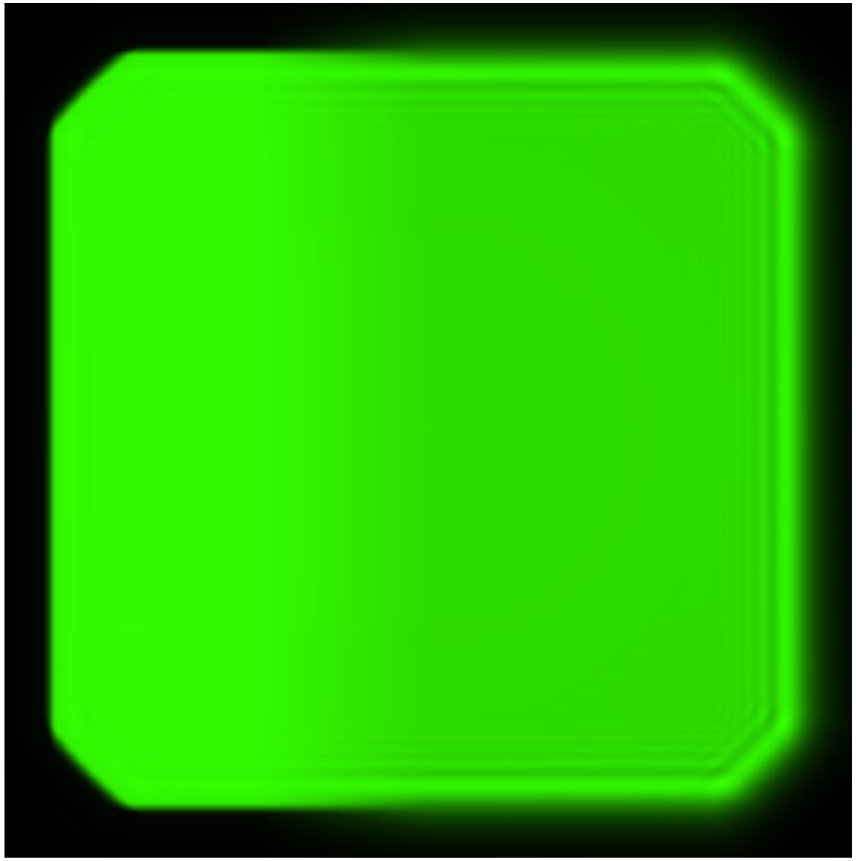
How to Control the Inclusion of Diffraction using Field Tracing

