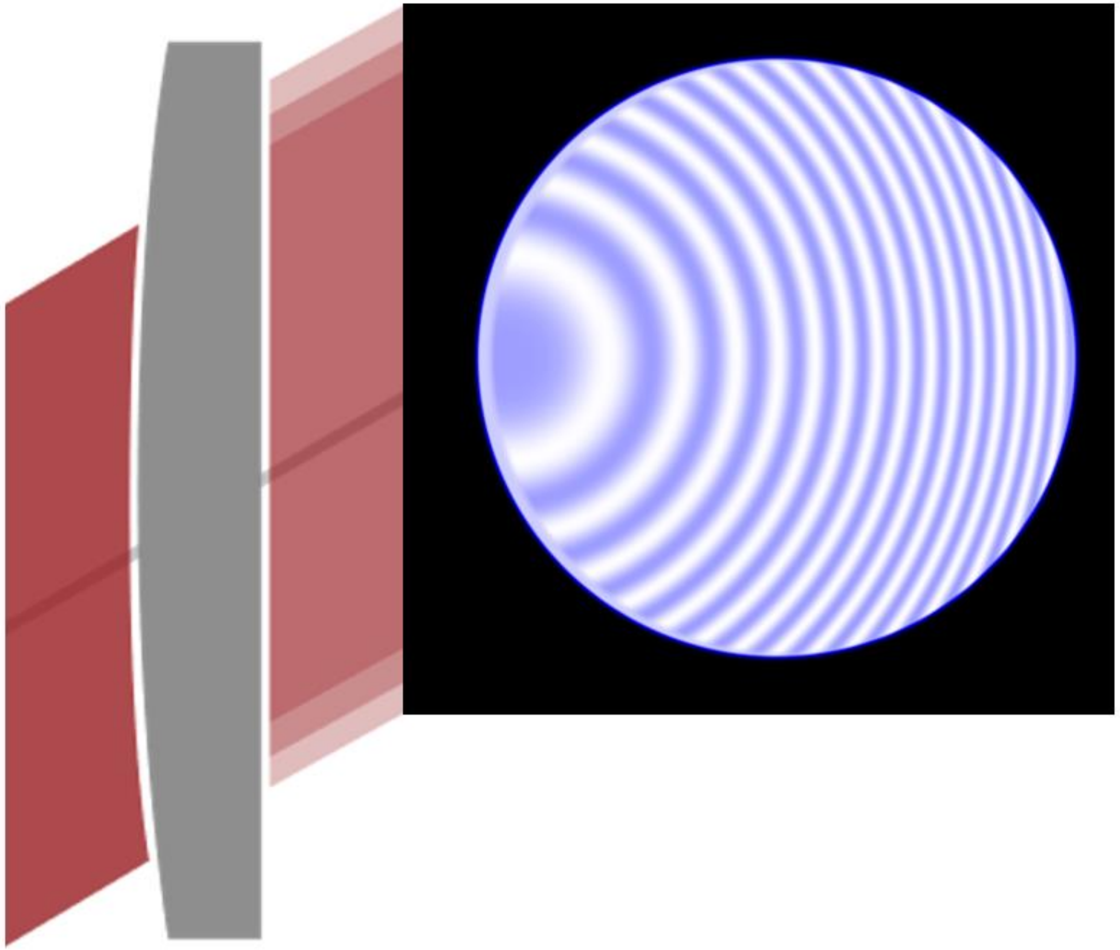
Modeling of Etalon with Planar and Curved Surfaces

Abstract



The basic setup of an optical etalon is a transparent plate with parallel surfaces. Such a structure forms a resonator, where transmittance and reflectance vary with the thickness of the etalon. Beside this simple configuration, more complex etalons, with e.g. non-parallel surfaces and curved surfaces, are designed and used for different applications. With the non-sequential field tracing technique of VirtualLab Fusion, several configurations of etalons are analyzed, and the differences in the output interference fringes are investigated including polarization effects.

