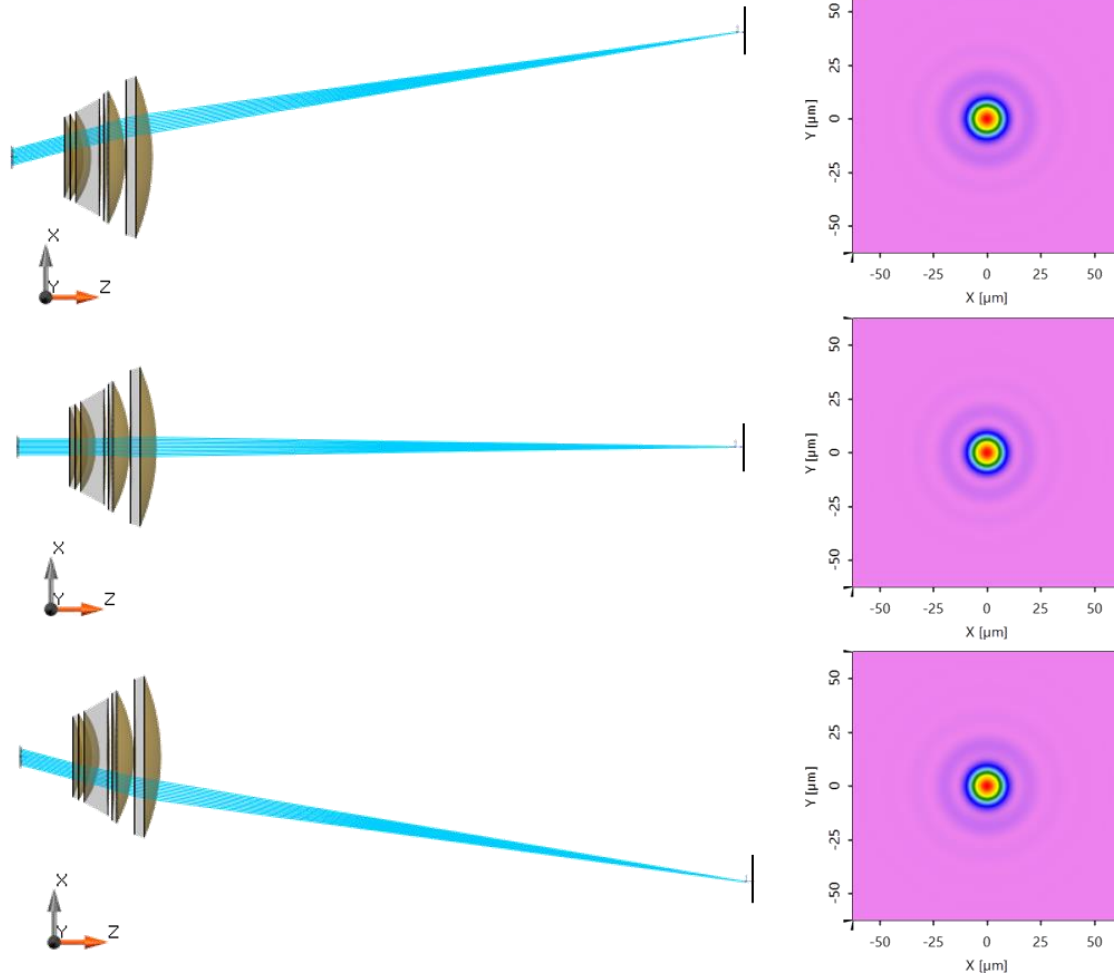


# Automatized Detector Positioning by using Parameter Coupling

# Abstract

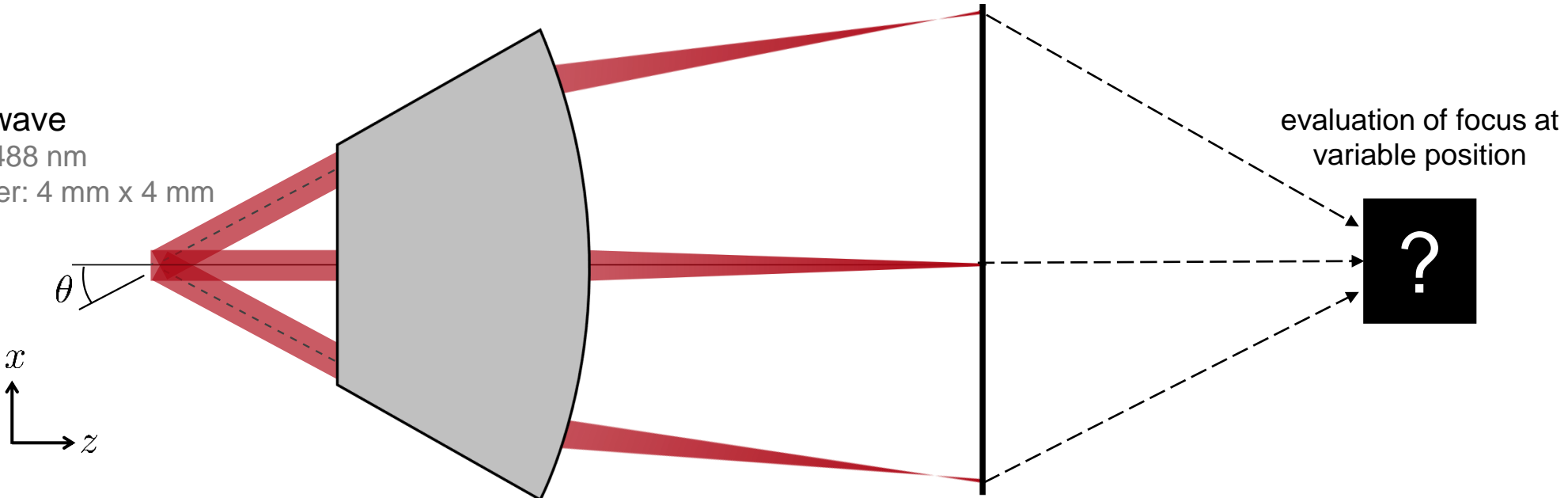


In this example, the focus (PSF) of an F-theta objective is investigated for certain angles of incidence. In order to avoid the superfluous computational effort introduced by the shift of the resulting foci with off-axis illumination, the detector position is shifted according to the main propagation direction of the light. VirtualLab's Parameter Coupling tool is applied to automatically handle this adjustment of the detector position.

