WYROWSKI PHOTONICS

UseCase.0084 (1.0)

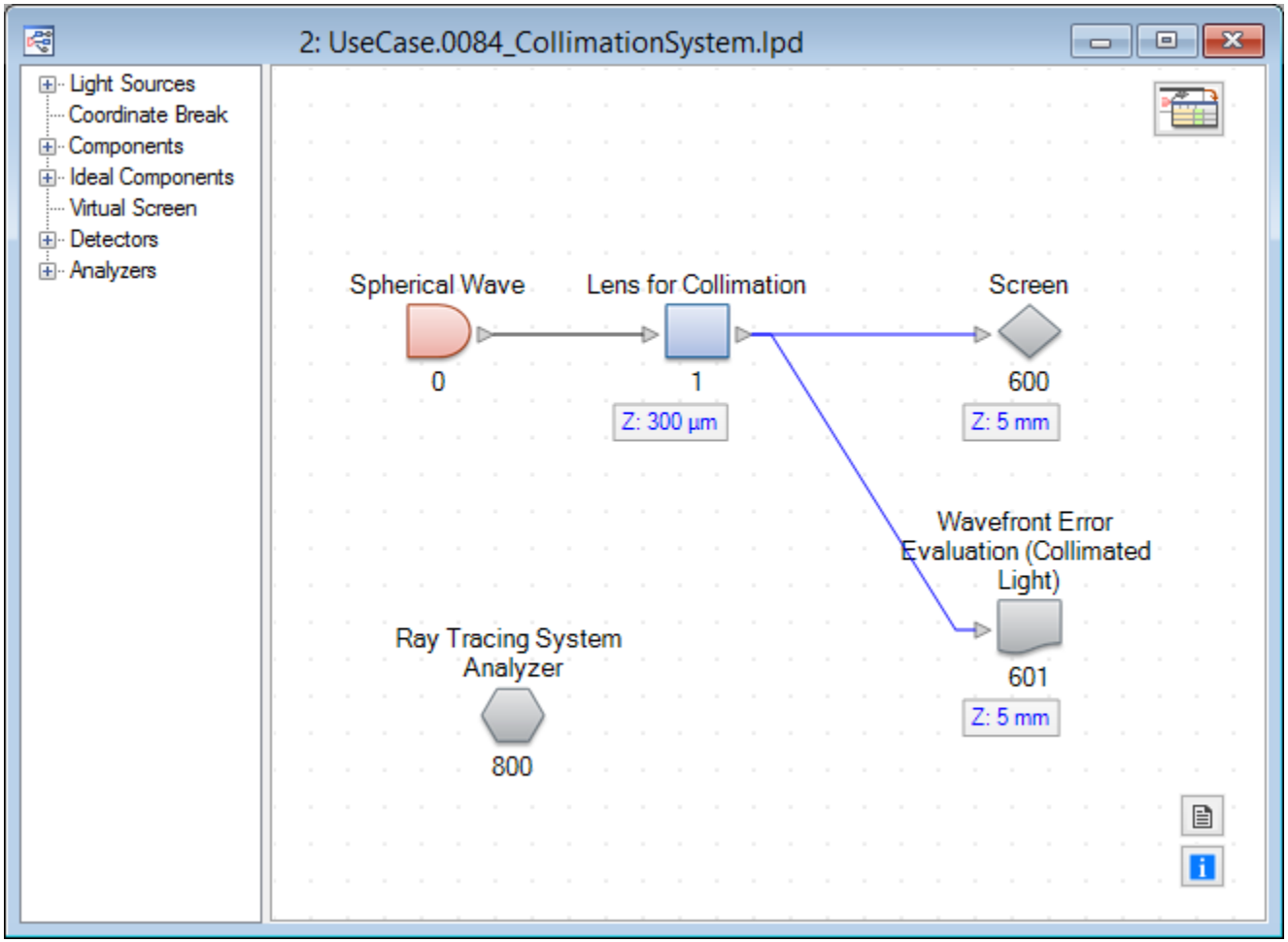
Ray Tracing Analysis of High NA Collimation System

Keywords: ray tracing, wave front error, customized merit functions, collimation, RMS

Description

- This use case demonstrates how the Ray Tracing engine within VirtualLab can be used to evaluate the performance of a collimating lens system with a high numerical aperture.
- The 2D and 3D ray tracing analyses are shown.
- In addition a programmable detector is used to introduce a customized merit function on the ray tracing result.
- The customized detector evaluates the wave front error per ray and also the RMS value of the wave front error for collimated light.

