

UseCase.0077 (1.0)

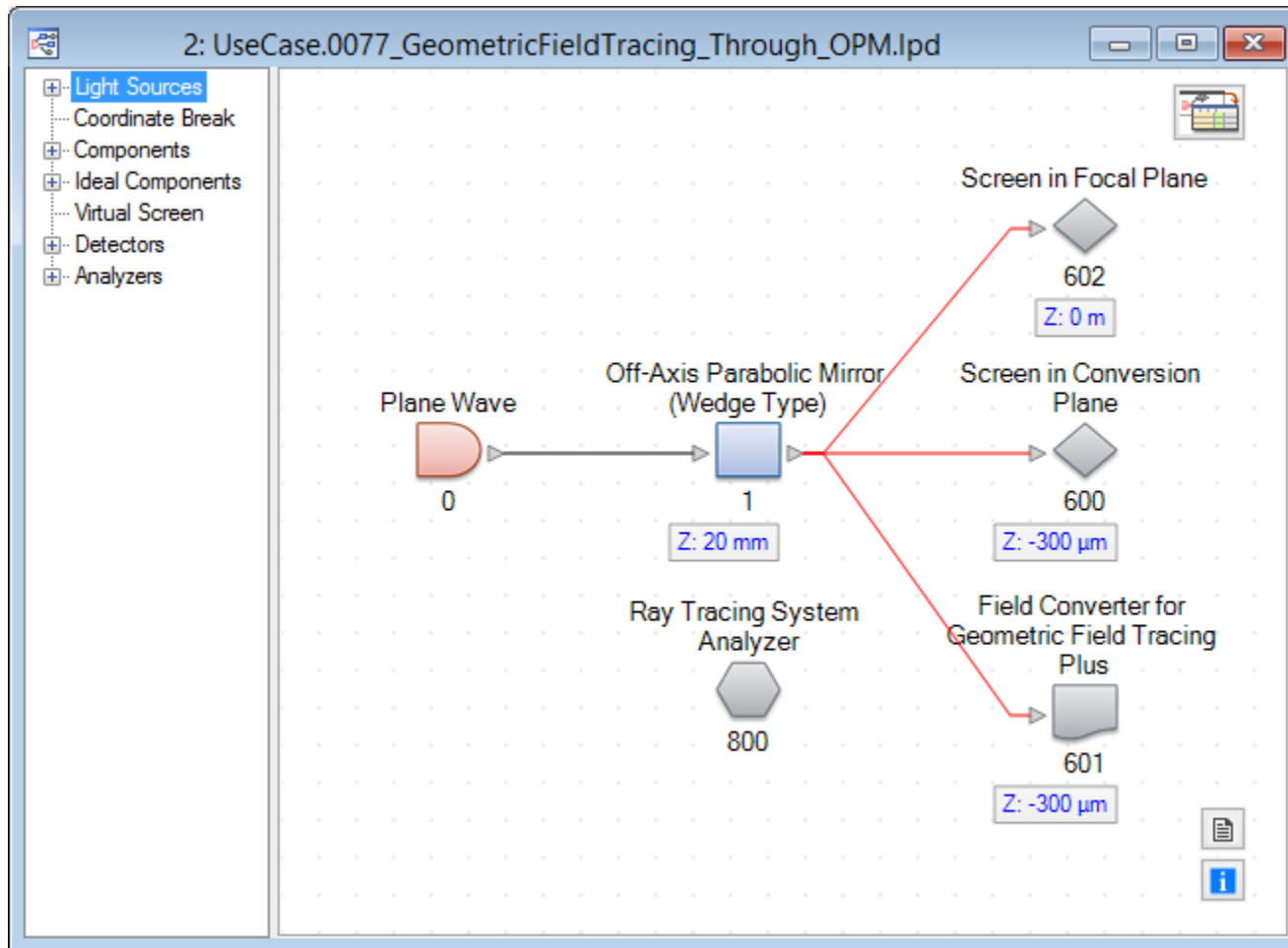
Geometric Field Tracing through an Off-Axis Parabolic Mirror

Keywords: focus, geometric field tracing, diffractive field tracing

Description

- This use case explains the usage of the Geometric Field Tracing Plus engine and shows how to get access to the electromagnetic field information of the propagated field in a detector plane.
- The Geometric Field Tracing engine is used to calculate the field in short distance before the focus.
- The result of the Geometric Field Tracing engine is converted into a harmonic field.
- The harmonic field is propagated by a diffractive propagation (rigorous SPW operator) step into the focus.

The System



Filename: UseCase.0077_GeometricFieldTracing_Through_OPM.Ipd

System Configuration

- The system contains a plane wave light source which has a diameter of 12mm x 12mm.
- The light source is monochromatic and has a defined wavelength of 532nm.
- The off-axis parabolic mirror is placed 20mm after the source.
- The mirror works in 90° deflection angle, has a focal length of 20mm and a diameter of 20mm x 20mm.
- Within the edit dialog of the mirror a special reference point (in the focal point) for positioning on the reflection channel is selected.



