UseCase.0012 (1.0)

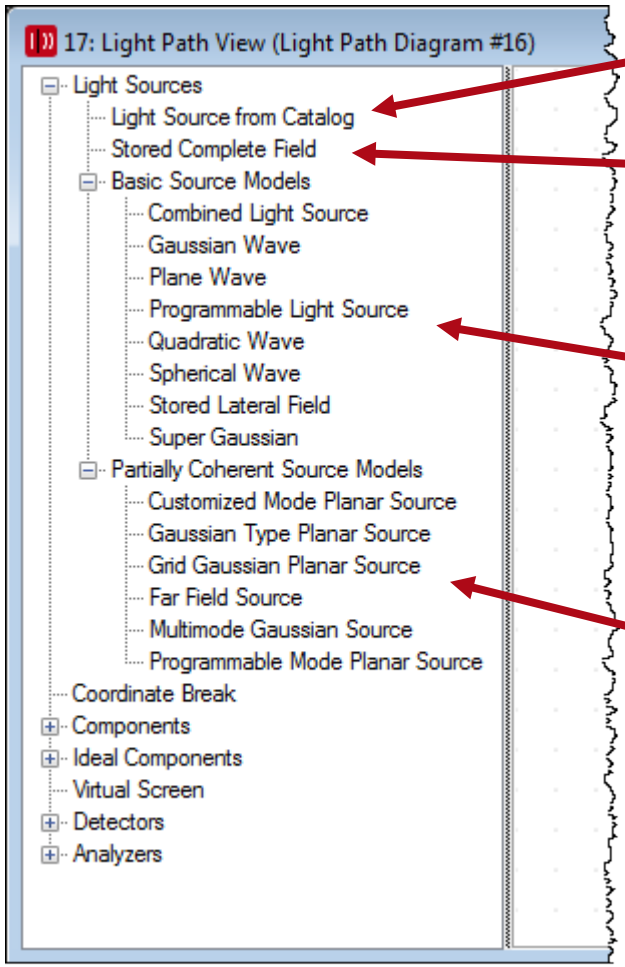
Configuration of Light Sources

Keywords: LED, laser, harmonic fields, harmonic fields set, spectra, pulses, polarization

Description

- This use case explains how light sources are configured to simulate different radiation in a plane.
- In general VirtualLab distinguishes between basic and partial coherent sources models.
- The lateral and spectral radiation can be defined by
  - Pre-defined formulas
  - Measurement data
  - User-defined formulas
- Light sources have no input and just one output channel.
- Apart from the Laser Resonator Toolbox in VirtualLab the processes inside of sources are not simulated.

