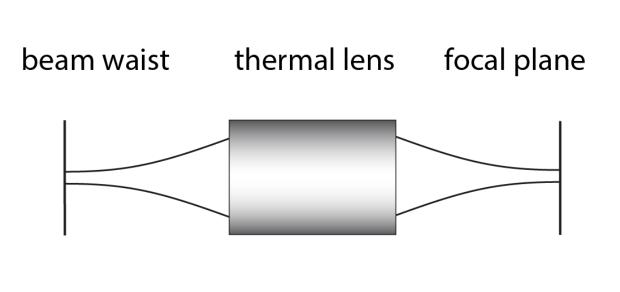
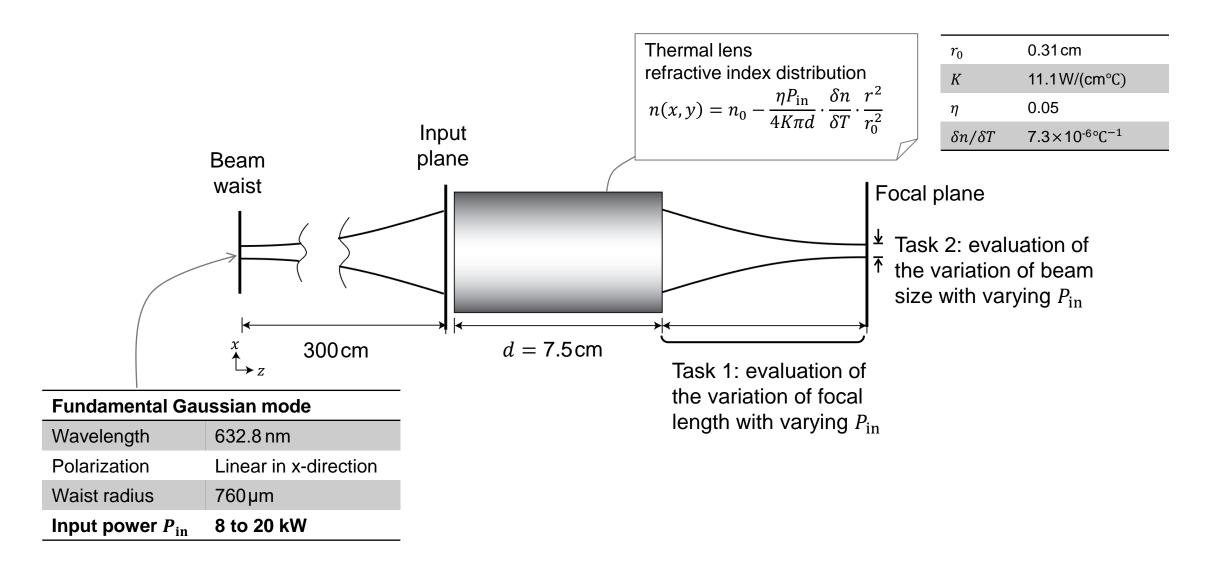