Geometry/Channel of the Mirror

Edit Off-Axis Parabolic Mirror (Wedge Type)

Internal Coordinate System | **Reference Points** | Optical Channels

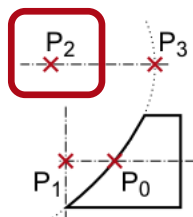


Diagram illustrating the geometry of an off-axis parabolic mirror. The diagram shows the mirror's profile and its internal coordinate system. Reference points are marked: P_0 (Parabola Vertex), P_1 (Maximum Extension Plane), P_2 (Focal Point), and P_3 (Surface Center). P_2 is highlighted with a red box.

Index	Description
0	Surface Center
1	Maximum Extension Plane
2	Focal Point
3	Parabola Vertex

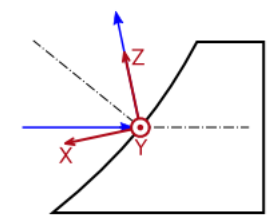
OK Cancel Help

Edit Off-Axis Parabolic Mirror (Wedge Type)

Internal Coordinate System | Reference Points | **Optical Channels**

Channel to Show: R

Axis Direction and Orientation



Default Position of Channel's Coordinate System

The direction of the Reflection Axis is calculated from the direction of the Input Axis using the law of reflection. Thus it is rotated by the Off-Axis Angle relative to the Input Axis. The associated coordinate system is rotated to the Internal Coordinate System accordingly. Initially, its origin is located at the front vertex.

