Mach-Zehnder Interferometer
Interferometry is an important technology for optical metrology. It is widely used for the measurements of e.g. surface profile, defects, mechanical and thermal distortion with high precision. As a typical example, a Mach-Zehnder interferometer with coherent laser source is build up in VirtualLab Fusion, with the help of non-sequential field tracing. It is demonstrated that how the tilt and shift of an optical elements may affect the interference fringe pattern.
Modeling Task

He-Ne laser
- fundamental Gaussian
- wavelength 632.8 nm

3x beam expander

beam splitter

reference path

BK7

BK7

beam splitter

test path
(test object may tilt and/or shift)

How to calculate interference fringe with the possible shift and tilt of components considered?
Interference Fringe Due to Component Tilt

Concentric ring pattern is seen for the well aligned system.

Due to the tilt of the lens, the center of the rings starts to shift.
Interference Fringe Due to Component Shift

With large shift distance, only the part of the lens contribute to the interference and the fringes tend to become linear.
Peek into VirtualLab Fusion

flexible position and orientation settings

non-sequential ray tracing analysis

direct observation of interference fringes
Workflow in VirtualLab Fusion

- Set up input Gaussian field
  - Basic Source Models [Tutorial Video]

- Set the position and orientation of components
  - LPD II: Position and Orientation [Tutorial Video]

- Configure the surface channels of components
  - Channel Configuration for Surfaces and Grating Regions [Use Case]
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<td>further reading</td>
<td>- Laser-Based Michelson Interferometer and Interference Fringe Exploration</td>
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