Light Sources in Light Path Diagram



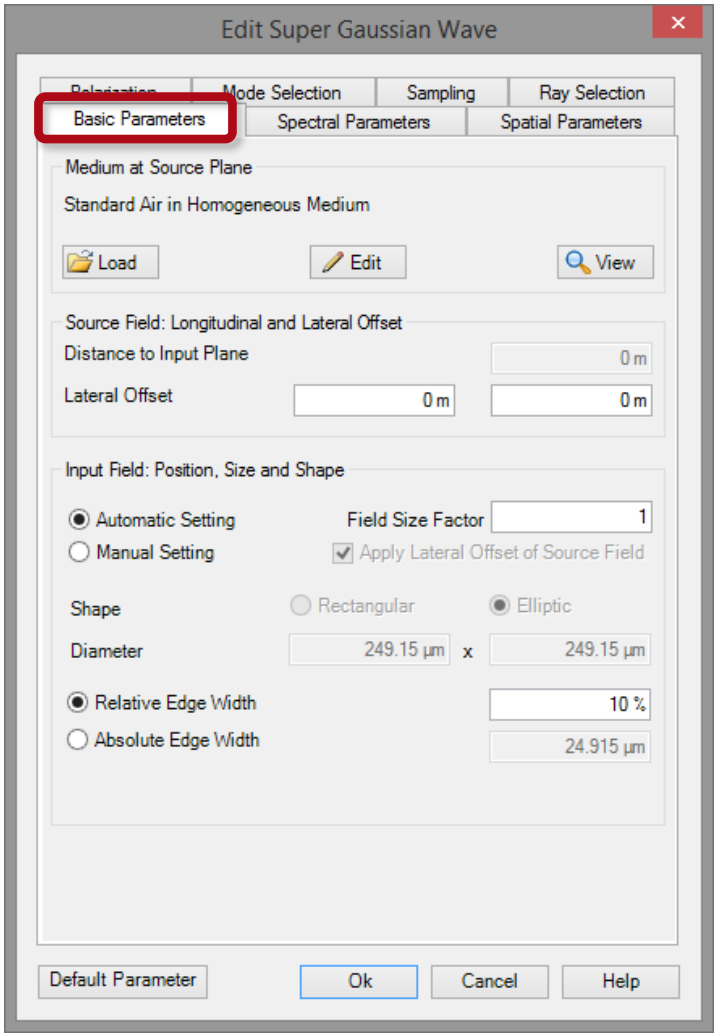
Loads source from Catalog

User defined source

Basic coherent, monochromatic and polychromatic sources

Spatial partial coherent radiation models for LED, Excimer and multimode laser simulation