Gaussian Beam Focused by a Thermal Lens

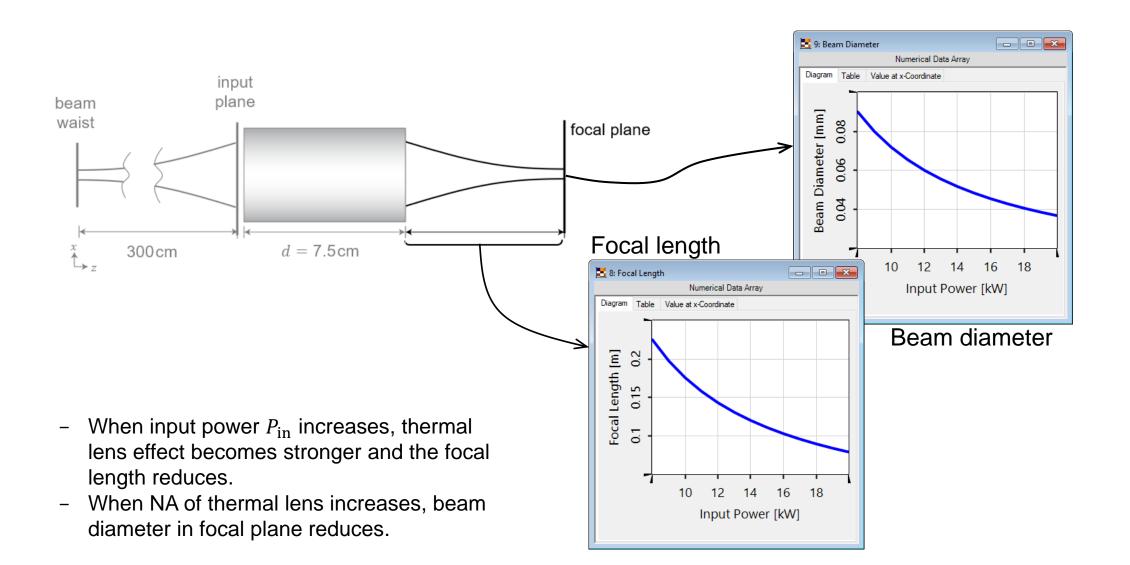


Thermal lens effect describes the inhomogeneity of refractive index of medium, which is induced by thermal gradient of a high-power incident laser beam. For a Gaussian beam with specified parameters, refractive index is mathematically the represented as a function of temperature and input power [W. Koechner, Appl. Opt. 9, 2548-2553 (1970)]. This use case shows the variation of the focal length of the thermal lens, as well as the focus beam diameter when the input power changes. This example is published in [H. Zhong, J. Opt. Soc. Am. A 35].

Modeling Task



Results



Peek into VirtualLab Fusion

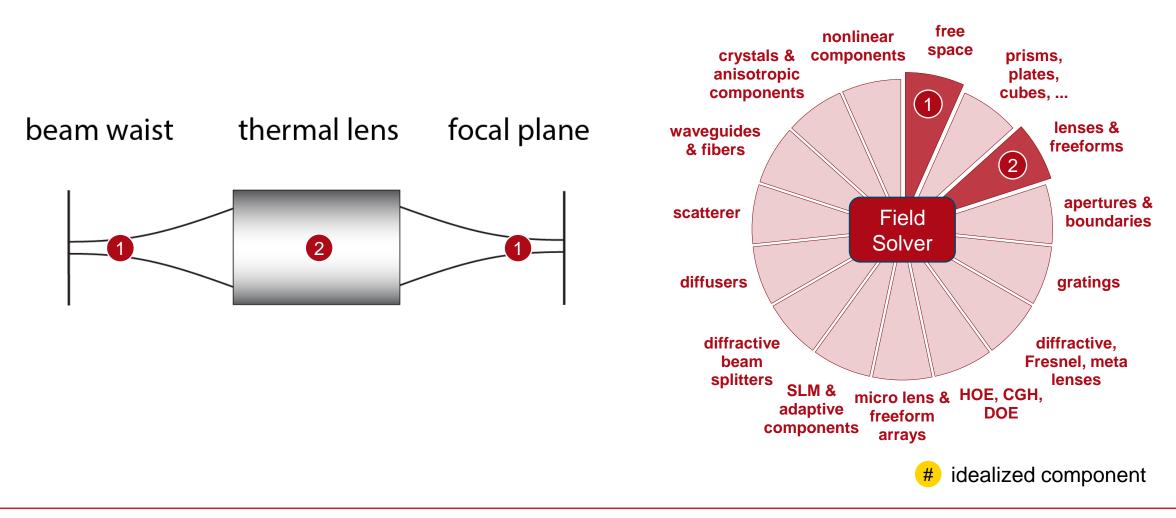
| Edit Programmable Medium (x-y-z-Modulated) | Customizable | | | | |
|---|---|---|--|--|--|
| Basic Parameters Scaling Periodization Base Material | graded-index | Edit Beam Parameters X | | | |
| Name Vacuum Q | Preview for Thermal Lens – – × Extension and Section Plane View Parameters | Detector Window and Resolution Detector Function Geometry / Channels Vectorial Component Ex Component | | | |
| State of Matter Gas or Vacuum | View Range (x, y, z) 1 mm 1 mm 1 mm Section Plane Image: section plane Image: section plane Image: section plane z-Position of Section Plane Image: section plane Image: section plane Image: section plane | Diameter X Diameter Y Waist Diameter X Waist Diameter Y | | | |
| Definition Image: Constraint of the second secon | Diagram Table Real Part of "Refractive Index" | Position / Orientation Full Divergence Angle X Full Divergence Angle Y Waist Distance X Waist Distance Y M2-Parameter in x-Direction M2-Parameter in x-Direction | | | |
| P 8kW r0 Source Code Editor Source Code Global Parameters Snippet Help Advanced Settings ig 1 ig 4 ig 5 ig 6 ig 6 ig 6 ig 7 double ita = 5E-2; double dndT = 7.3E-6; 10 double dndT = 7.3E-6; 11 double no = 1.823; double c1 = (-1.0) * ita * P / (4.0 * triat * P / (4.0 * tria | ***********/ ² [double] Wavelength [double] r0 [double] K * Math.PI * ; | Detector Parameters M*2-Parameter in y-Direction Centroid X Erree Space Parameters Rotation Angle of the Principal Axis Selection Tools Calculate Beam Parameters Relative to the Centroid Calculate Beam Parameters Relative to the Principal Axes Refine Sampling to Fully Sampled Spherical Phase Values having less than 0.001 ½ of the maximum intensity are ignored. | | | |
| Check Consistency Validity: 4 ² | Carcel Intel Action Carcel | Detector for Gaussian beam parameters | | | |

