HSL.001 Homogenization of an LED by a Lens Array.

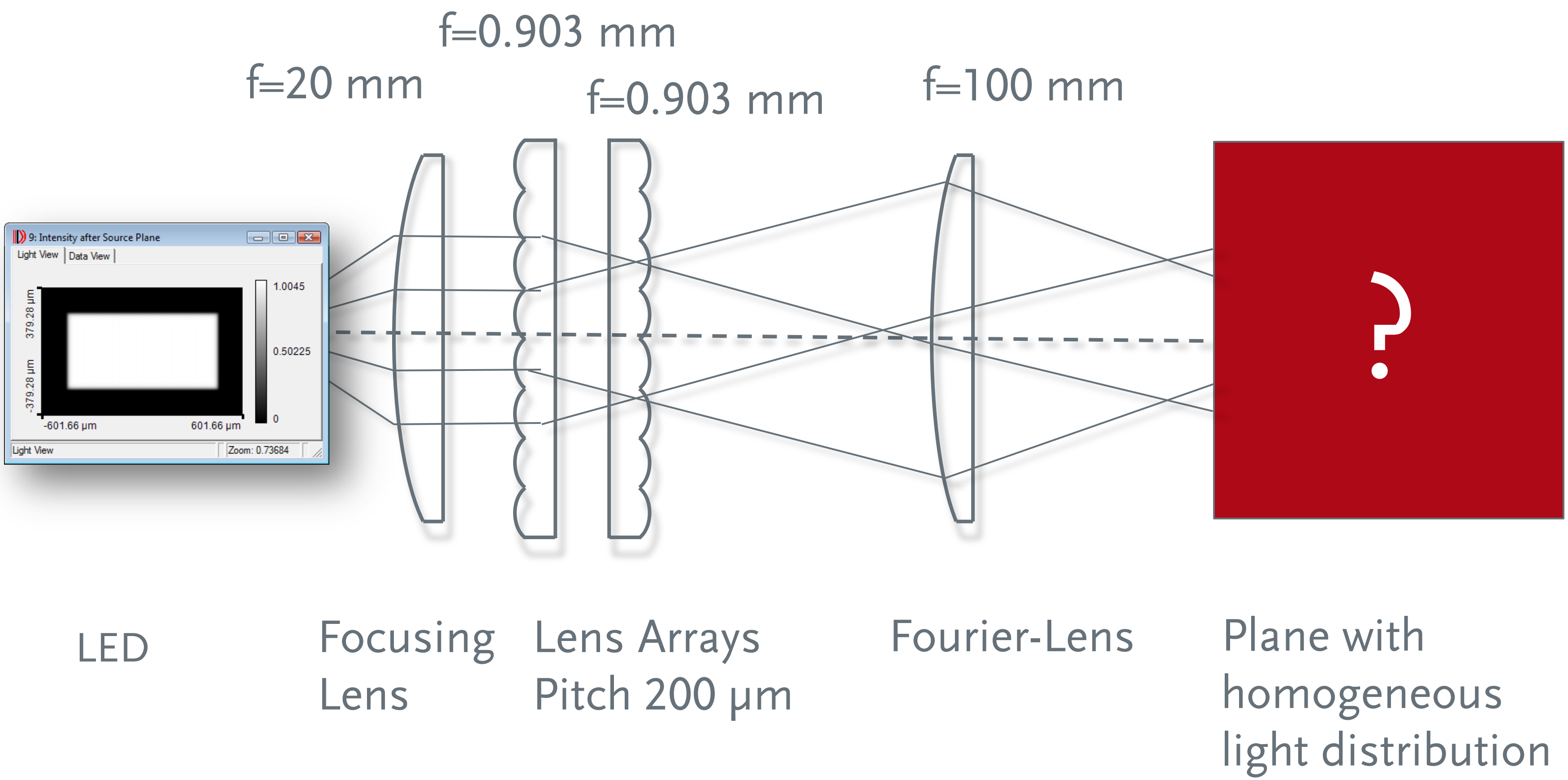
Example for the homogenization of a LED by two lens arrays with rotational symmetric lenses.

Keywords: Diffractive Optics, Diffractive Optical Elements, Homogenization, Lens Array, LED, Partial Coherence

