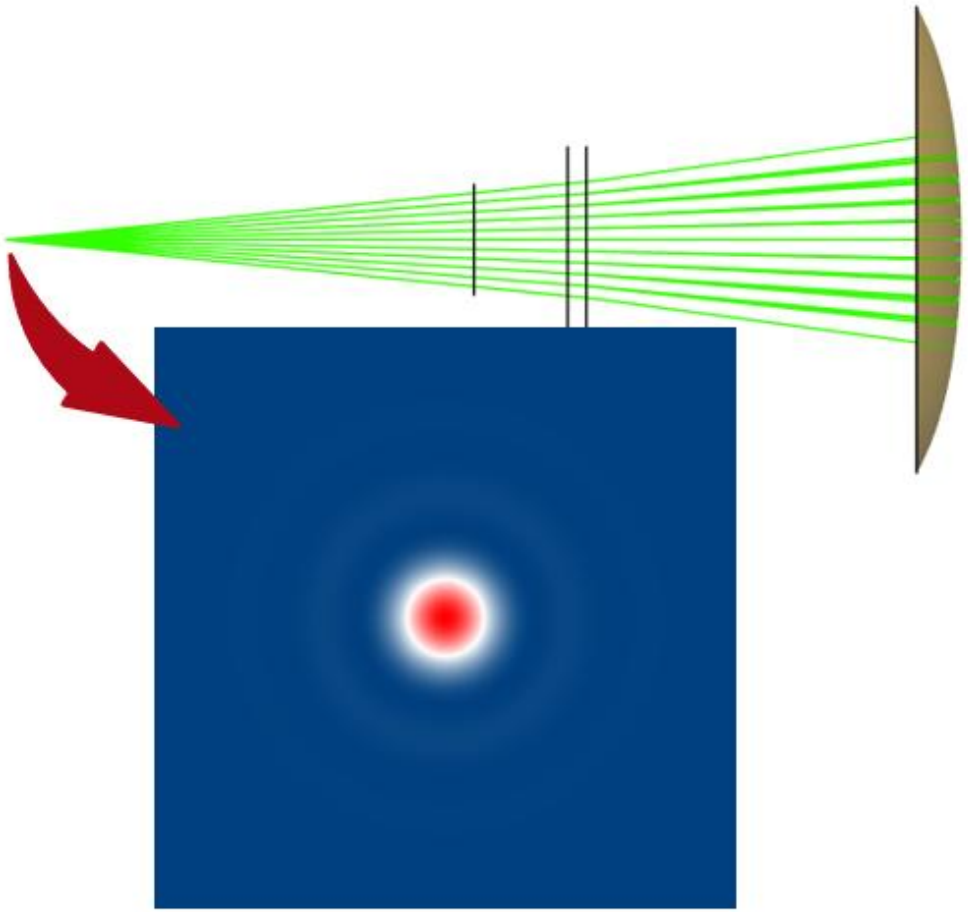
Design of a Computer Generated Hologram (CGH) for Null-Testing

Abstract

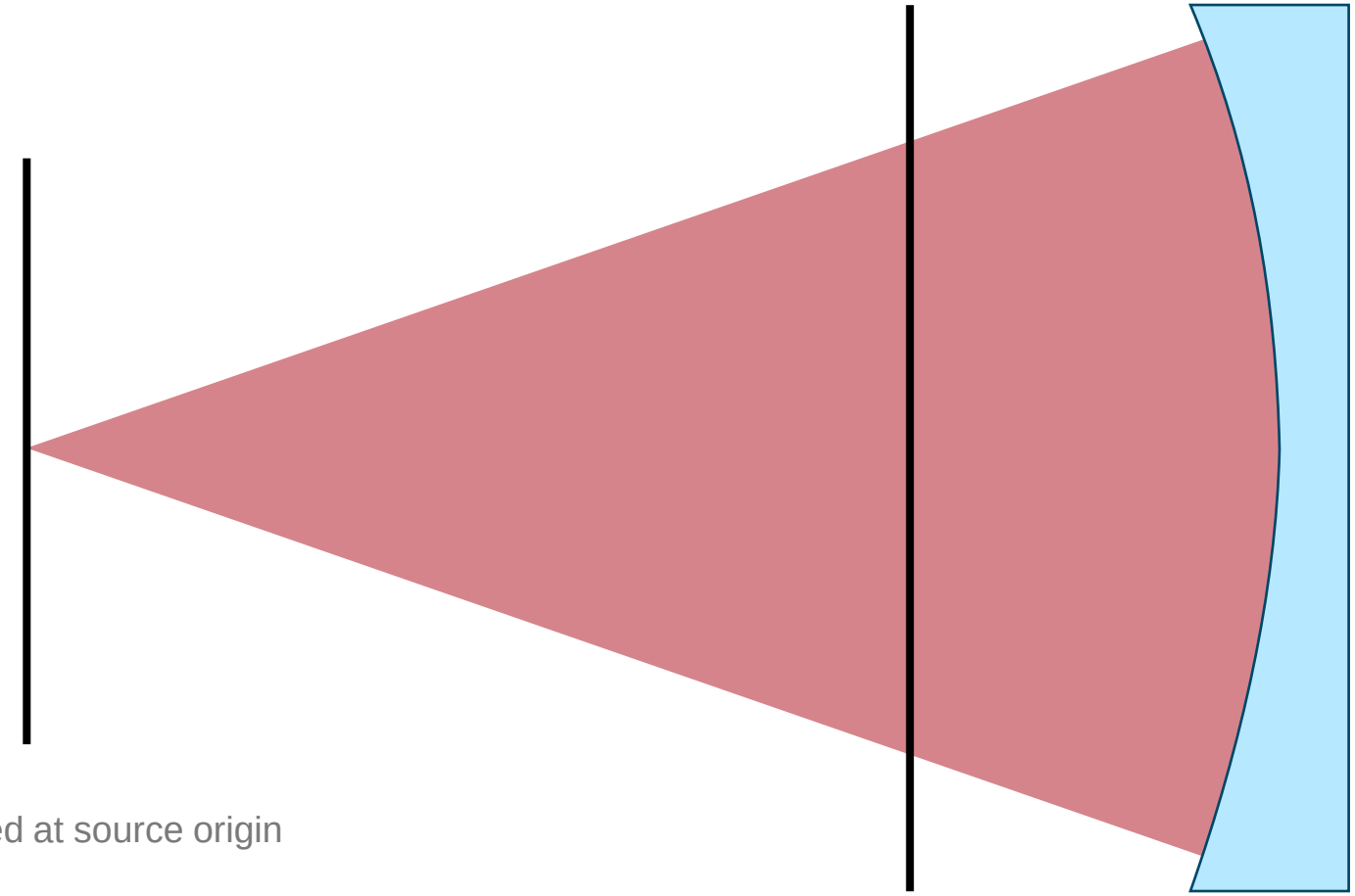


This document presents the design and application of a Computer-Generated Hologram (CGH) for the null-testing of an aspherical lens. A simplified system was considered, consisting of a point source, the CGH in form of an ideal diffractive lens, and the asphere. We then optimized the CGH to compensate the aberrations introduced by the lens. By introducing the optimized CGH into the optical path, the aberrations are corrected such that the system produces a diffraction limited spot at the output.