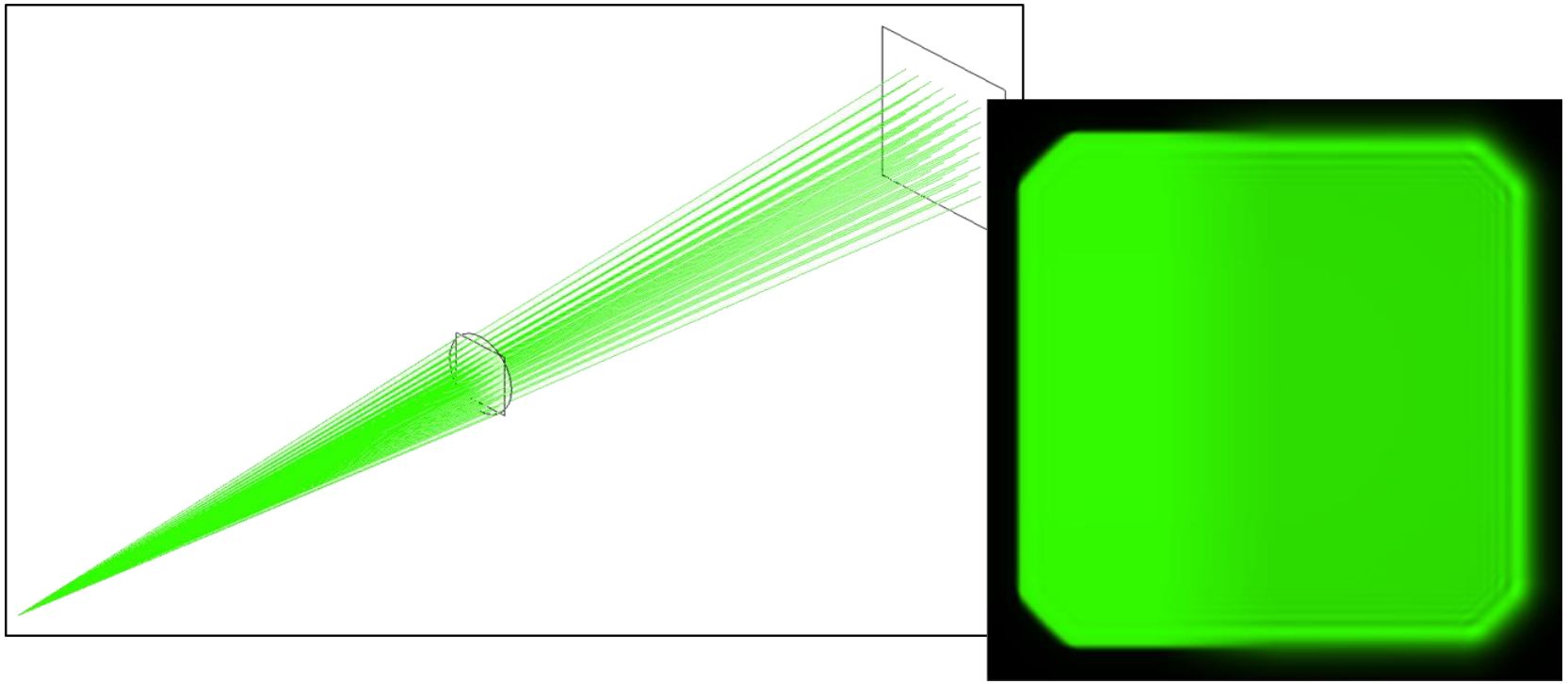
Abstract



VirtualLab Fusion includes a whole range of modelling approaches that allow the user to easily adjust the accuracy level and time of their optical simulations. Not only that, this capacity also facilitates the task of isolating the physical causes of different effect. In this document we present a clear workflow for how to configure a simulation so that diffraction effects are accounted for or disregarded in a physical optics simulation.

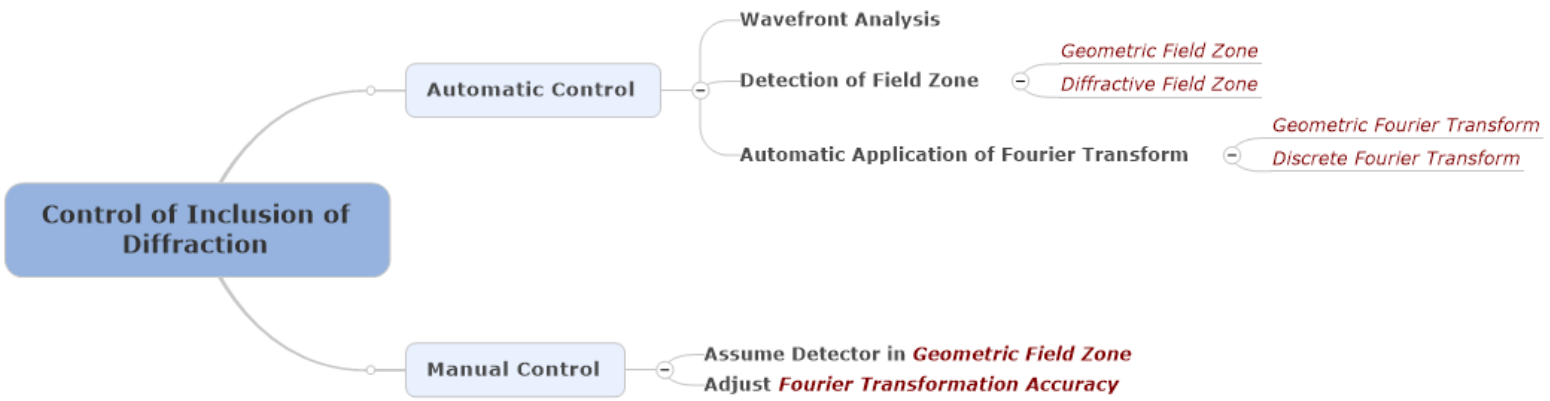
Modeling Task

How to control the inclusion of diffraction in the *Field Tracing 2nd Generation* engine.