Required Toolboxes: Starter Toolbox

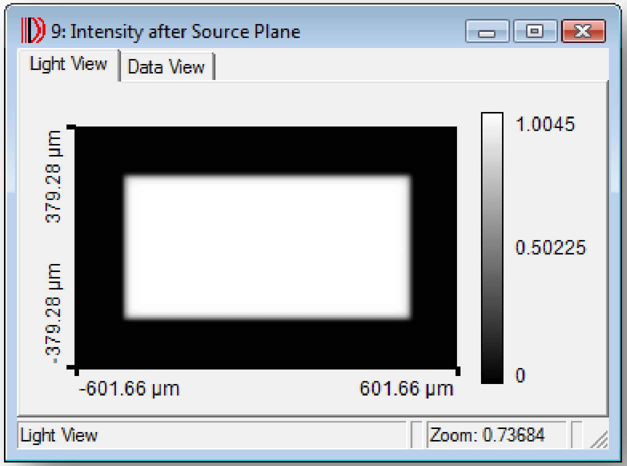
Related Tutorials: HSL.2

Modeling Task



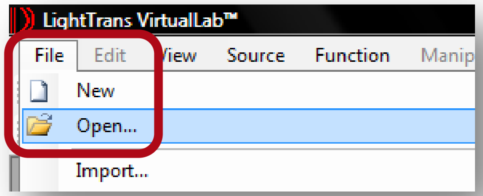
Modeling Task

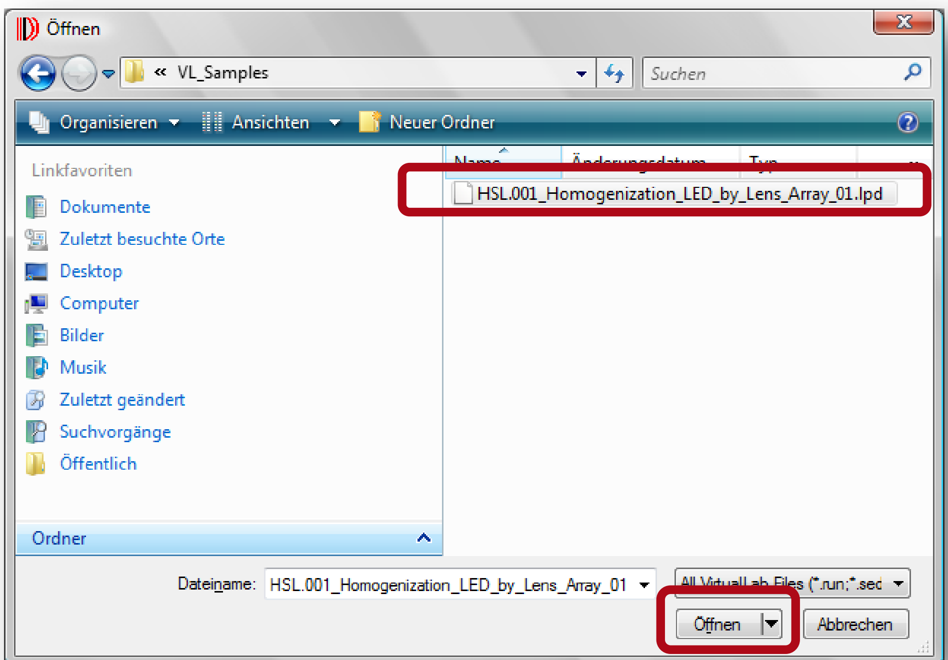
Illuminating Beam Parameters



- Source Plane Diameter:
  220µm x 220µm
- Divergence Angle (HWHM):
  5°x5°
- Spatial Coherence Length:
  800nm x 800nm
- Power spectrum:
  Gaussian (526 ± 30)nm

Loading of Light Path Diagram

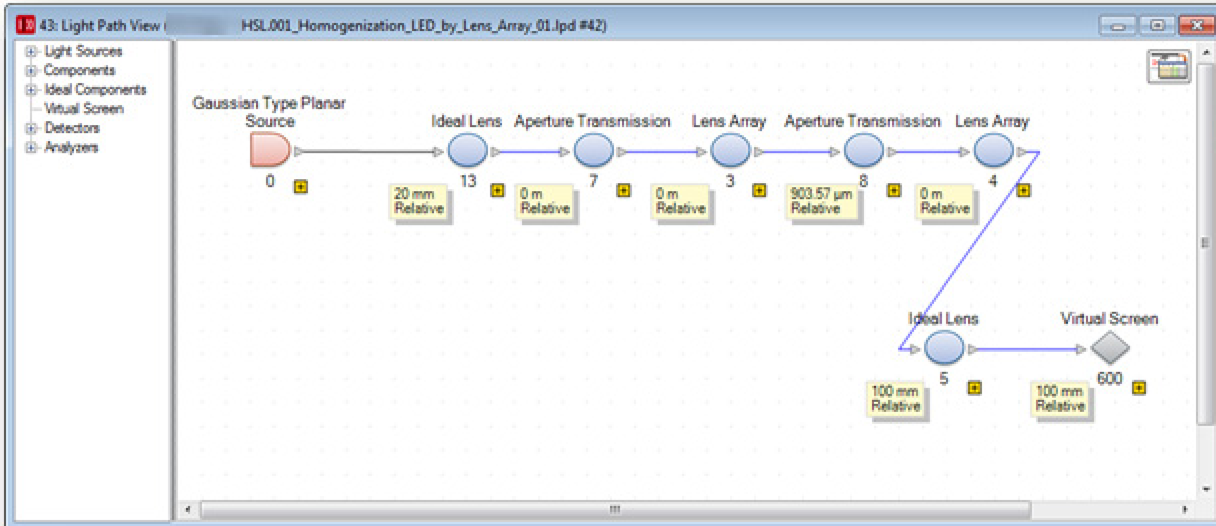


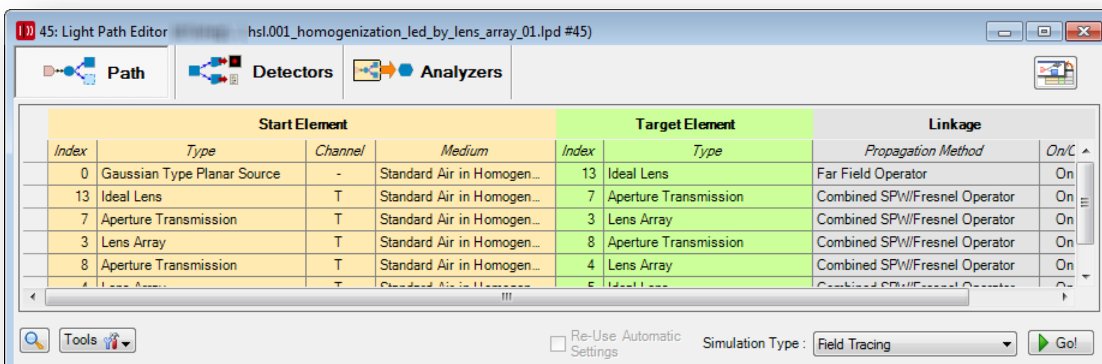


- Load the file HSL.001_Homogenization_LED_by_Lens_Array_01.lpd.
- The file can be found in the VL_Samples folder of this tutorial.