Workflow in VirtualLab Fusion

- Set up input Gaussian field
 - Basic Source Models [Tutorial Video]
- Customize the graded-index medium
 - How to Work with the Programmable Medium and Example (Thermal Lens) [Use Case]
- Use the Parameter Run
 - Usage of Parameter Run [Use Case]

| | Specification | | | | | | | |
|------------------------|--|----------------------|-----------|-----------------|-------------------|------------|----------------------|-----------------|
| bet up the p | arameter(s) to be varied | • | | | | | | |
| | | | | | | | | |
| | ect one or more paramet ow the parameters are v | | ried as w | ell as the resu | Iting number of i | terations. | Several <u>modes</u> | are available |
| specifying n | ow the parameters are v | aried per iteration. | | | | | | |
| | | | | | | | | |
| Jsage Mode | Standard | \sim | | | | | | |
| P | | | | | | × | Show Only | Varied Paramete |
| Object | Category | Parameter | Varv | From | Το | Steps | Step Size | Original Value |
| Object | First Interface (Plane Interface) | Scaling z-Direct | | -1E+300 | 1E+300 | Jiepa | 2E+300 | |
| Interface) Medium b | | Alpha | | -180° | 180° | 1 | | |
| | | Beta | | -180° | 180° | 1 | | |
| | Medium between | Base Material (V | | 0 | 1E+300 | 1 | 1E+300 | |
| | Interfaces (Thermal | Р | | 0 W 0 | 1 MW | 2 | 1 MW | 8 k\v/ |
| Thermal | Second Interface (Plane Interface) | Definition Area (| | 1 pm | 1E+303 mm | 1 | 1E+303 mm | |
| Lens #1 | | Definition Area (| | 1 pm | 1E+303 mm | 1 | 1E+303 mm | |
| | | Scaling x-Directi | | -1E+300 | 1E+300 | 1 | | |
| | | Scaling y-Directi | | -1E+300 | 1E+300 | 1 | | |
| | | Scaling z-Directi | | -1E+300 | 1E+300 | 1 | | |
| | | Alpha | | | | | | |
| | | Beta | | | | | | |
| Linkage | Automatic Propagation Operator | Accuracy Factor | | | | | | |
| from #1 (T) to | | Deviation Thresh | | | | | | |
| #607 | | Power Portion | | | | | | |
| 1 | | | | | | | | |

VirtualLab Fusion Technologies



| title | Gaussian Beam Focused by a Thermal Lens |
|------------------|---|
| document code | GRIN.0004 |
| version | 1.2 |
| edition | VirtualLab Fusion Basic |
| software version | 2020.1 (Build 1.202) |
| category | Application Use Case |
| further reading | <u>Construction and Modeling of a Graded-Index Lens</u> <u>Modeling of Graded-Index (GRIN) Multimode Fiber</u> |