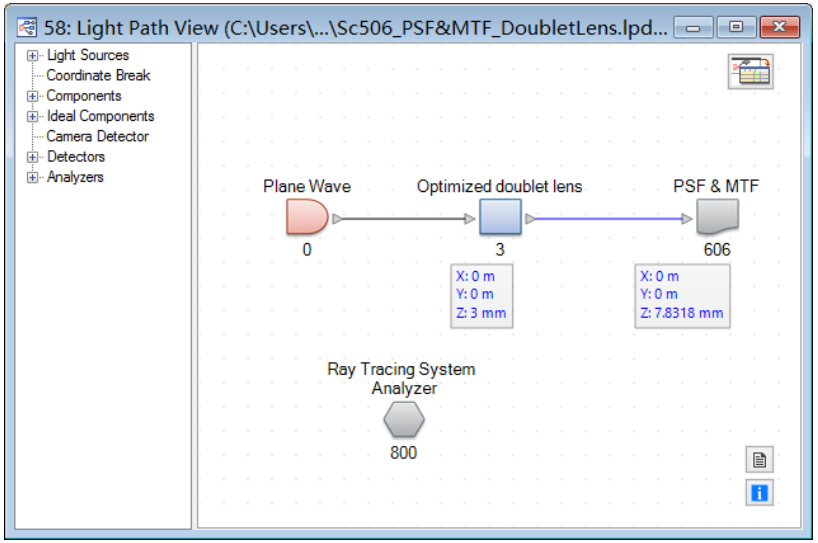
Components to Integrate selects the vectorial field components to display.

Output can be

- PSF displayed in either real color or false color
- One-dimentional (1D) MTF, either along x/y-axis, or/and two-dimensional (2D) MTF, versus either line density or wave number
- selected color lookup table.

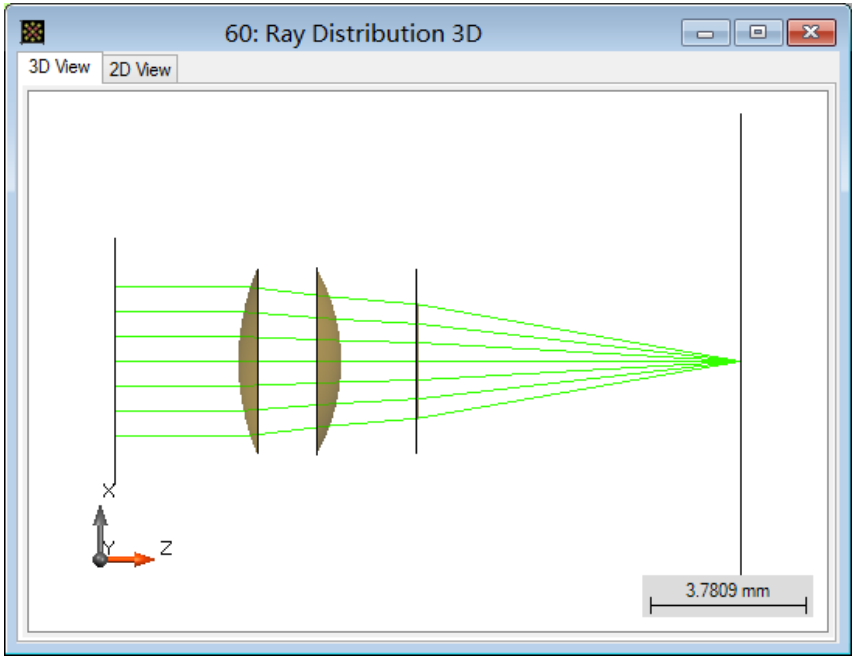
Example

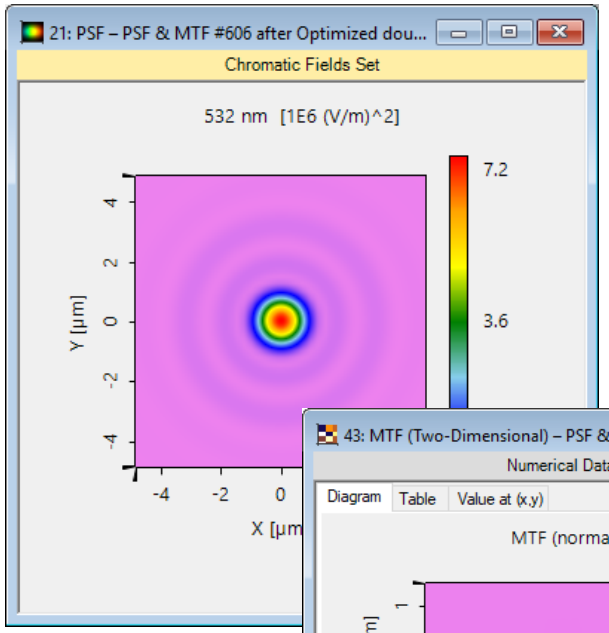
- PSF and MTF is calculated at the focal plane behind a doublet.
- We set the detector as follows
  - not apply an ideal lens
  - different modes are coherently summed
  - E_x, E_y and E_z are displayed
  - PSF is displayed in false color
  - 2D MTF versus wave number is calculated.



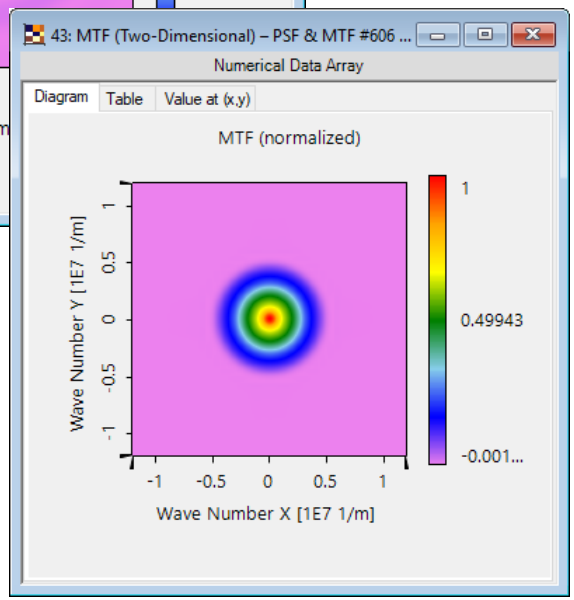
Simulation Results

Ray Tracing System Analyser





PSF obtained by field tracing simulation



MTF obtained by field tracing simulation

Document Information

title	Usage of PSF/ MTF Detector
version	1.0
VL version used for simulations	7.0.3.4
category	Feature Use Case