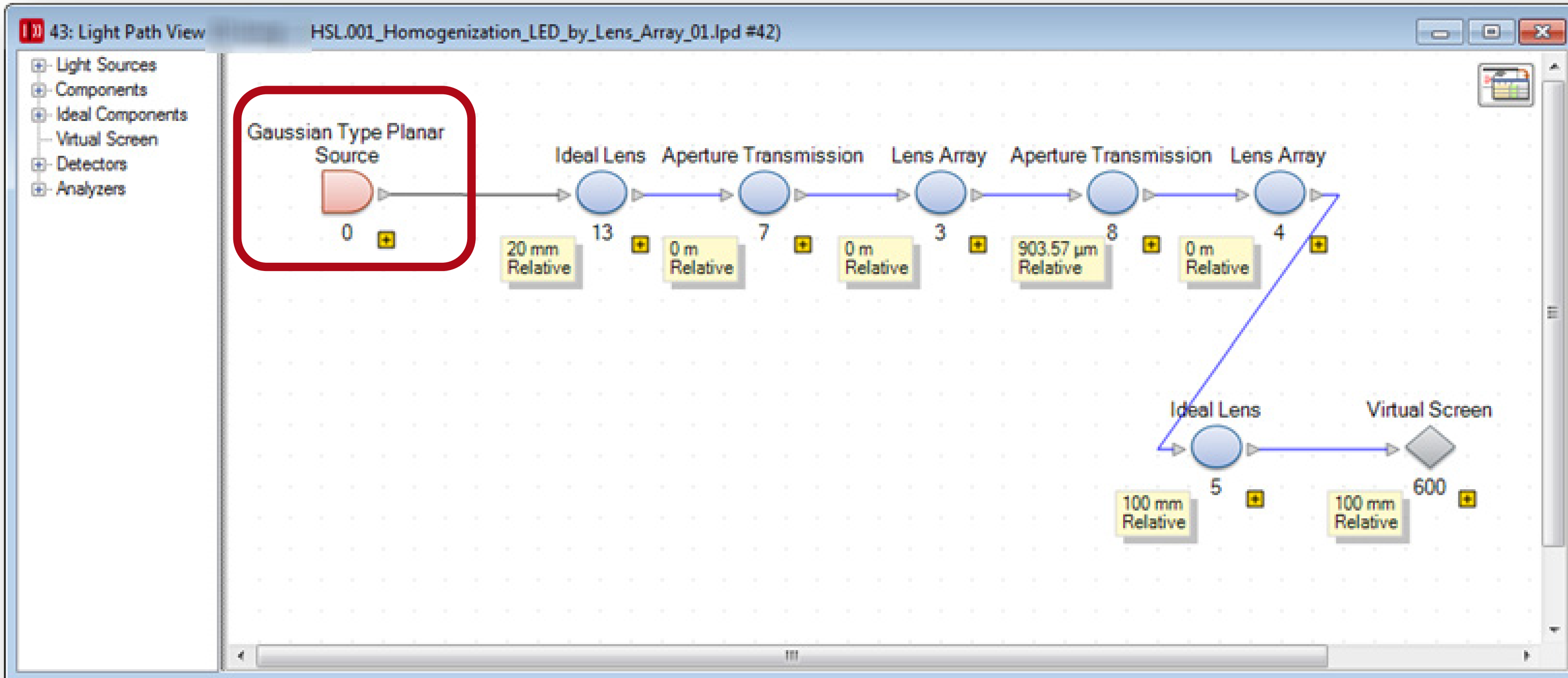
Results in

Light Path Diagram



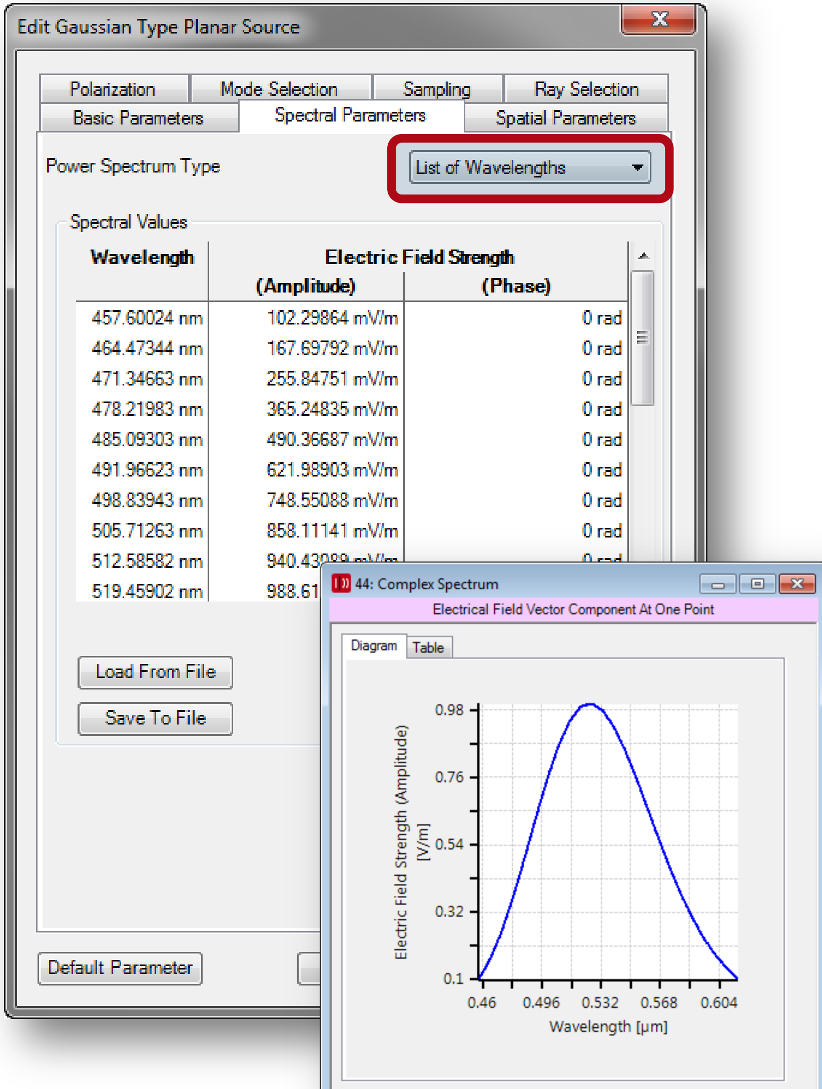