# Modeling Task

source: plane wave

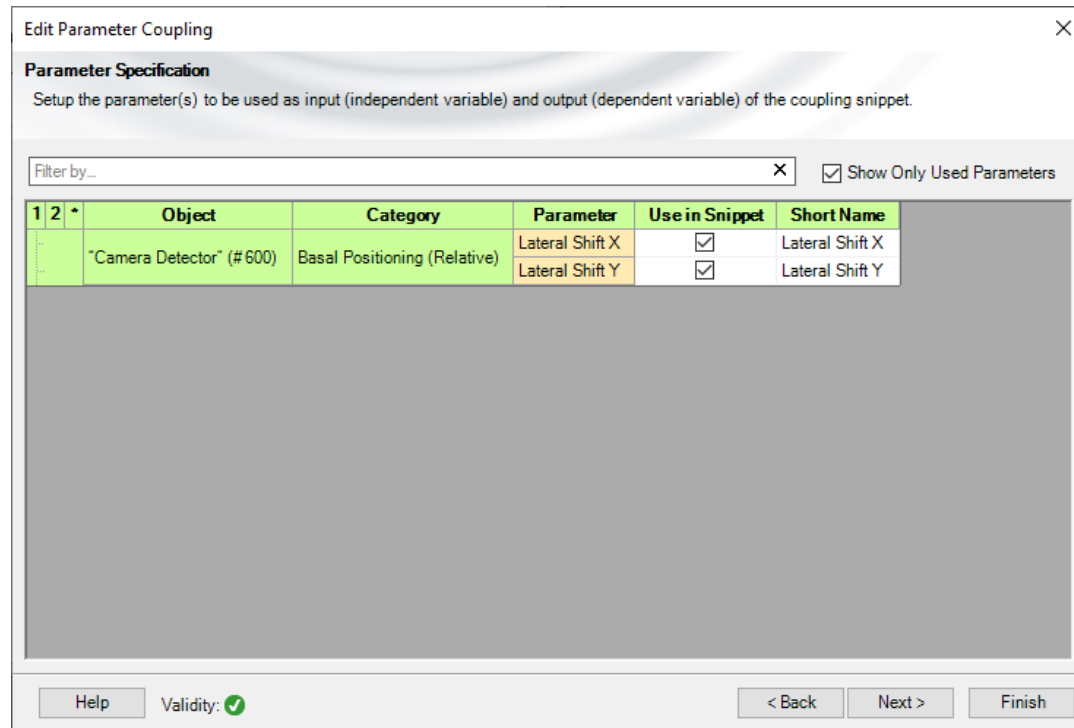
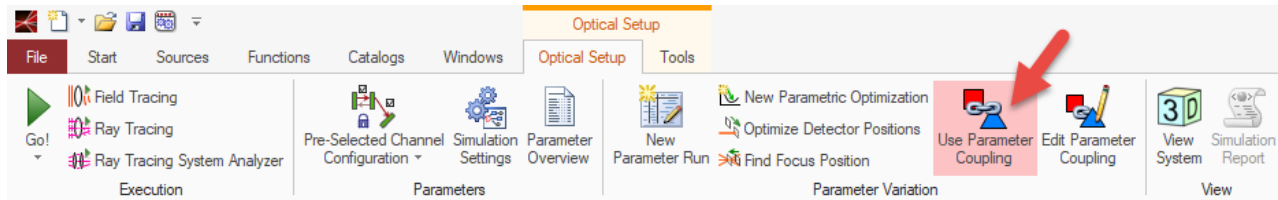
- wavelength: 488 nm
- beam diameter: 4 mm x 4 mm
- theta:  $0, \pm 15^\circ$



F-theta objective

- effective focal length  
 $f_{\text{eff}} = 100.18\text{mm}$
- from patent  
USP 4436383

# Automatic Detector Positioning via Parameter Coupling



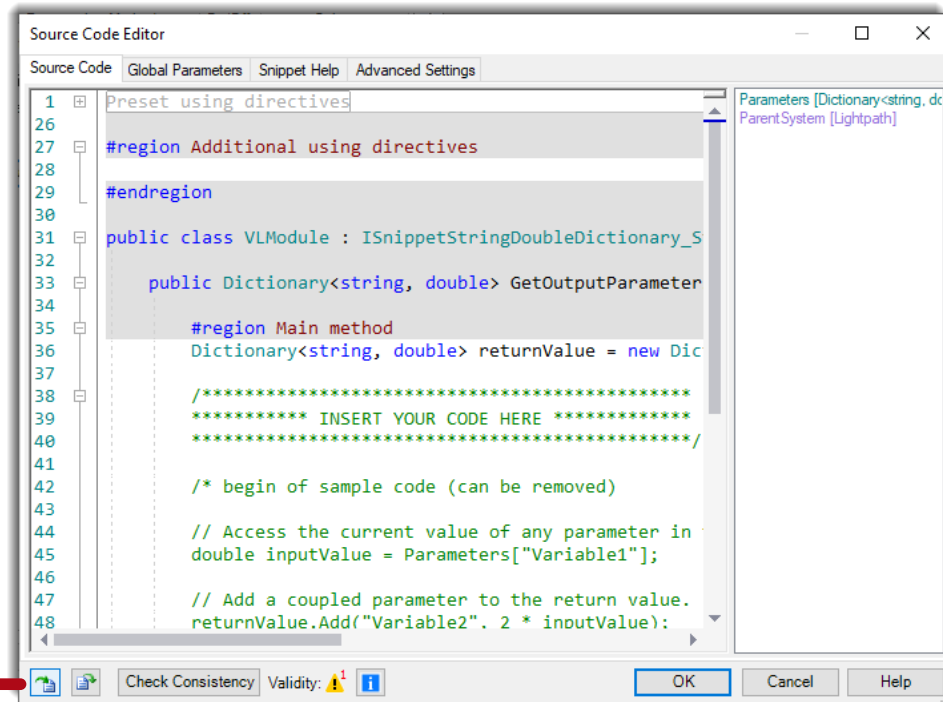
Parameter Coupling allows the user to define the variation of the desired system parameters through a small script “snippet”.