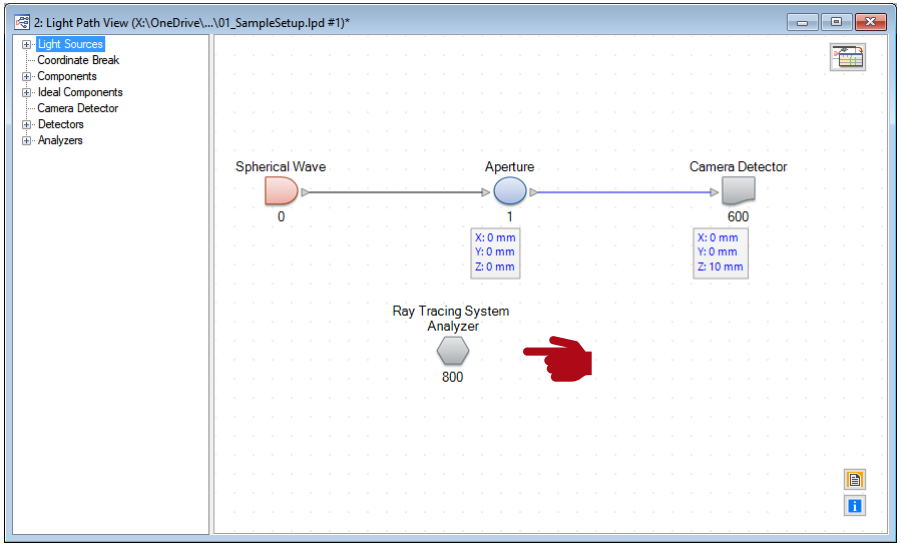
Overview

- A workflow how to control the inclusion of diffraction is shown on a sample setup consisting of a spherical wave, an aperture and a camera detector.
- First, the setup is analyzed by the *Ray Tracing* engine, where in general no diffraction is included.
- Next, the setup is analyzed by the *Field Tracing* engine, where the inclusion of diffraction is in general automatically included but can be controlled by different user settings.



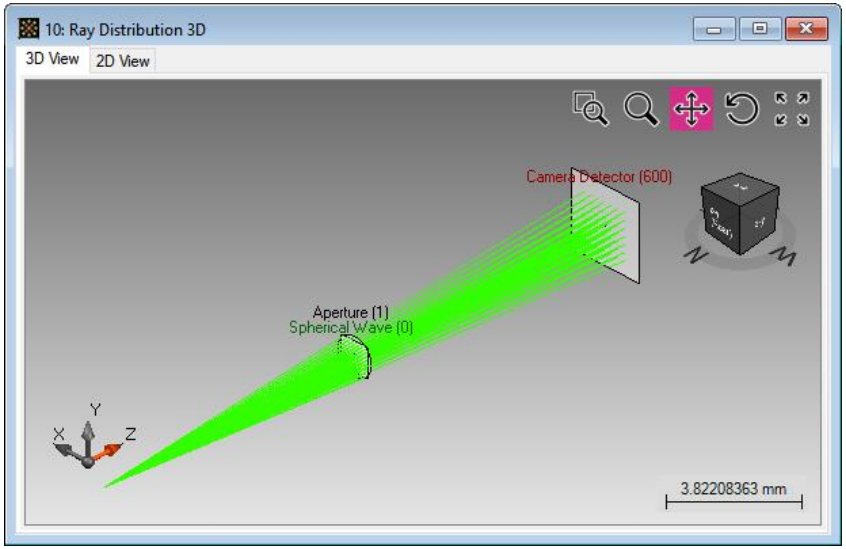
Ray Tracing System Analysis

- Ray Tracing System Analyzer
  - Always start to analyze your system using the *Ray Tracing System Analyzer*