Origin (Reference Point): Focal Point

Homogeneous Channel Medium

Standard Air in Homogeneous Medium

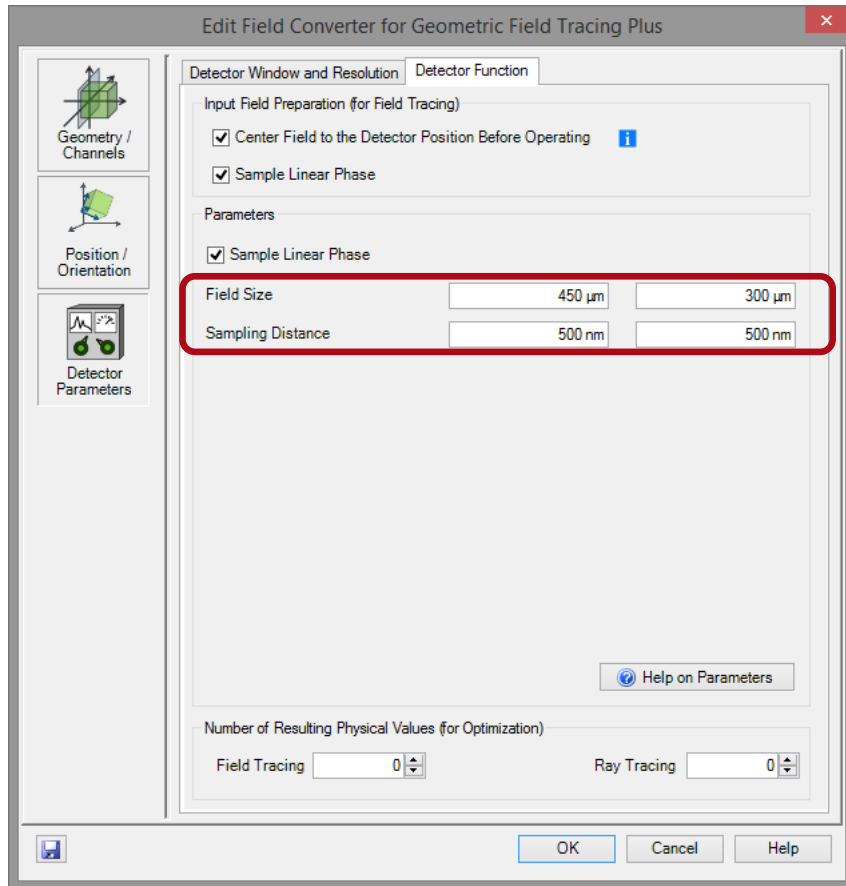
Load Edit View

OK Cancel Help

System Configuration

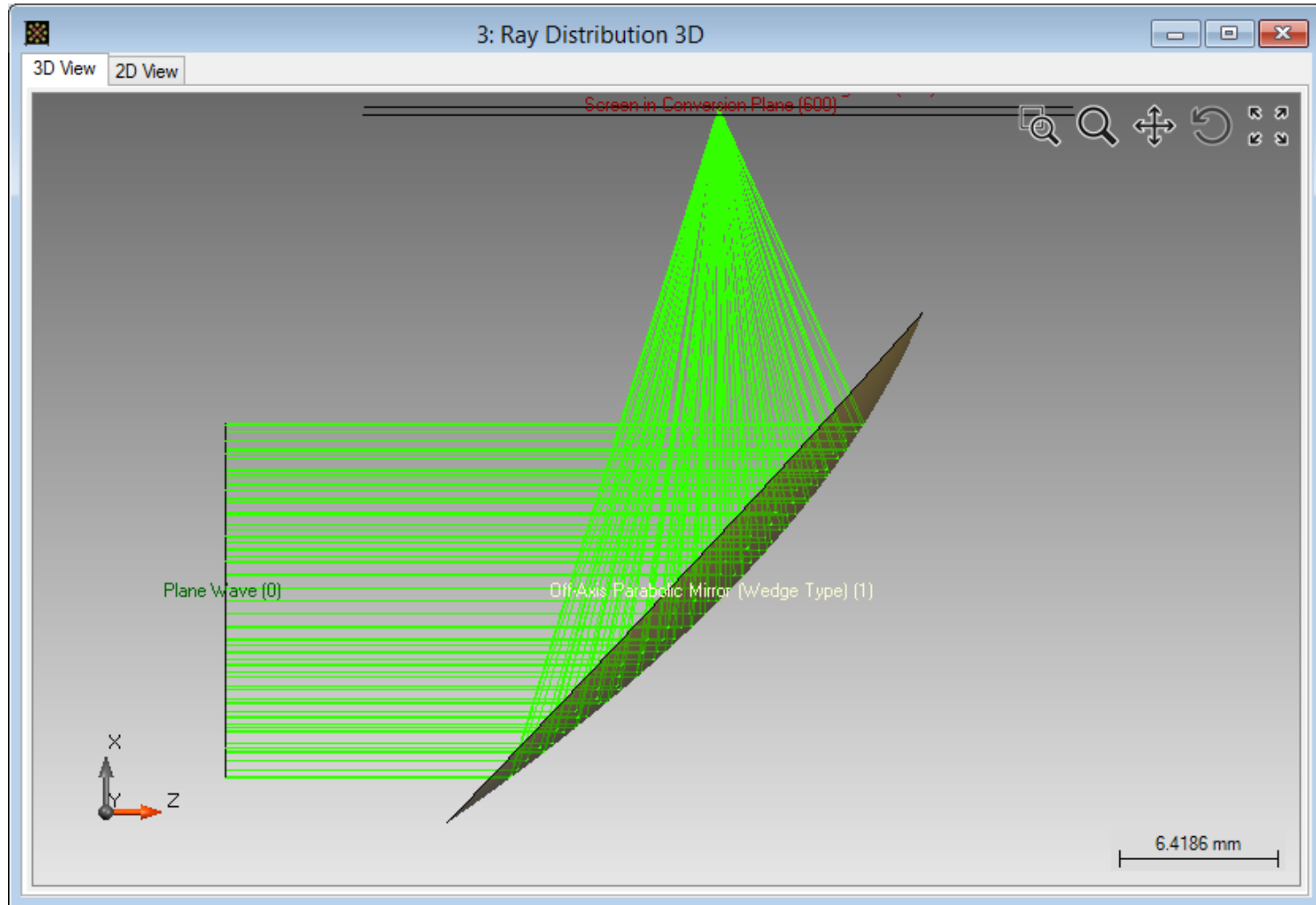
- By this positioning specification the detectors are now positioned relatively to the focal plane.
- Within the optical setup we use three detectors:
 - Virtual Screen (in focal plane)
 - Virtual Screen (300 μ m before the focal plane → conversion plane)
 - Field Converter for Geometric Field Tracing Plus (300 μ m before the focal plane → conversion plane)
- The converter is part of the User Experience Program. It is not yet available as integrated component.
- **The combination of geometrical and diffractive field tracing techniques will be automatized soon. This is part of the User Experience Program.**