Gaussian Type Planar Source



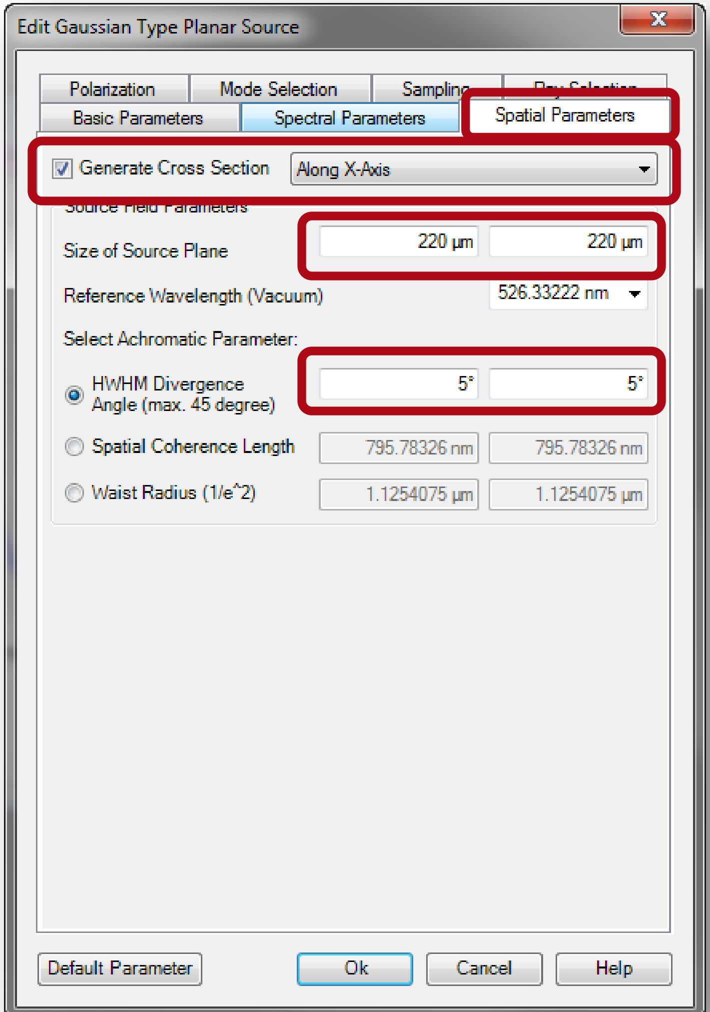
- Double click *Gaussian Type Plane Source* to open edit dialog.