Application Scenario

Application Scenario: System

Computer generated hologram (CGH)

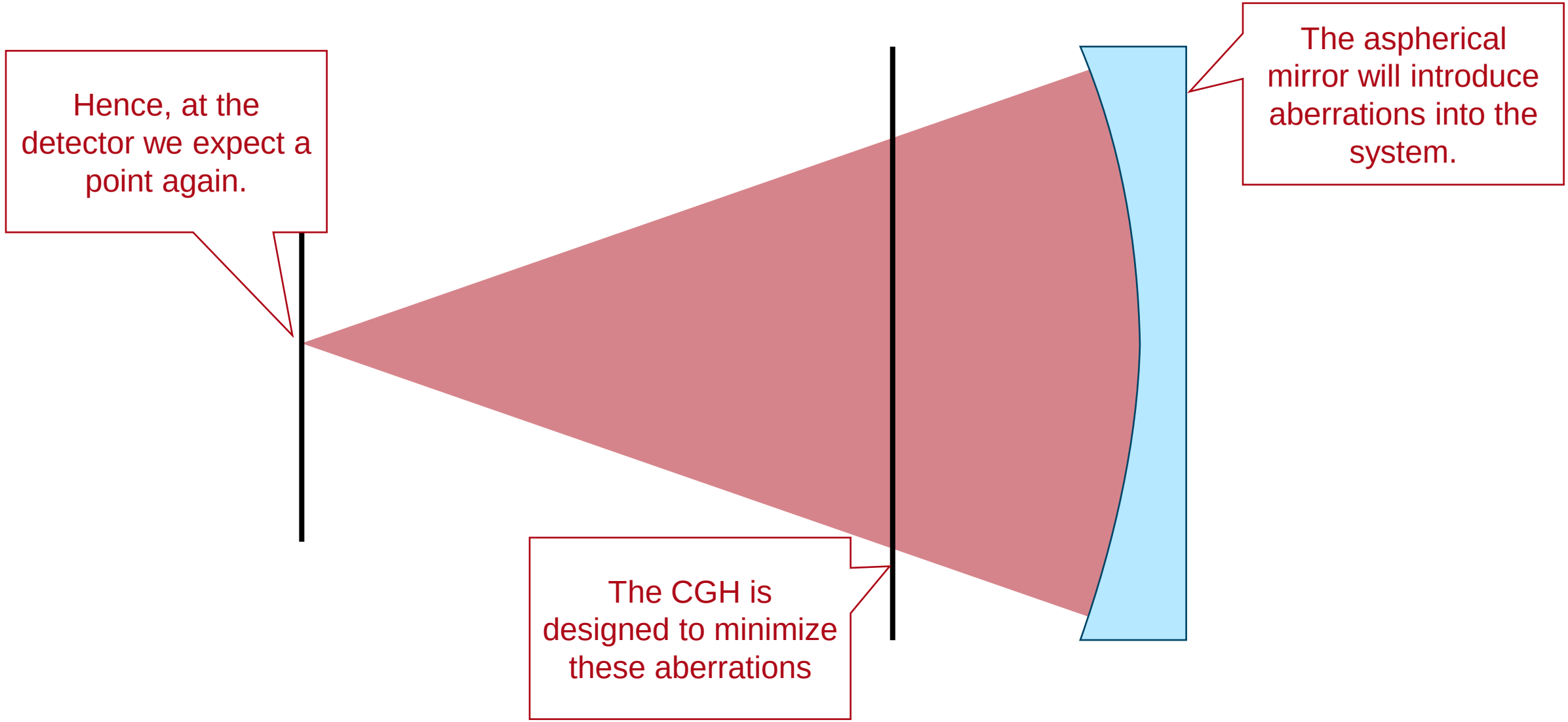


Source
- Spherical wave
- wavelength: 532 nm

Detector
- Positioned at source origin

Asphere
- Radius of curvature: 102.09 nm
- Conical constant: -0.83321
- Asphere coefficients:
  - 4: 3.4881e-06 mm^{-3}
  - 6: 1.1518e-09 mm^{-5}
  - 8: 1.2018e-12 mm^{-7}
  - 10: -1.1835e-15 mm^{-9}

Application Scenario: System



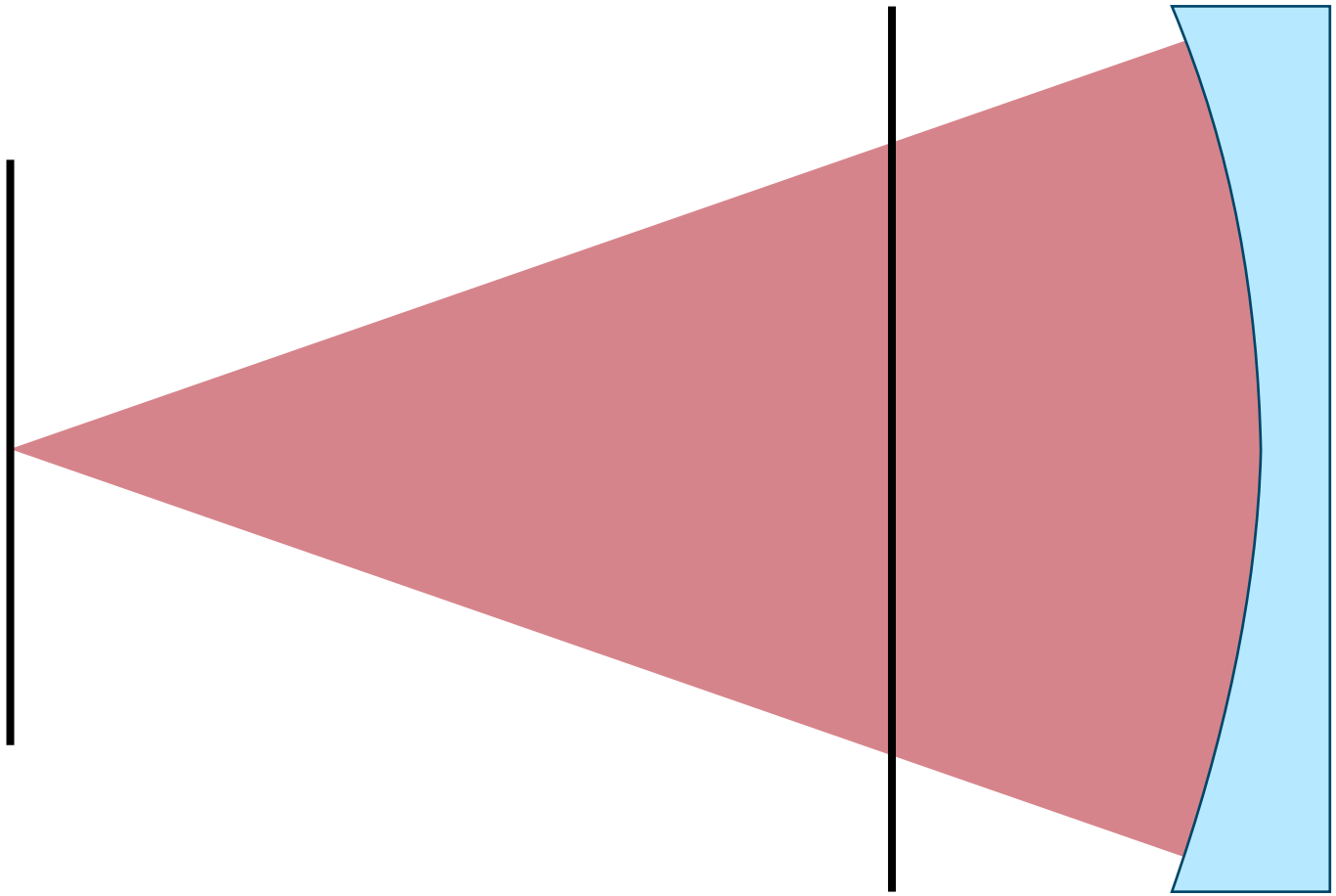
Application Scenario: Task

Task: Minimize spot size and investigate the irradiance and spot pattern at the detector plane

Computer Generated Hologramm

Parameters to be varied:

- **Aspherical coefficients (2,4,6,8,10,12,14)**

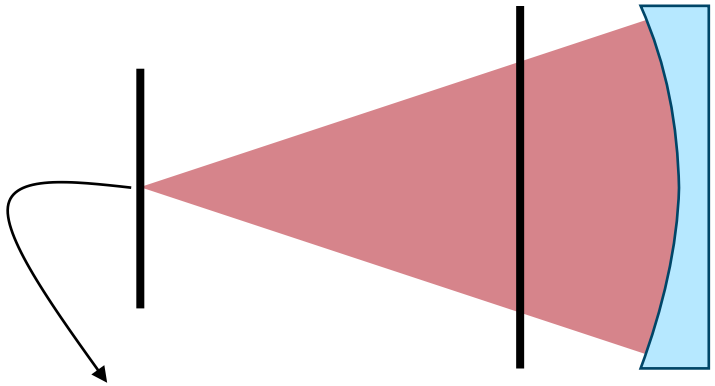


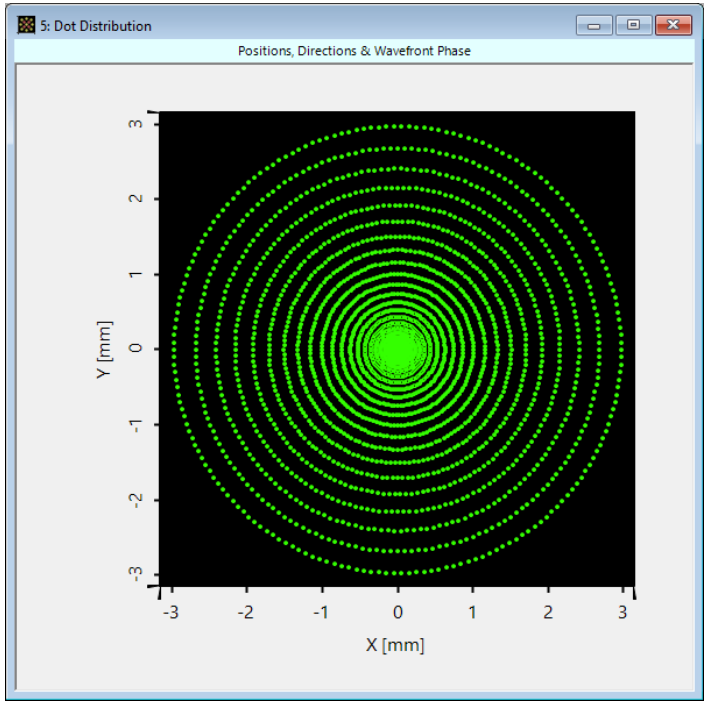
Detector

- **Irradiance**
- **Spot size**

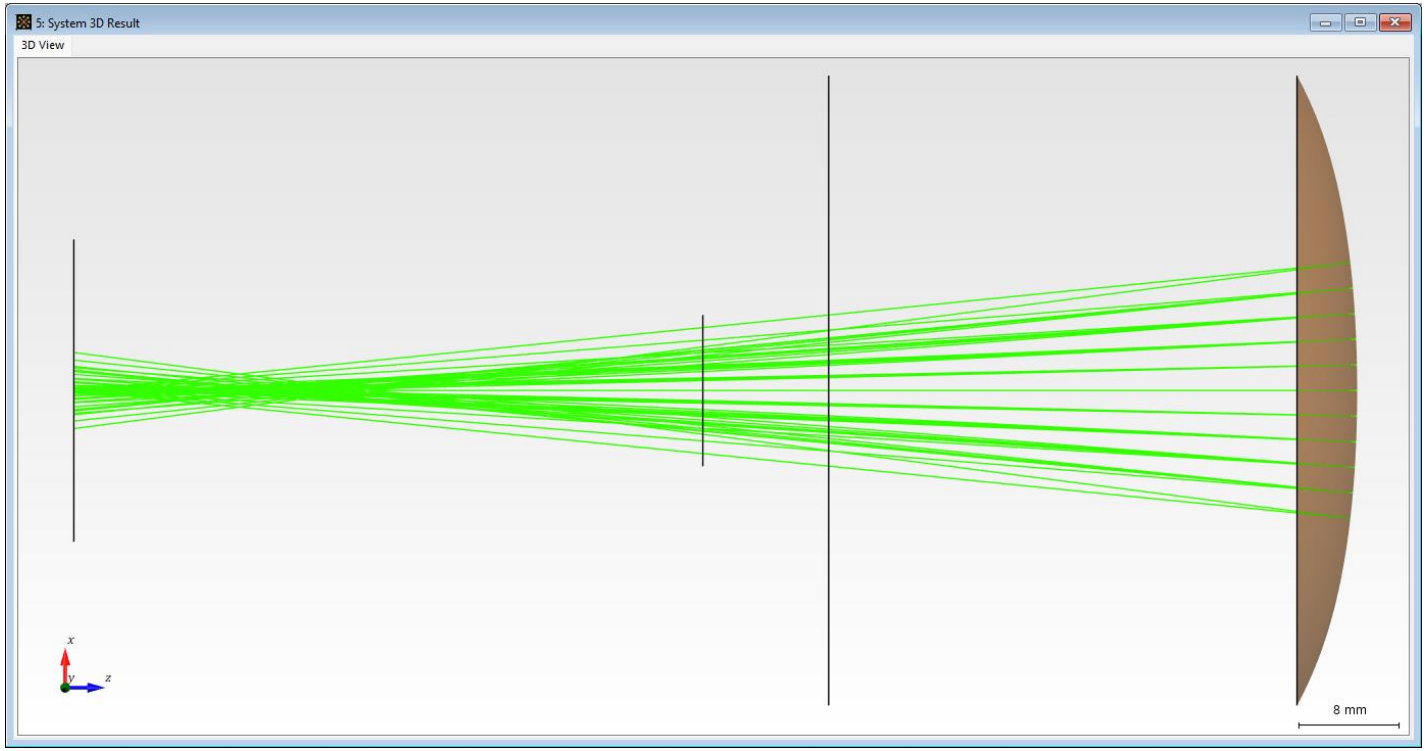
Results

System Visualization and Spot Diagram of Initial System





Spot Diagram

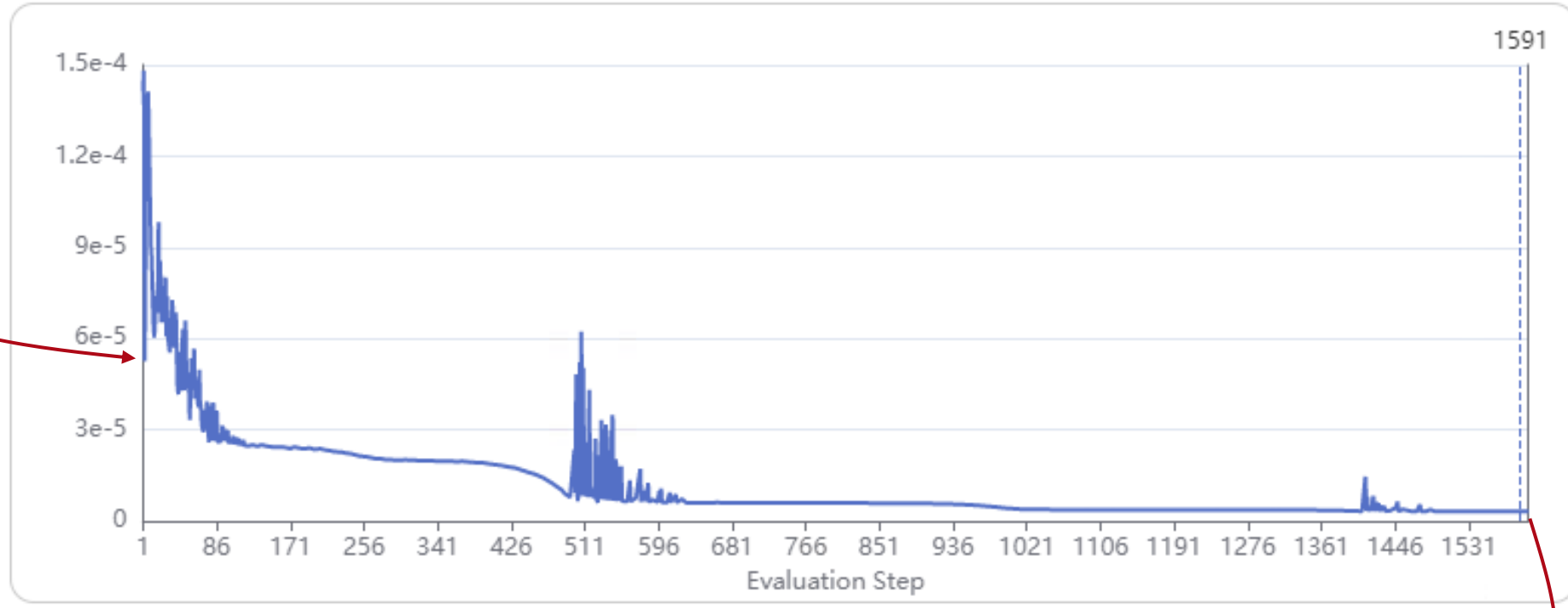


System visualization