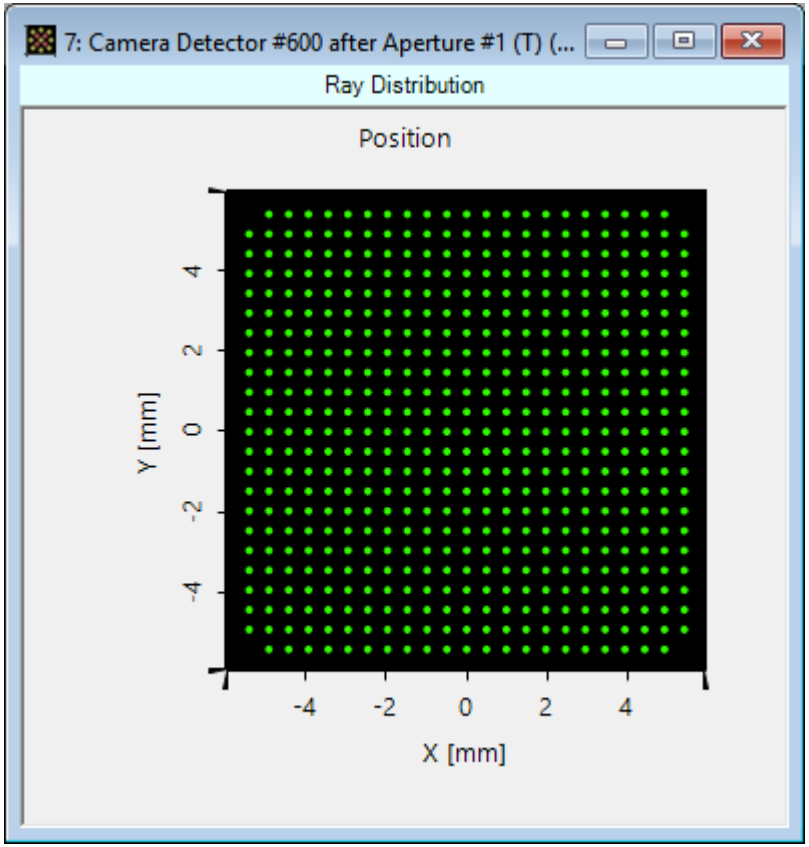
Ray Tracing System Analysis

- Ray Tracing System Analyzer
  - The principle setup to demonstrate the workflow consists of
    - spherical wave with default settings but a *Distance to Input Plane* of *10 mm*
    - rectangular aperture with *Rectangular Aperture* of *1 mm×1 mm*
    - camera detector with default settings



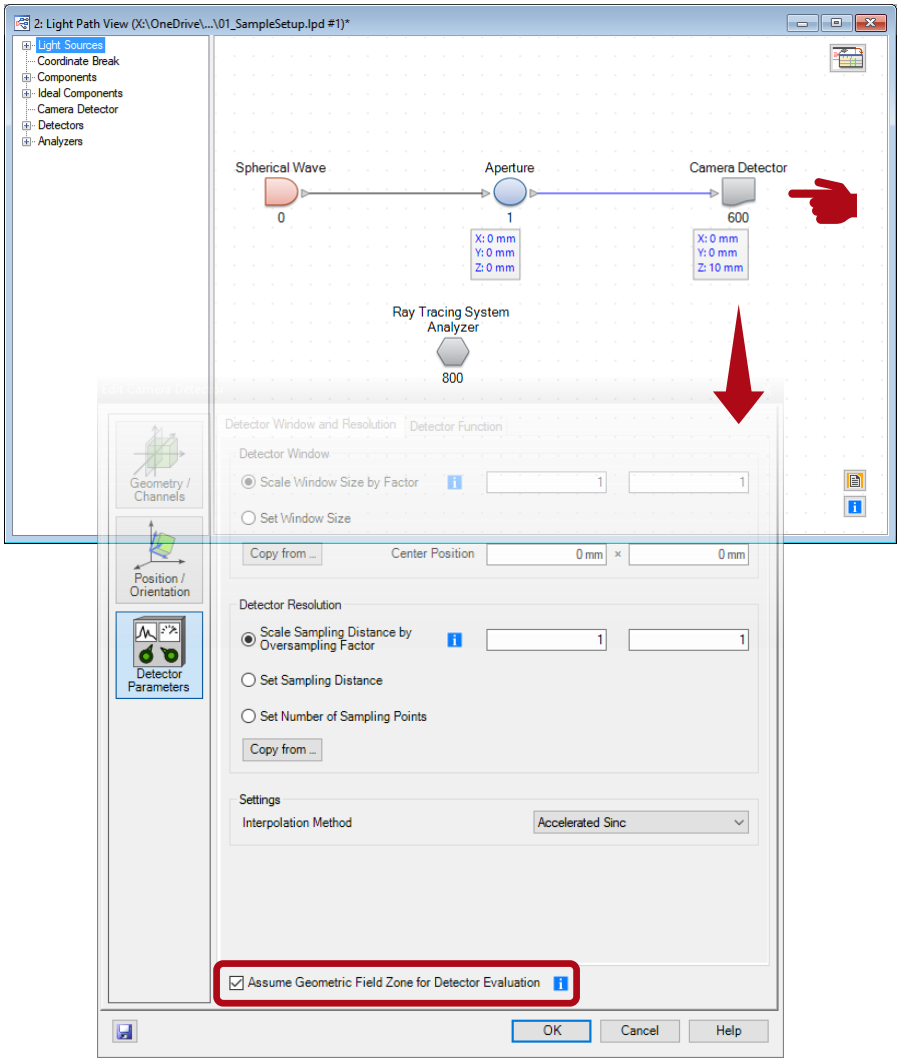
Ray Tracing System Analysis

- Ray Tracing Engine
  - Next, the *Ray Tracing* engine should be used to inspect the output at the detector without any inclusion of diffraction effects.