Gaussian Type Planar Source



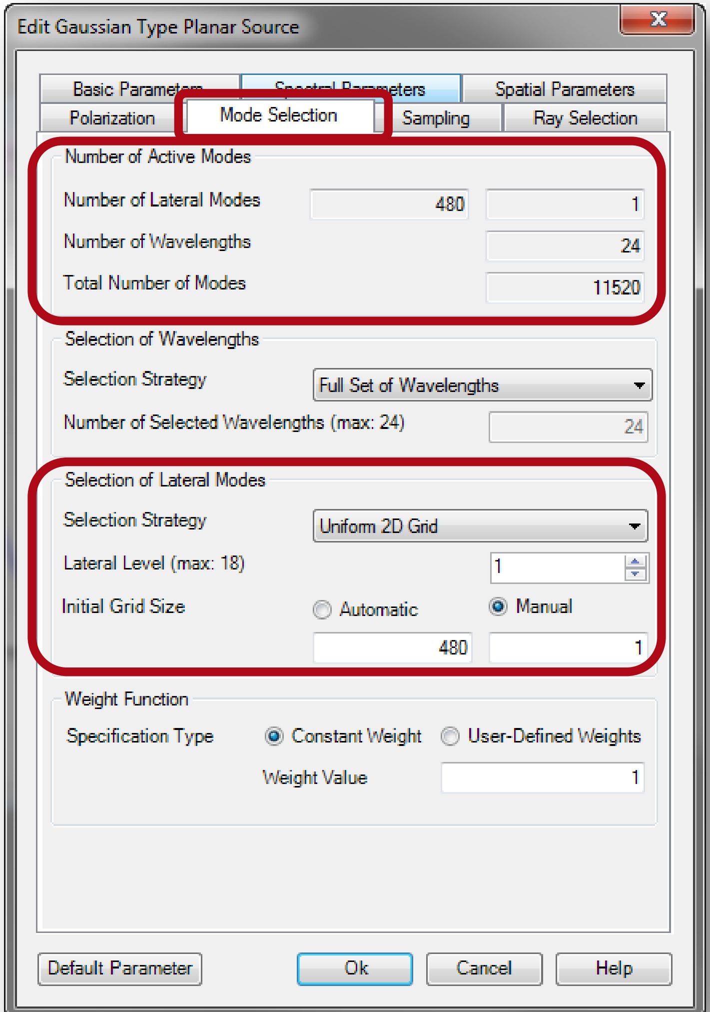
- The *Gaussian Type Plane Source* simulates a partial coherent source by several Gaussian modes that are incoherent to each other.
- This source will be used in the following to model an LED.
- A Gaussian spectral distribution is used.

Gaussian Type Planar Source



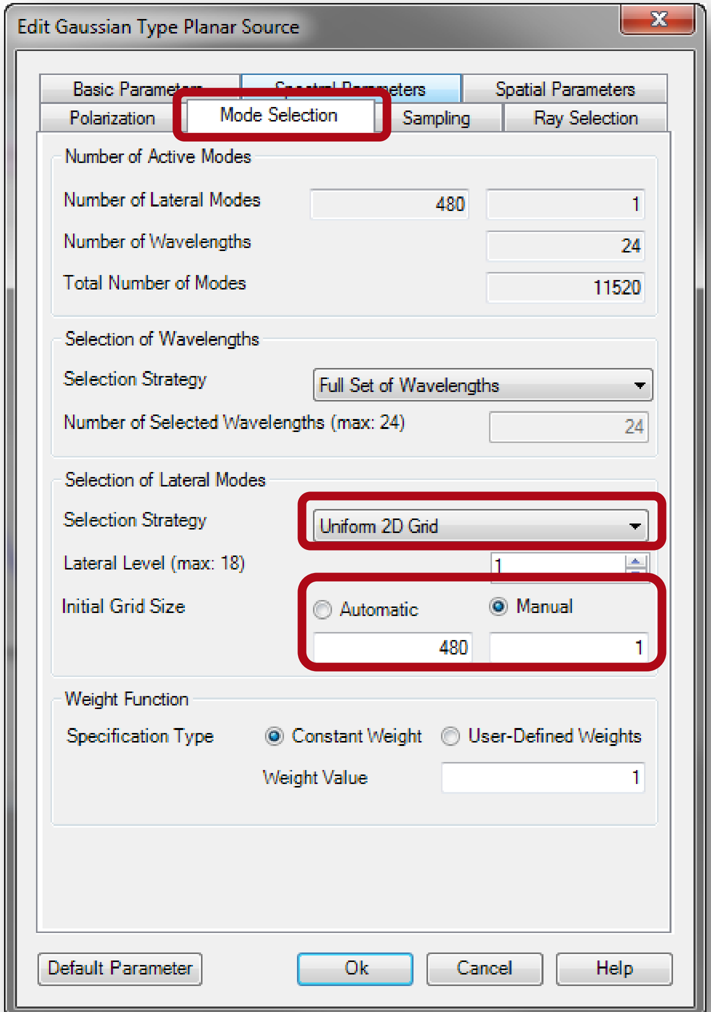
- The radiation characteristic of the source can be changed on the *Spatial Parameters* panel.
- The source is defined by the *Size of Source Plane* and *Divergence* angle or *Spatial Coherence Length* or *Waist Radius* of a mode. The last three parameters can't be changed independently since they depend on each other.
- A one dimensional simulation will be used.

