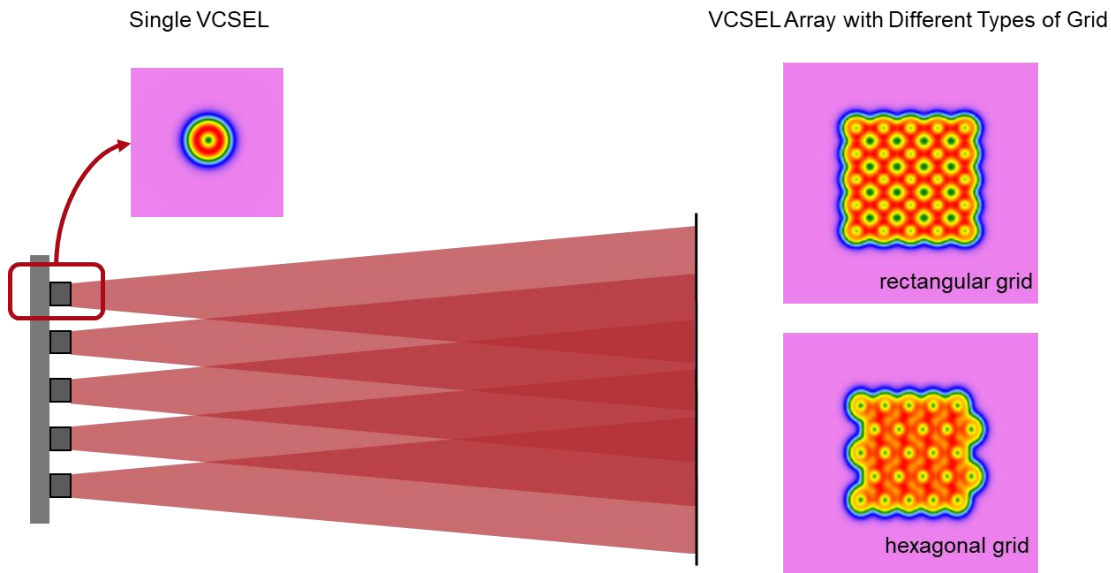


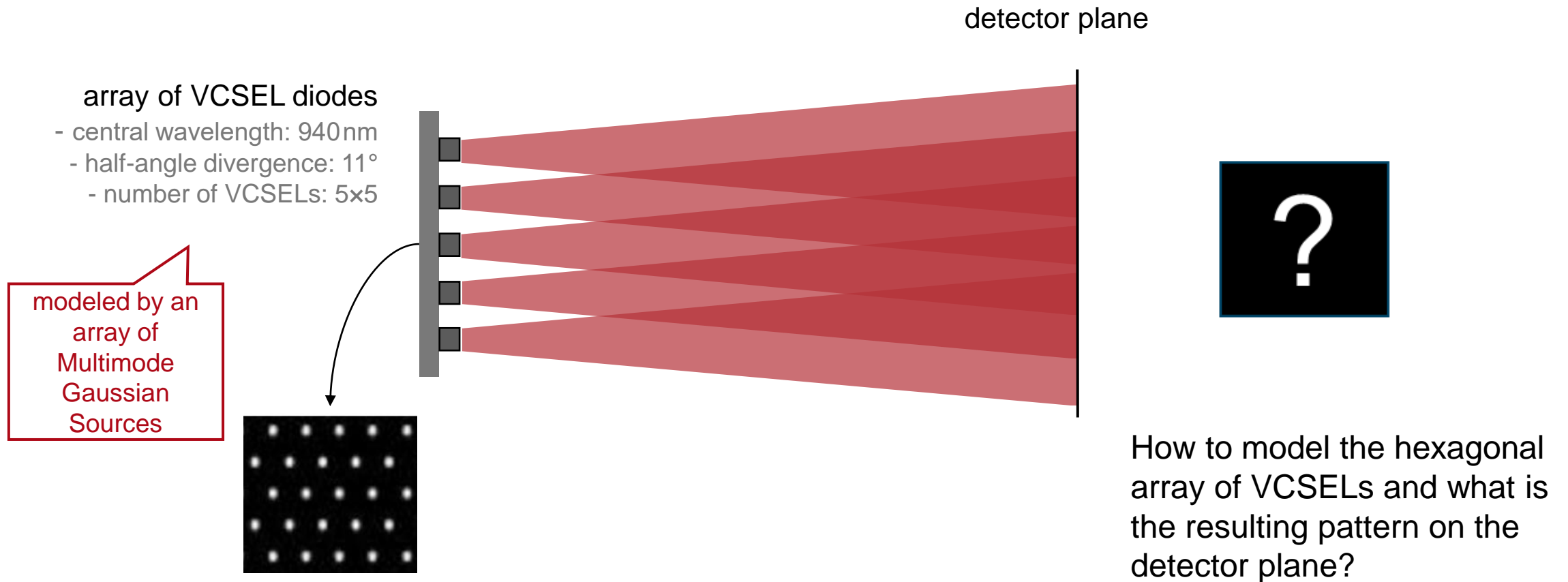
# **Modeling of an Array of Vertical Cavity Surface Emitting Laser (VCSEL) Diodes**