As a result, any change of the value of the independent input parameter will simultaneously result in a change of the dependent (coupled) parameter.

In this example, we couple the lateral position of the desired detector to coincide with the position of chief ray.

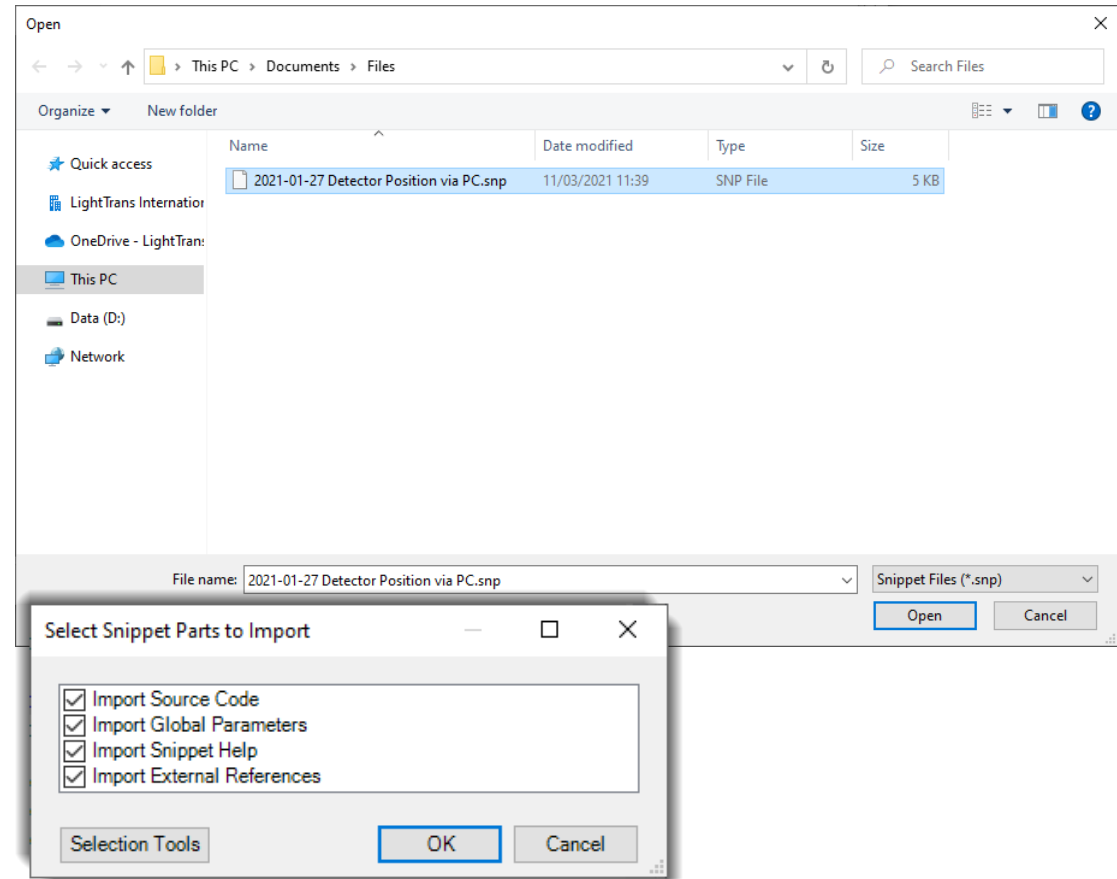
# Parameter Coupling Procedure

In order to find the appropriate lateral position of the detector, an additional ray tracing step is performed by the applied Parameter Coupling snippet. This particular snippet can be imported:



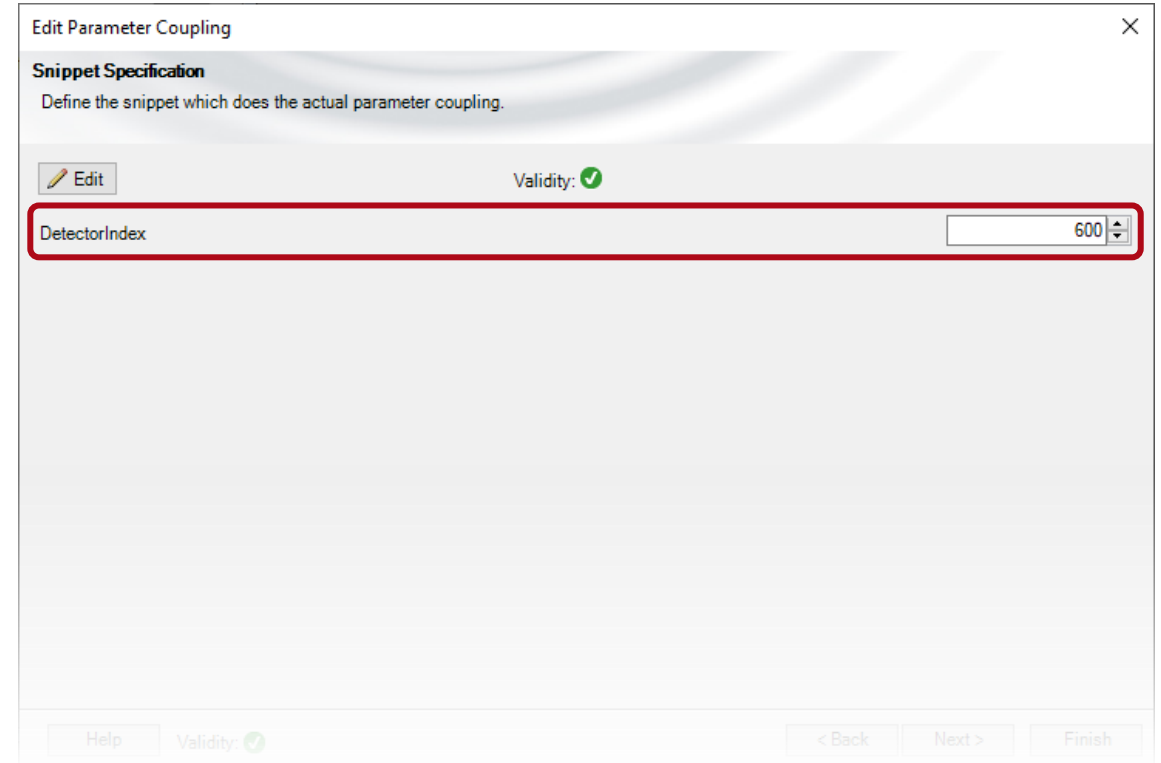
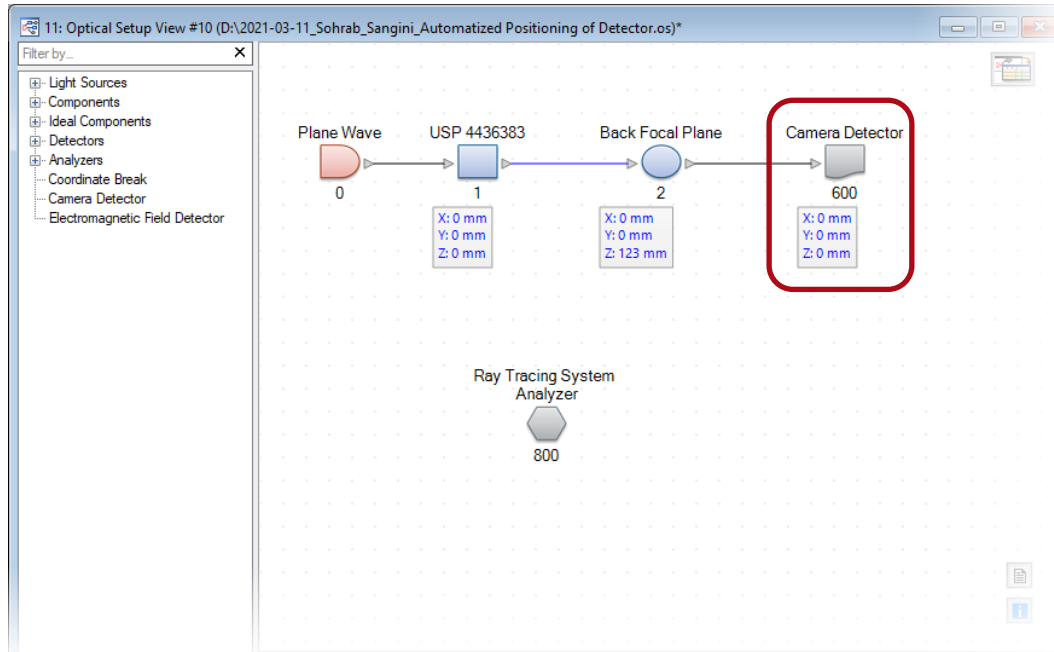
The screenshot shows a Source Code Editor window with a snippet titled "2021-01-27 Detector Position via PC.snp". The code is as follows:

```
1  Preset using directives
26
27  #region Additional using directives
28
29  #endregion
30
31  public class VModule : ISnippetStringDoubleDictionary_S
32
33      public Dictionary<string, double> GetOutputParameter
34
35          #region Main method
36          Dictionary<string, double> returnValue = new Dic
37
38          /*
39          ***** INSERT YOUR CODE HERE *****
40          */
41
42          /* begin of sample code (can be removed)
43
44          // Access the current value of any parameter in
45          double inputValue = Parameters["Variable1"];
46
47          // Add a coupled parameter to the return value.
48          returnValue.Add("Variable2". 2 * inputValue);
```



