

UseCase.0080 (1.0)

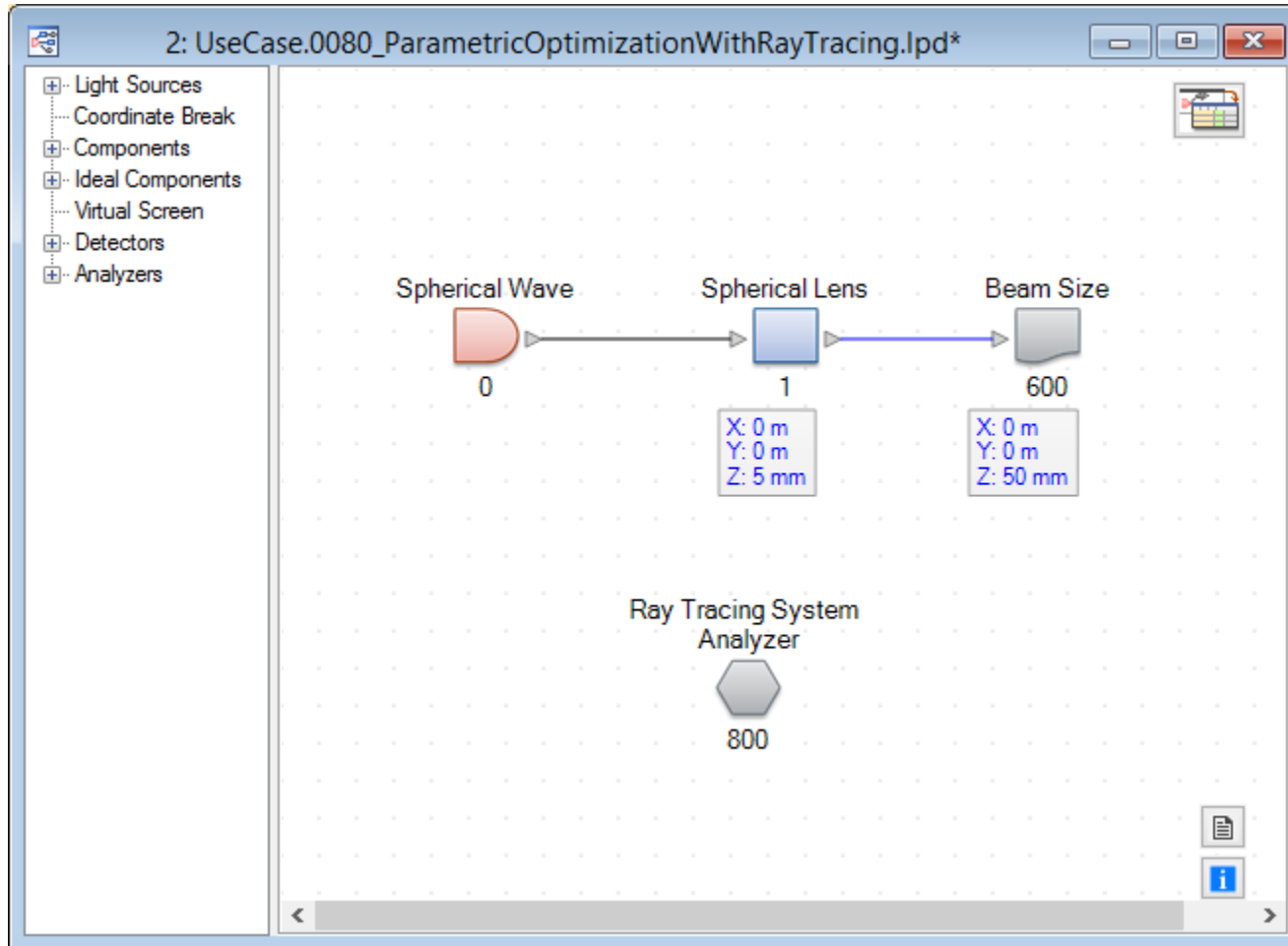
Parametric Optimization using the Ray Tracing Engine

Keywords: ray tracing, lenses, optimization, radius of curvature, design

Description

- This use case demonstrates how VirtualLab can be used to perform a parametric optimization using the ray tracing engine.
- In the considered example a spherical lens shall be optimized to generate a focal spot at a user-defined distance after the lens.
- The free parameters for the design are the radii of curvature of the interfaces of the spherical lens.