# Abstract

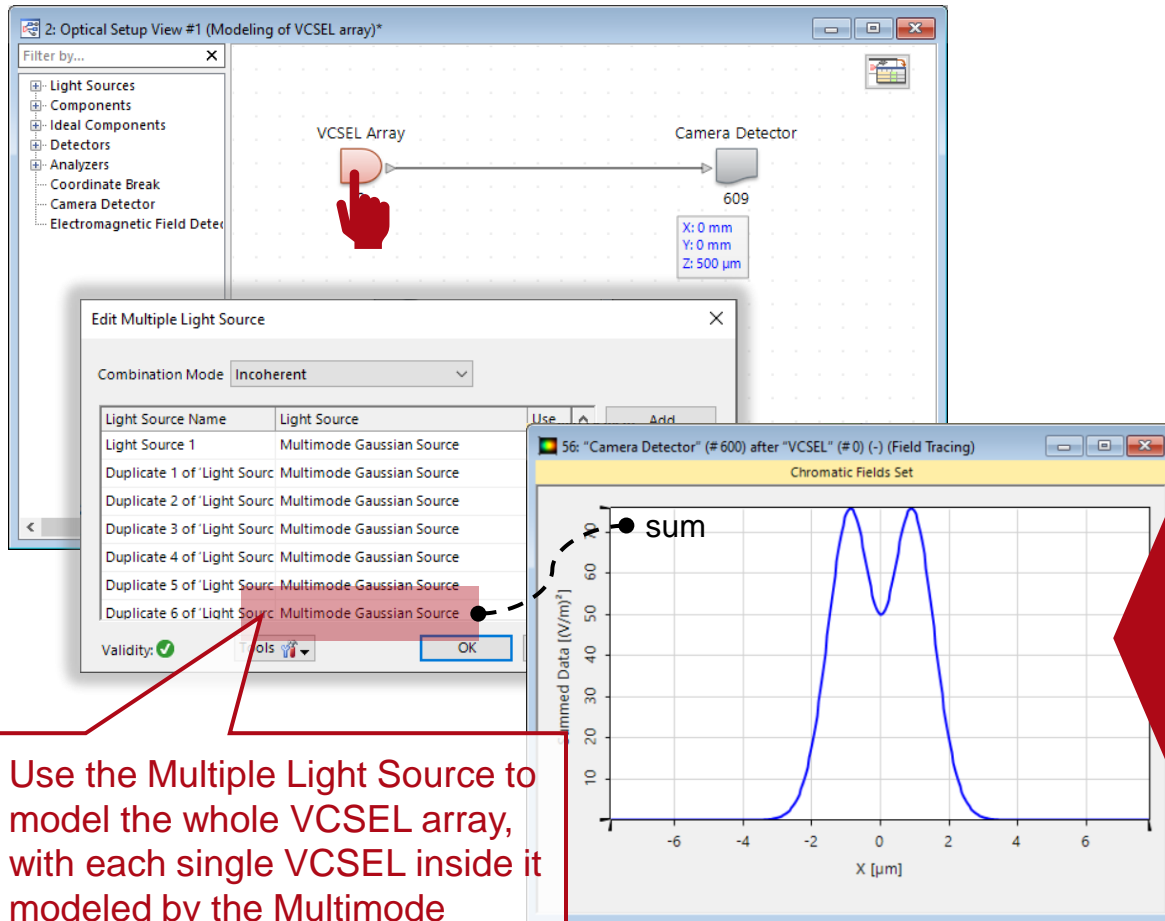


Arrays of vertical cavity surface emitting laser (VCSEL) diodes are of interest for various applications, e.g. beam splitters and pattern generators. In order to be able to investigate optical systems with this kind of light source an appropriate source model is required. In this document it is shown how a VCSEL array source can be modeled in VirtualLab Fusion.