Gaussian Type Planar Source



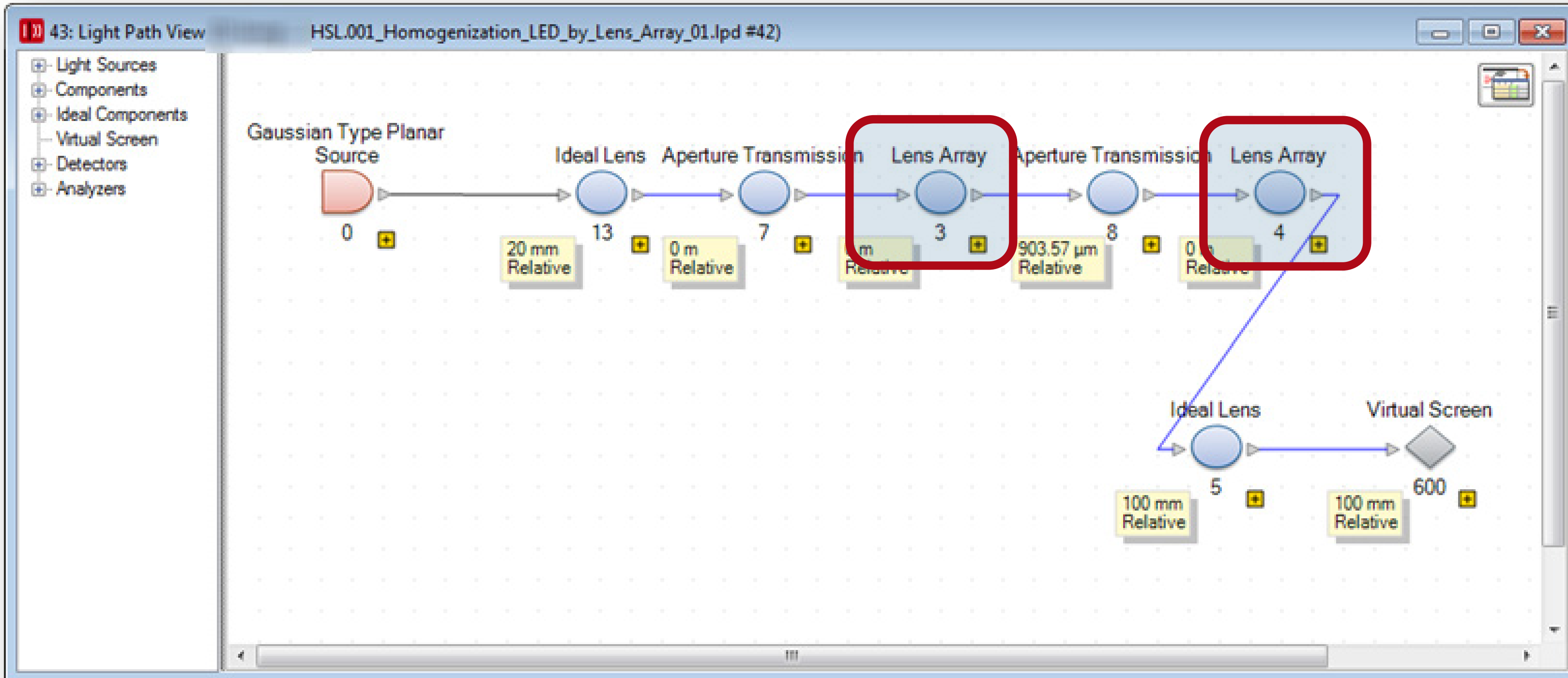
- The panel *Mode Selection* allows to control the number of modes used for simulating spatial and temporal coherence (the temporal coherence is simulated by the power spectrum).
- On top of the panel you see the total number of modes.
- The lower part allows to control the number of lateral modes used for the simulation of spatial coherence.

Gaussian Type Planar Source



- Lateral modes can start at *Uniform 2D Grid* positions or at *Random* positions.
- In case of Uniform 2D Grid the number of modes is determined by an *Initial Grid Size* and a *Lateral Level* that helps to easily increase the number of modes.
- The larger the number of modes the more accurate is the simulation result but the more memory and computational time is required.

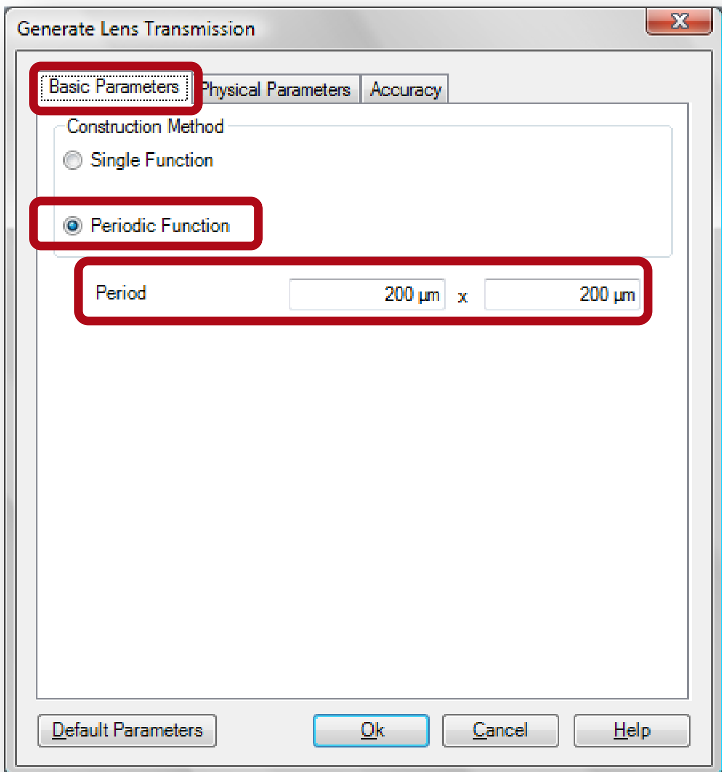
Simulation of Lens Arrays



- Two *Ideal Lens* components are used to simulate the arrays.