Optimization of Spot Size

Initial system

- Spot size: 3 mm

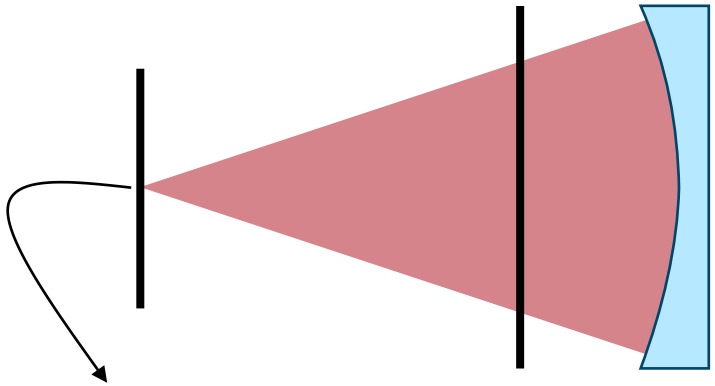


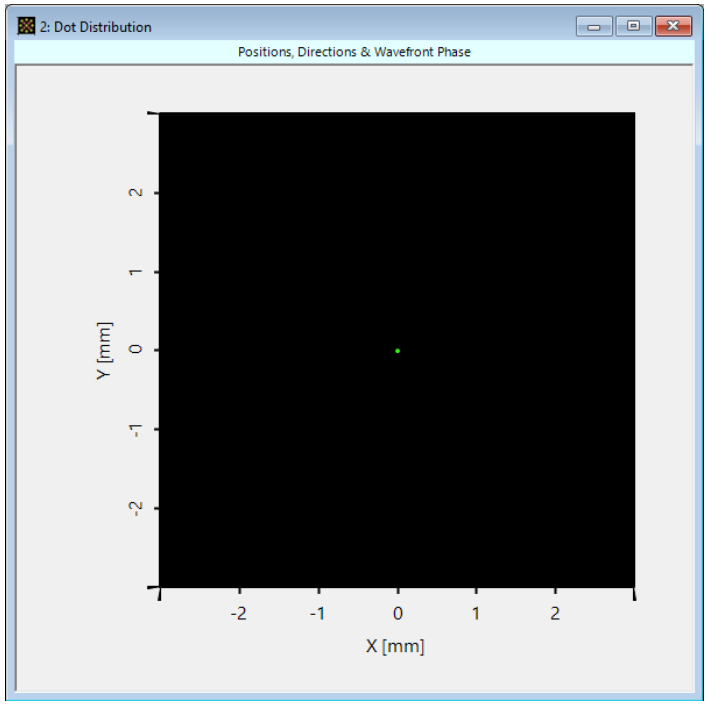
Optimized system (*)

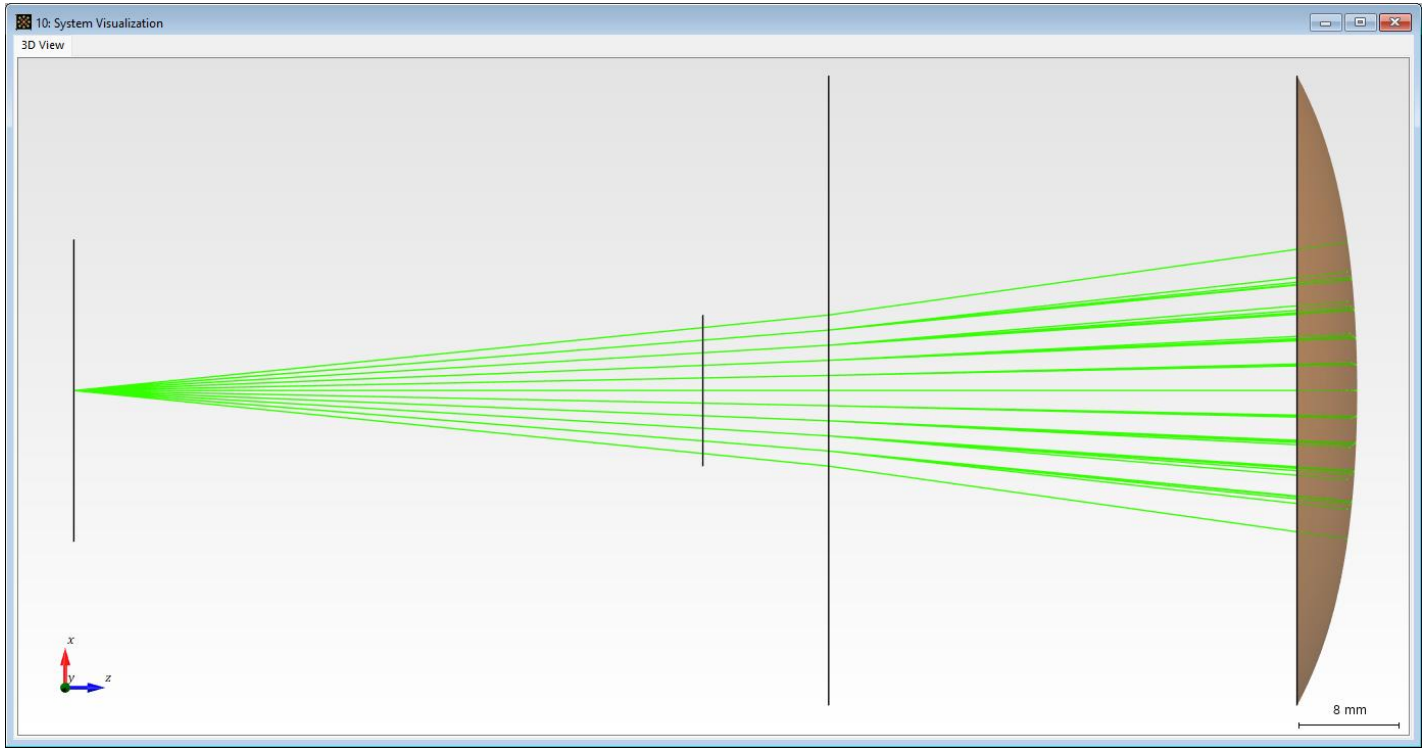
- Spot size: 5.4 µm

(*) Note: We only optimized the spot size until we reached a diffraction limited spot. For applications even better results may be achievable.