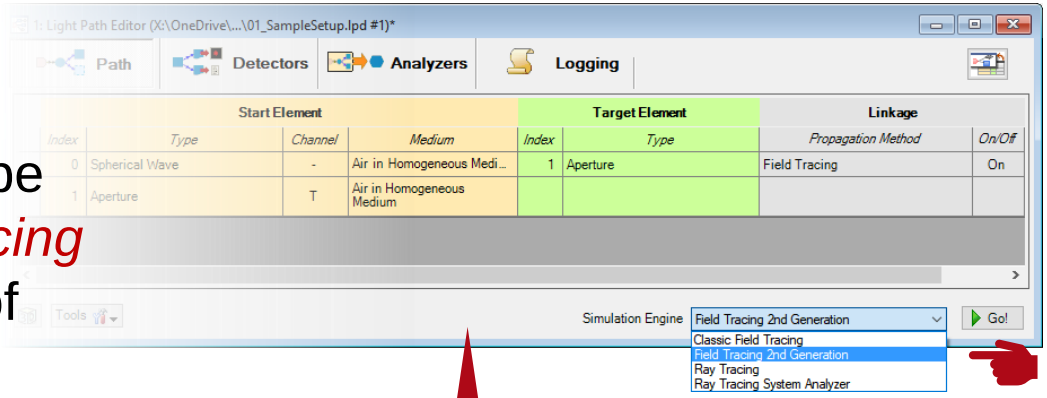
Field Tracing System Analysis

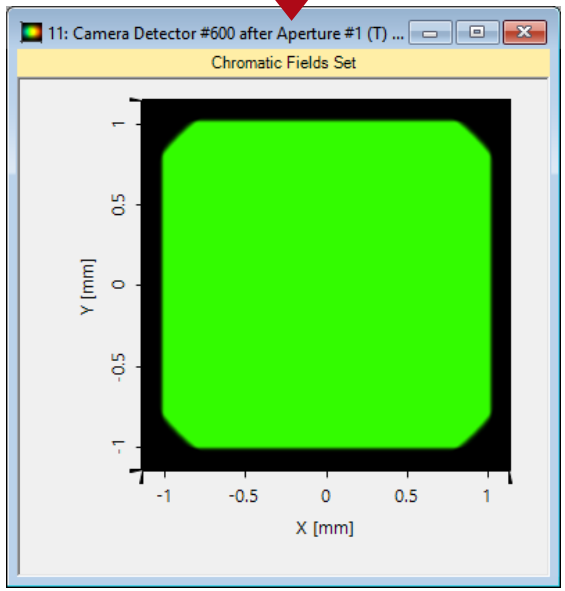
- Field Tracing 2nd Generation
  - Now, the system can be analyzed by *Field Tracing* without the inclusion of diffraction.
  - This must be set in the detector settings by activating the Check box *Assume Geometric Field Zone for Detector Evaluation*.



Field Tracing System Analysis

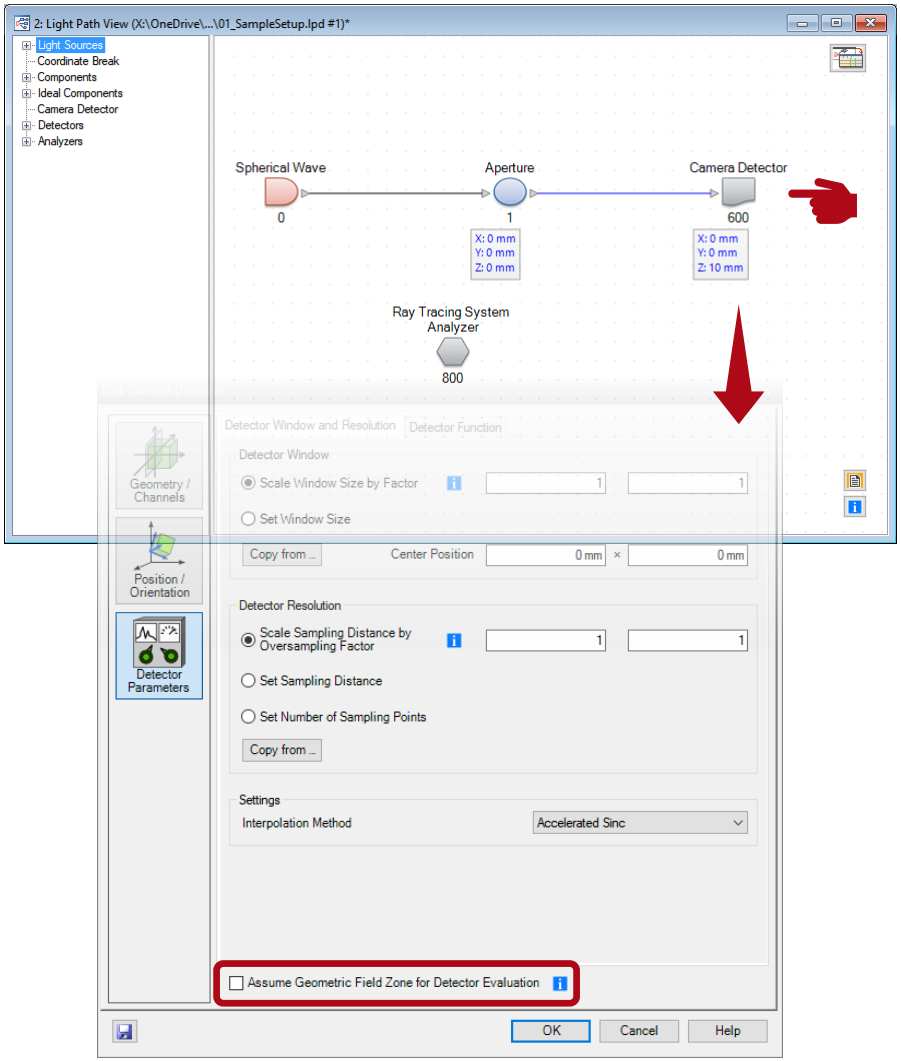
- Field Tracing 2nd Generation
  - Now, the system can be analyzed by *Field Tracing* without the inclusion of diffraction.
  - As a result the intensity pattern at the detector does not show any diffraction effects.