Modeling Task

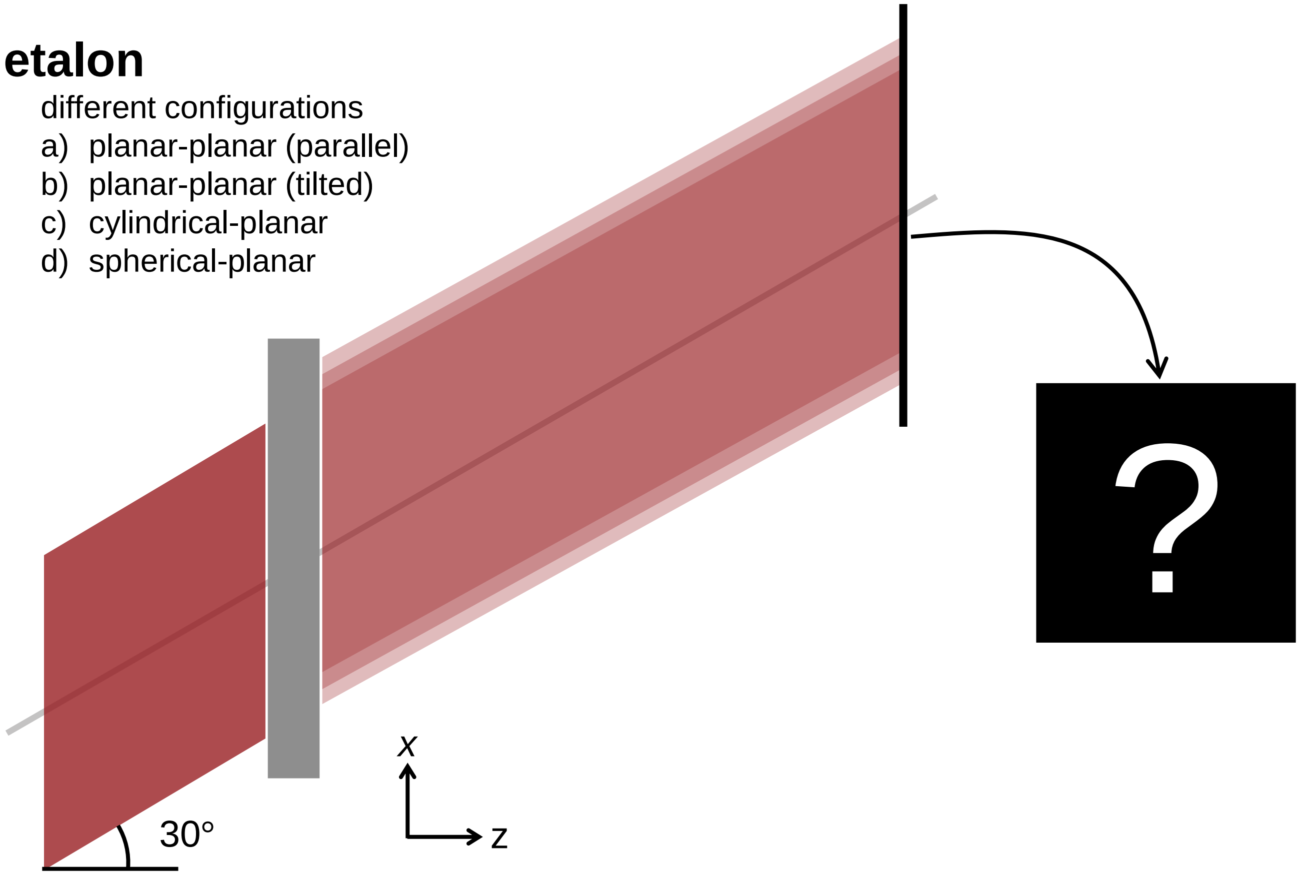
etalon

different configurations

a) planar-planar (parallel)
b) planar-planar (tilted)
c) cylindrical-planar
d) spherical-planar