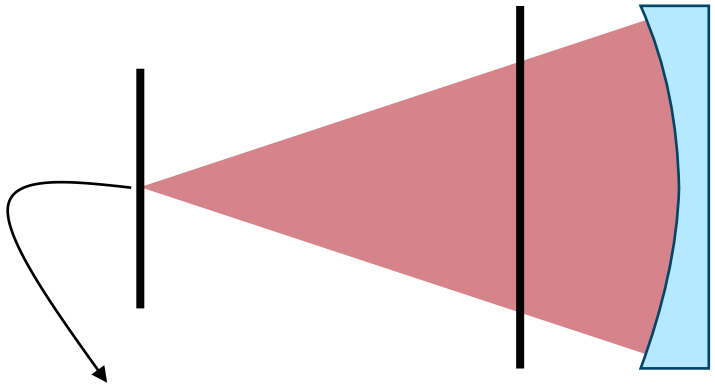
System Visualization and Spot Diagram of Optimized System

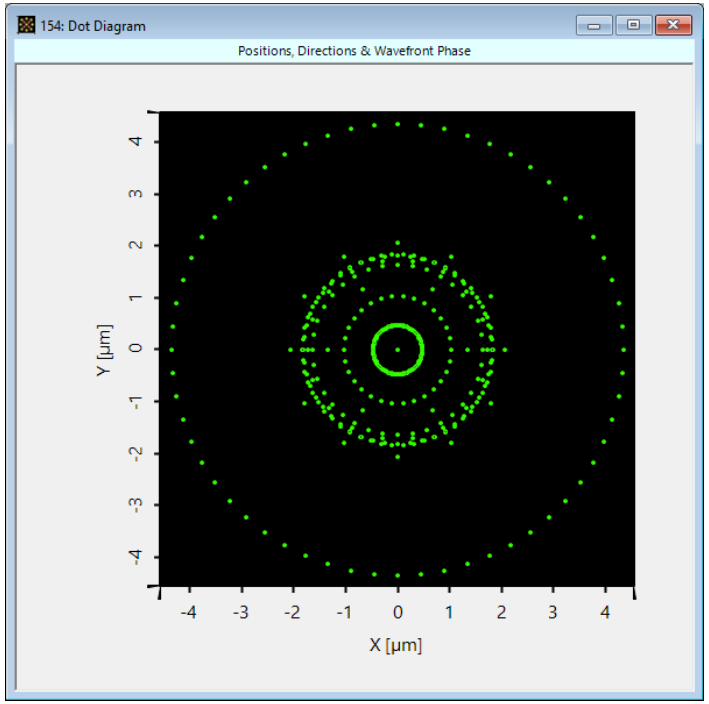


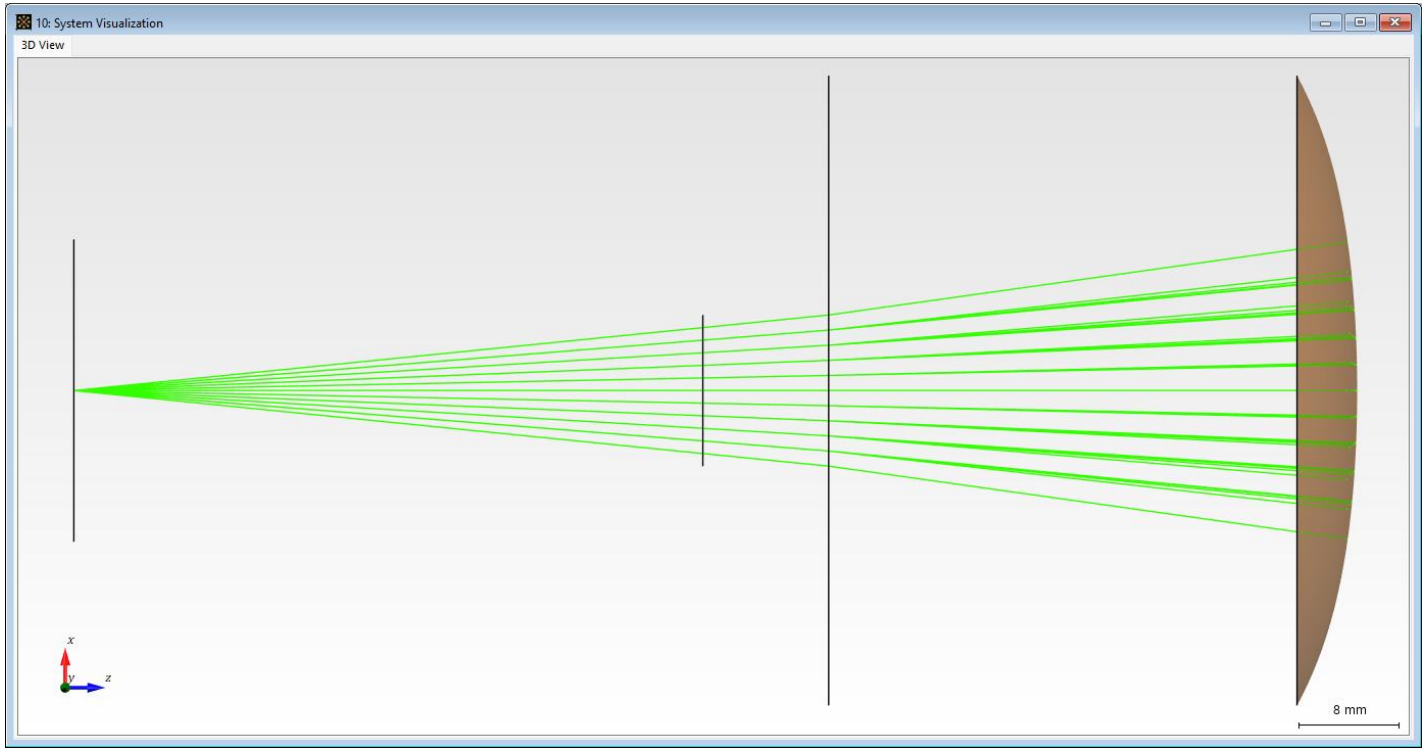




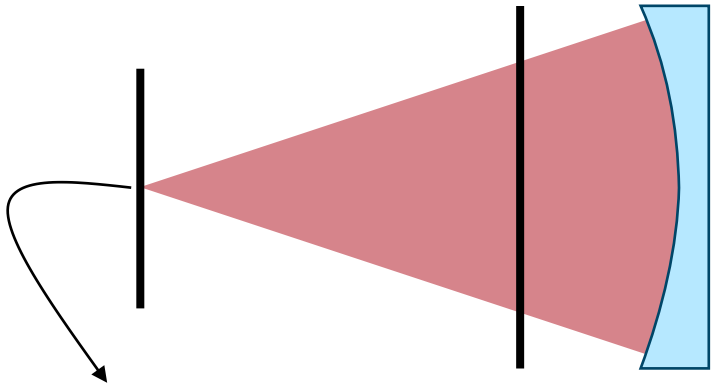
System Visualization and Spot Diagram of Optimized System