Edit Options of the Converter

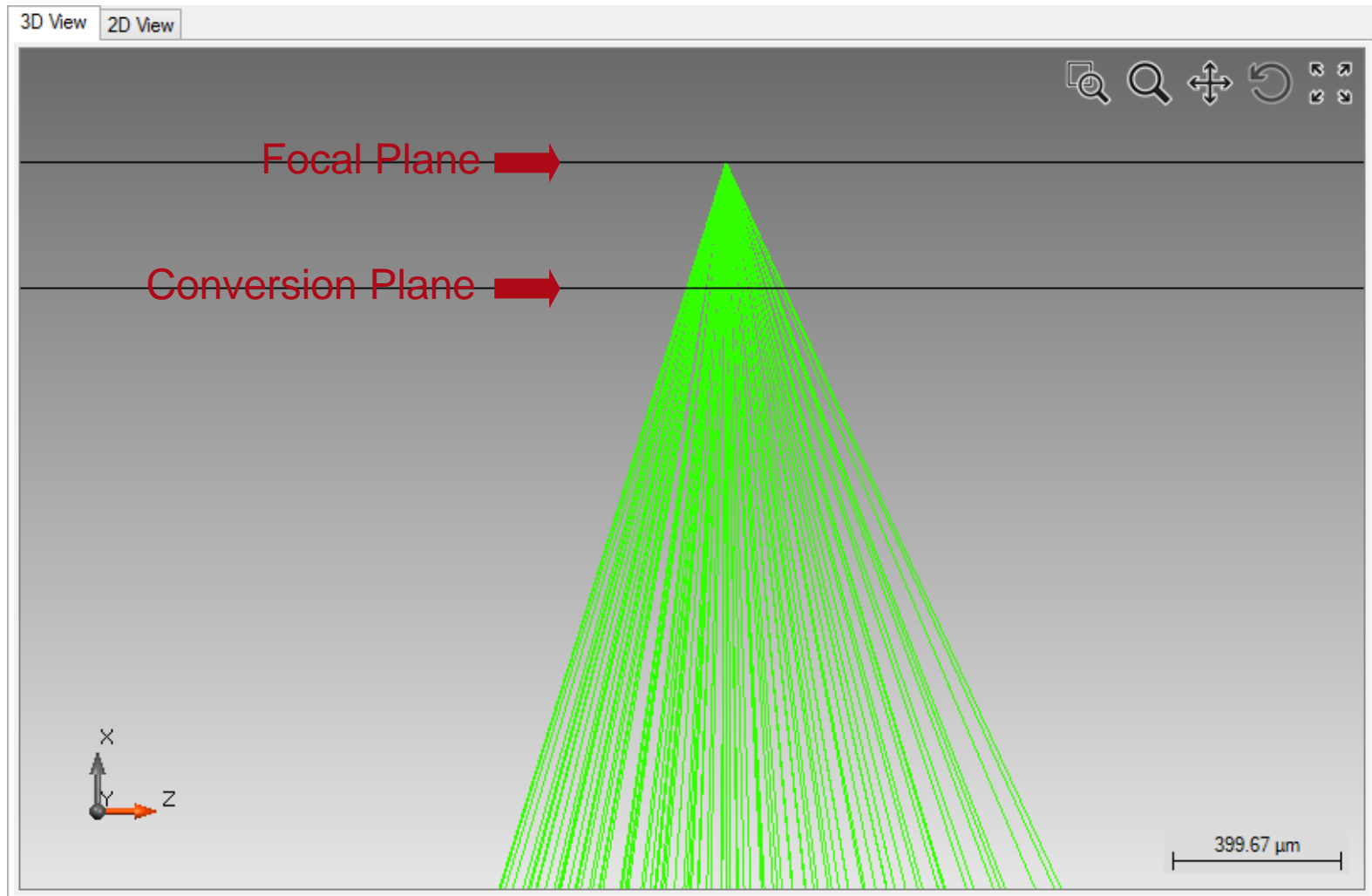


- On the left side the edit dialog of the field converter is shown.
- The user can enter
 - Field Size
 - Sampling Distance
- These parameters will be used for conversion.
- These functions will be automated soon.

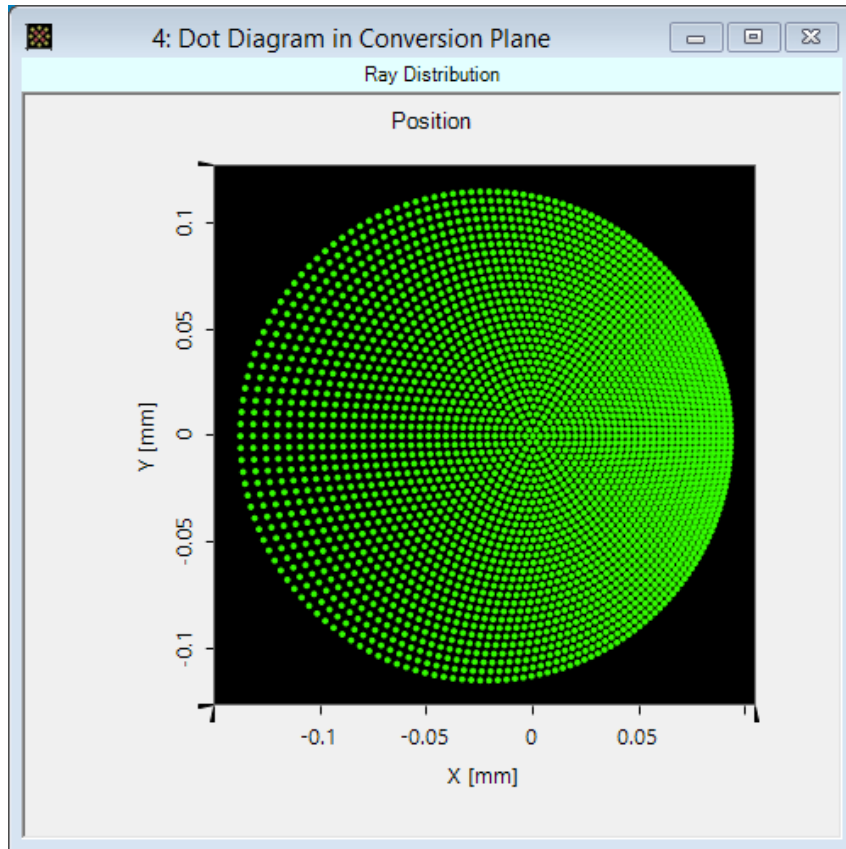
Simulation Result Ray Tracing System Analyzer