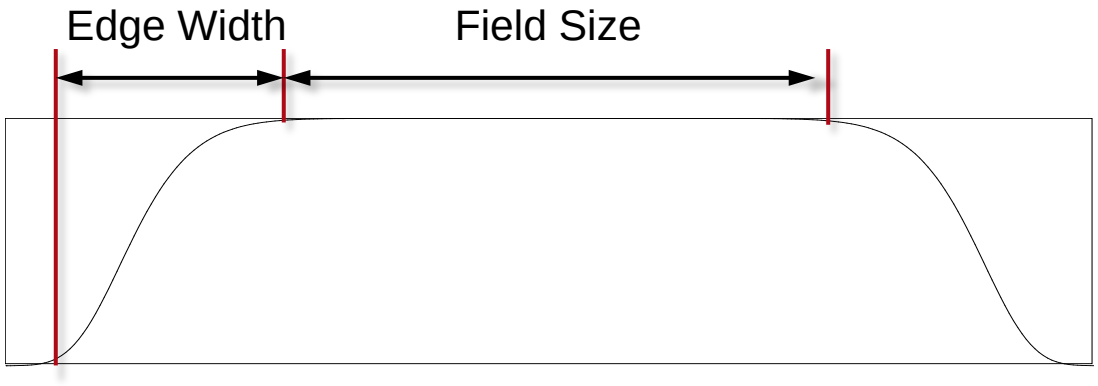
Light Sources – Basic Parameters



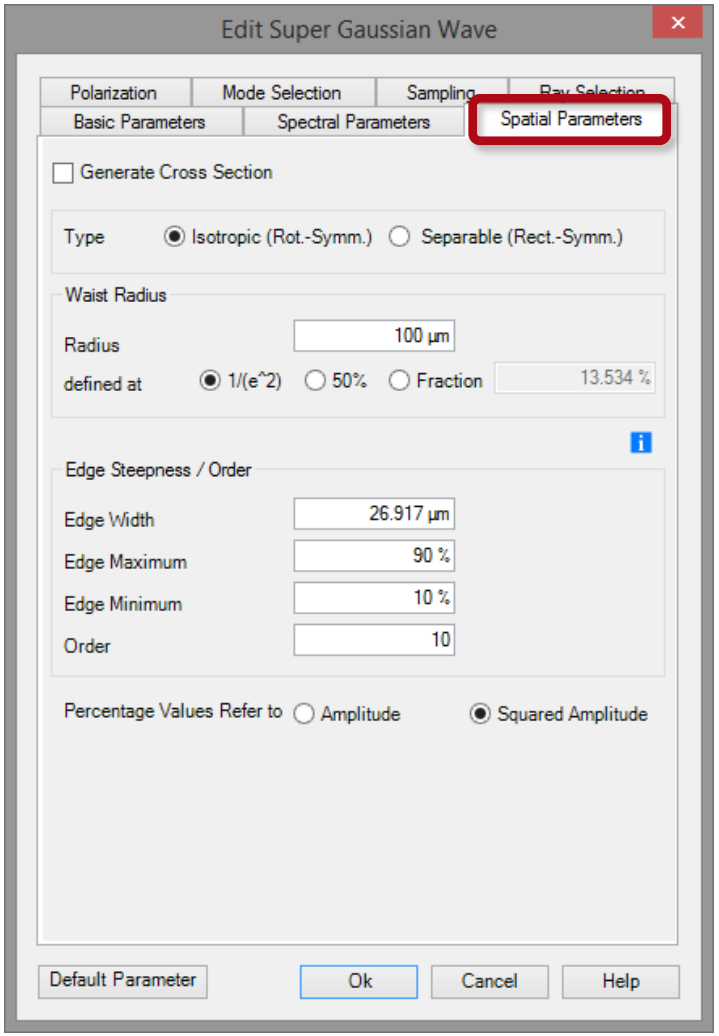
- The basic parameters tab can be configured for all light sources alike.
- It allows to enter the lateral offset and distance from source plane.
- The user defines the medium directly after the source plane.
- Supports in addition the configuration of
  - Field size
  - Field shape (rectangular, elliptical)
  - Edge width (apodization)

Light Sources – Field Size and Shape

- Most analytical light distributions have infinite extension.
- For the computer all light distributions must have a finite extension.
- VirtualLab introduces the concept of field size, field shape and edge width (apodization).
- A Gaussian like apodization is used on the edges of the field in order to reduce numerical errors.
- The field size can be defined automatically (for some sources) or manually.
- In addition the suggested field size can be changed by a Field Size Factor.