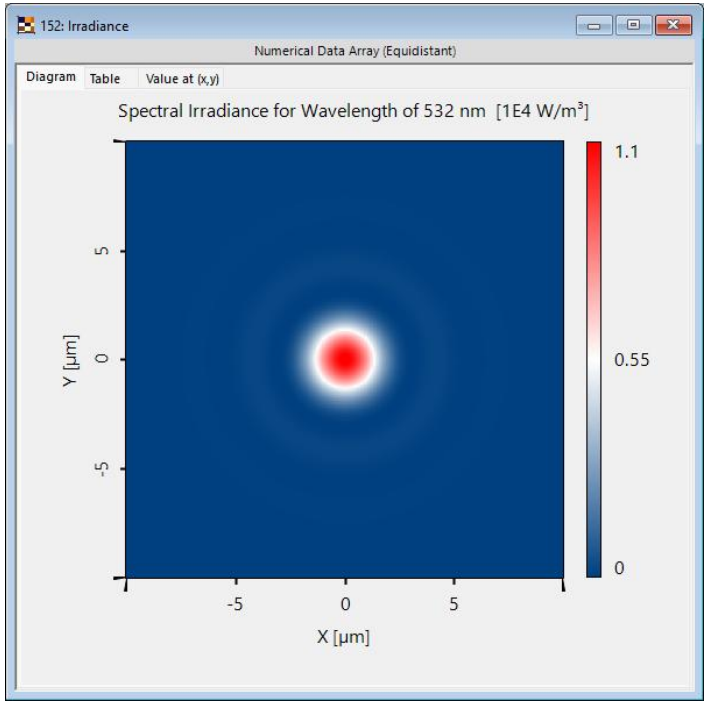


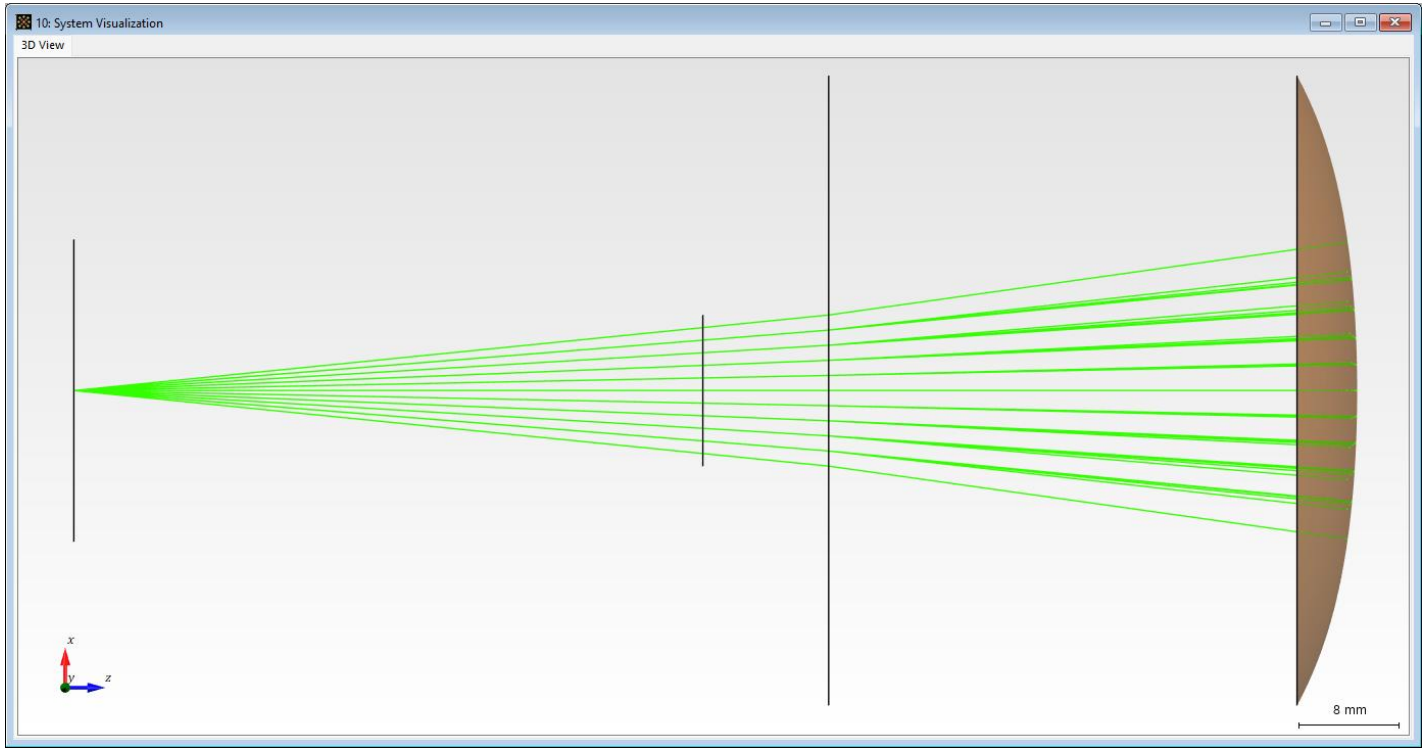




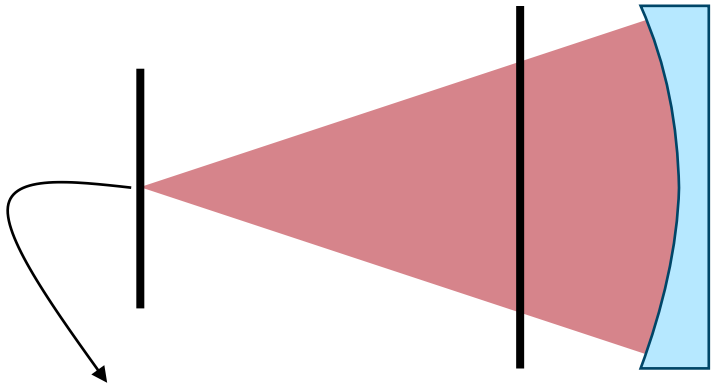
System Visualization and Irradiance of Optimized System