The System

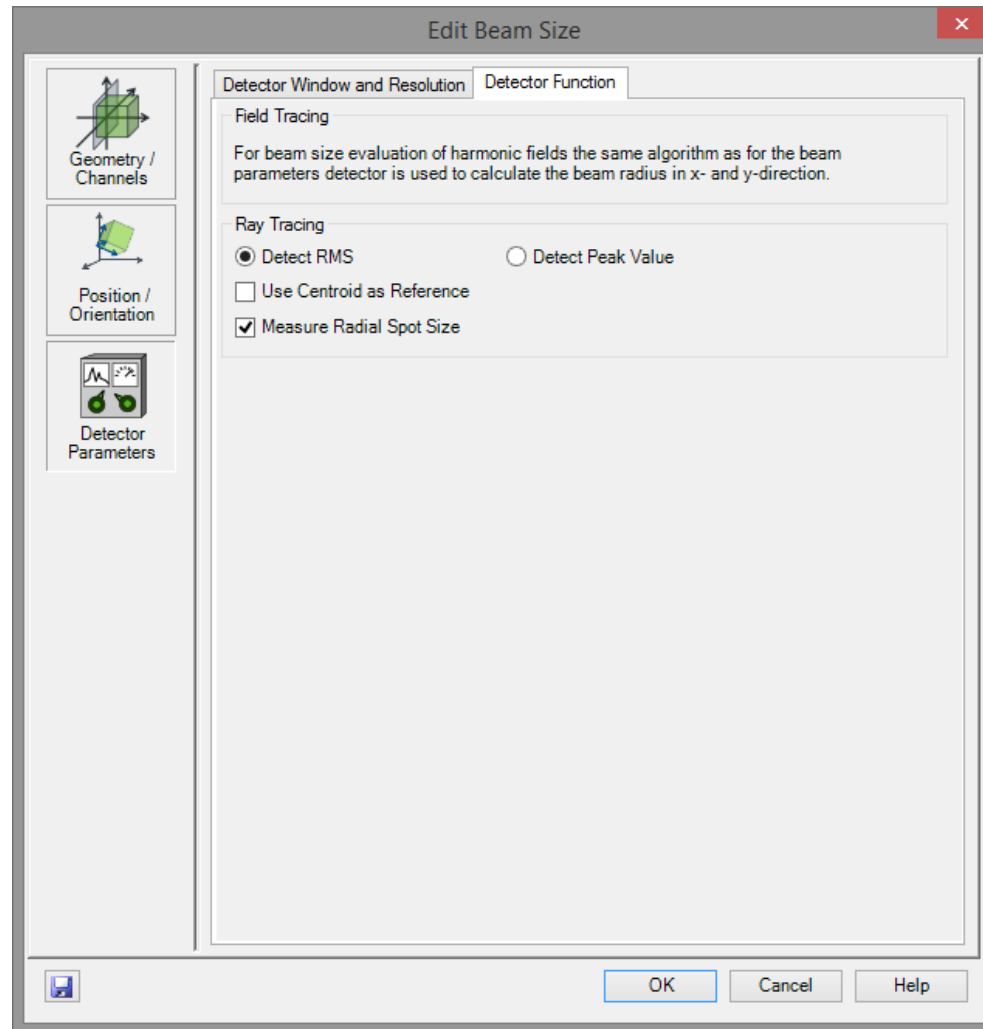


Filename: UseCase.0080_ParametricOptimizationWithRayTracing.Ipd

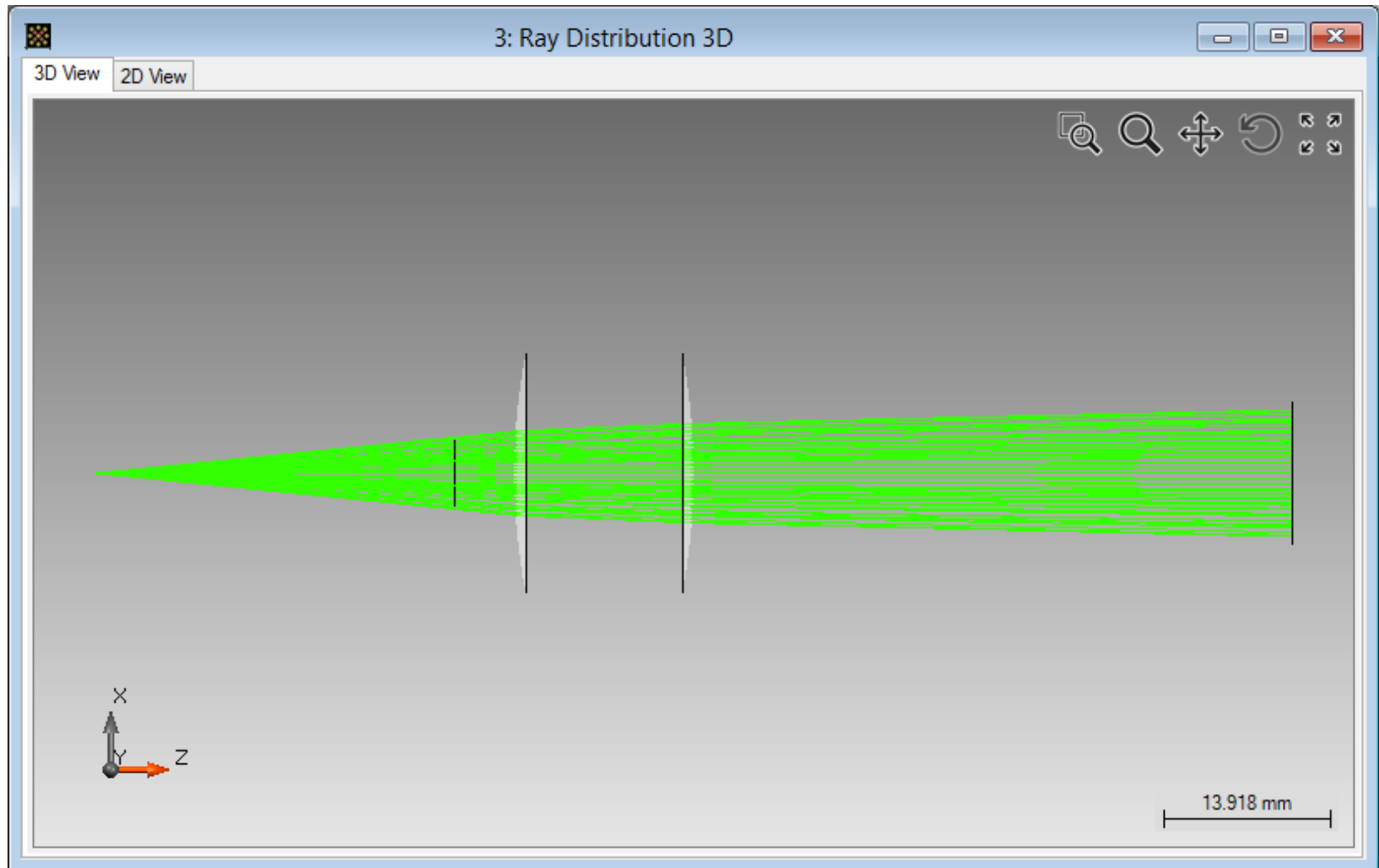
System Configuration

- The optical setup consists of a spherical wave which illuminates a spherical lens.
- The lens shall be designed so that the focus appears at a distance of 50mm directly after the lens.
- At the target plane we use the beam size detector to evaluate the size of the spot.
- The beam size detector offers several options within the Ray Tracing engine to evaluate the size of the spot.
- The user can select the measurement method (RMS or peak value) for the calculation, as well as additional parameters.