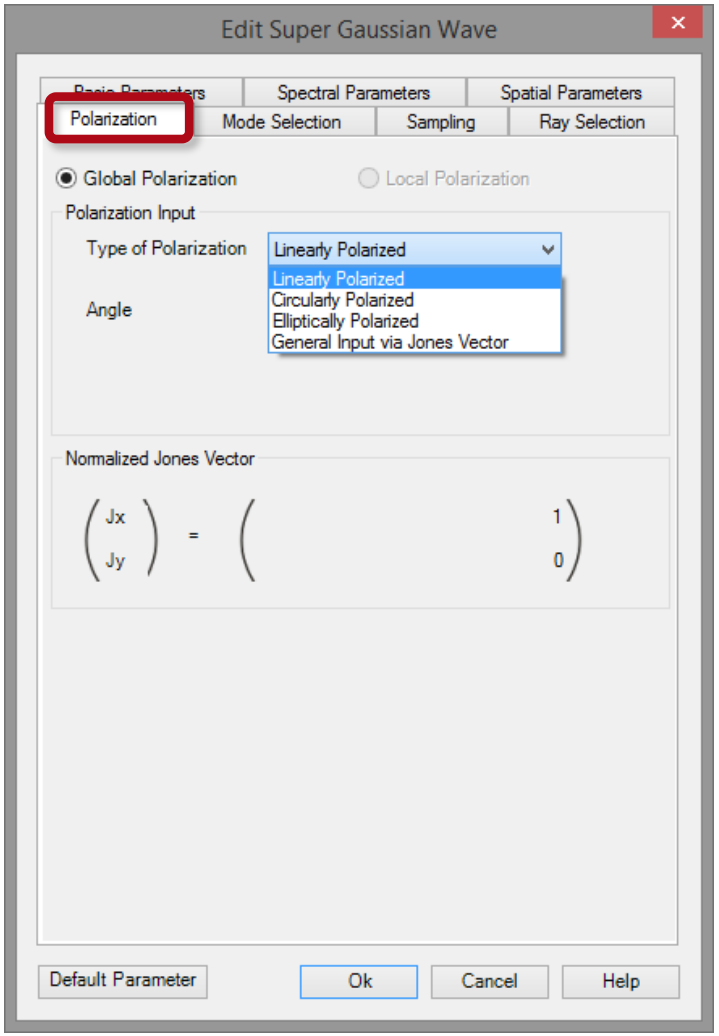


Light Sources – Spatial Parameters



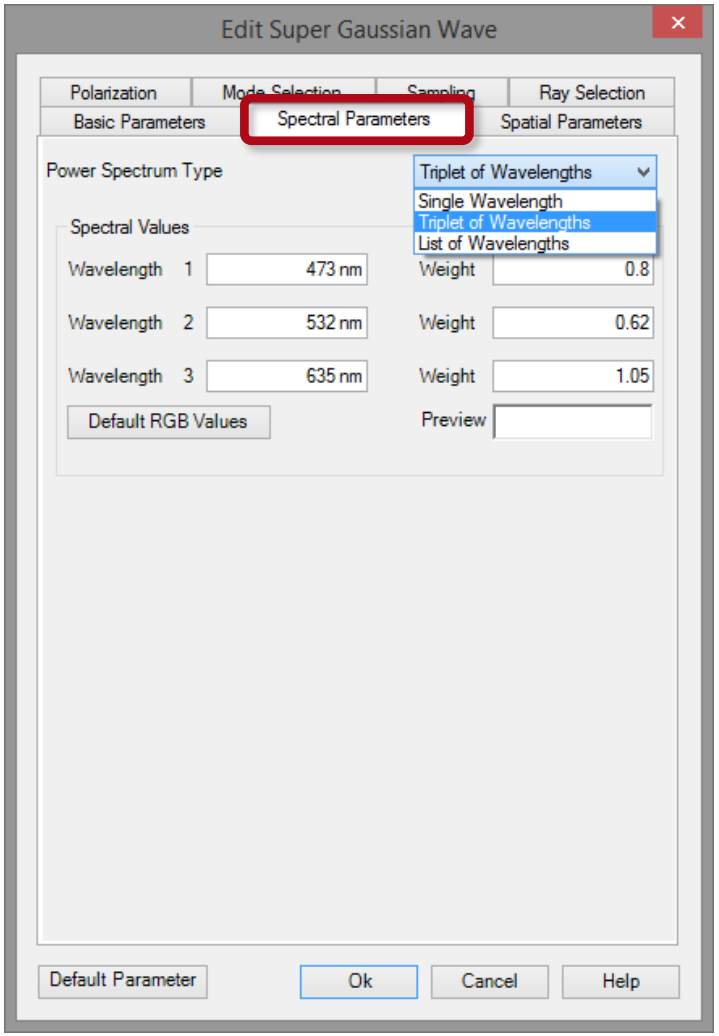
- On the spatial parameters page the user can define additional parameters of the lateral distribution.
- The content of the spatial parameters depend on the light source which is configured.

Light Sources – Polarization



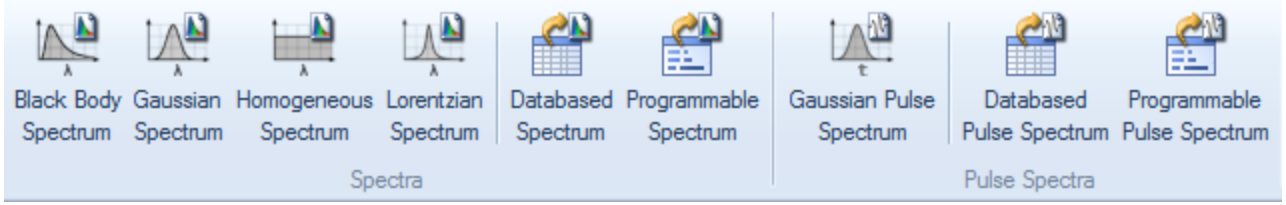
- On the polarization tab the user can define the global polarization of the source.
- The following polarization types are available:
  - Linear (input of angle to x-axis)
  - Circular (left or right rotation of polarization)
  - Elliptical (define polarization ellipses)
  - General (input of Jones vector)
- Resulting Jones vector is displayed.

