DO.001 Design of Diffractive Diffuser for Generation of Line Focus

Example for the design of a diffractive optical element for diffuse deflection of light along the x-axis.

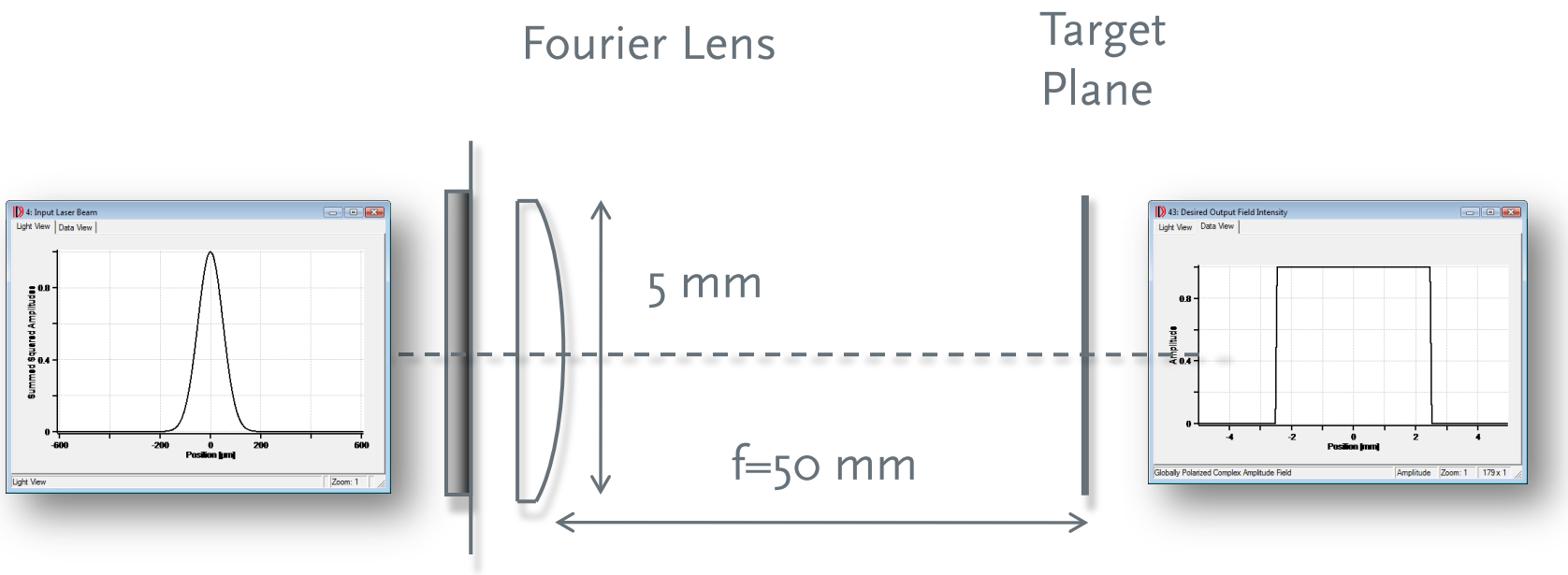
Keywords: Diffractive Optics, Diffractive Optical Elements, Diffusers, Line Focus

