Modeling of Graded-Index (GRIN) Lens
Abstract

Graded-index (GRIN) media, with smooth variation of refractive indices, can be used to e.g. make a lens with flat surface, or reduce the aberrations. VirtualLab Fusion provides a physical-optics modeling technique for light propagation through GRIN media. With the same speed but far beyond ray tracing, the physical-optics modeling takes fully electromagnetic fields into consideration, which includes the polarization crosstalk effects.
How to model light propagation through GRIN media?

input point source
- wavelength 1024 nm
- linearly polarized in x direction

How to calculate field on focal plane behind a GRIN lens?

refractive index distribution

1 mm

1.60

1.45

1 mm

1 mm
Ray Tracing Results

dot diagram on focal plane

ray tracing analysis of the complete system
Field Tracing Results – behind GRIN Lens

- Input field is linearly polarized along x direction.
- Fully vectorial modeling of field propagation through the GRIN lens.

Images show the electric field after passing through the GRIN lens, with polarization crosstalk indicated.
Field Tracing Results – Focal Plane

Input field is linearly polarized along x direction.

GRIN lens

polarization crosstalk
Peek into VirtualLab Fusion

- Ray tracing system analyzer
- Electromagnetic field detector
- PSF & MTF detector
Workflow in VirtualLab Fusion

• Set up input point source
  – Basic Source Models [Tutorial Video]

• Construct a graded-index lens
  – Construction and Modeling of a Graded-Index Lens [Use Case]

• Configure a Detector
  – Usage of PSF & MTF Detector [Use Case]
  – Electromagnetic Field Detector [Use Case]
VirtualLab Fusion Technologies

Field Solver

1. Crystals & anisotropic components
2. Nonlinear components
3. Free space
4. Prisms, plates, cubes, ...
5. Lenses & freeforms
6. Apertures & boundaries
7. Gratings
8. Diffractive, Fresnel, meta lenses
9. HOE, CGH, DOE
10. SLM & adaptive components
11. Diffusive beam splitters
12. Diffusers
13. Waveguides & fibers
14. Scattering

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<td>- Gaussian Beam Focused by a Thermal Lens</td>
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