Light Sources – Spectral Parameters



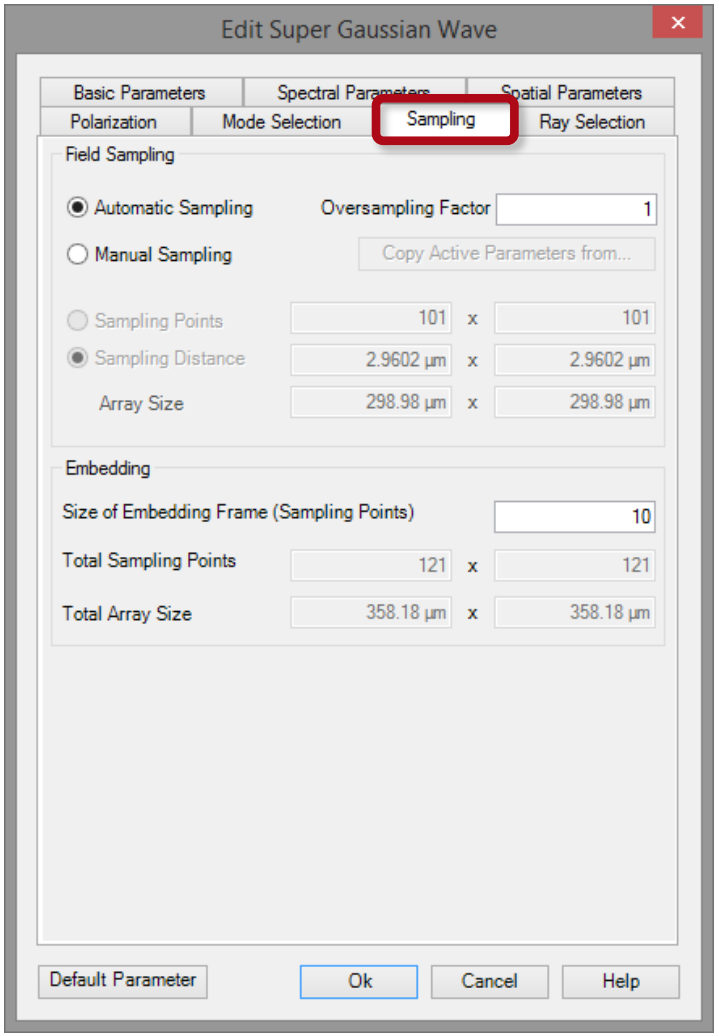
- The user can select between three different spectral modes
  - Single wavelength (mono-chromatic simulation)
  - Triple wavelength (three wavelength and weights have to be defined)
  - List of wavelength (list of wavelength with weights, import from diagram or ASCII)
- Resulting color is displayed if visible, otherwise black.

Light Sources – Spectra Gererators



- Within the source ribbon several generators for the definition of spectra for sources and pulses are available.
- The generated data arrays representing the spectrum can be imported into the light source.