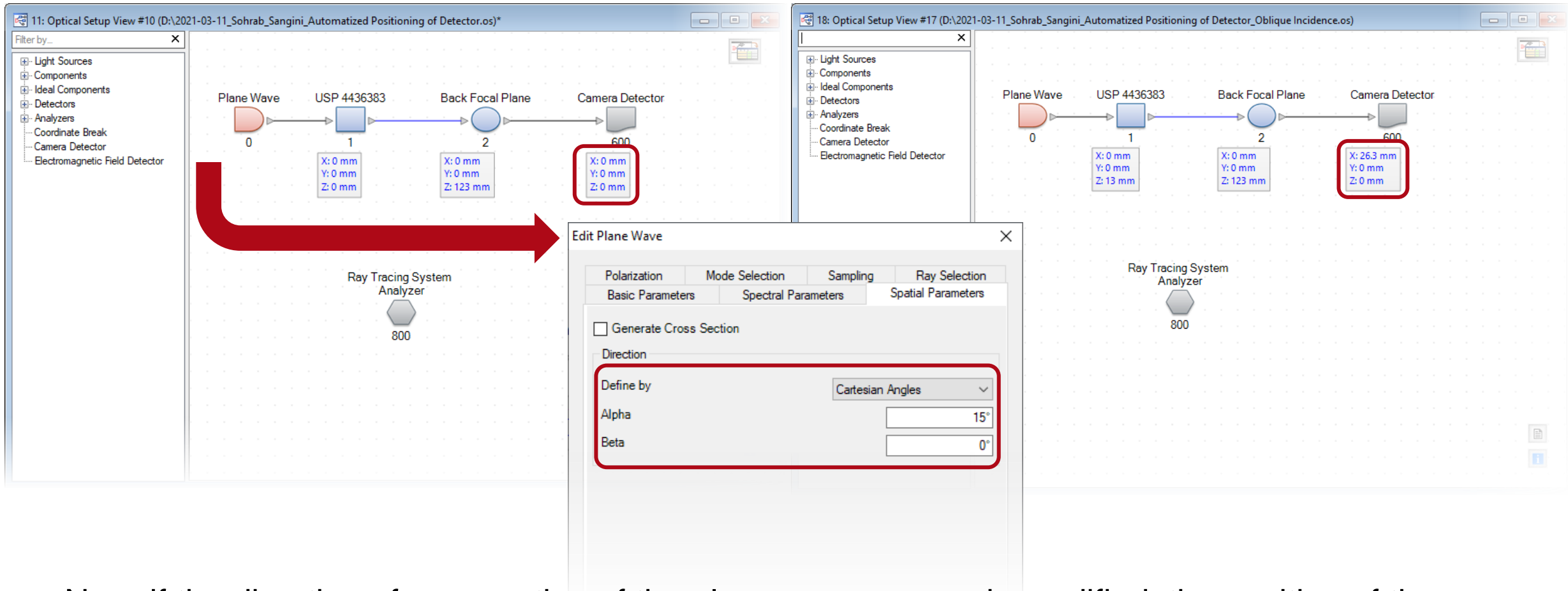
import snippet 

# Detector Index Selection



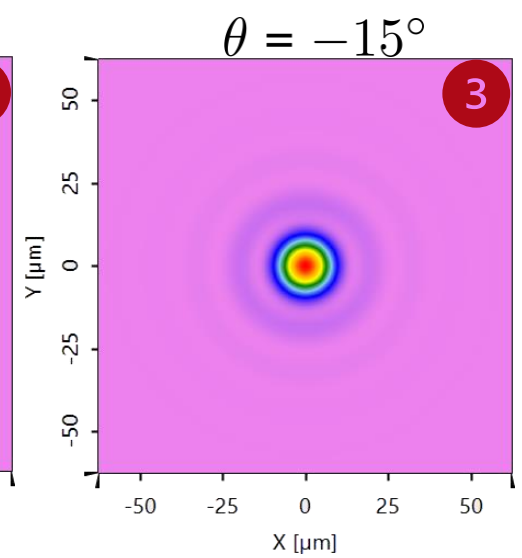
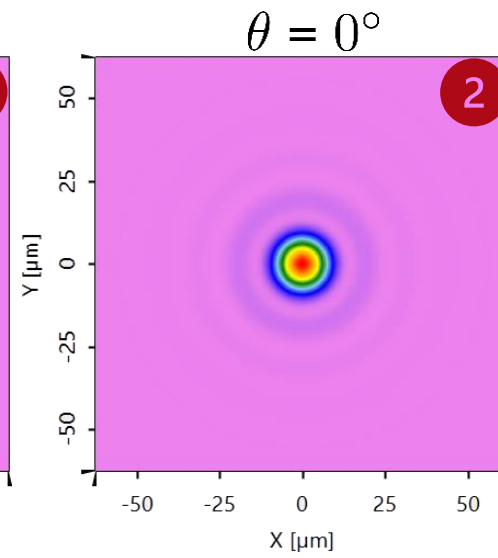