Required Toolboxes: Diffractive Optics Toolbox

Related Application Scenarios: DO.002;DO.003
Related Tutorials: 144.01

LightTrans

Modeling Task



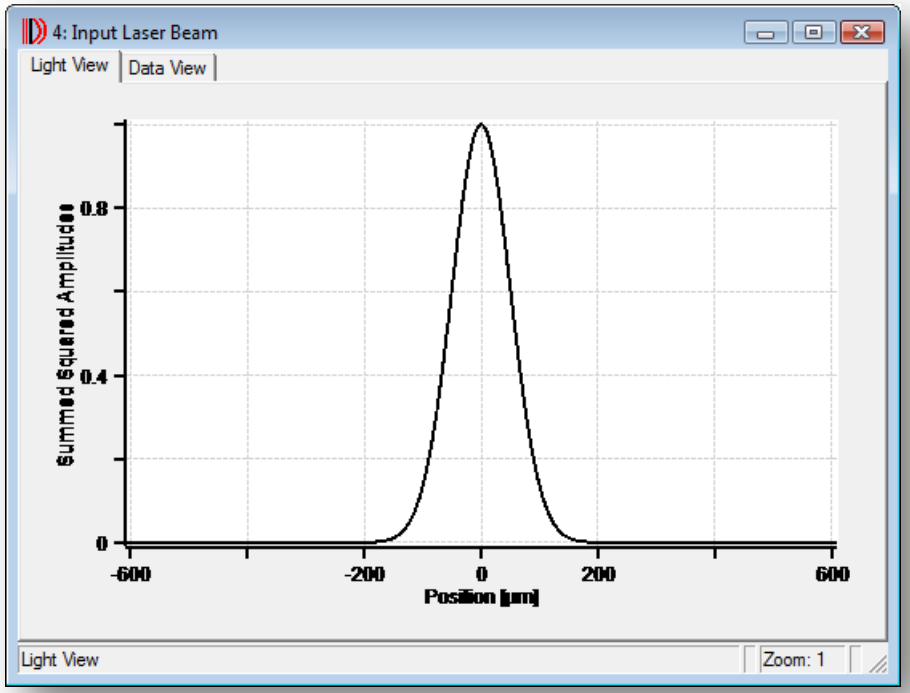
Illuminating Beam Intensity

Diffractive Diffuser
Phase Levels: 4
Pixel Size: >0.1µm
Diameter: 1.4 mm

Line Focus Intensity

Modeling Task

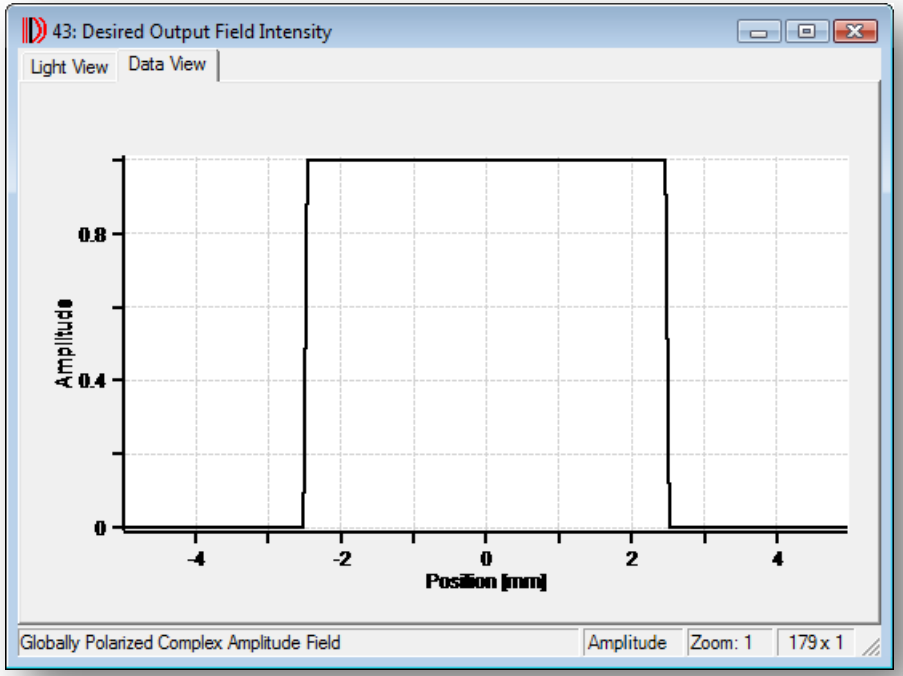
Illuminating Beam Parameters



Wavelength: 632.8 nm
Laser Beam
Diameter ($1/e^2$): 700 µm

Modeling Task

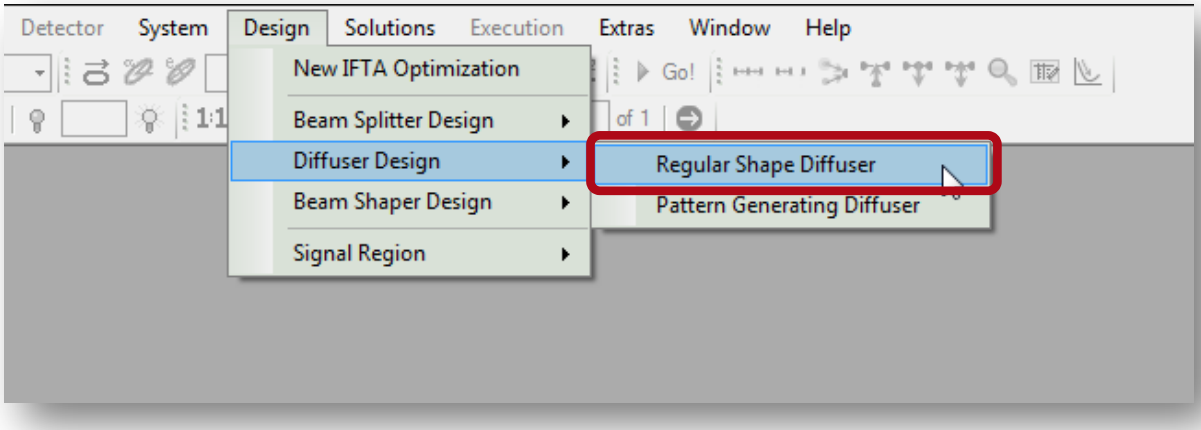