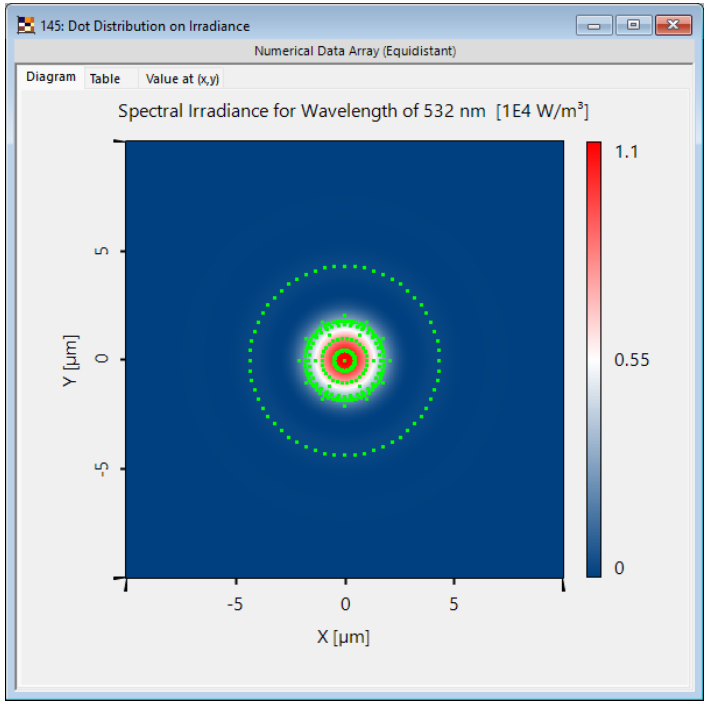


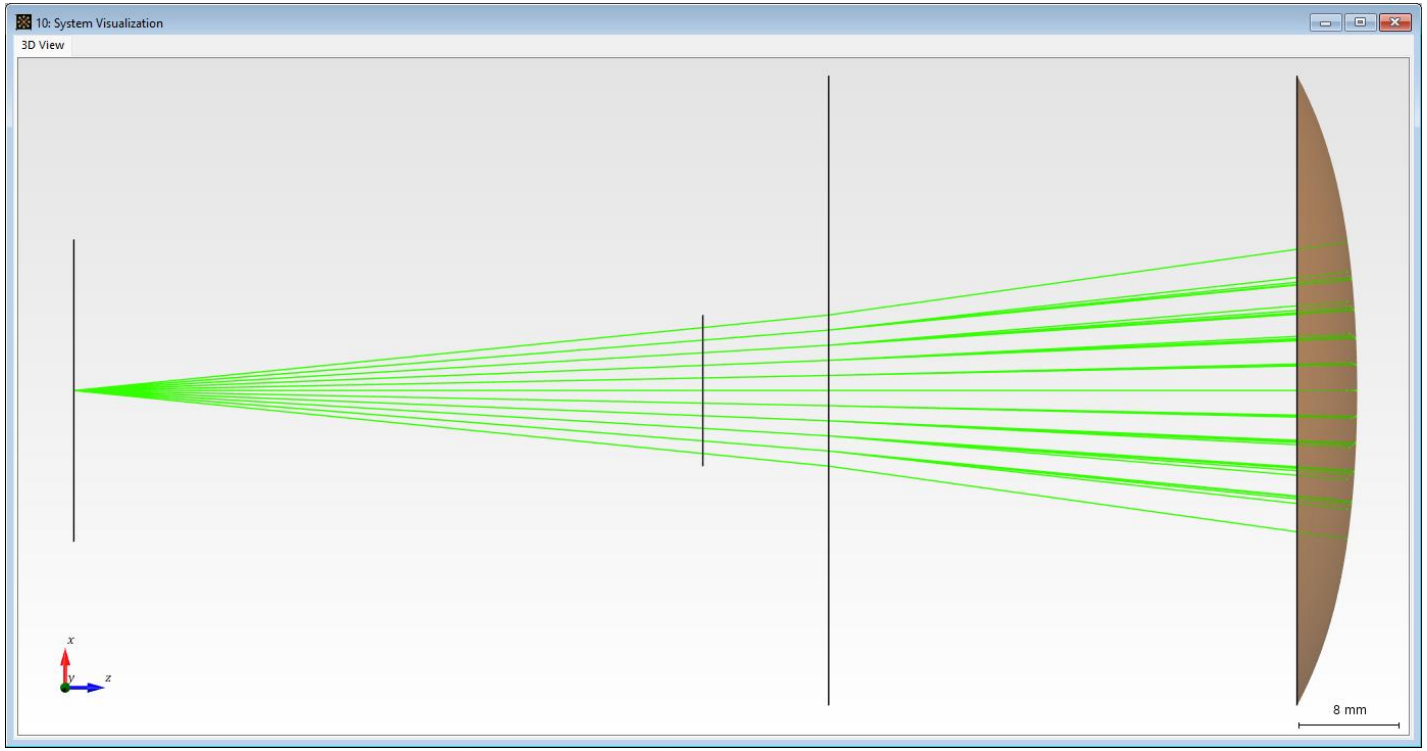




Irradiance and Spot Diagram of Optimized System







Workflows

LP Mode Source

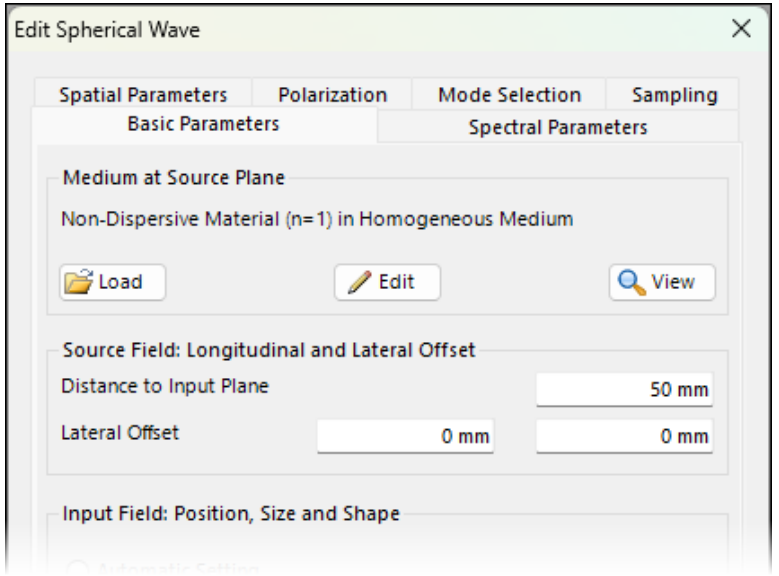
Source selection

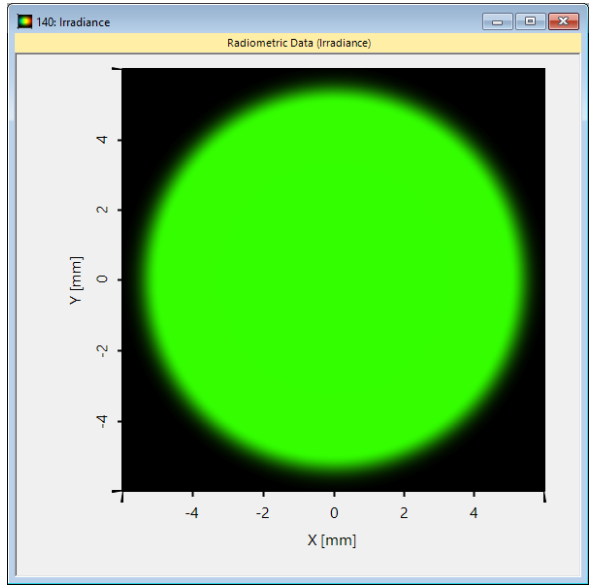
System setup

Detector selection

Getting it done in VirtualLab Fusion:

- Spherical Wave





System Setup

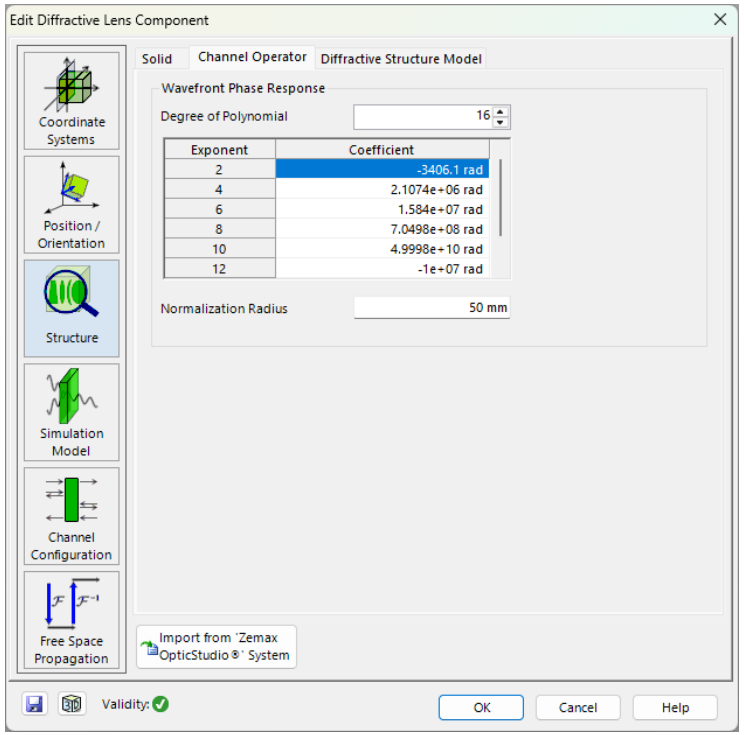
Source selection

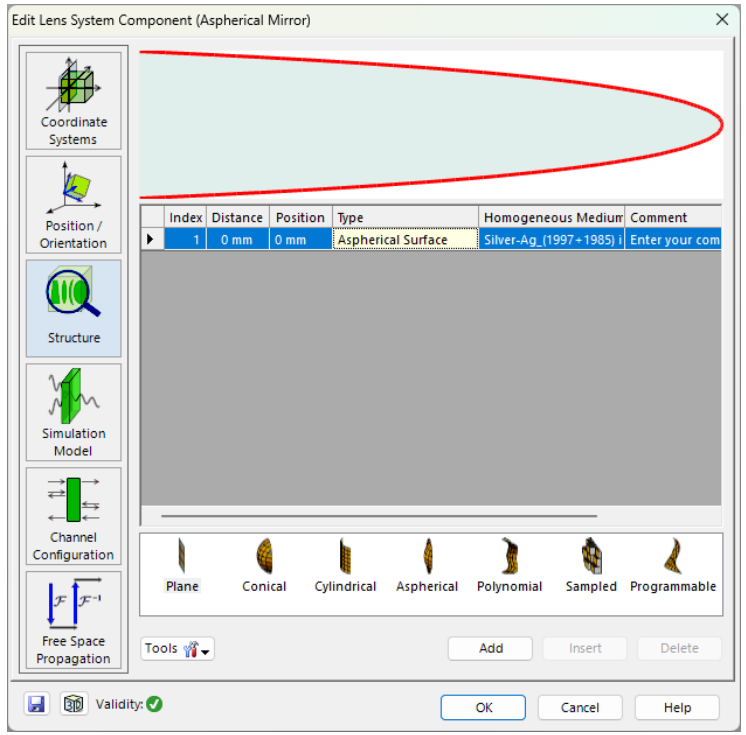
System setup

Detector selection

Getting it done in VirtualLab Fusion:

- Model CGH by Diffractive Lens component
- Include Aspherical Surface into Lens System component





Detector Selection

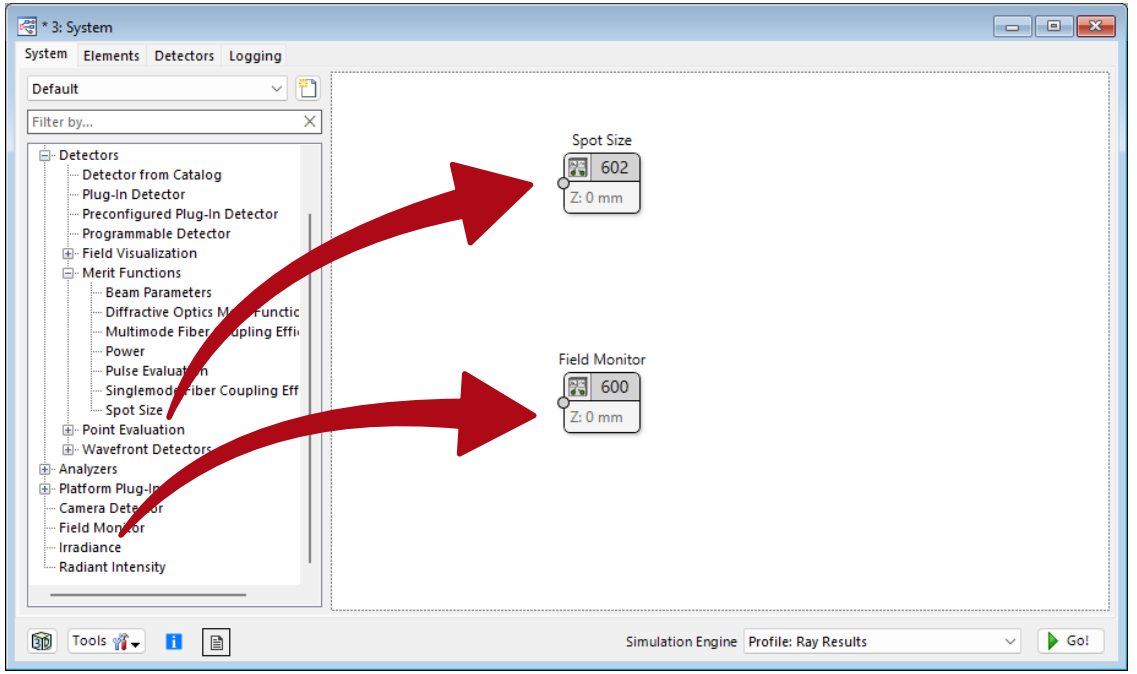
Source selection

System setup

Detector selection

Getting it done in VirtualLab Fusion:

- Load Irradiance detector into system
- Load Spot Size detector into system

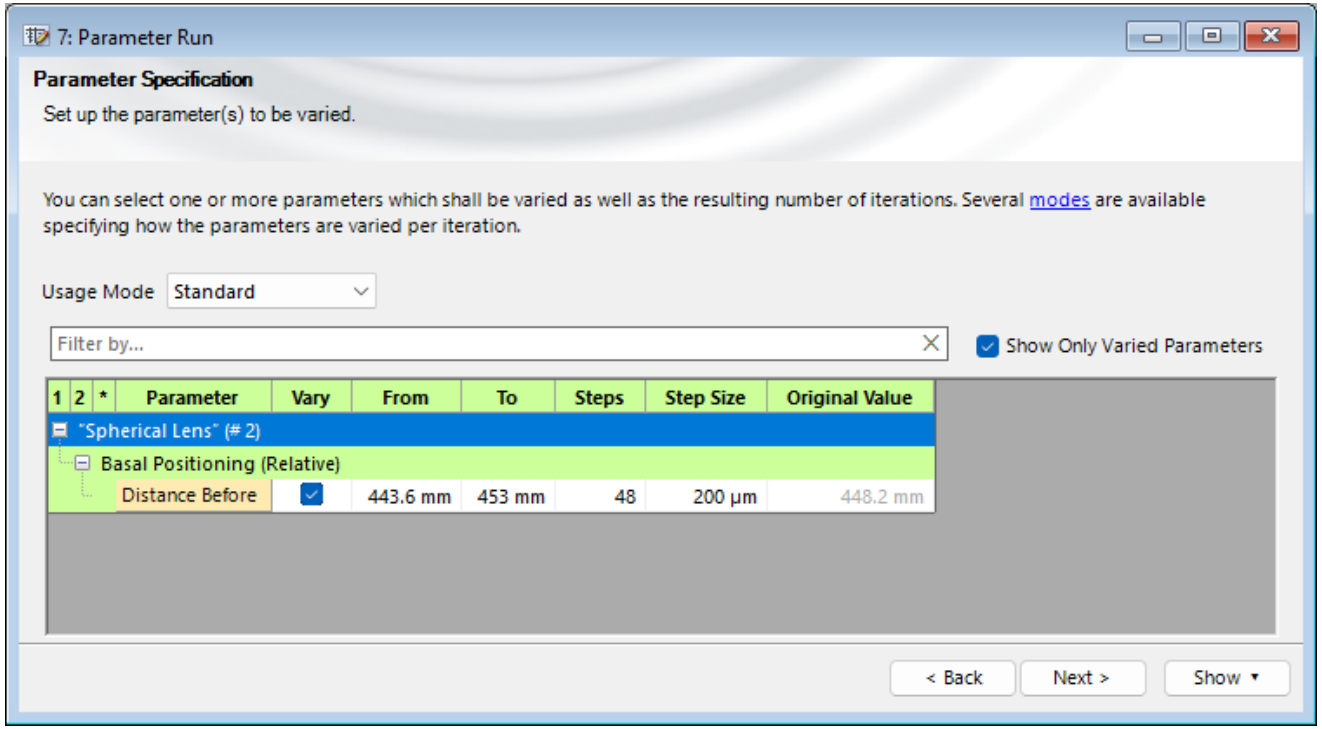


Specific Workflow Steps Related to Use Case

Perform Optimization

Getting it done in VirtualLab Fusion:

- Parameter Run document



Parameter Run document

Document Information

Title	Design of a Computer Generated Hologram (CGH) for Null-Testing
Document code	USC.0466
Publication date	29.09.2025
Required packages	- No additional package required for simulation - Optimization package required to perform the optimization
Software version	2025.1 (Build 2.118)*
Category	Use Case
Further reading	- Chromatic Aberration Correction by an Idealized Diffractive Lens in a Hybrid Eyepiece Model - Focus Investigation behind Aspherical Lens

* *The files attached to this document require the specific version or later.*

Marketing Picture