The System

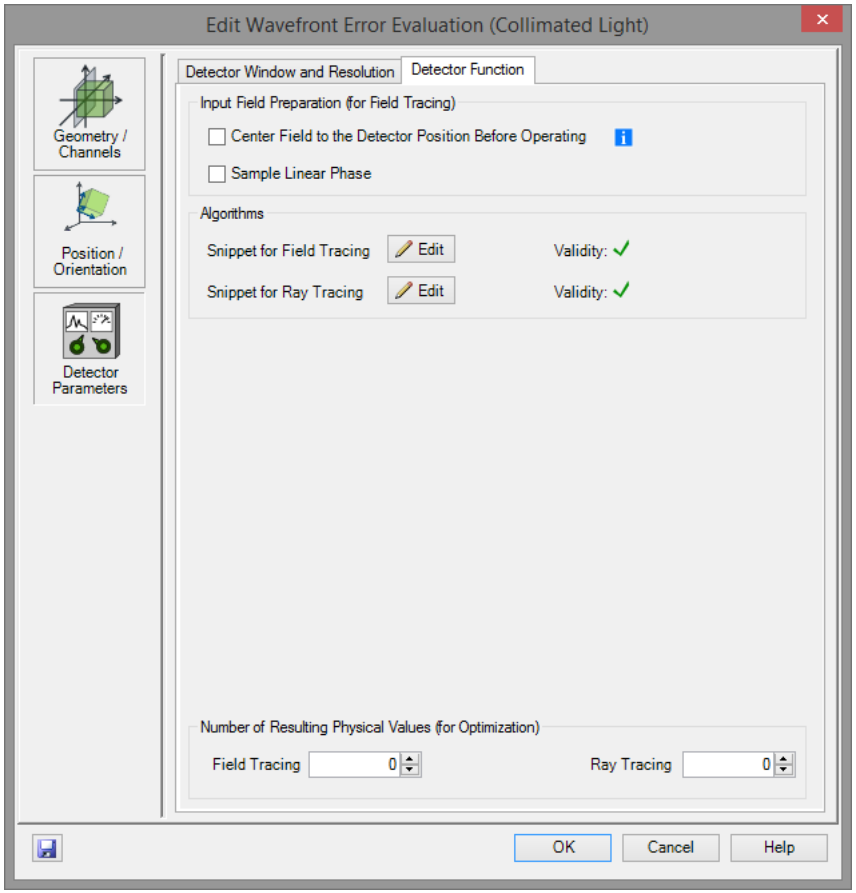


File name: UseCase.0084_CollimationSystem.lpd

System Configuration

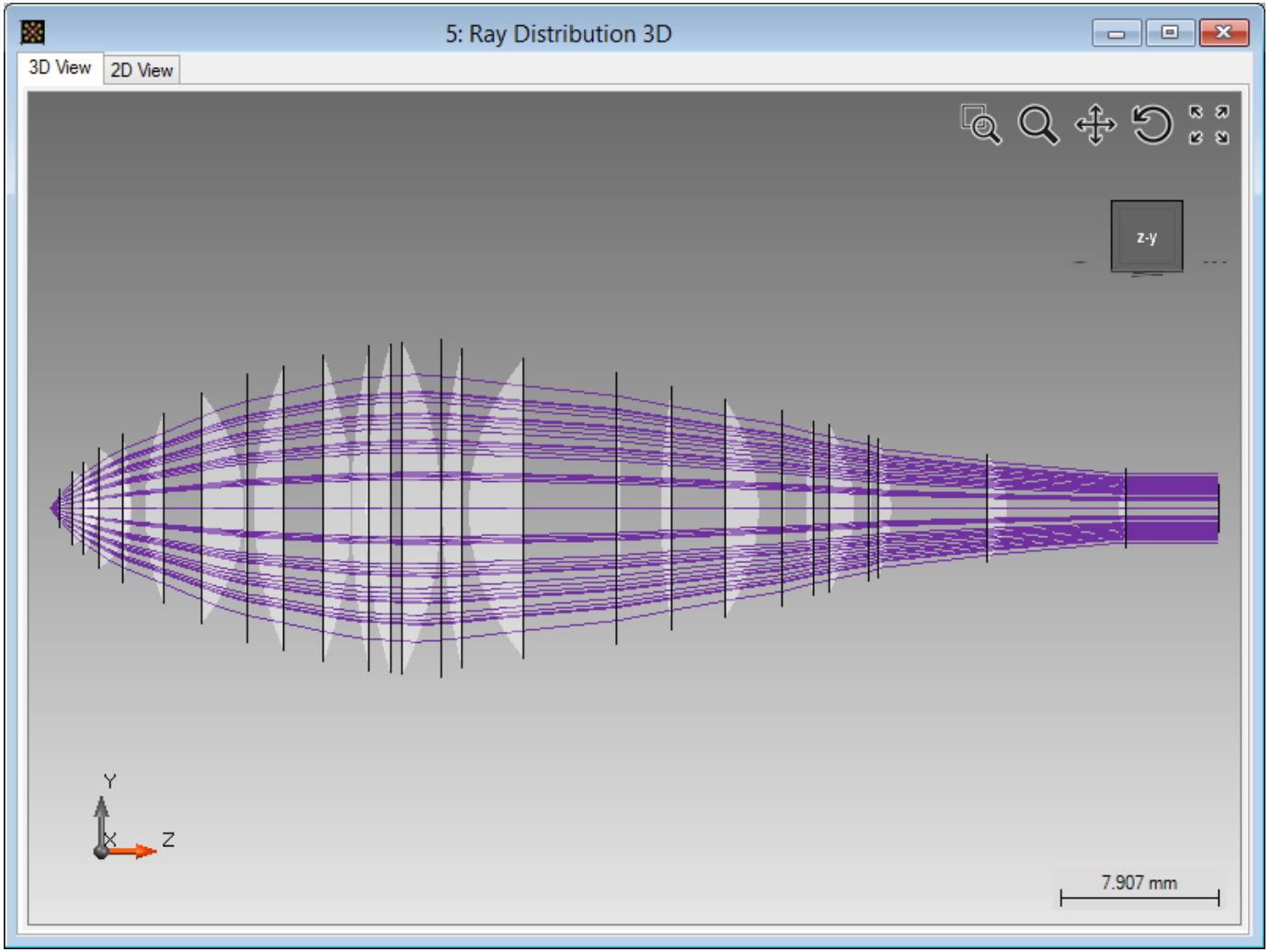
- The system contains a spherical wave which illuminates a lens system that shall be used for collimation.
- The lens system is defined by an Optical Interface Sequence (OIS).
- At a distance of 5mm behind the lens system a virtual screen is placed, as well as a programmable detector.
- The programmable detector allows the definition of customized merit functions for ray and field tracing.
- In this example the ray tracing information (optical path length) is used to calculate the wave front error.
- Currently the detector can be used for collimated light only. This will be improved in the near future.