Desired Output Field Parameters



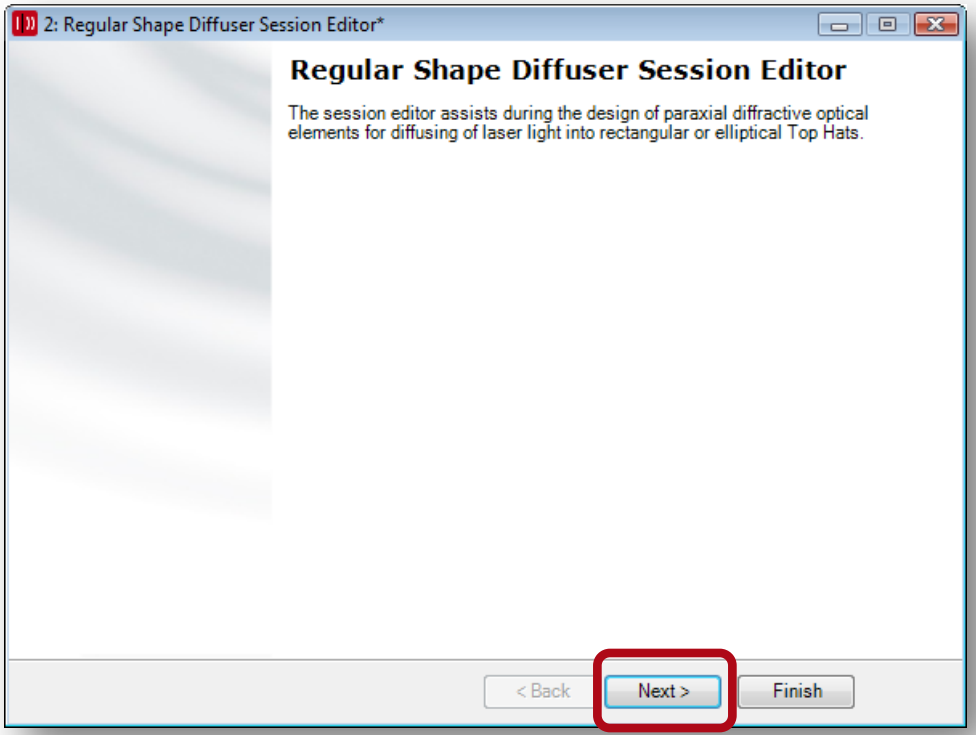
Diameter: 5 mm
Efficiency: >80 %
Noise limit: 5 %

The final light distribution will contain speckles because of coherent illumination!!!

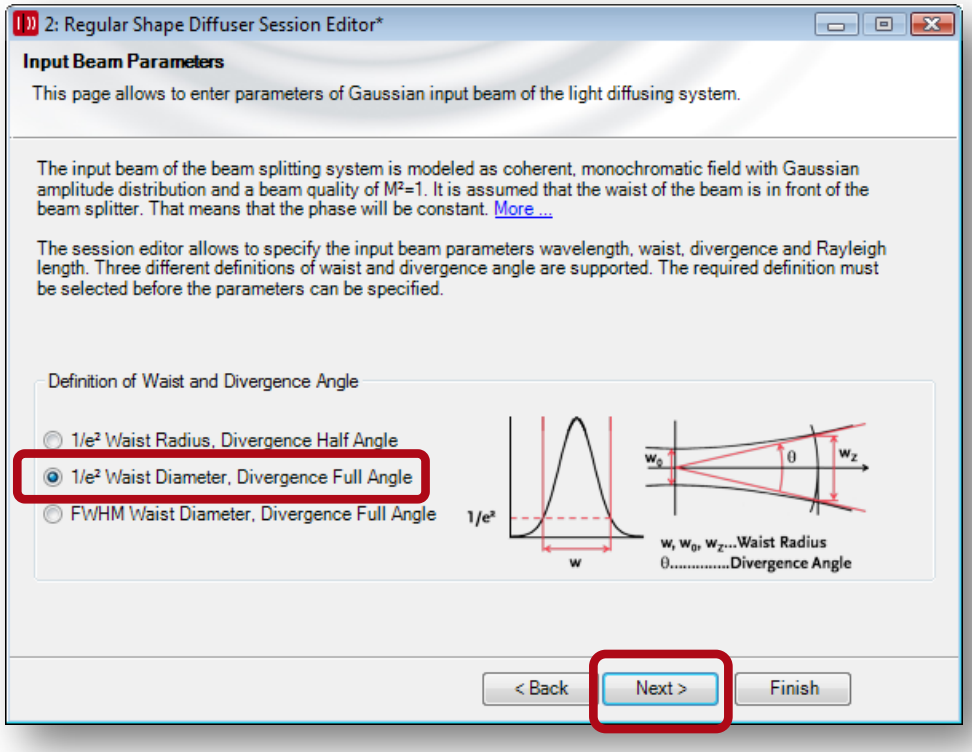
Setup of Design Parameters



1. Illuminating Beam Specification



1. Illuminating Beam Specification



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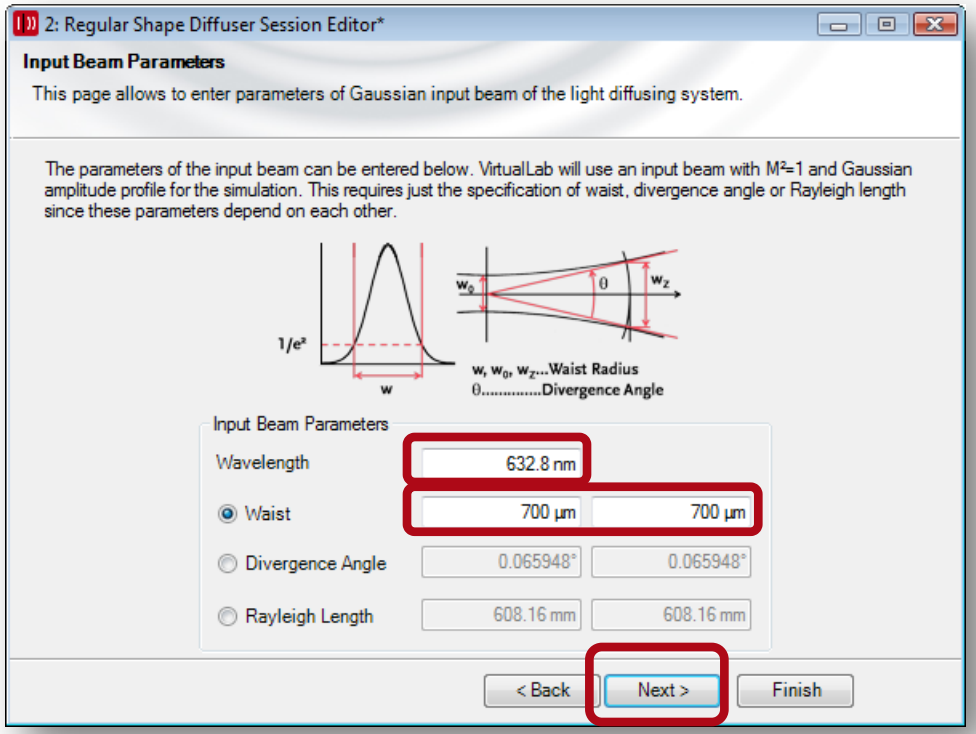
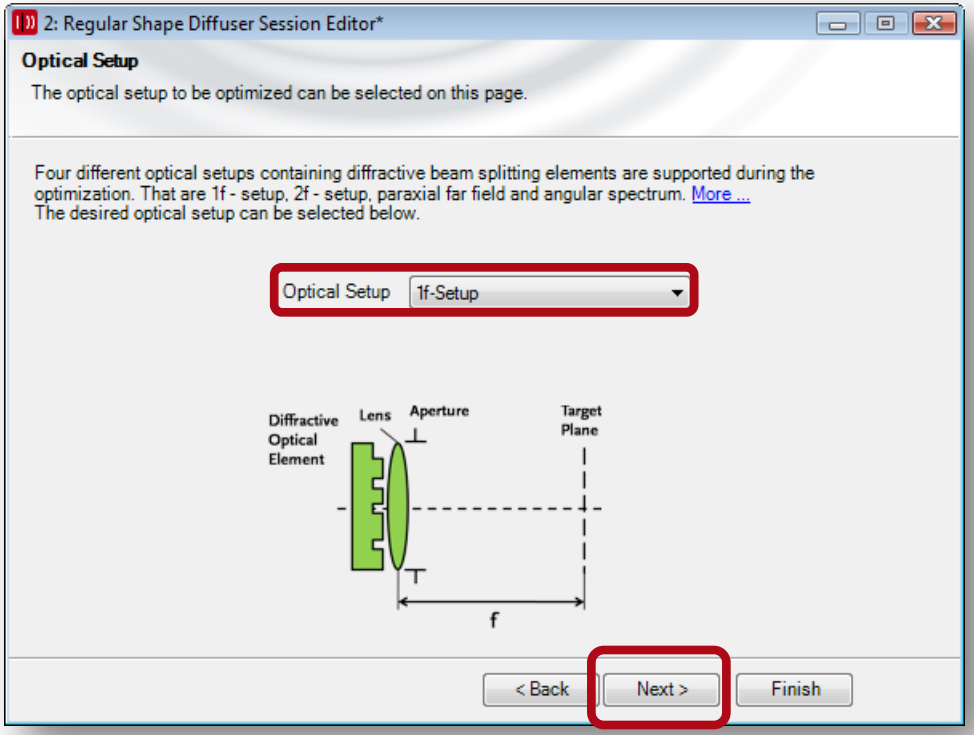


