

### Abstract

It is demonstrated how a GRIN lens with a pitch of 0.25 can be simulated with VirtualLab™.

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<b>Requirements:</b>	VirtualLab™ version 4.5.0 or higher – <b>Starter Toolbox</b>
<b>Scenario Version:</b>	1.0
<b>Sample Files:</b>	Corresponding files can be found <a href="#">here</a> .

The refractive index profile  $n(r)$  of a standard GRIN lens can be described as

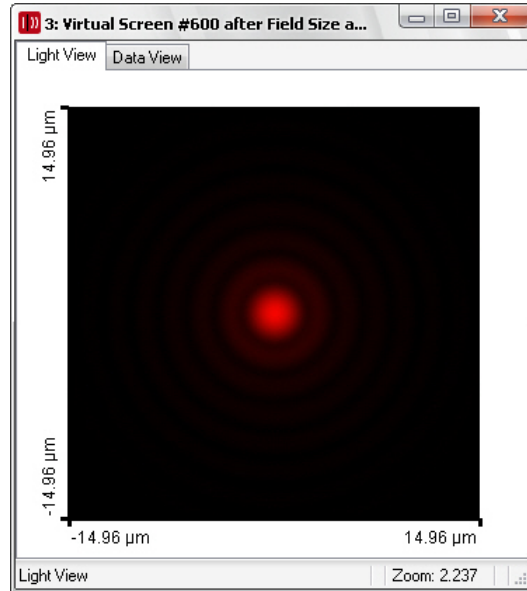
$$n(r) = n_0 \left( 1 - \frac{g^2}{2} r^2 \right) \quad (1)$$

where  $r$  is the distance from the optical axis of the lens. In the following, a catalog lens with  $n_0 = 1.624$ ,  $g = 305 \text{ m}^{-1}$  and a length of 5.15 mm is simulated. Such a lens has a pitch of 0.25 for a wavelength  $\lambda$  of 810 nm, which means that a collimated beam would be focused directly behind the lens.

To simulate a GRIN lens with VirtualLab™ you need a Double Interface Component where Split Step (BPM) is used as inhomogeneous medium propagation.

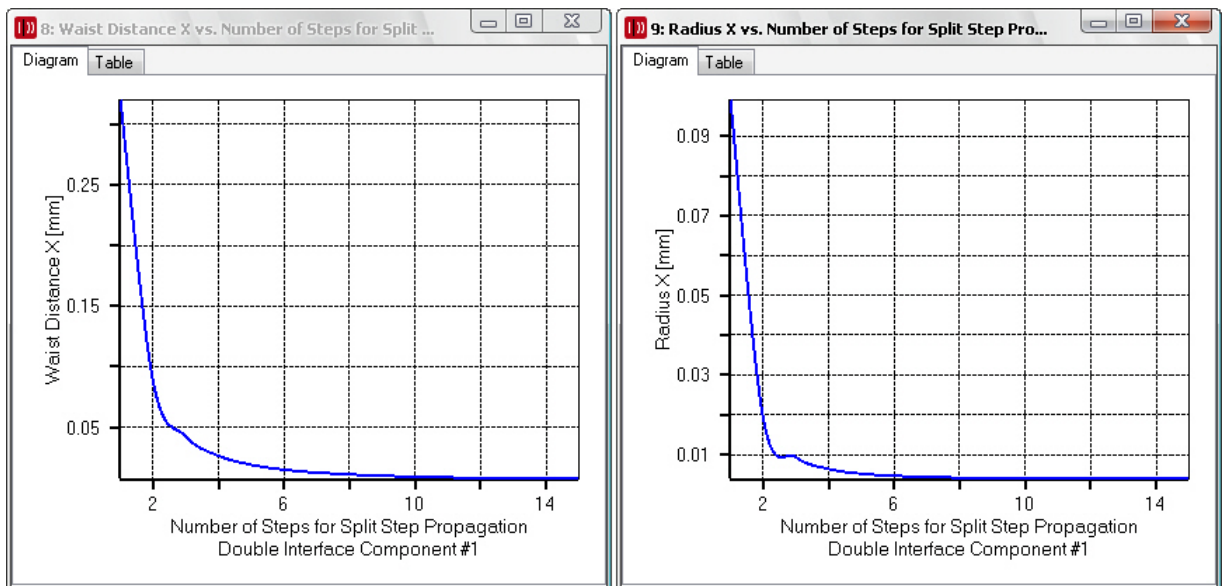
GRIN\_Lens.1pd contains the fully set-up Double Interface Component for simulating the specified GRIN lens as well as a collimated beam with a diameter of  $750 \mu\text{m}$ . The resulting field directly behind the lens is shown in

**Fig. 1.** At this position the beam diameter is only  $8.0\ \mu\text{m}$  and the waist distance is (nearly) zero, which means that the beam is indeed focused.



**Figure 1.** The beam directly after the GRIN lens.

GRIN\_Lens\_Variation\_of\_SplitStep\_Accuracy.run shows the convergence of the simulation if the number of steps used within the Split Step propagation. As you can see in Fig. 2, 10 steps are quite suitable for the simulation of a GRIN lens.



**Figure 2.** The convergence of beam radius and waist distance measured directly behind the GRIN lens if the number of steps of the split step propagation is increased.

## Technical Support

If you have any questions, remarks or problems concerning this application scenario, or in using VirtualLab™ in general, please do not hesitate to contact us by E-Mail [support@lighttrans.com](mailto:support@lighttrans.com).

Please use the update service to install the current version of VirtualLab™. Alternatively you can use the latest **Trial Version** of VirtualLab™ which is available at our [download site](#). If you have been registered already for an older trial version, just contact us by [E-Mail](#).

To ensure that this application scenario gives the same results as described, set the global settings to the default values. In VirtualLab™ this can be done in the **Extras > Global Options** dialog with the **Reset All** button.