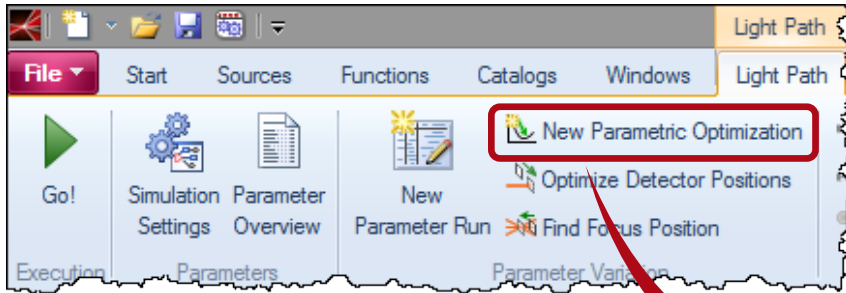
Parameters of Beam Size Detector



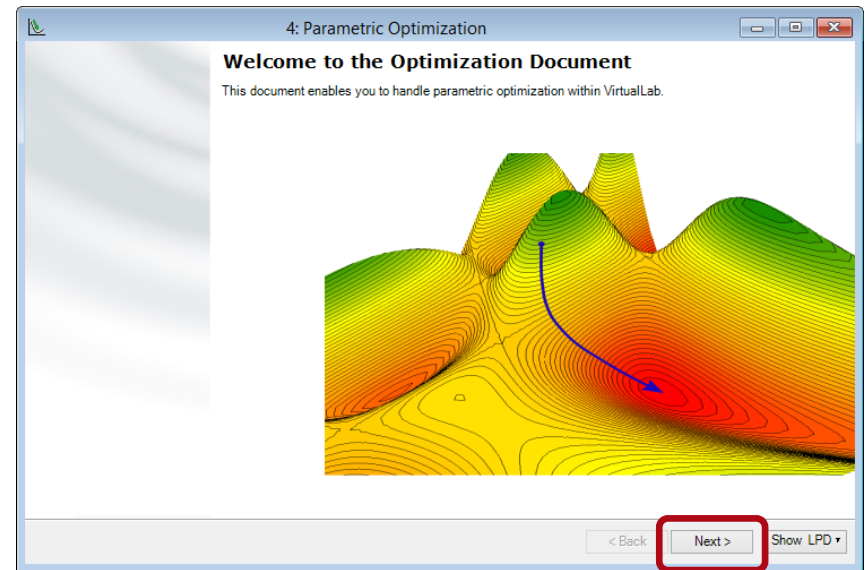
Ray Tracing Result (3D) of Initial System



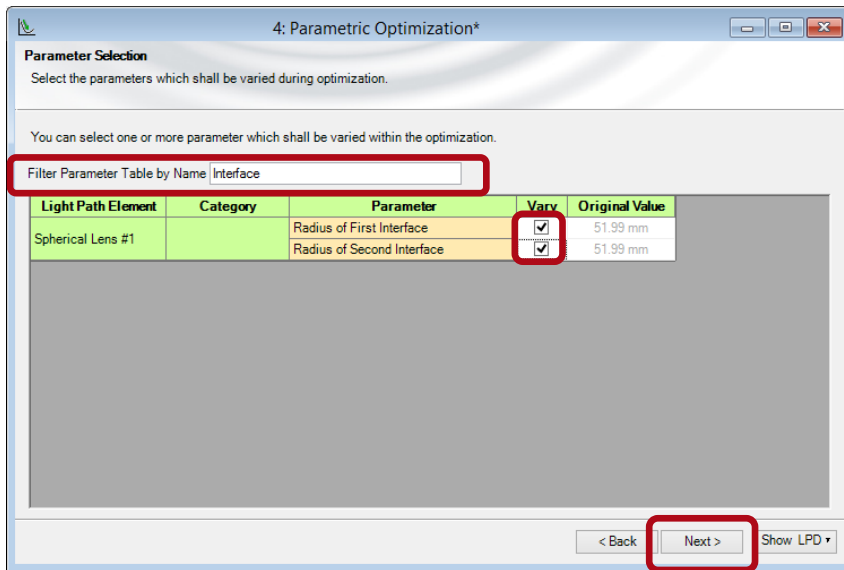
Generation of Parametric Optimization



- By clicking on the corresponding ribbon item in the Light Path ribbon a new parametric optimization is generated.