Edit the Programmable Detector

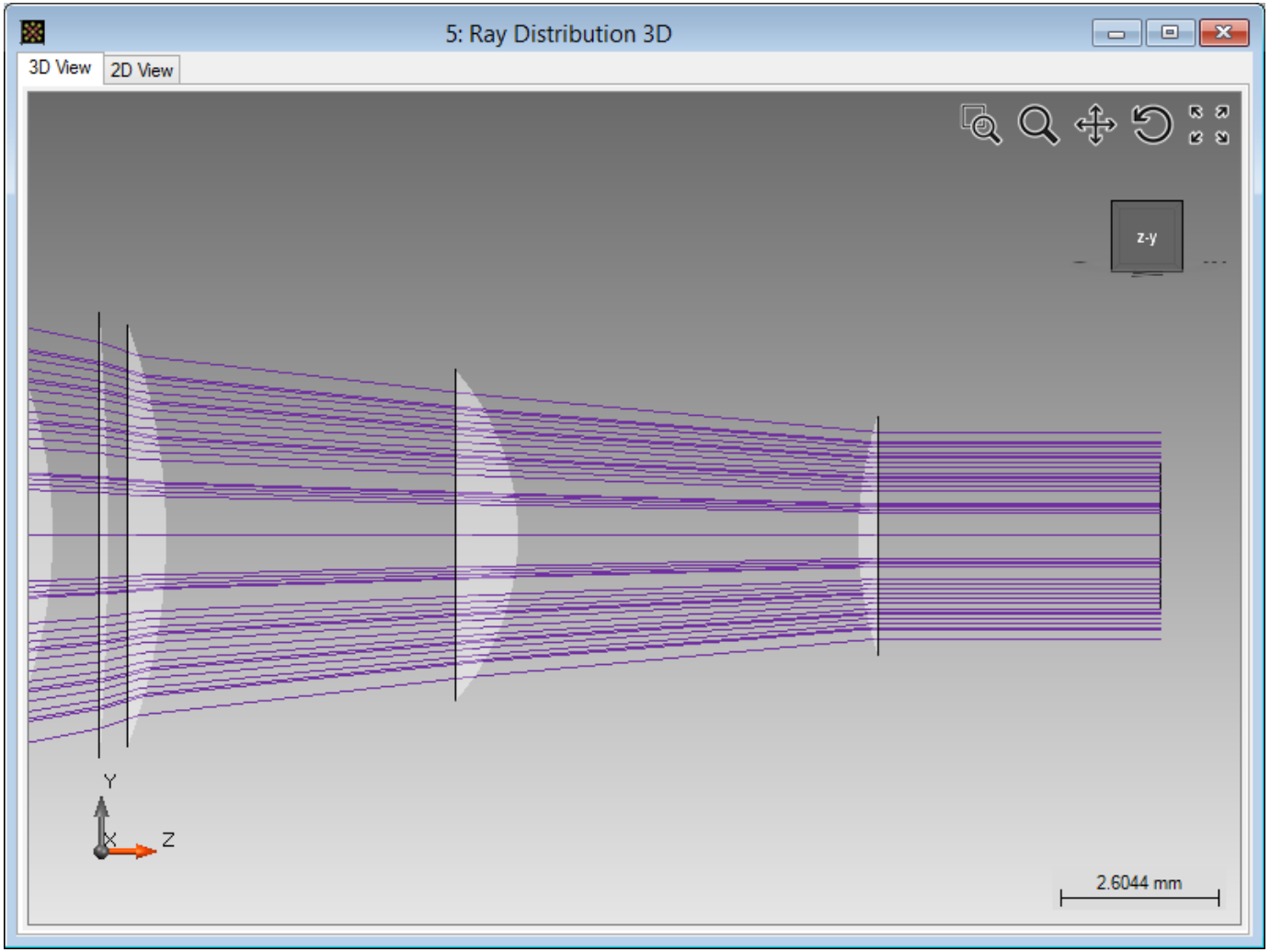


- The edit dialog of the programmable detector allows the user to access the source code of the algorithm used to perform the evaluation of the incident light information.
- In addition global parameters can be accessed here. In this case no global parameters are available.