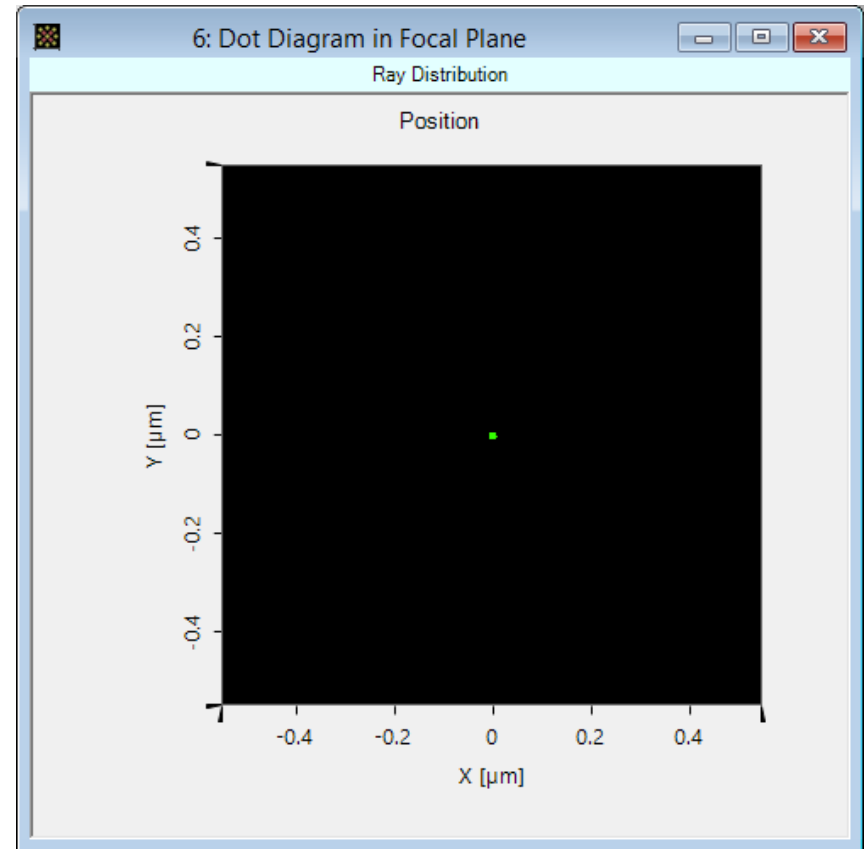
Simulation Result Ray Tracing System Analyzer