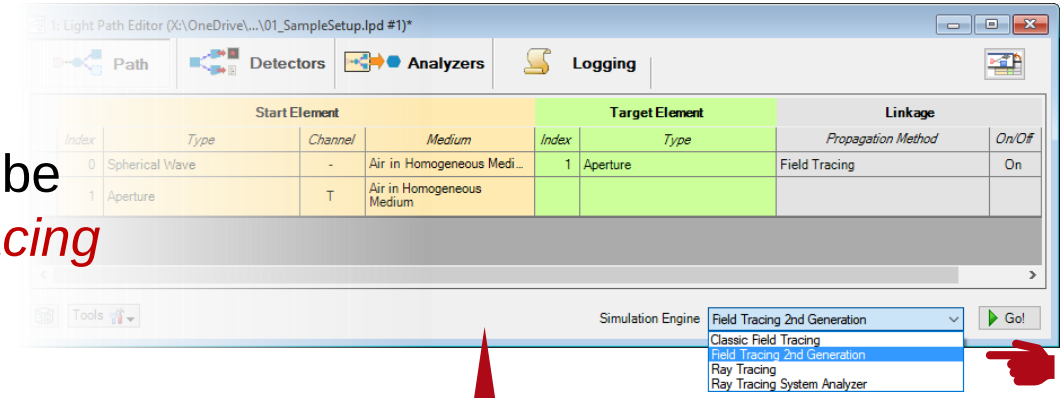
Field Tracing System Analysis

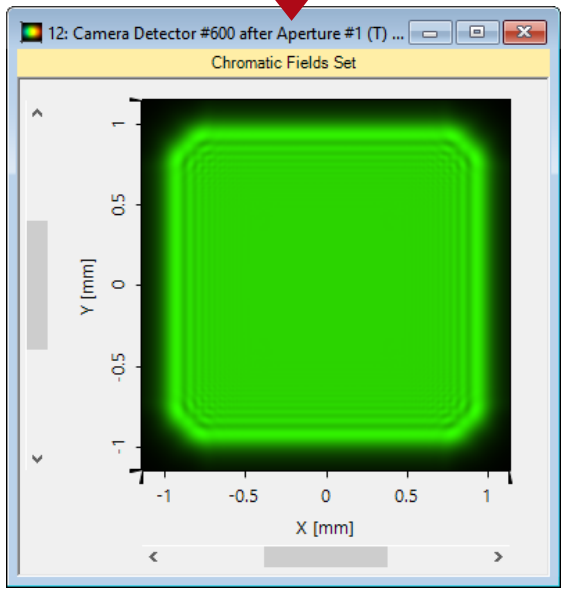
- Field Tracing 2nd Generation
  - Now, the system can be analyzed by *Field Tracing* with the inclusion of diffraction.
  - This must be set in the detector settings by disabling the Check box *Assume Geometric Field Zone for Detector Evaluation*.