2. Optical Setup



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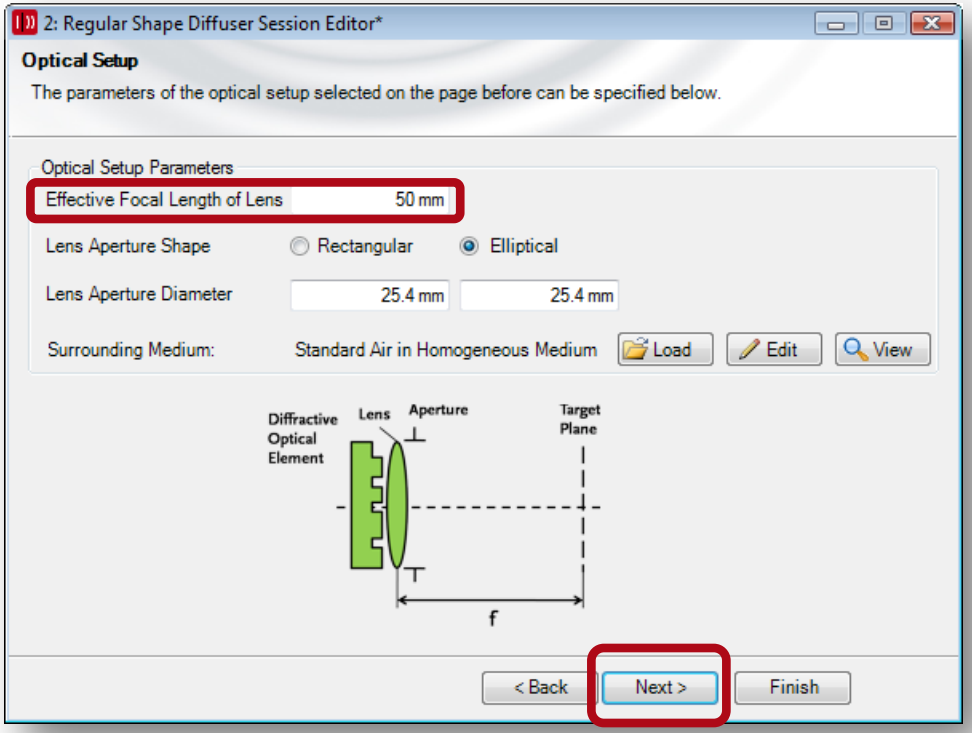
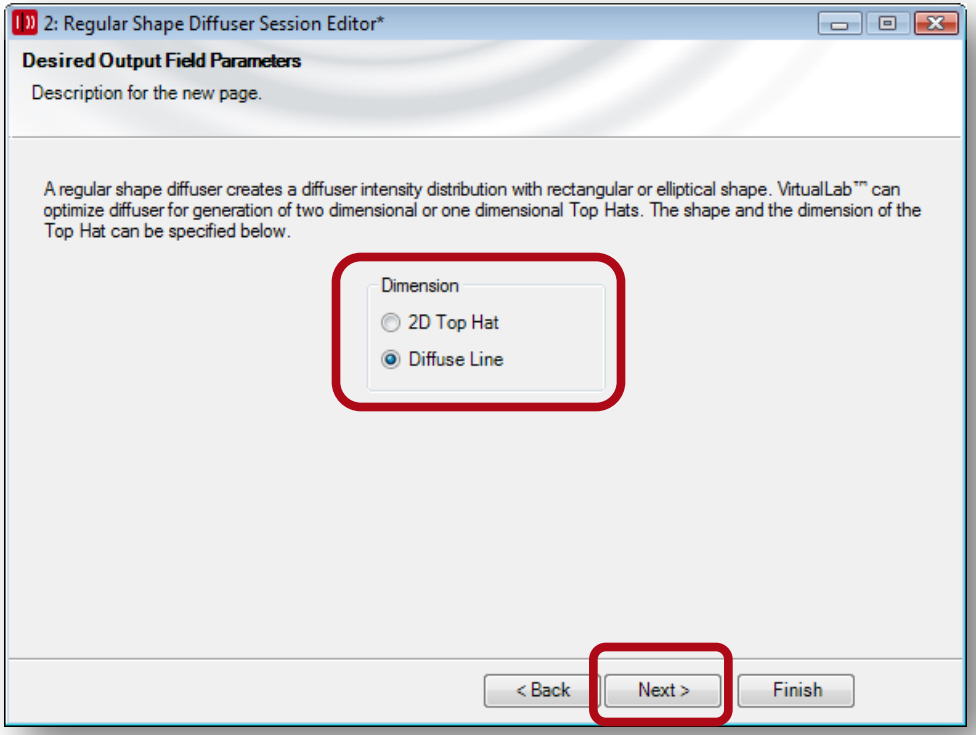