Light Sources – Sampling



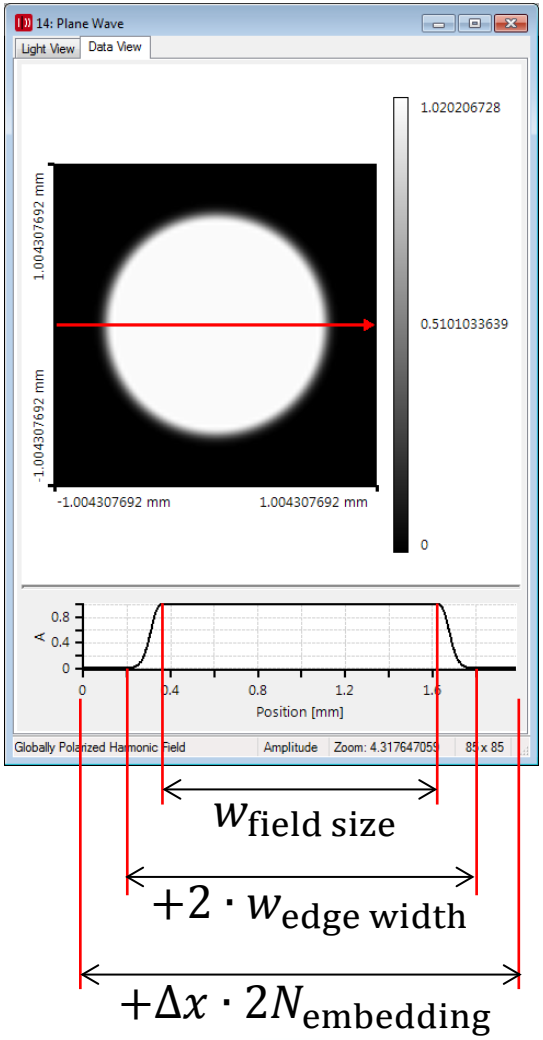
- On the sampling tab the user can define the sampling parameters that shall be used for the generation of the field.
- By default VirtualLab provides the user an automatic sampling mode which is for most cases sufficient.

Light Sources – Sampling

- The automatic sampling suggestion can be modified using the Sampling Factor.
- If wanted, the user can also define the sampling manually.
- In manual mode the user can select whether to specify the number of data points or the sampling distance.
- The embedding factor is used to introduce zero padding around data points.
- Thus the total array size for the light representation in the input plane is defined by

$$w_{\text{array}} = w_{\text{field size}} + 2 \cdot w_{\text{edge width}} + \Delta x \cdot 2N_{\text{embedding}}$$