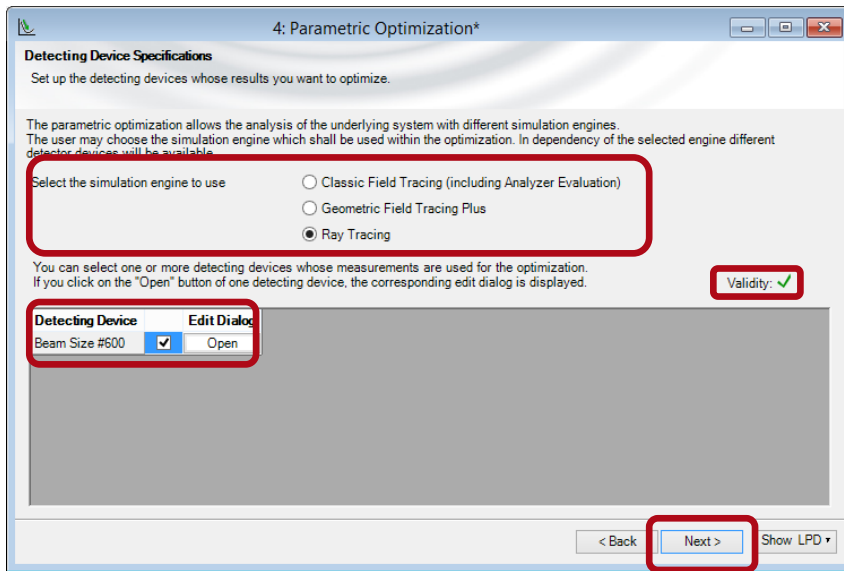


Set up Parametric Optimization



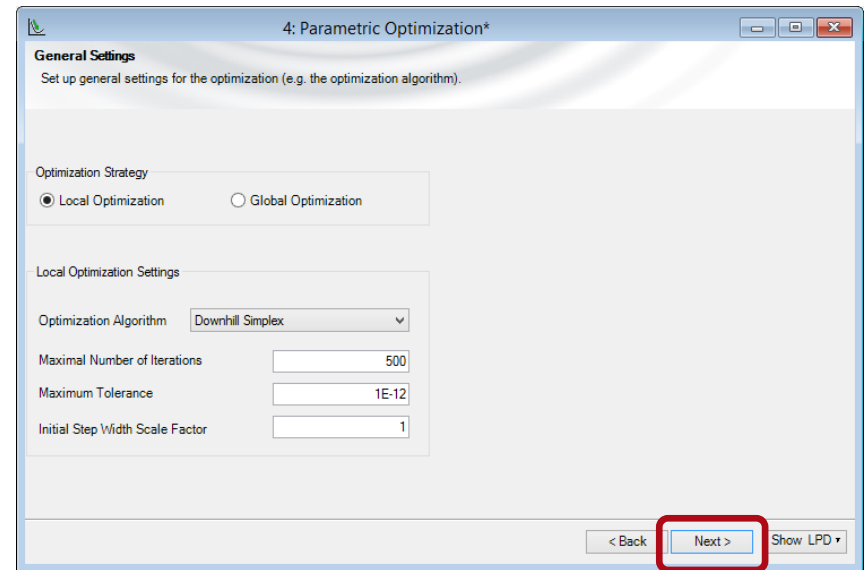
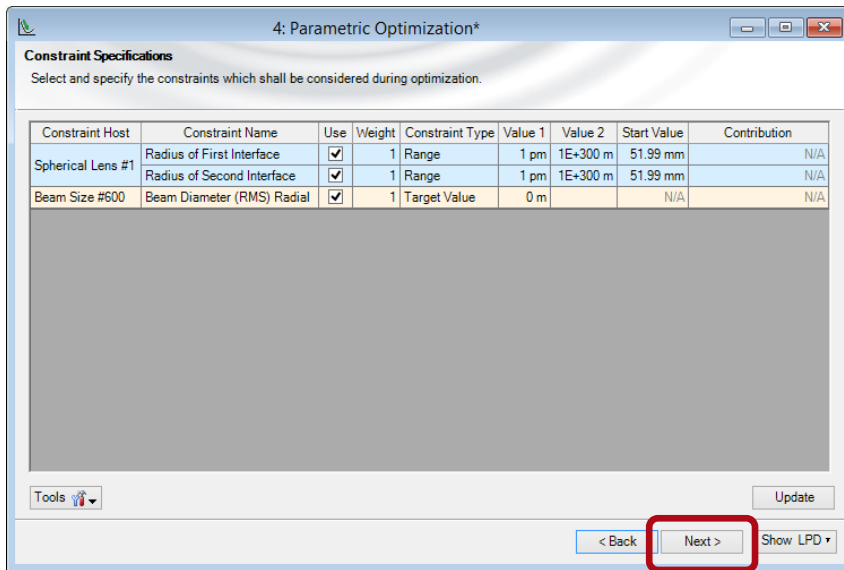
- The filter option on the Parameter Selection page allows you fast access to the parameter you would like to release for optimization.
- In this case the radii for the first and the second interface shall be selected.