3. Desired Output Field Specification



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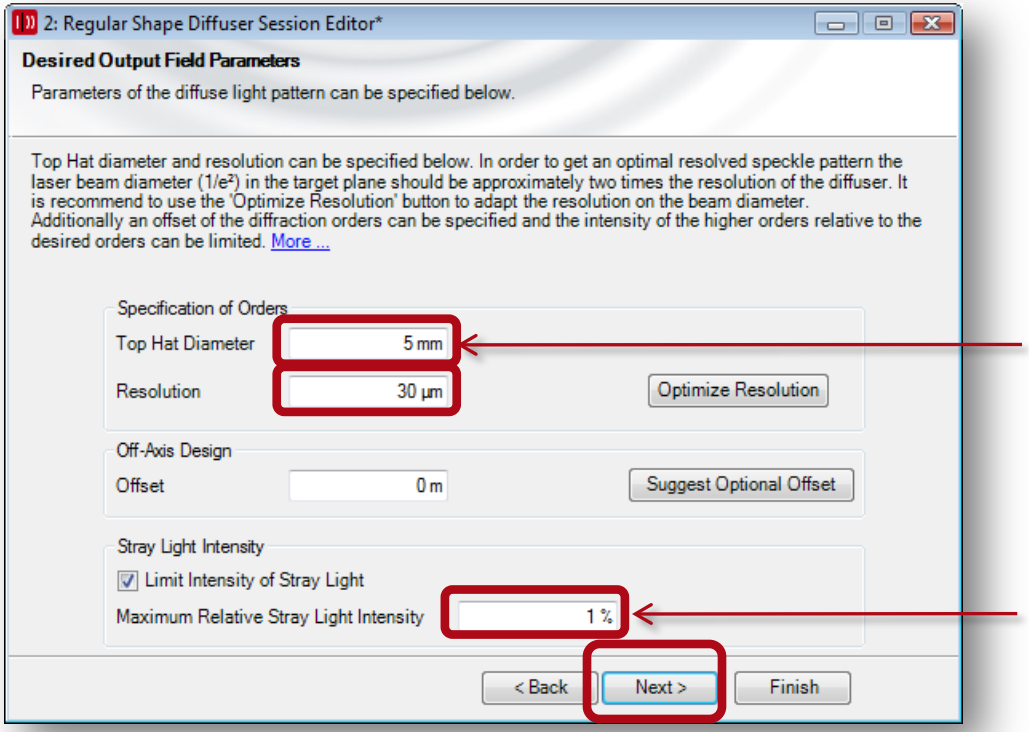
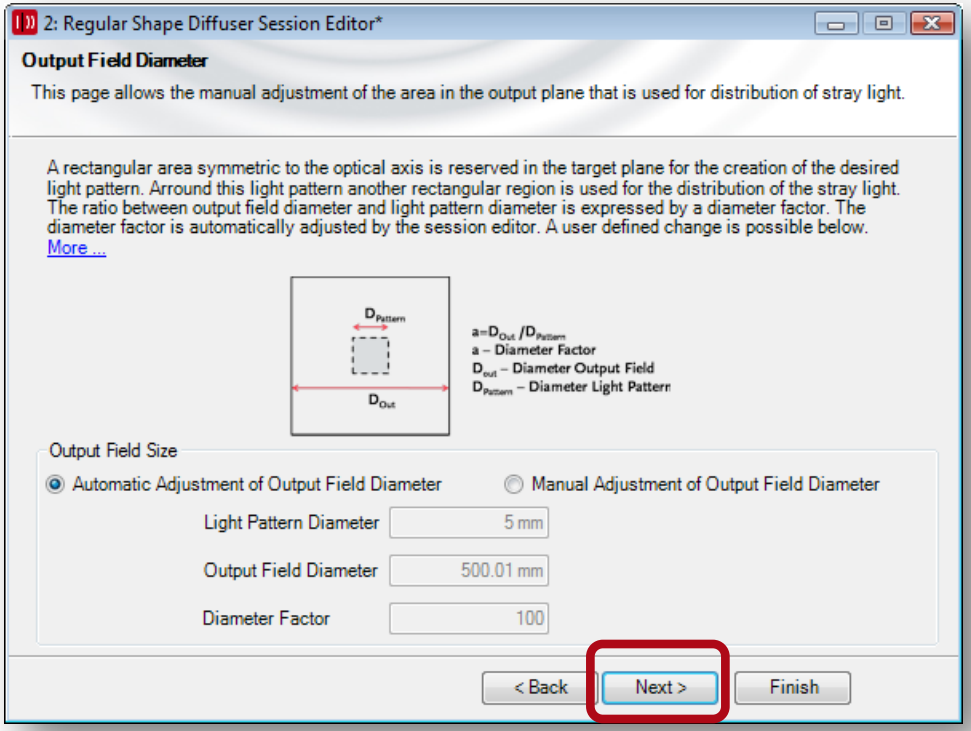


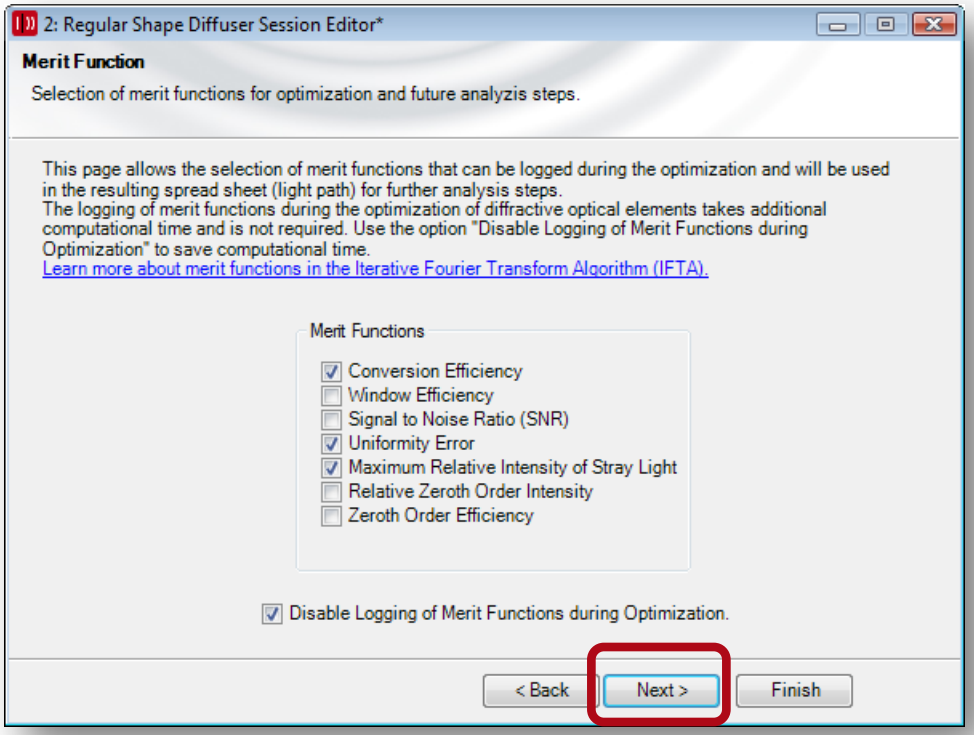
Automatically calculated but can be modified by user.

The stray light limit can be smaller.