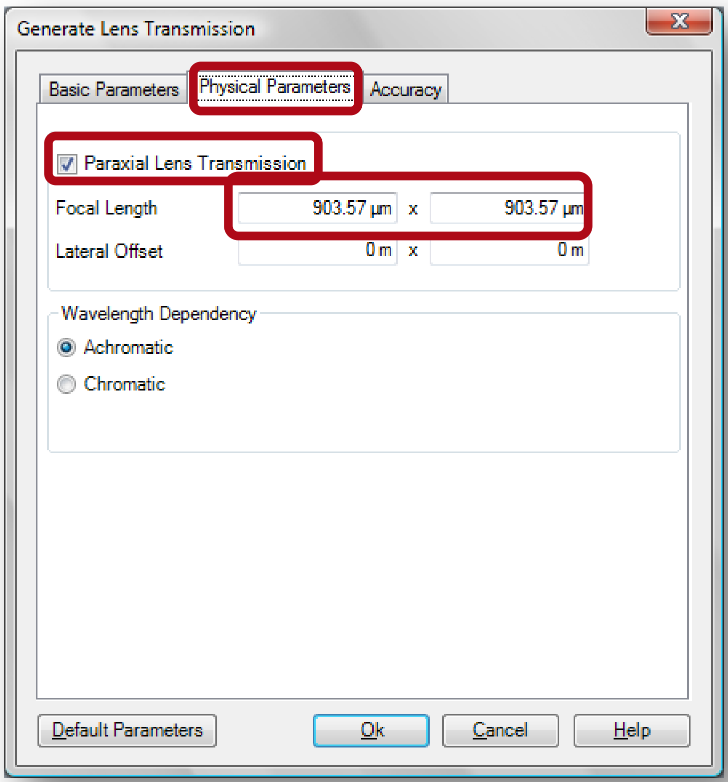
- Double click the *Ideal Lens* component with index #3 to open its edit dialog.

Simulation of Lens Arrays



- To simulate a lens array the ideal lens component must be switched to *Periodic Function* an the *Period* must set to a lens pitch of 200µm x 200µm.

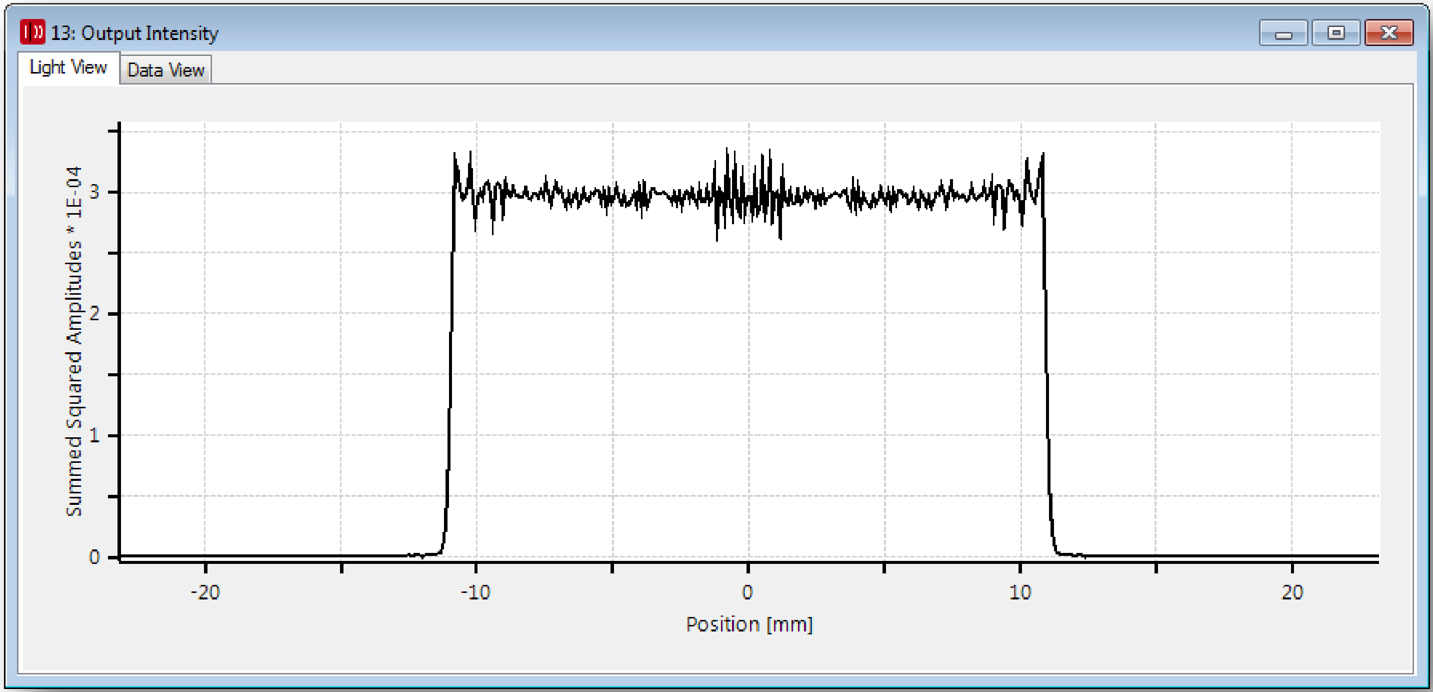
Simulation of Lens Arrays



- The focal length is defined at the *Physical Parameters* panel.
- The option *Paraxial Lens Transmission* allows to use different focal lengths in x- and y-direction. This allows e.g. the simulation of paraxial cylindrical lens arrays. (The optical effect of a paraxial lens is simulated by a quadratic phase, i.e. a paraxial approximation of the spherical phase).