Set up Parametric Optimization

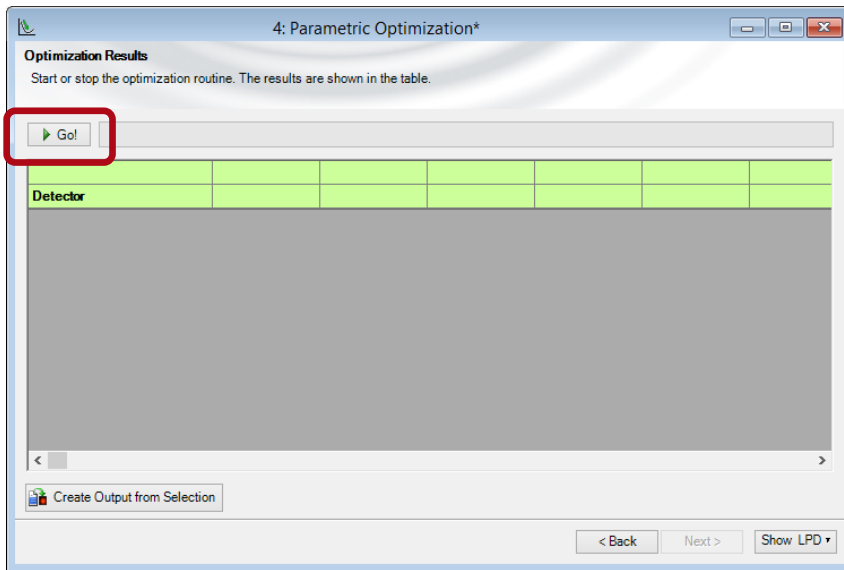


- On the next page, the user can select the simulation engine which shall be used.
- For different simulation engines different detectors might be available.
- The validity icon shows whether the selection is valid, or whether problems appear.

Set up Parametric Optimization



Start the Parametric Optimization



- On the final page you can start the parametric optimization.
- The optimization is started by simply clicking on the Go! button.
- In the table on the last page all intermediate results are logged.
- In our case the optimization took 12 seconds for 261 iterations.

Result of Parametric Optimization

4: Parametric Optimization*

Optimization Results
Start or stop the optimization routine. The results are shown in the table.

Go!