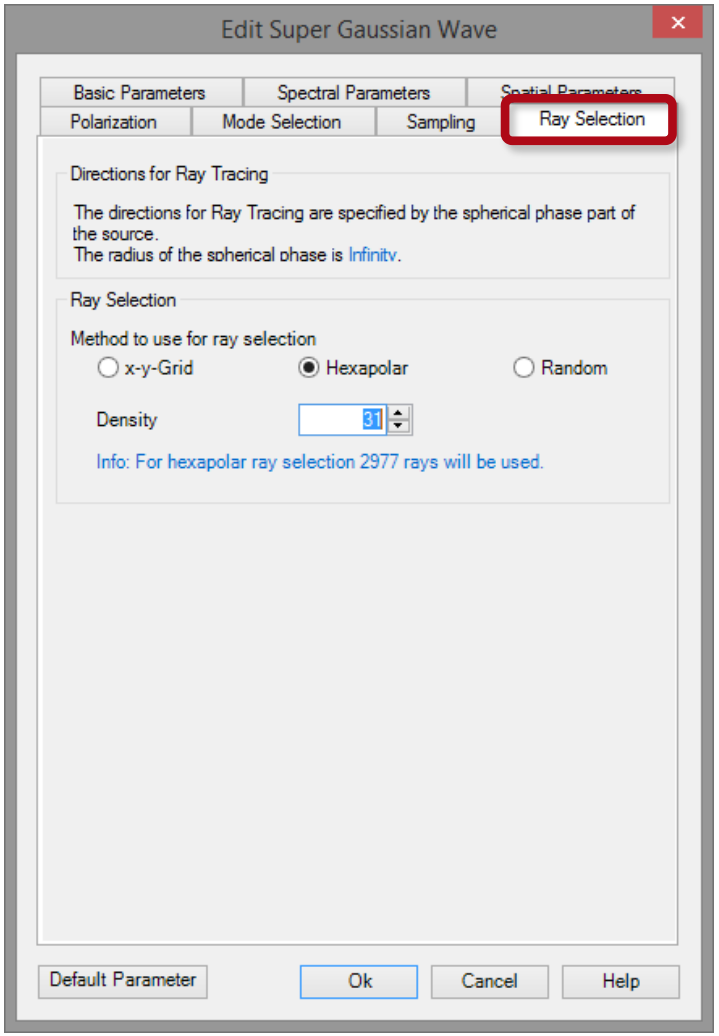
Light Sources – Sampling



The array size is defined by:

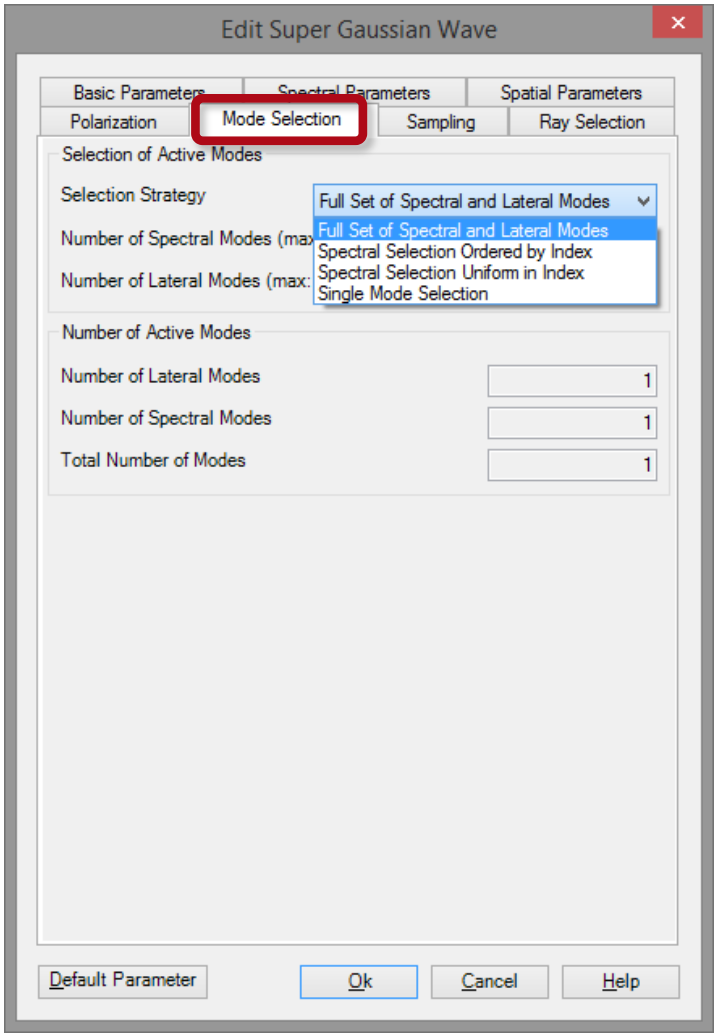
- w_{array} → Array size
- $w_{field\ size}$ → Field Size
- $w_{edge\ width}$ → Absolute Edge Width
- Δx → Sampling distance
- $N_{embedding}$ → Embedding frame width in sampling points