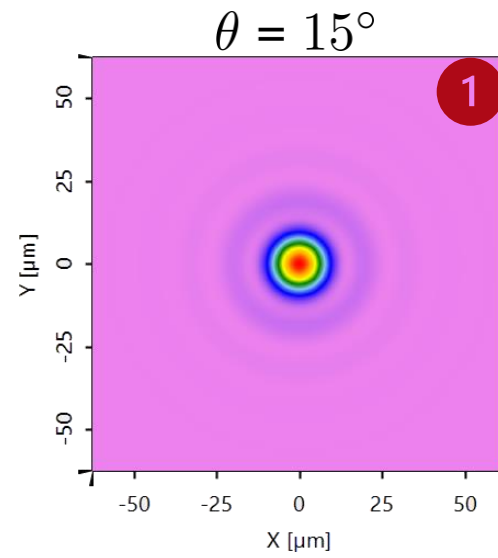
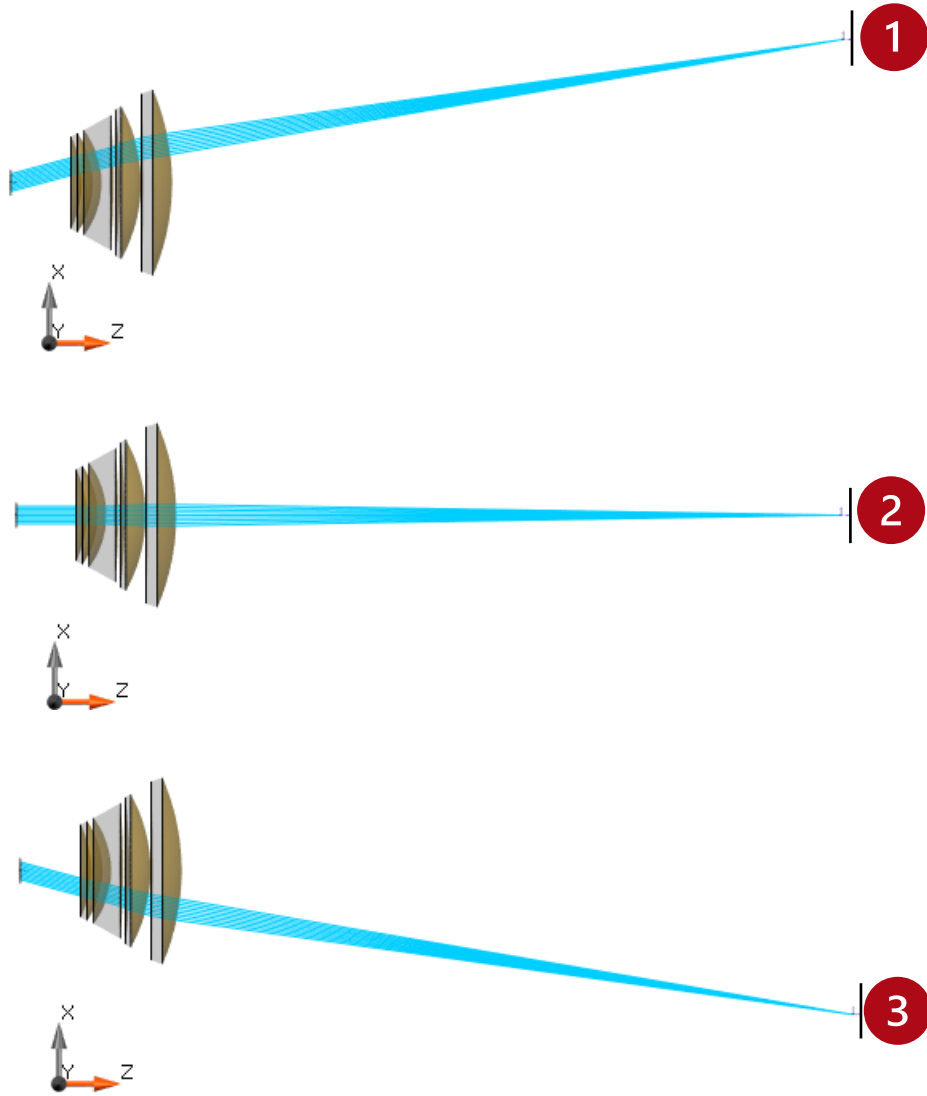
The unique index of the detector has to be specified in the specification tab of the snippet.