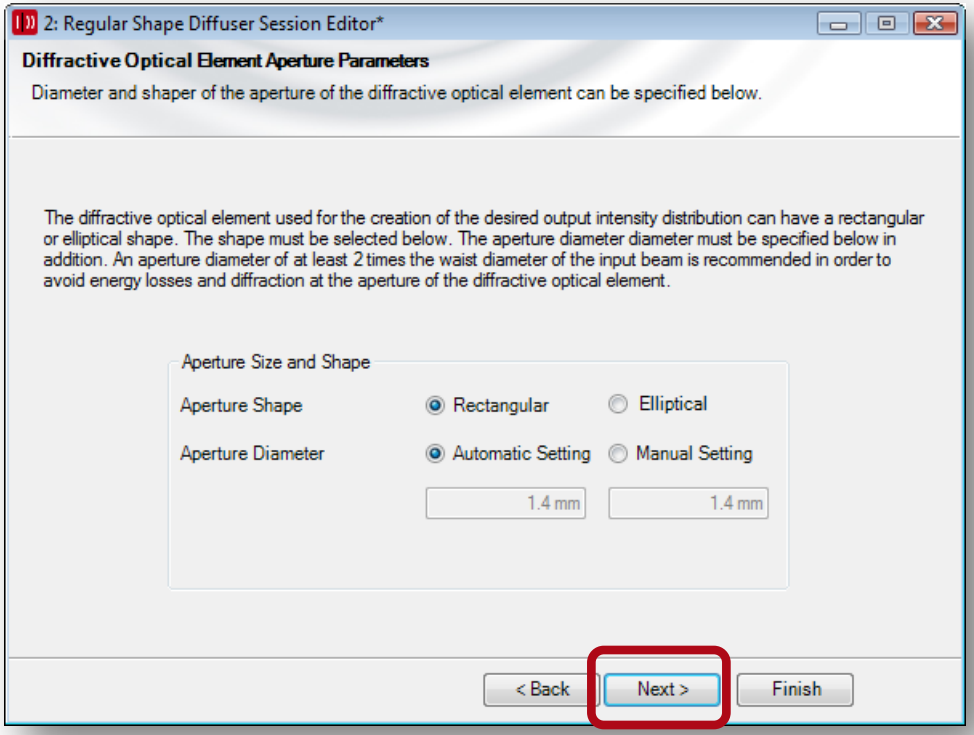
3. Desired Output Field Specification



4. Merit Functions Selection



5. Diffuser Parameter



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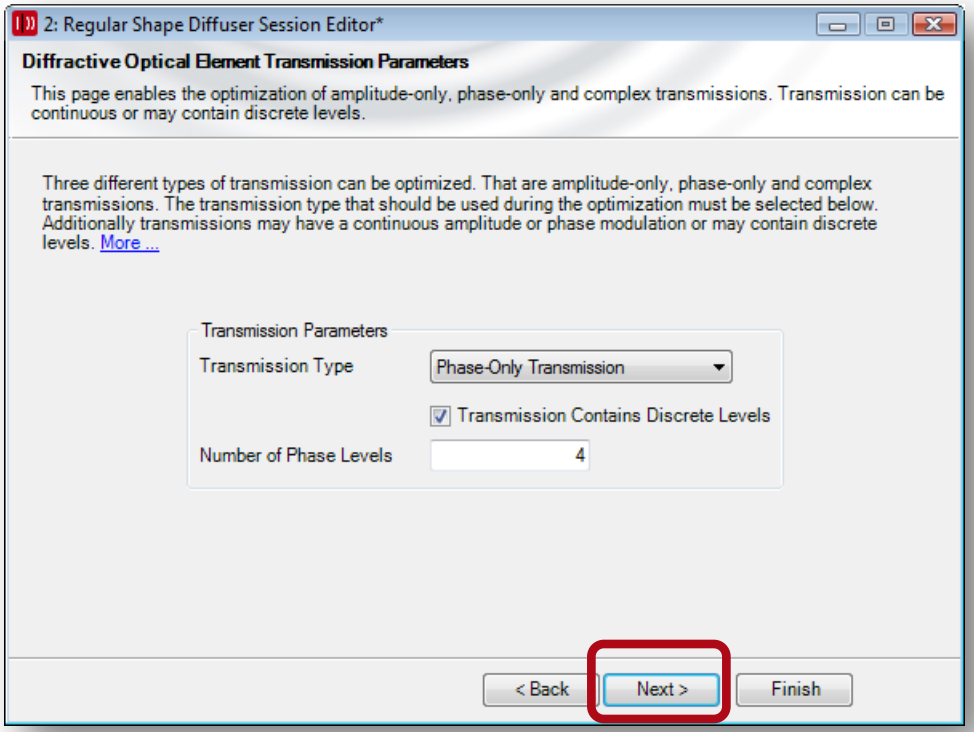

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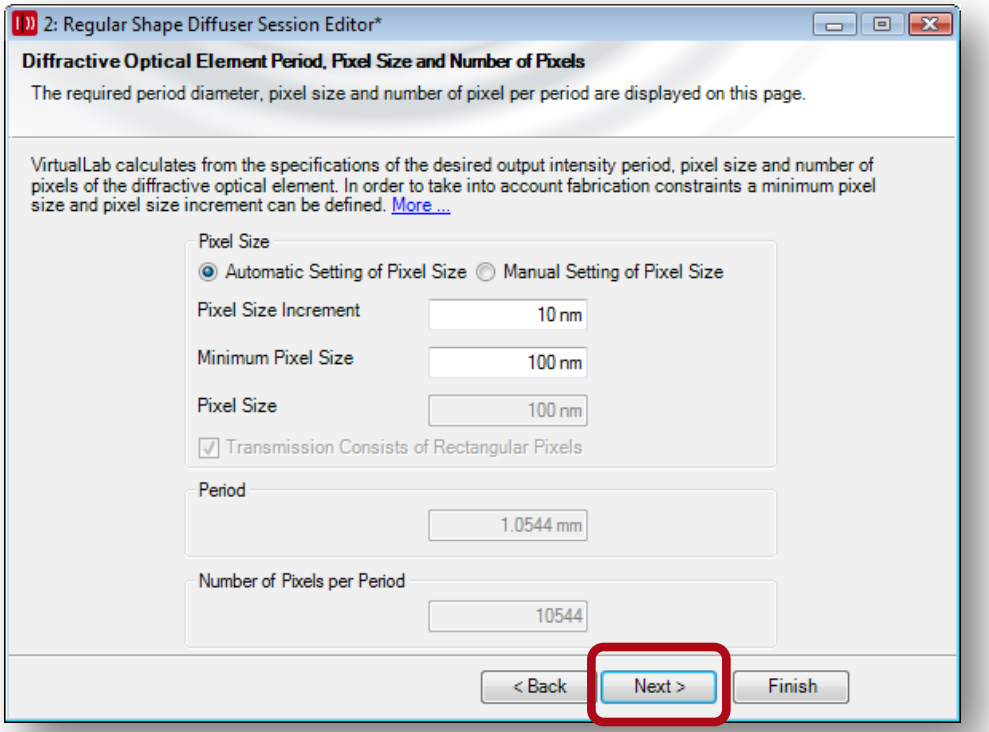
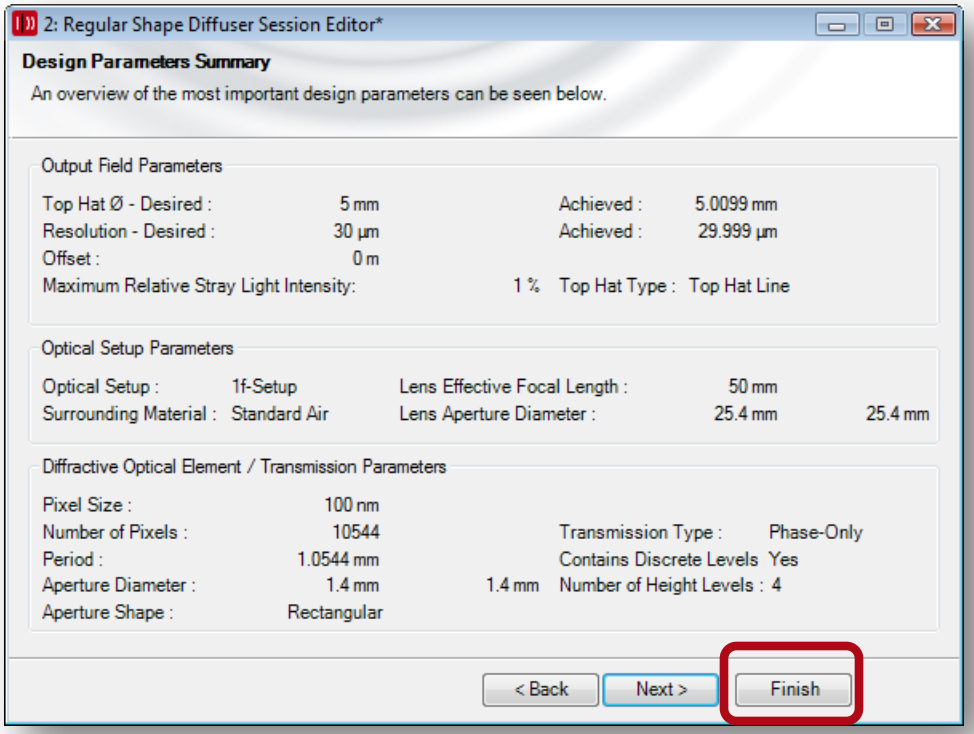
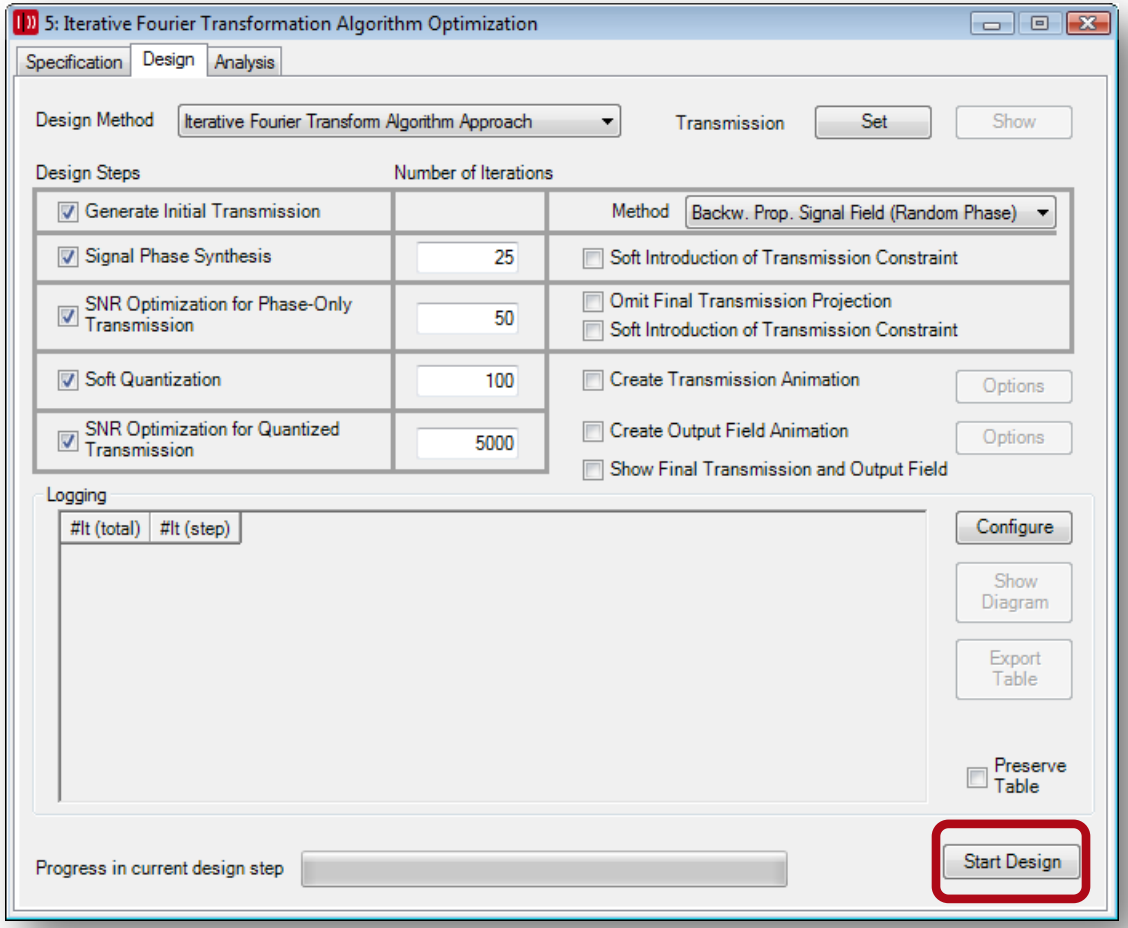