Light Sources – Ray Selection



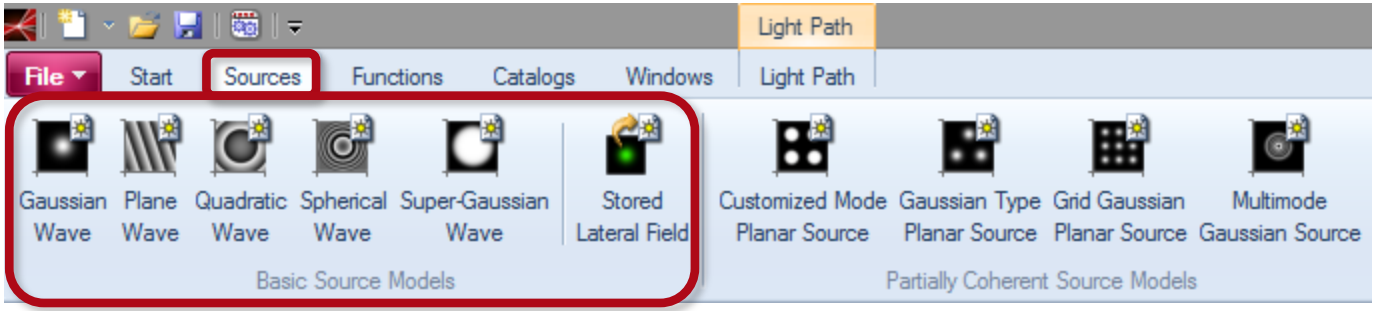
- The user can define the number and the mode for the generation of rays (used for ray tracing)
- The following modes are supported:
  - x-y – Grid (equidistant grid in x and y)
  - Hexapolar (definition of the density of the rays)
  - Random (number of rays which will be distributed randomly, including seed)

Light Sources – Mode Selection



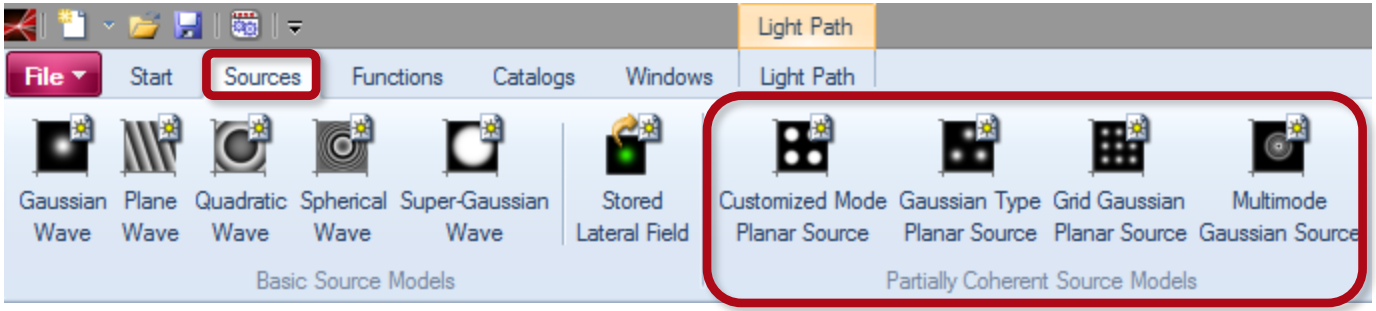
- For partial coherent modes the modes' positions and weights are defined on the mode selection tab.
- For all light sources the user can specify the modes to be generated.
- The selection can be used to generate only a subset of modes to check the general performance of the light source and the system.

Light Source Generation in Main Window



- Source generators can also be triggered within the main menu to generate harmonic field (s sets).
- For basic sources different coherent light sources can be specified as mono- or polychromatic.

Light Source Generation in Main Window



- For partially coherent models also generators are available in the main window.
- These sources can be used e.g. to simulate LEDs, Excimer or multi-mode lasers.

Summary

- The light source generators of VirtualLab allow a very flexible and user-friendly way to define source fields that can be used for further simulations or manipulations.
- The standardized way to specify a light source with all its parameters enable the user to get familiar with the usage concept and to be able to configure all sources in the same way.
- The simulation of basic sources (e.g. spherical, plane or Gaussian fields) as well as simulations of partial coherent sources (LED, Excimer or multi-mode lasers) can be done with VirtualLab.