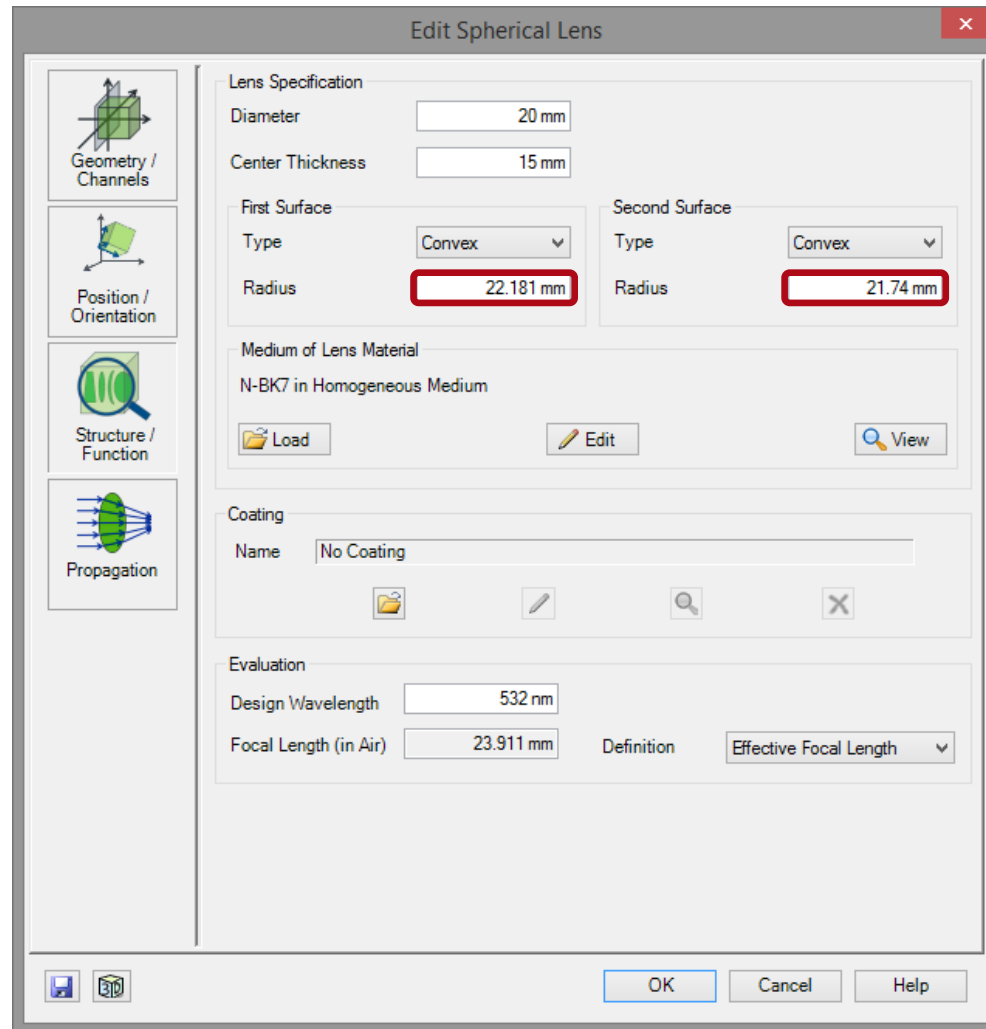
Detector	Subdetector	Simulation Step				
		257	258	259	260	261
Optimizer Logging	Target Function Value	0433E-09	9.0428E-09	9.0439E-09	9.0428E-09	9.0428E-09
Parameter Constraints	Radius of First Interface (Spherical Lens #1)	2.203 mm	22.161 mm	22.091 mm	22.181 mm	22.181 mm
	Radius of Second Interface (Spherical Lens #1)	1.722 mm	21.756 mm	21.816 mm	21.74 mm	21.74 mm
Beam Size #600	Beam Diameter (RMS) Radial	5.096 μm	95.094 μm	95.099 μm	95.093 μm	95.093 μm