6. Summary

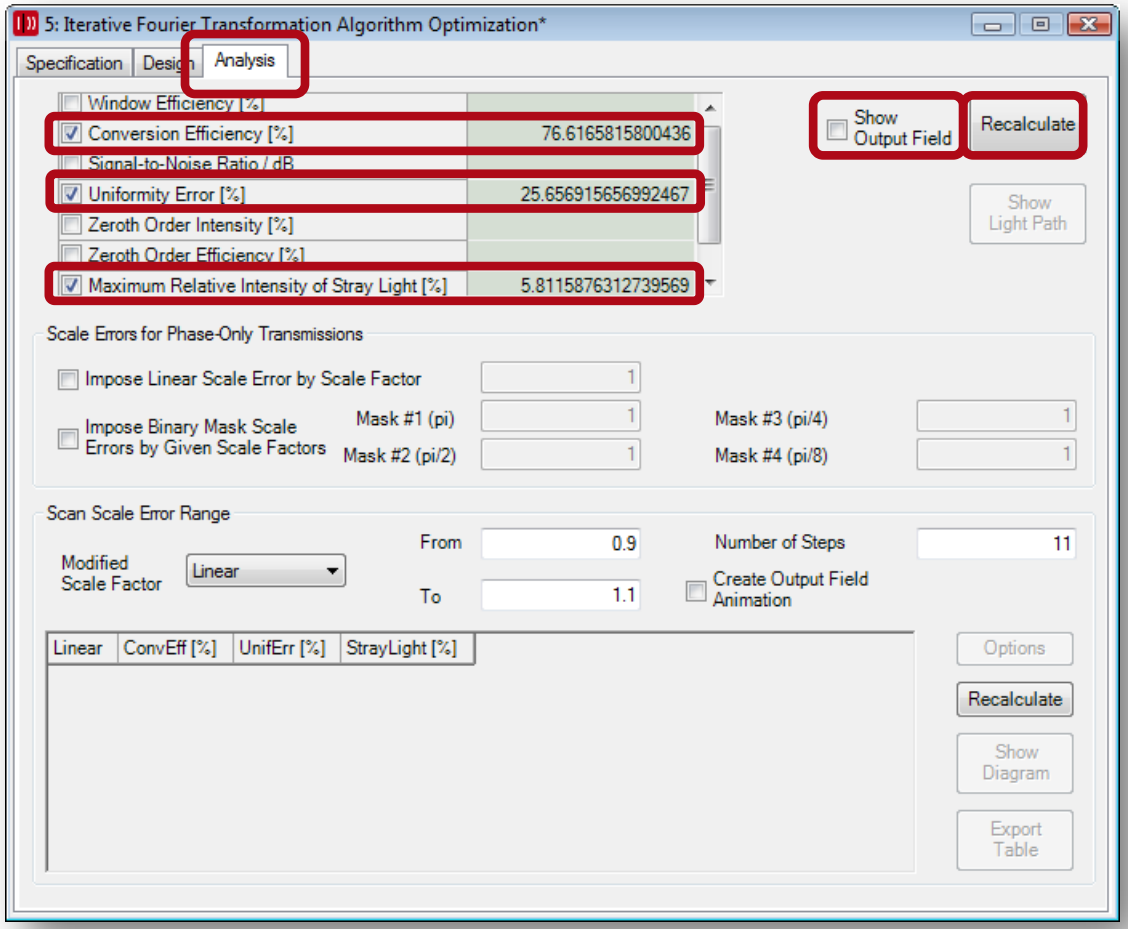


Results in

7. Diffuser Optimization

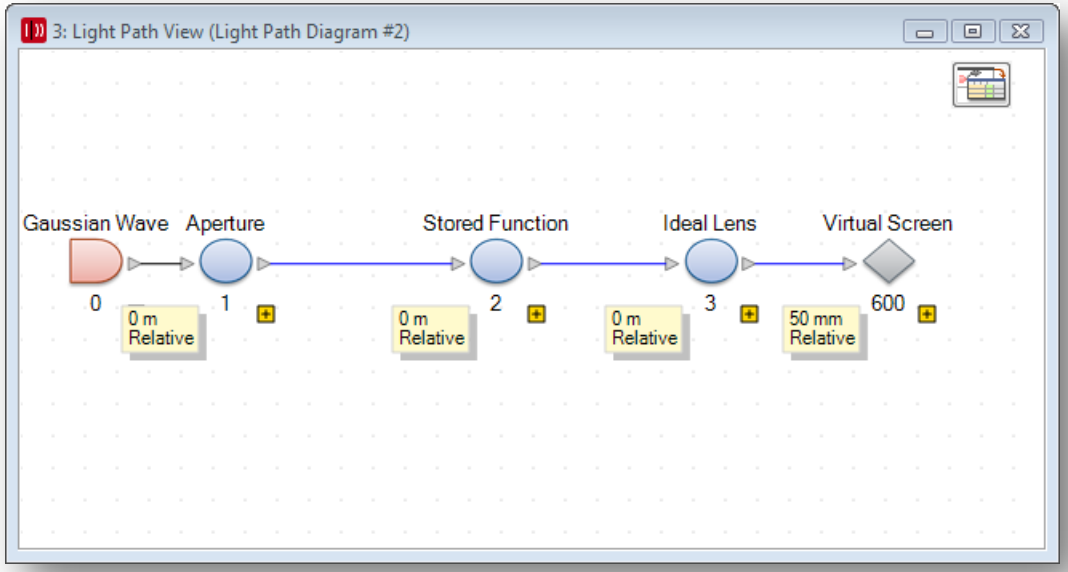


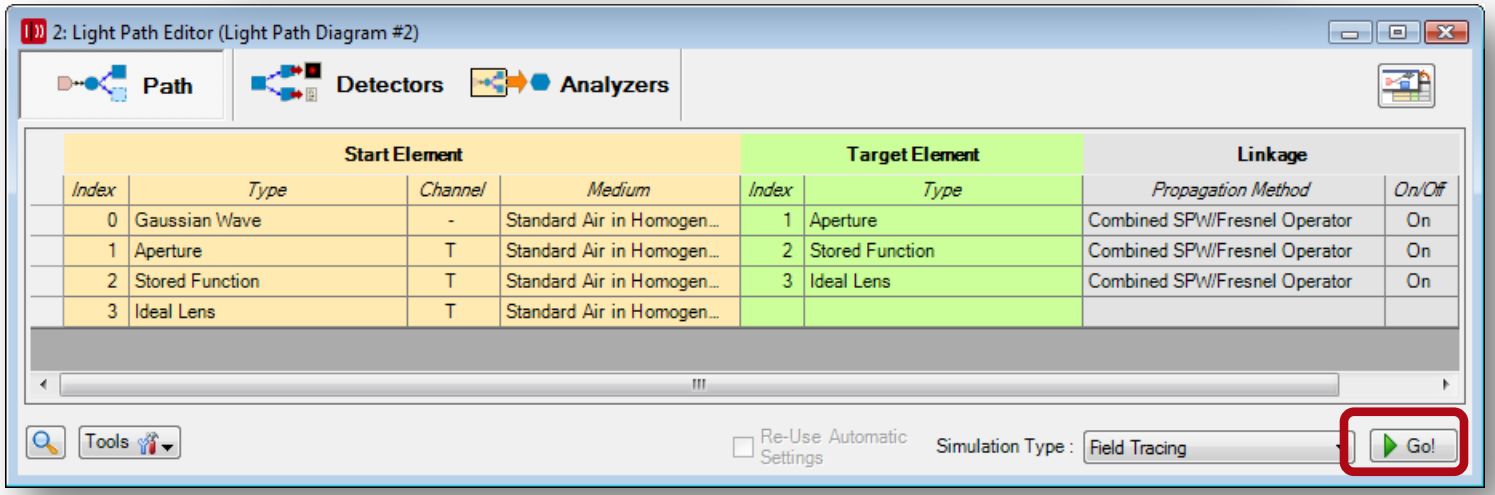
7. Diffuser Optimization



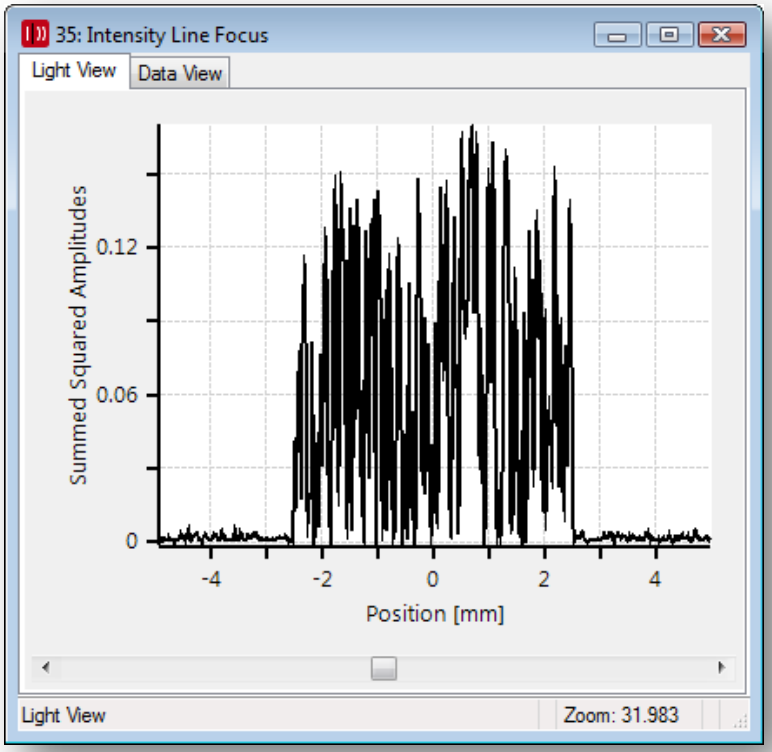
The *Analysis* tab allows to calculate the merit functions results of the output field generated by the diffuser.
Repeat optimization and keep best diffuser transmission.

8. Light Path

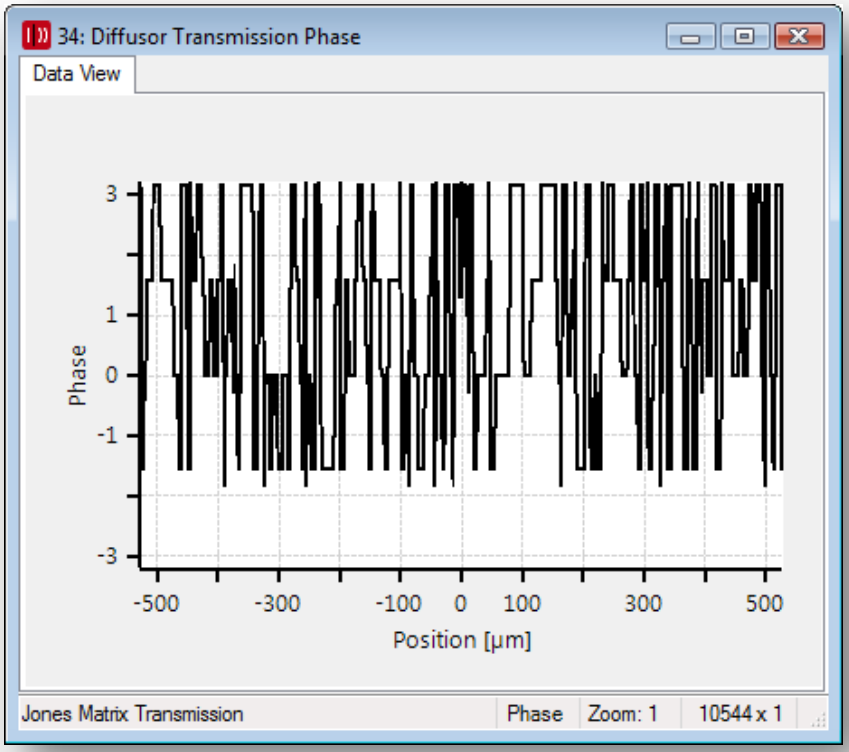

3: Light Path View (Light Path Diagram #2)
Gaussian Wave
Aperture
Stored Function
Ideal Lens
Virtual Screen
0
1
2
3
600
0 m
Relative
0 m
Relative
0 m
Relative
50 mm
Relative


2: Light Path Editor (Light Path Diagram #2)
Path
Detectors
Analyzers
Start Element
Target Element
Linkage
Index
Type
Channel
Medium
Index
Type
Propagation Method
On/Off
0 Gaussian Wave - Standard Air in Homogen... 1 Aperture Combined SPW/Fresnel Operator On
1 Aperture T Standard Air in Homogen... 2 Stored Function Combined SPW/Fresnel Operator On
2 Stored Function T Standard Air in Homogen... 3 Ideal Lens Combined SPW/Fresnel Operator On
3 Ideal Lens T Standard Air in Homogen...
Tools
Re-Use Automatic Settings
Simulation Type :
Field Tracing
Go!