Result of Ray Tracing Engine

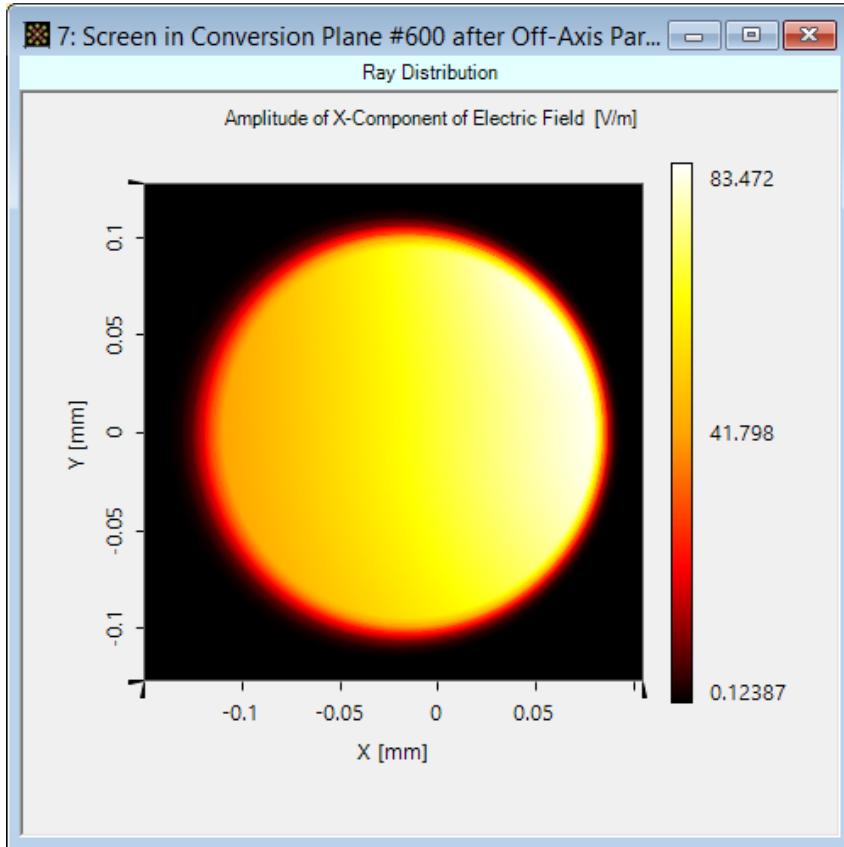


Result in Conversion Plane

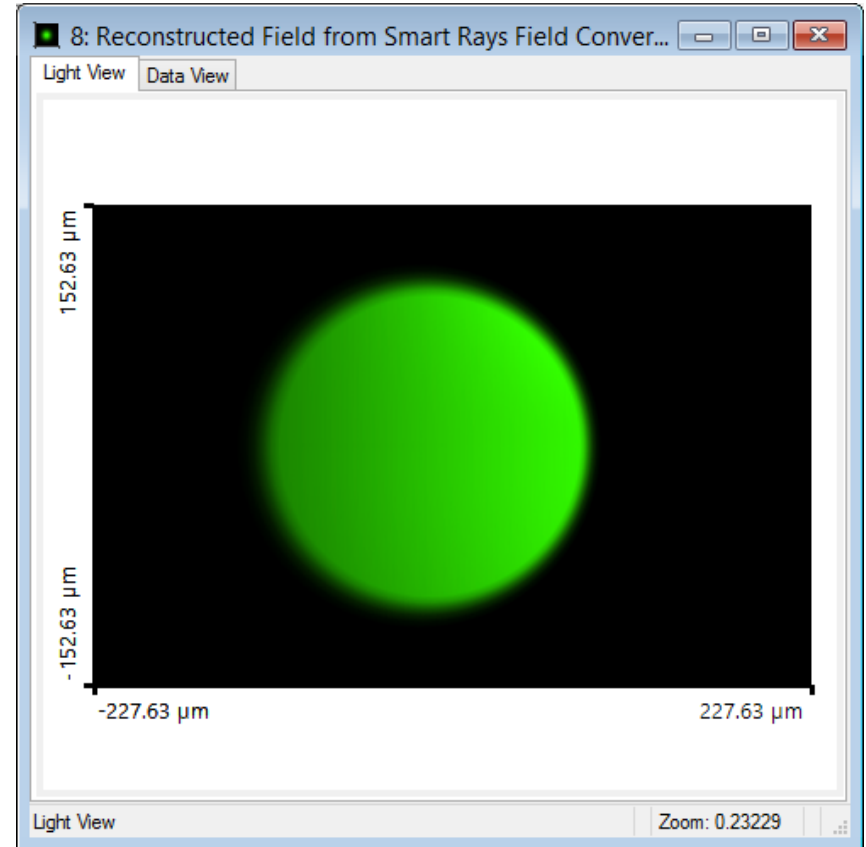


Result in Focal Plane

Results of Geometric Field Tracing Plus



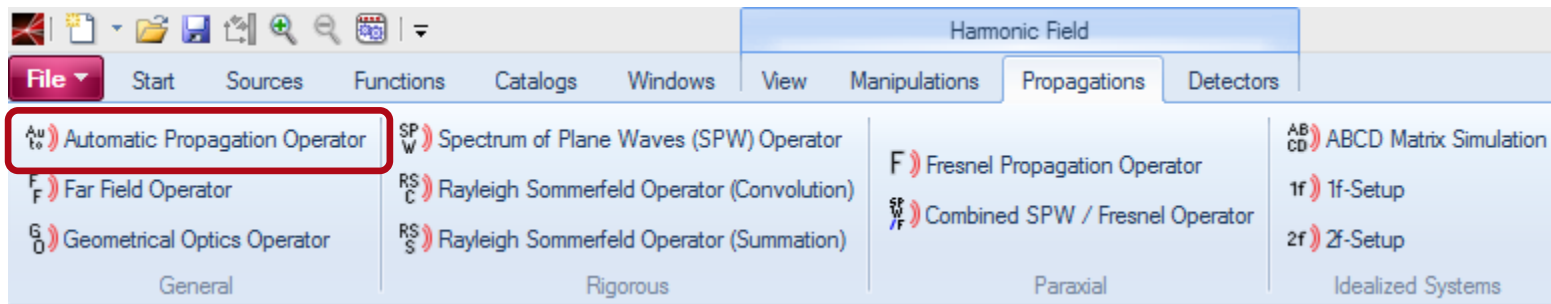
Result in Conversion Plane



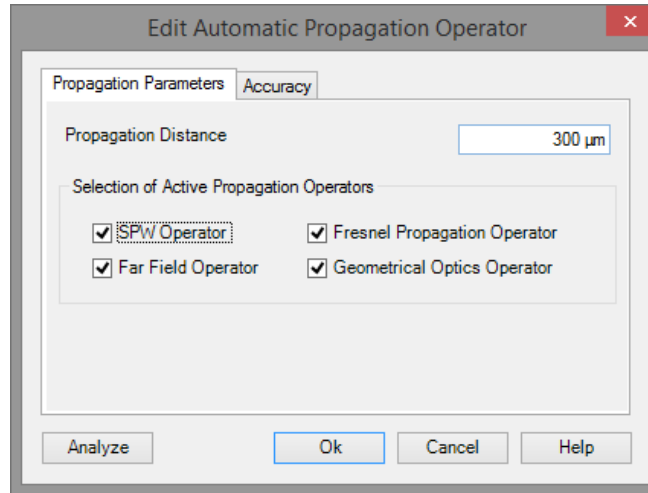
Converted Harmonic Field

Propagation into the Focal Plane

- The converted field information can now be propagated into the focal plane using a diffractive propagation operator.
- The propagation operator can be selected on the Propagation ribbon.
- In this case we use the Automatic Propagation Operator.