# Oblique Incidence



Now, if the direction of propagation of the plane-wave source is modified, the position of the detector is automatically adapted. In this example, an angle of  $15^\circ$  will lead to a shift of 26.3 mm in x direction.

# Performance Evaluation – Oblique Incidence





# On- & Off-Axis Illumination

The image displays two optical simulation setups side-by-side, comparing on-axis and off-axis illumination. Both setups include a Plane Wave (0), a lens (USP 4436383, 1), a Back Focal Plane (2), and a Camera Detector (600). In the on-axis setup, the detector is centered at X: 0 mm, Y: 0 mm, Z: 0 mm. In the off-axis setup, the detector is shifted to X: 100 μm, Y: 0 mm, Z: 0 mm. An 'Edit Lens System Component' dialog is open, showing the translation parameters for the detector: Delta X = 100 μm, Delta Y = 0 mm, and Delta Z = 0 mm. A red arrow points from the on-axis setup to the dialog.

Component	X (mm)	Y (mm)	Z (mm)
Plane Wave (0)	0	0	0
USP 4436383 (1)	0	0	123
Back Focal Plane (2)	0	0	123
Camera Detector (600)	0	0	0

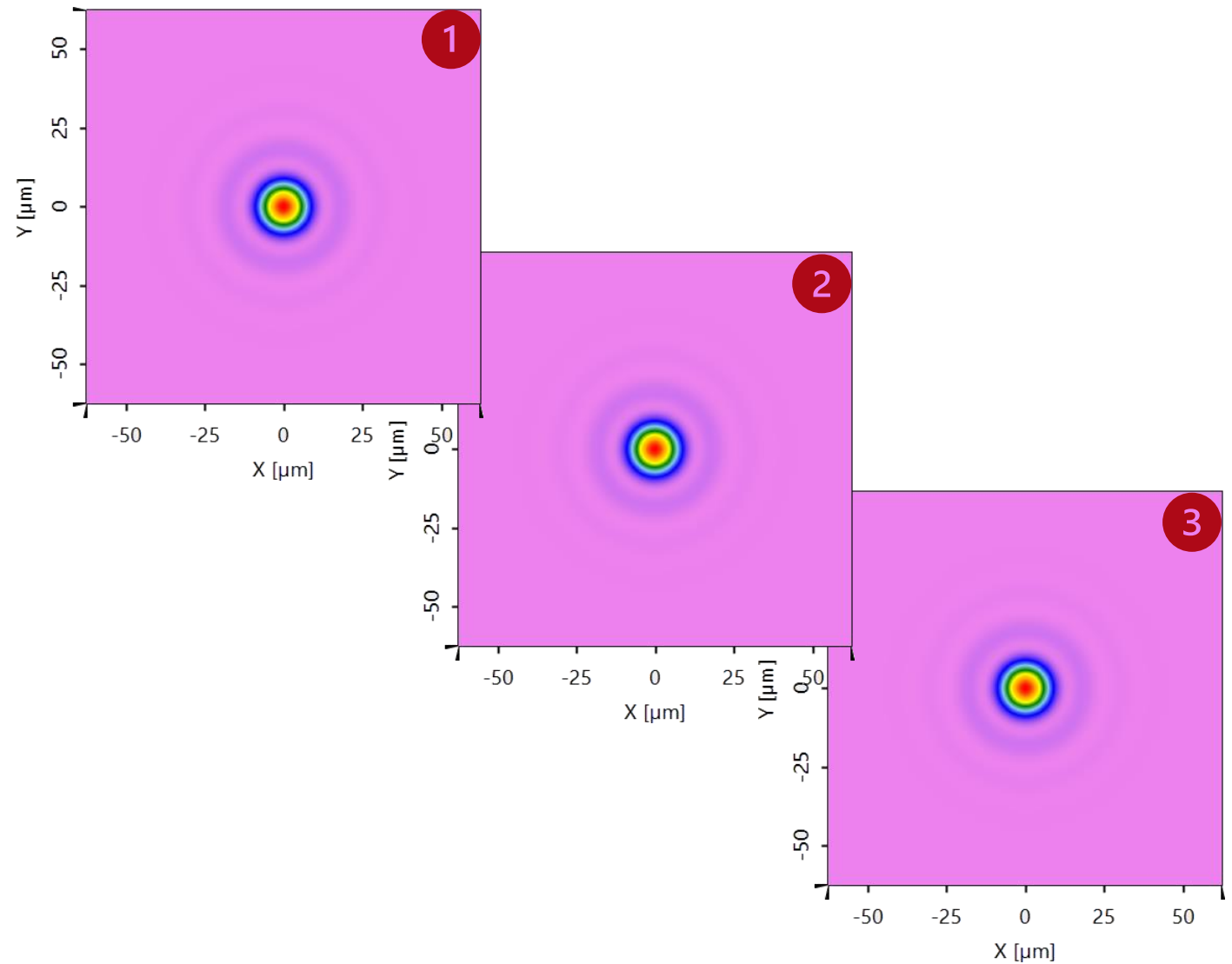
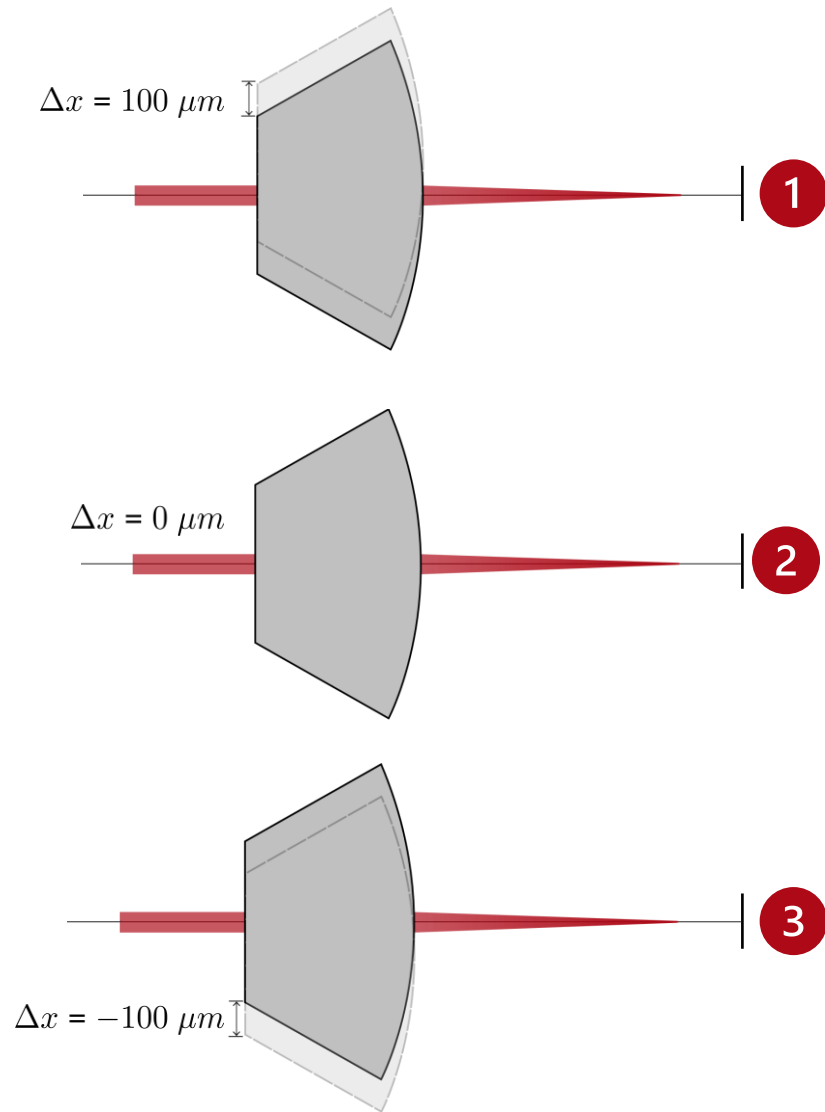
Component	X (mm)	Y (mm)	Z (mm)
Plane Wave (0)	0	0	0
USP 4436383 (1)	0	0	123
Back Focal Plane (2)	0	0	123
Camera Detector (600)	100 μm	0	0