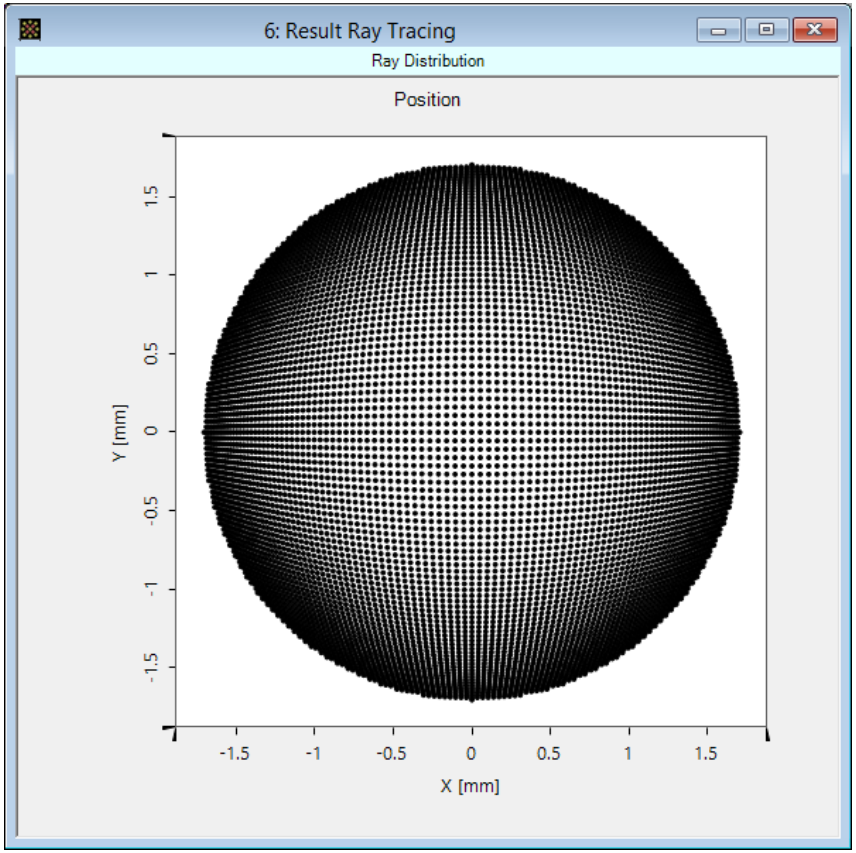
Result Ray Tracing System Analyzer (3D)



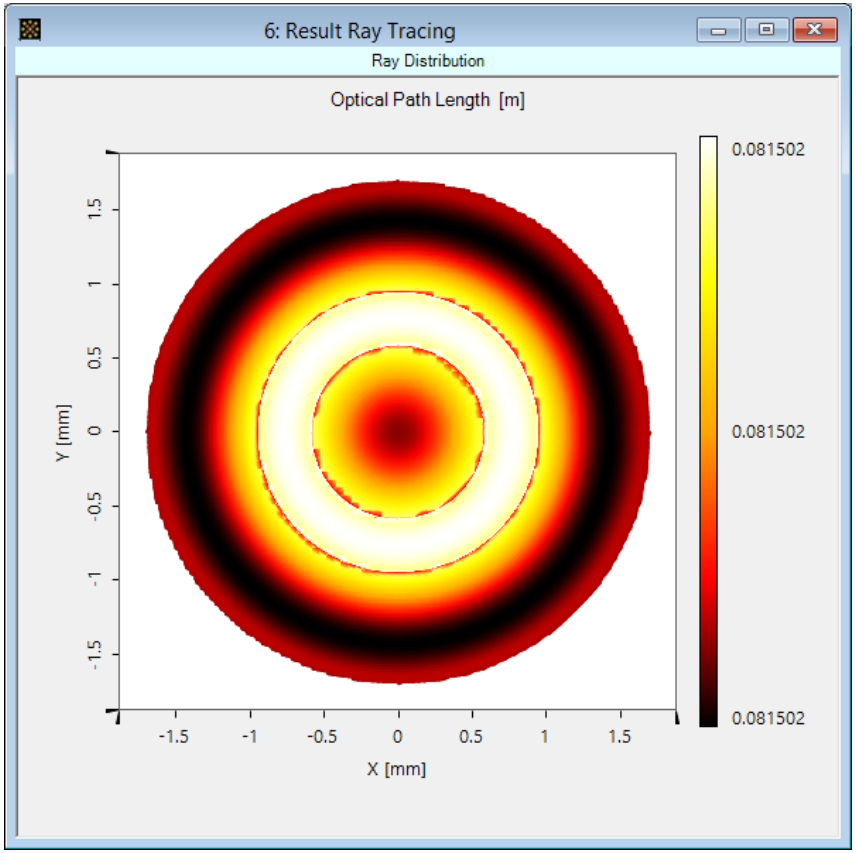
Result Ray Tracing System Analyzer (3D)