Field Tracing System Analysis

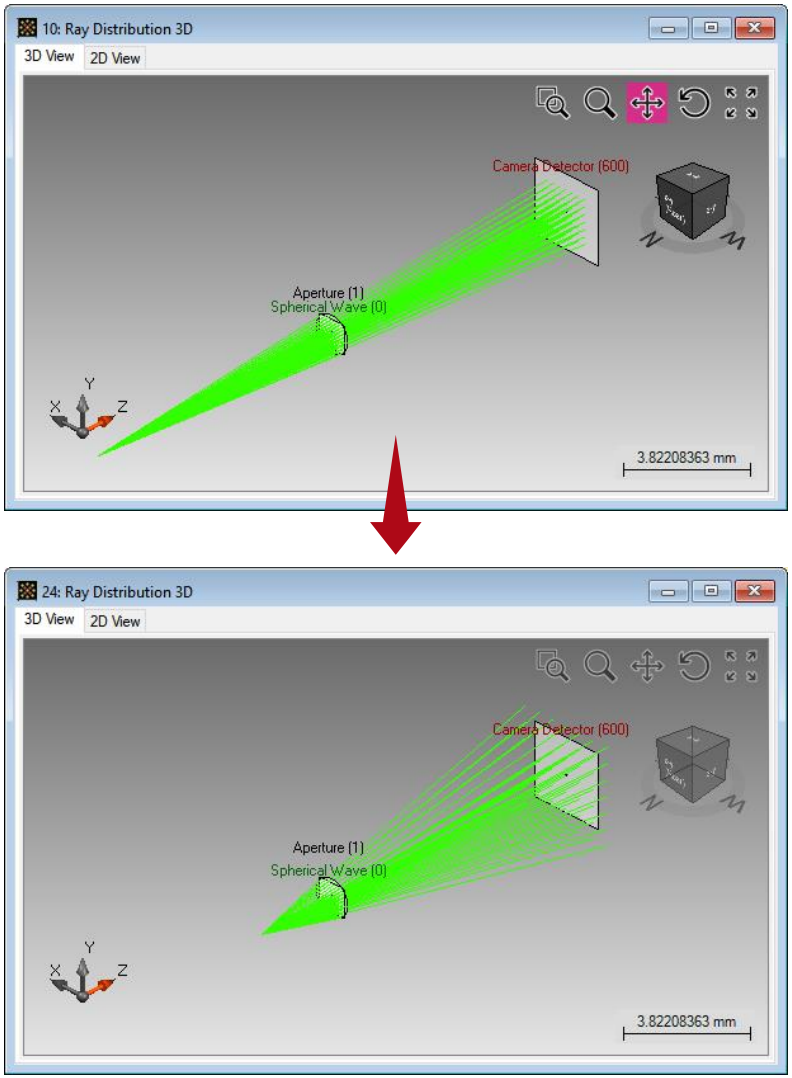
- Field Tracing 2nd Generation
  - Now, the system can be analyzed by *Field Tracing* with the inclusion of diffraction.
  - In VirtualLab the need of including diffraction is automatically determined by the engine.
  - As a result the intensity pattern at the detector shows diffraction effects.