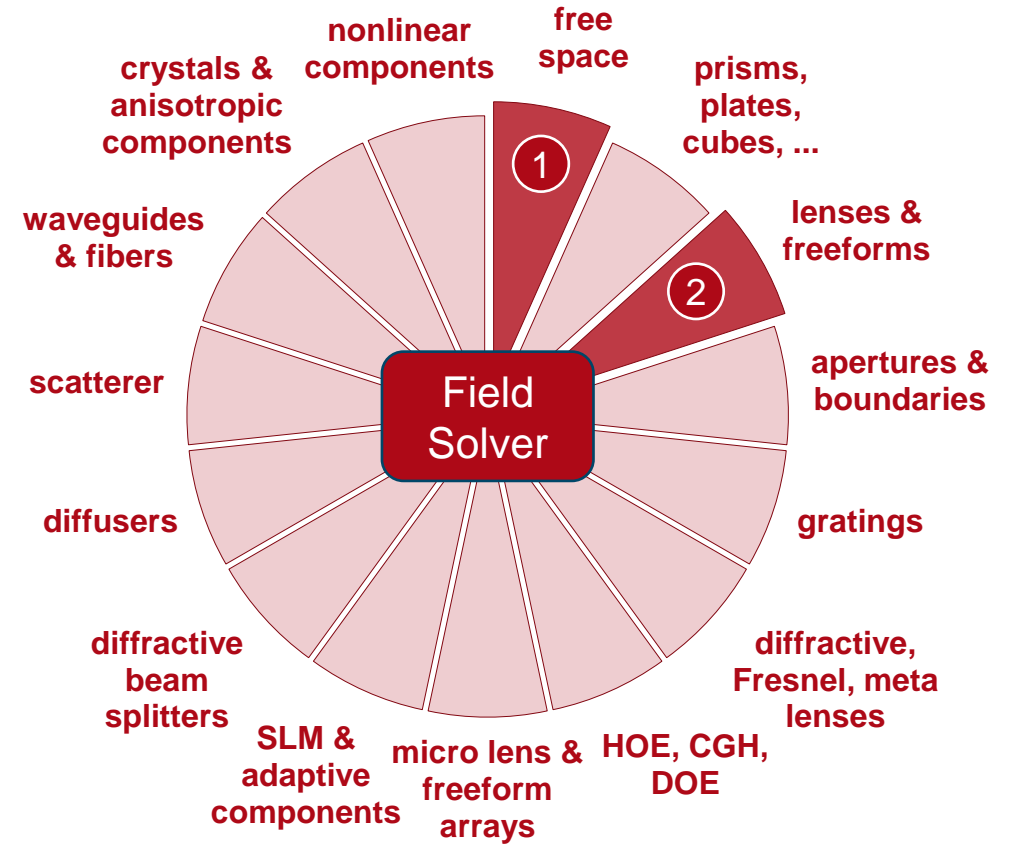
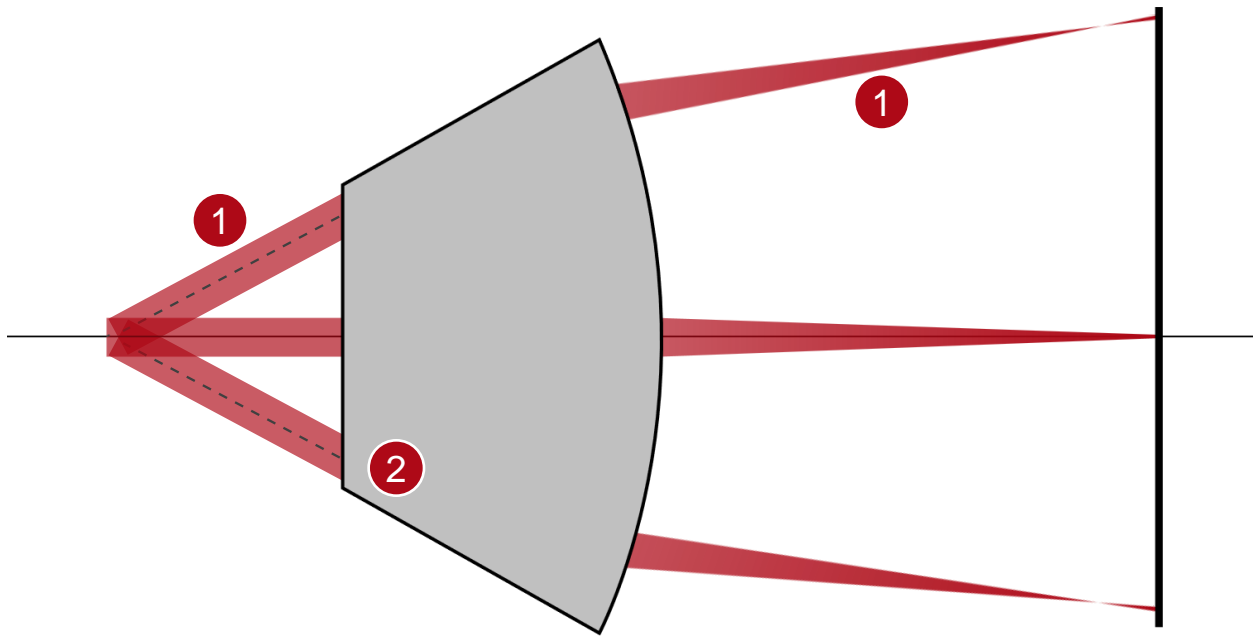
Parameter	Value
Delta X	100 μm
Delta Y	0 mm
Delta Z	0 mm

In the case of off-axis illumination, the position of the detector is also automatically adapted. In this example, a shift of 100 μm is automatically considered by the Parameter Coupling.

# Performance Evaluation – Off-Axis Illumination



# VirtualLab Fusion Technologies



# Document Information

---

title	Automatized Detector Positioning by using Parameter Coupling
document code	SWF.0039
document version	1.1
software version	2023.1 (Build 1.556)
software edition	VirtualLab Fusion Basic
category	Feature Use Case
further reading	<ul style="list-style-type: none"><li>• <a href="#"><u>Performance Analysis of Laser Scanning System</u></a></li><li>• <a href="#"><u>Coupling of Parameters in VirtualLab Fusion</u></a></li></ul>