8. Simulation Results

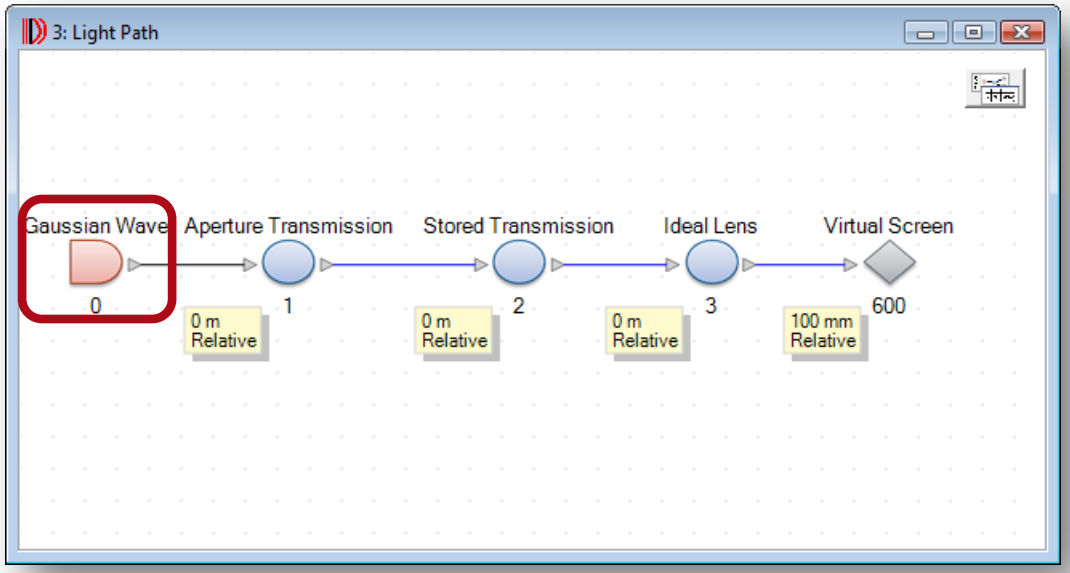


Intensity Line Focus

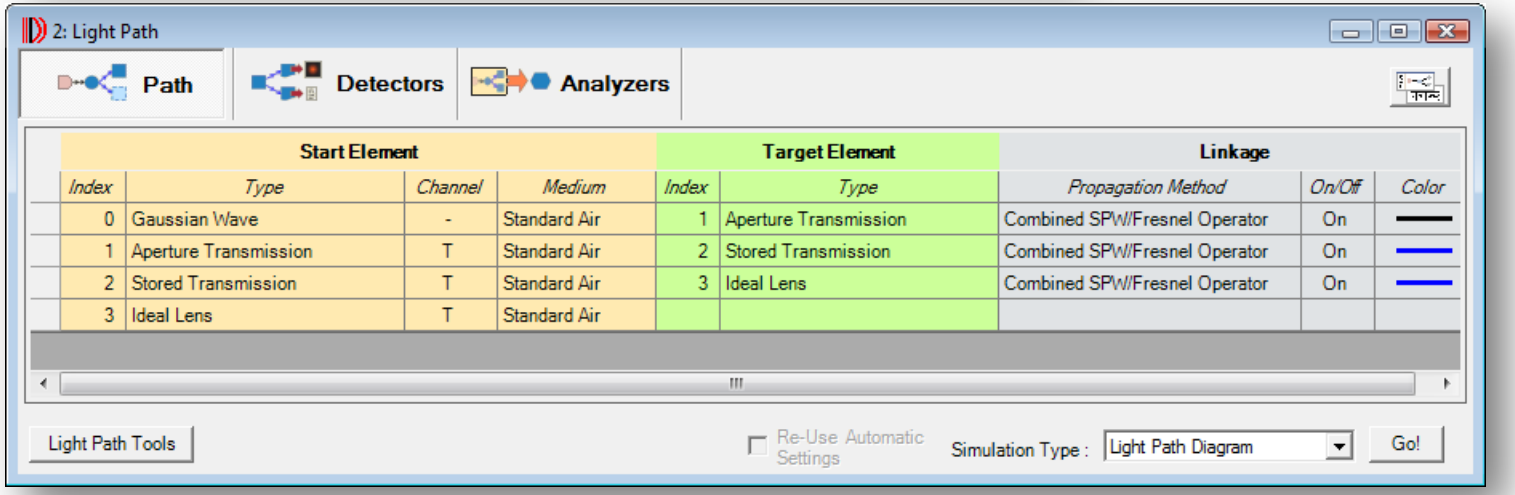


Diffuser Transmission Phase
(Click φ on toolbar)

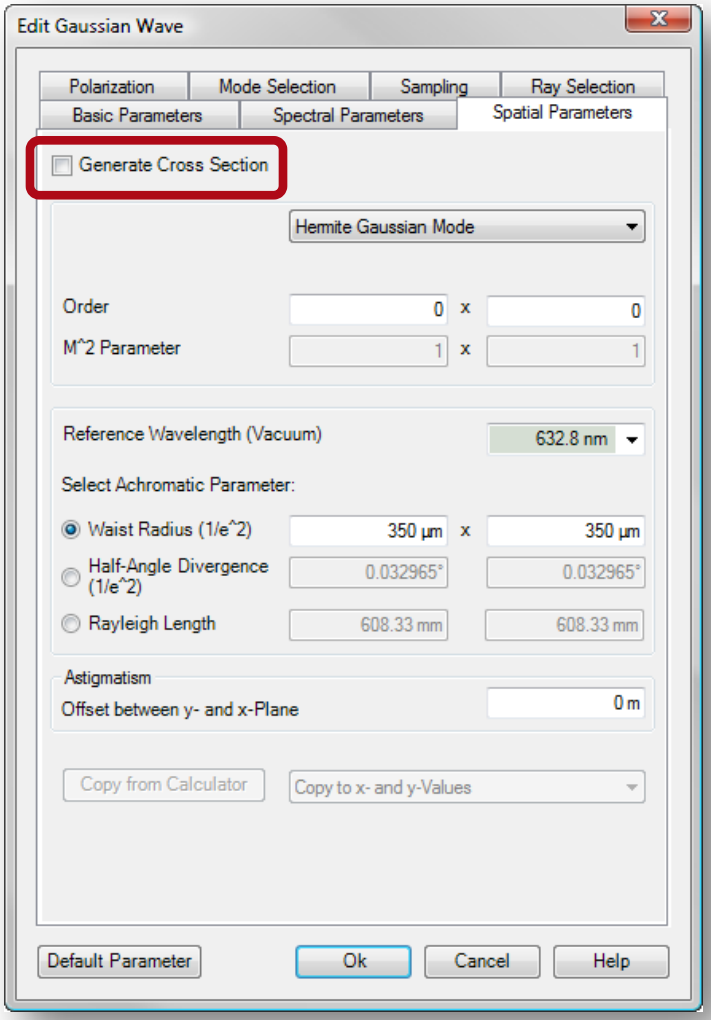
9. Light Path



Double click Gaussian Wave light source.

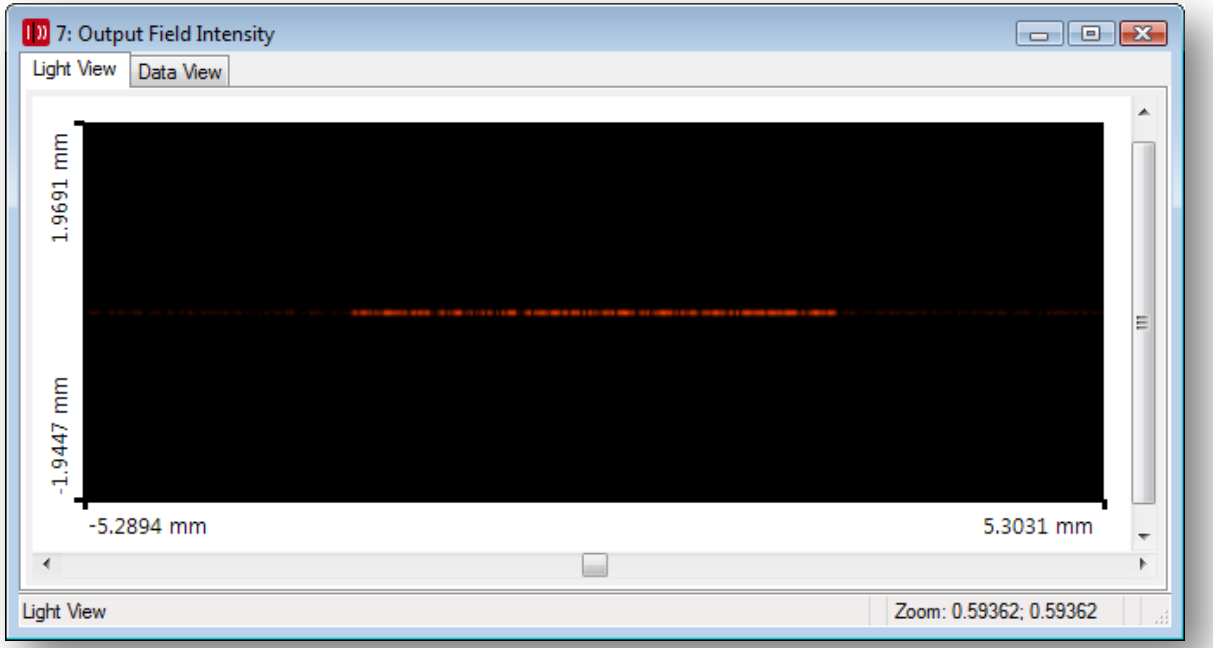


9. Gaussian Wave Light Source



- Switch off Generate Cross Section.
- Click Ok button.
- Press *Go!* on the Light Path Table

10. Simulation Results



2D Intensity distribution in target plane

Conclusion

- VirtualLab™ assists customer during design of diffractive optical elements for generation of diffuse lines or Top Hats.

- Assisted design steps enable also optical engineers inexperienced in diffractive optics to benefit from current developments.