# Modeling Task: Array of VCSEL Modes Modeling

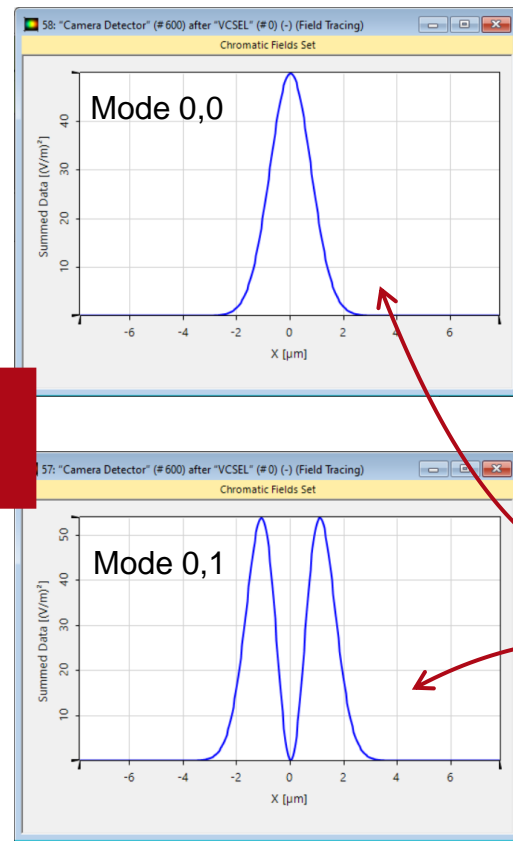


# Source Modeling – the Single VCSEL



Use the Multiple Light Source to model the whole VCSEL array, with each single VCSEL inside it modeled by the Multimode Gaussian Source.

Two Laguerre Gaussian modes with adjustable weights and divergence angle/waist radius are combined to model each single VCSEL point.



The 'Edit Multimode Gaussian Source' dialog box is shown with the following settings:

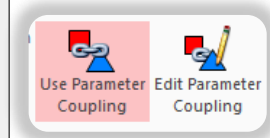
- Polarization:** Basic Parameters
- Mode Selection:** Spectral Parameters
- Sampling:** Spectral Parameters
- Ray Selection:** Spatial Parameters
- Generate Cross Section
- Parameters of Fundamental Mode:**
  - Type: Laguerre Gaussian Mode
  - Reference Wavelength (Vacuum): 940 nm
  - Select Achromatic Parameter:
    - Waist Radius (1/e<sup>2</sup>): 1.538893651 μm
    - Half-Angle Divergence (1/e<sup>2</sup>): 11°
    - Rayleigh Length: 7.91692151 μm
- Multimode Parameters:**
  - Coherent Accumulation of Modes
  - Maximum Order: 0 × 1
- | Radial Order | Angular Order | Active                              | Weight | Phase Offset |
|--------------|---------------|-------------------------------------|--------|--------------|
| 0            | 0             | <input checked="" type="checkbox"/> | 50     | 0 rad        |
| 0            | 1             | <input checked="" type="checkbox"/> | 50     | 0 rad        |

# Positioning of VCSELs on Grid Using Parameter Coupling

After setting the single VCSEL, use duplicate tool to have 5 x 5 VCSEL modes in total.

define snippet for the coupling

select relative parameters

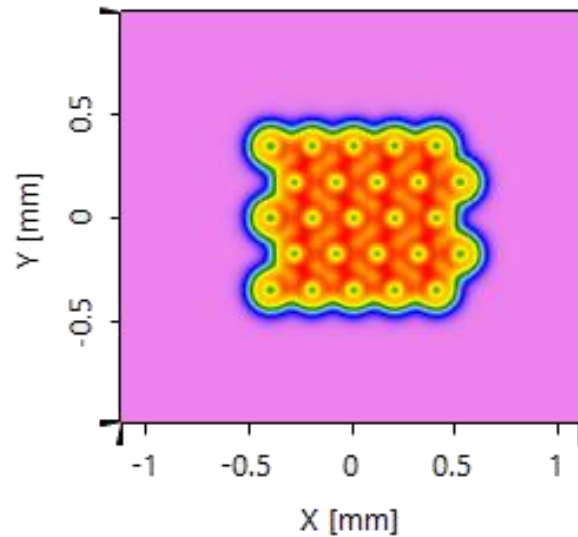


Use Parameter Coupling to automatically generate the desired array grid.