Result Ray Tracing (Screen)

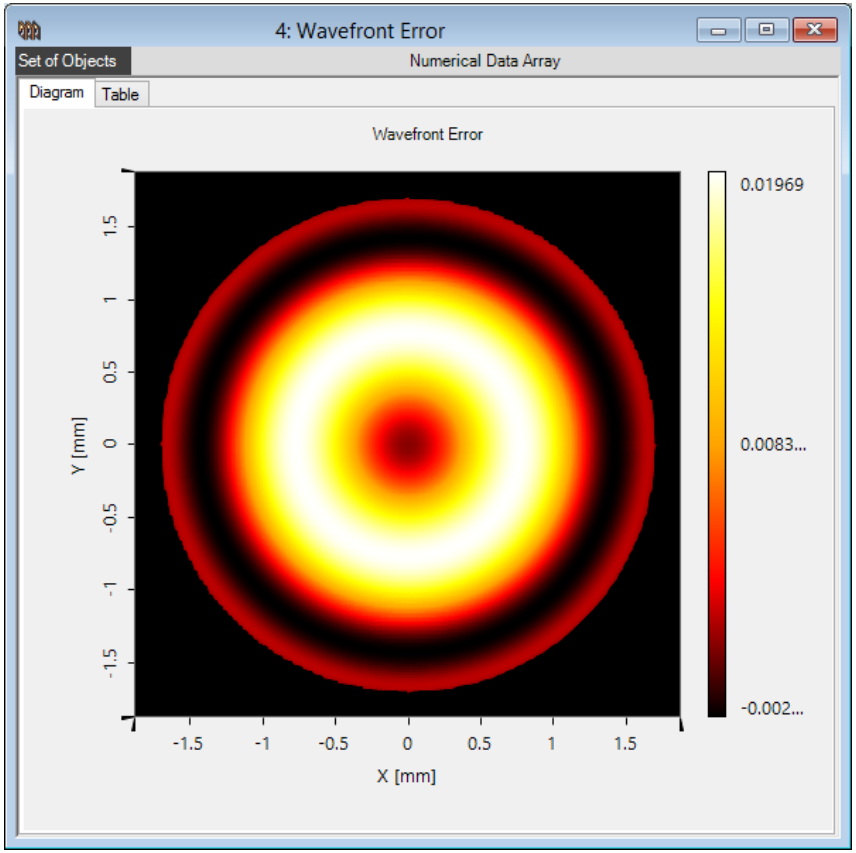


Positions



Optical Path Length

Result Ray Tracing (Wave Front Error Detector)



- The programmable detector calculates a data array which contains the deviation for the OPL with respect to the wavelength.
- In addition the detector calculates the RMS value of the wave front error.
- In the example discussed here we have a RMS value of **0.0077292** (given as a multiple of the wavelength).

Summary

- The use case demonstrates that VirtualLab can be used to analyze complex optical setups.
- It is possible to perform 3D and 2D evaluations with ray tracing.
- The programmable detector allows the user to define customized merit functions. This enable a fast generation of missing (non built-in) detector functions.
- The wave front error and the RMS detection on it will be improved and included as standard (built-in) detectors in the near future.