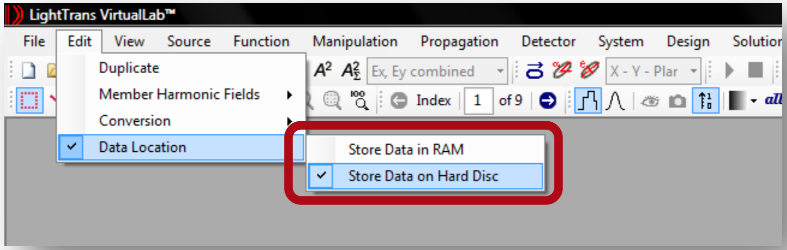
Simulation Results

Please note: the calculation of this particular system will take about 2 hours.



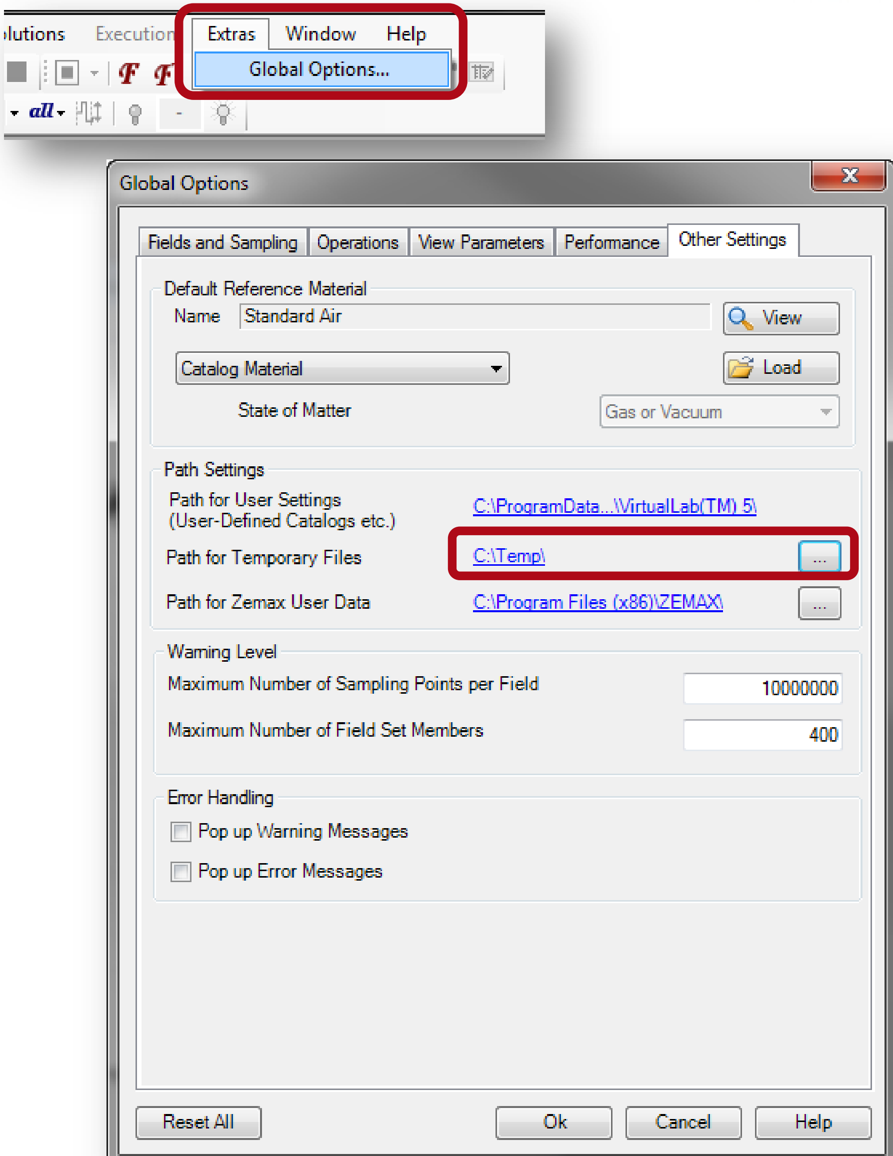
Simulation result of 480 lateral modes and 24 wavelengths. Reduce the number of lateral modes in order to get an approximated result in a shorter time.

Harmonic Field Sets



- Since harmonic fields sets may contain hundreds of modes, the amount of data can be too large for the RAM memory. Because of this the modes are stored on the hard disc.
- If a user likes to keep the data in the RAM memory anyway, it is possible to change the data location of the current harmonic fields set as shown on the left.

Harmonic Field Sets



- Depending on the number of modes and the number of sampling points per mode a huge amount of hard disc space can be required to store a single harmonic field set.
- This may require to change the folder used for temporary storage to another location: the *Global Options dialog* allows to change the *Path for Temporary Files*.
- It is recommended to have more than 100 GB free hard disc space.

Conclusion

- VirtualLab™ enables the simulation of spatial partial coherence of light sources.
- Different source models can be used to simulate Excimer lasers, multimode lasers and LED's.
- These models are Multimode Gaussian Source, Gaussian Type Planar Source, Customized Mode Plane Source.
- The ideal lens component enables the simulation of lens arrays.