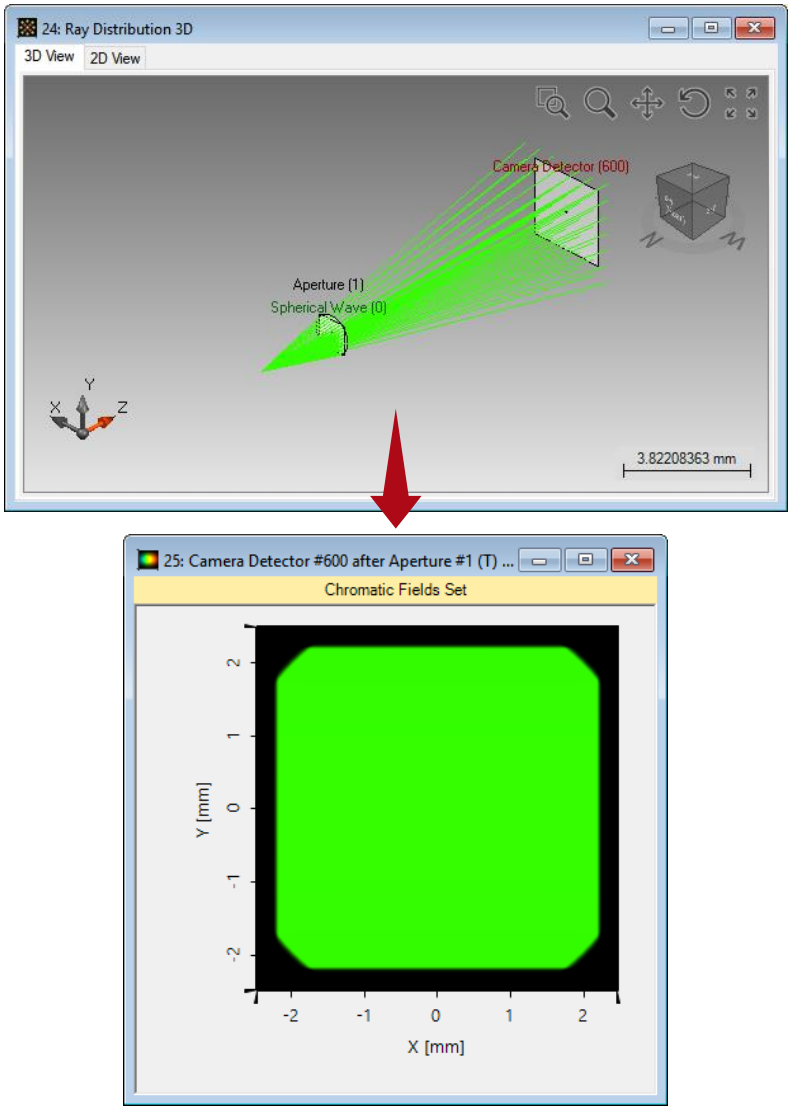
Field Tracing System Analysis

- Field Tracing 2nd Generation
  - In the example the impact of the diffraction can be reduced by decreasing the distance of the spherical wave to the aperture.
  - Hence, the *Distance to Input Plane* of the spherical wave is reduced to *3mm*.



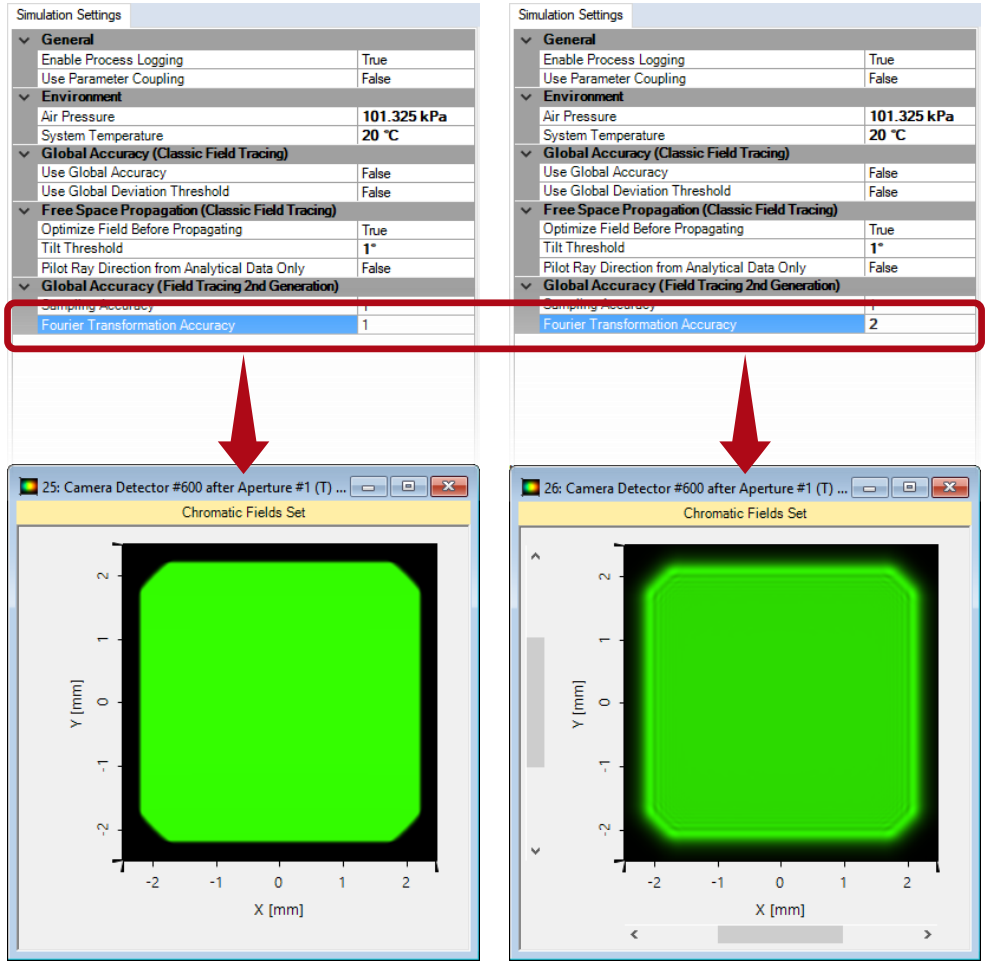
Field Tracing System Analysis

- Field Tracing 2nd Generation
  - In the example the impact of the diffraction can be reduced by decreasing the distance of the spherical wave to the aperture.
  - At a certain point the Field Tracing engine switches to a pure geometric evaluation of the intensity pattern without taking diffraction into account.



Field Tracing System Analysis

- Field Tracing 2nd Generation
  - The inclusion of diffraction can be added again by increasing the *Fourier Transformation Accuracy* in the simulation settings of the *Field Tracing 2nd Generation* engine.



Document Information

title	How to Control the Inclusion of Diffraction using Field Tracing
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category	Feature Use Case