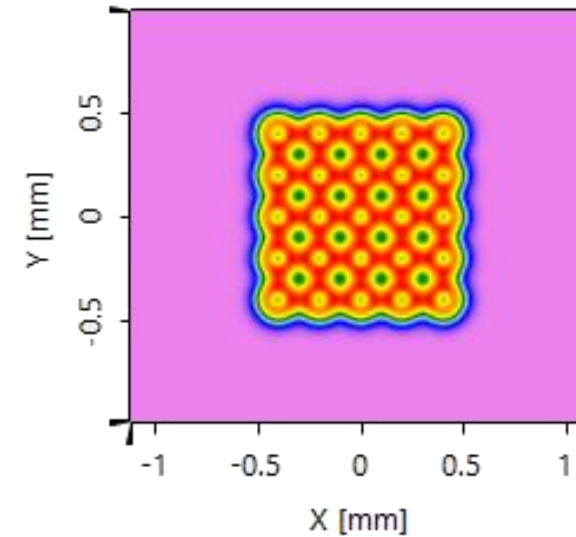
Parameter	Description
NumberGridPoints	defines the number of VCSELs in the array
Pitch	pitch of the array according to x and y
GridAngle	sets the angle inside the array

# Results

Intensity distribution of a 5x5 VCSEL array



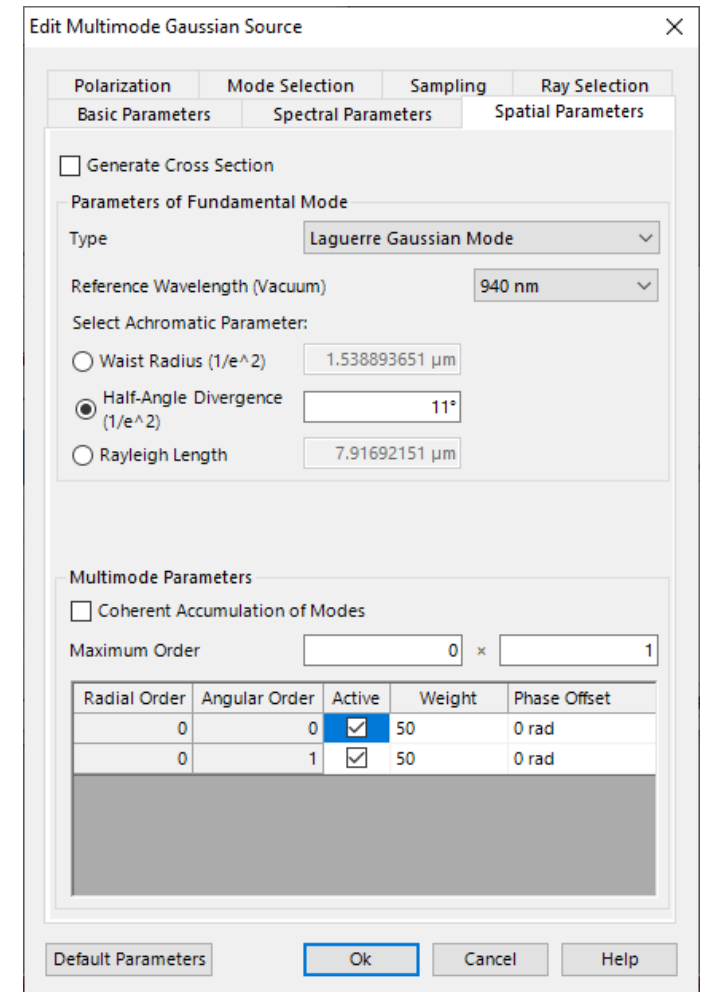
hexagonal grid with grid angle =  $60^\circ$



rectangular grid with grid angle =  $90^\circ$

# Workflow in VirtualLab Fusion

- Set up input field
  - [Basic Source Models](#) [Tutorial Video]
  - [Simulation of Multiple Light Source with VirtualLab Fusion](#) [Use Case]
- Calculate the parameters of both uncorrelated modes by using Parametric Optimization
  - [Modeling of VCSEL Source by Two Uncorrelated Laguerre Modes](#) [Use Case]
- Define Parameter Coupling for Automatic Positioning
  - [Coupling of Parameters in VirtualLab Fusion](#) [Use Case]



# Document Information

title	Modeling of an Array of Vertical Cavity Surface Emitting Laser (VCSEL) Diodes
document code	SRC.0005
version	1.0
edition	VirtualLab Fusion Basic
software version	2021.1 (Build 1.176)
category	Application Use Case
further reading	<ul style="list-style-type: none"><li>- <a href="#">Modeling of VCSEL Source by Two Uncorrelated Laguerre Modes</a></li><li>- <a href="#">Simulation of Multiple light Source with VirtualLab Fusion</a></li></ul>