Create Output from Selection

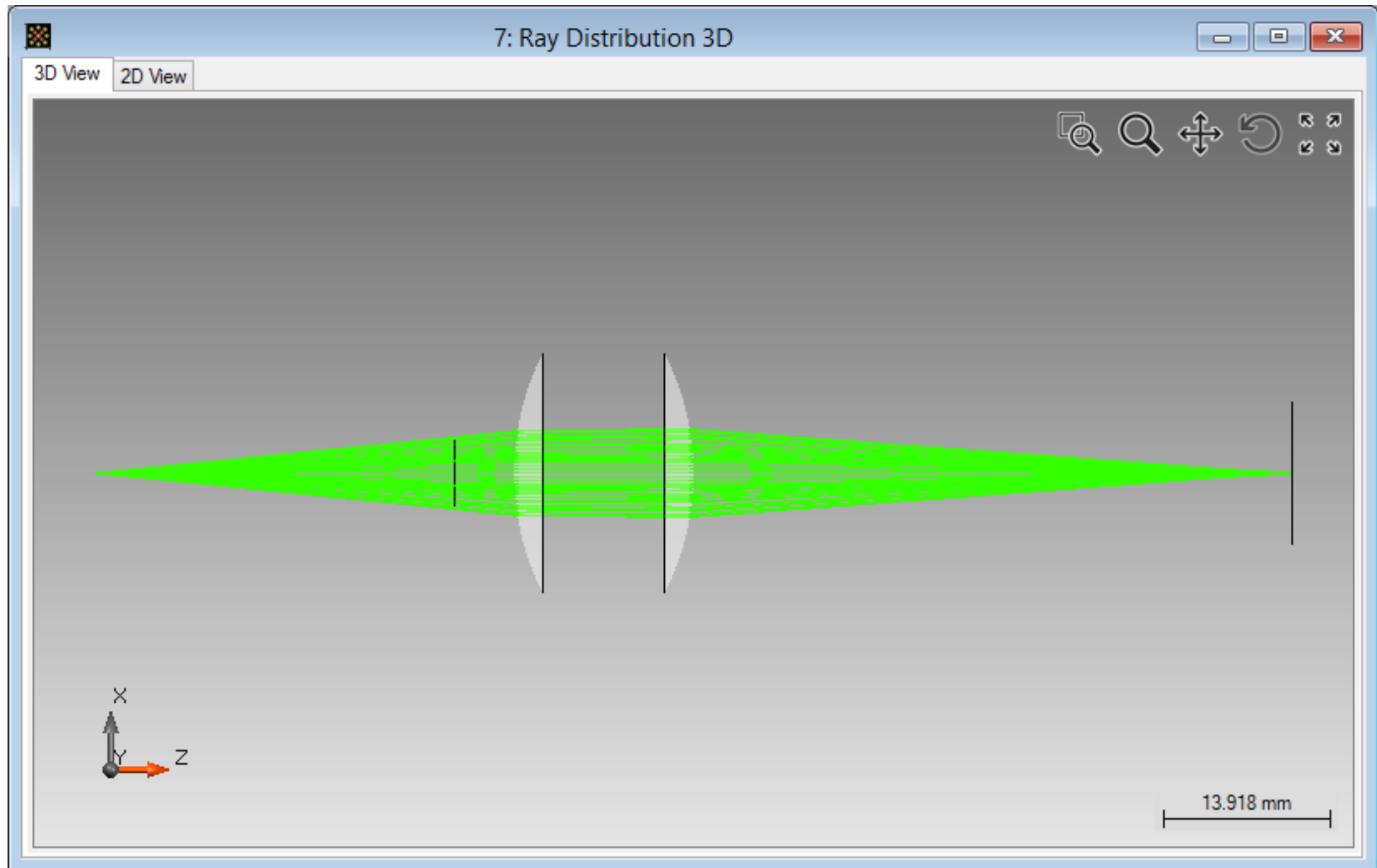
< Back Next > Show LPD ▾

Show Optimized LPD
Show Initial LPD

Lens Parameters of Optimized System



Ray Tracing Result (3D) of Optimized System



Summary

- VirtualLab Fusion can be used to perform Ray Tracing simulations of your optical setup.
- VirtualLab provides 3D ray tracing as well as 2D ray tracing (generation of dot diagrams and customized merit functions).
- Within the parametric optimization in VirtualLab all engines can be used.
- This enables the optimization of an optical system using Ray Tracing in a parametric optimization.
- Different optimization algorithms are available.