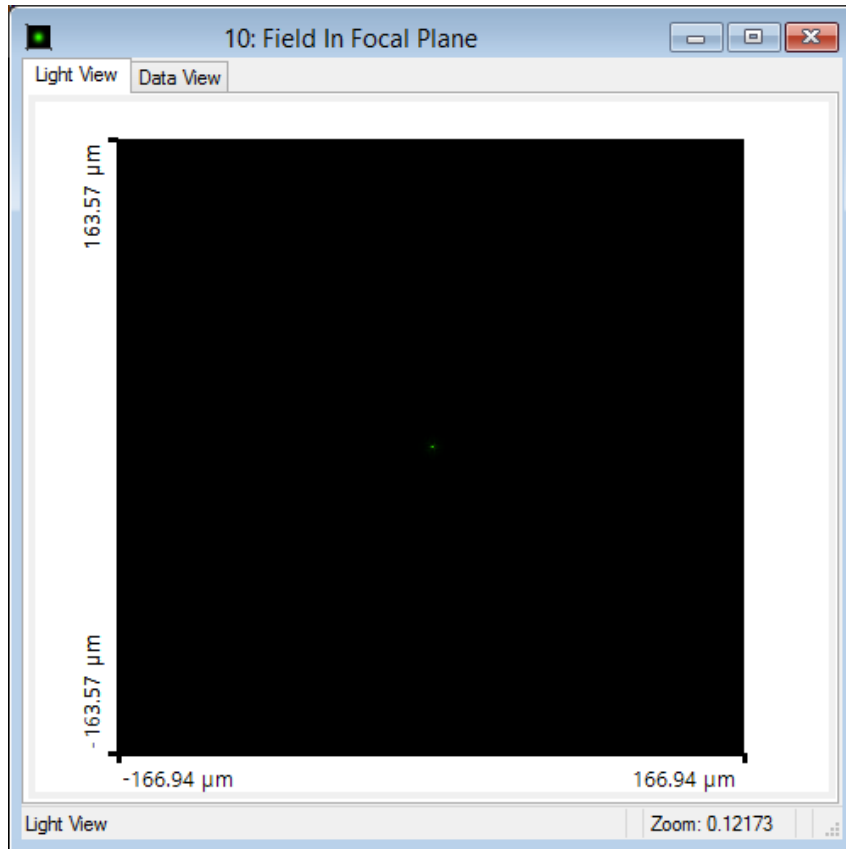


Specification of the Propagation Operator

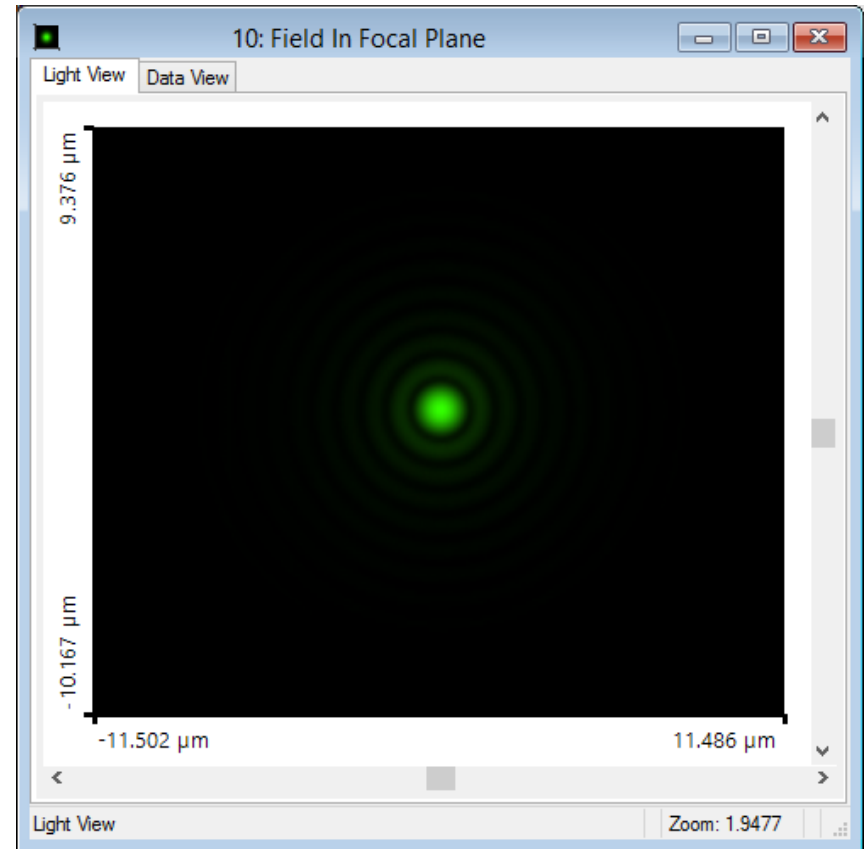


- For the diffractive propagation step we enter a distance of 300 μm . (This was the difference between the conversion and the focal plane)
- In our case the automatic propagation operator will select the rigorous Spectrum of Plane Waves operator.

Result within the Focal Plane

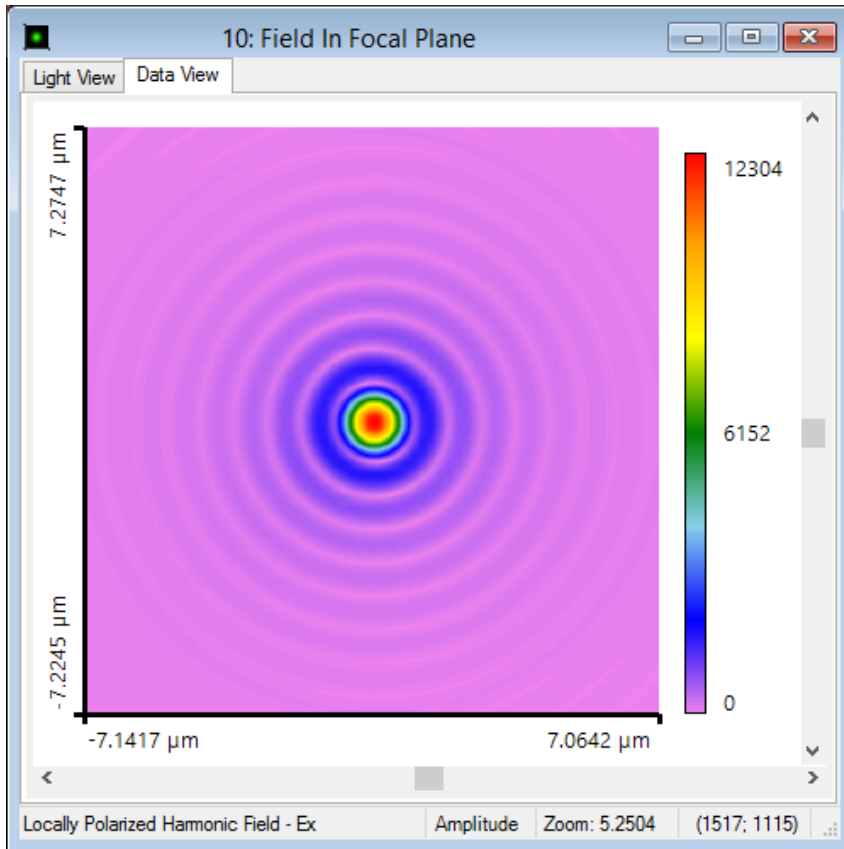


Field in Focal Plane

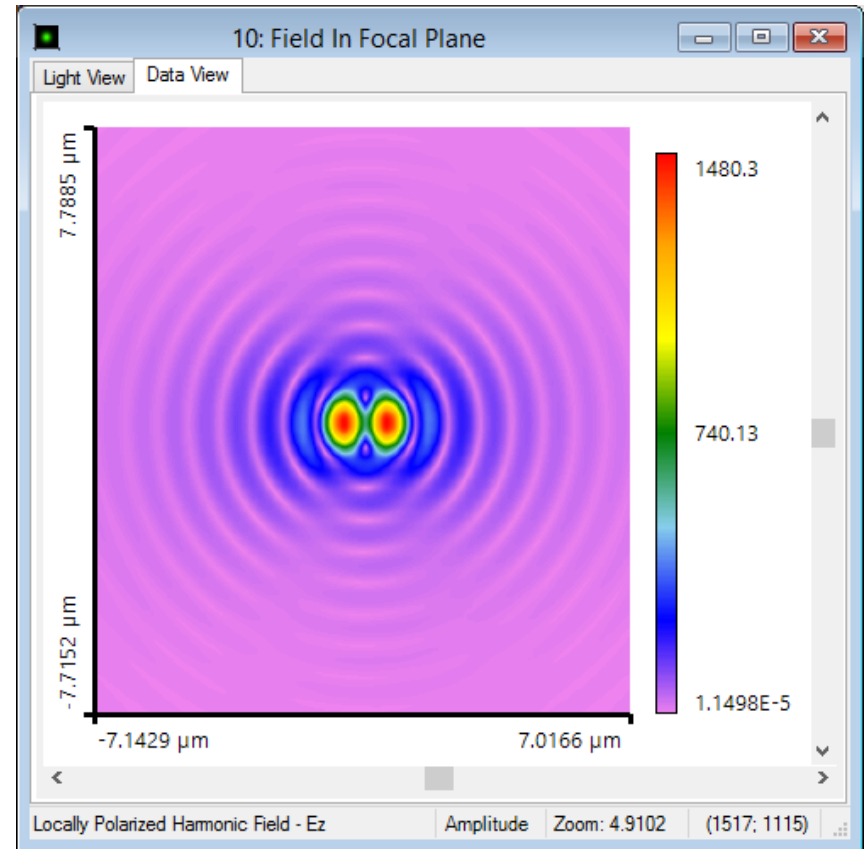


Field in Focal Plane (Zoomed)

Result within the Focal Plane



Field in Focal Plane (E_x)



Field in Focal Plane (E_z)

Summary

- VirtualLab Fusion allows the usage of the Geometric Field Tracing engine.
- With this engine you can investigate electromagnetic field information within your system as fast as smart ray tracing can deliver the information.
- The conversion into harmonic fields (sets) allow a further propagation by diffractive propagation techniques.
- This enables the evaluation of the field in the focus of (for example) an off-axis parabolic mirror.
- Currently the combination between geometric and diffractive field tracing techniques has to be done manually. This will be improved soon.