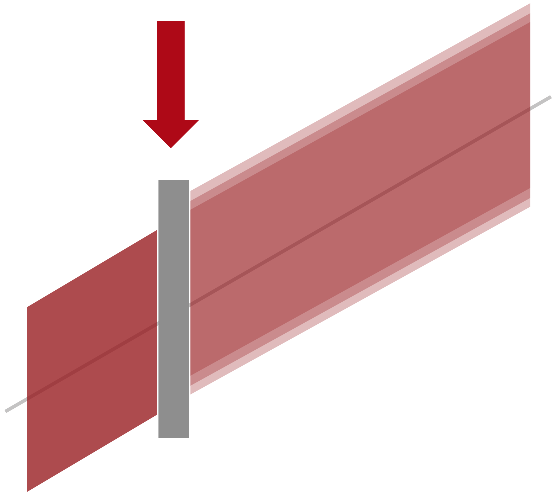
input plane wave

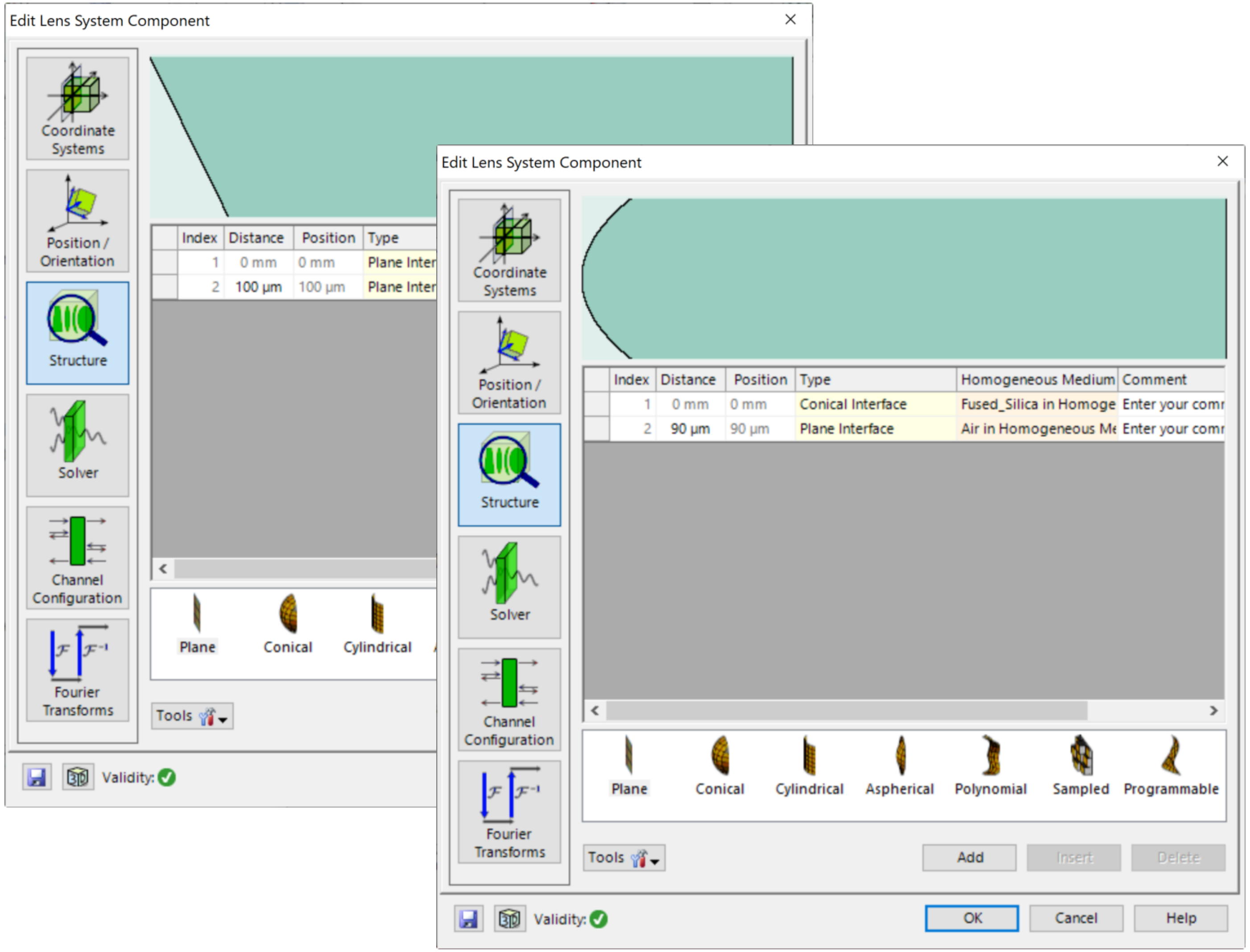
- wavelength 532 nm
- linearly polarized along *y*- or *x*-direction



How to calculate the interference fringes for etalons with different configurations?

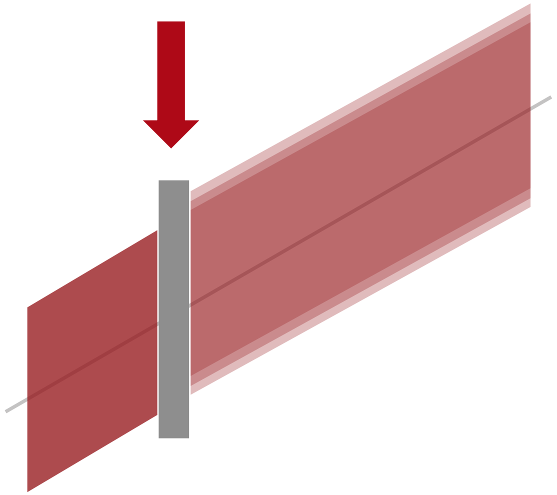
Etalon





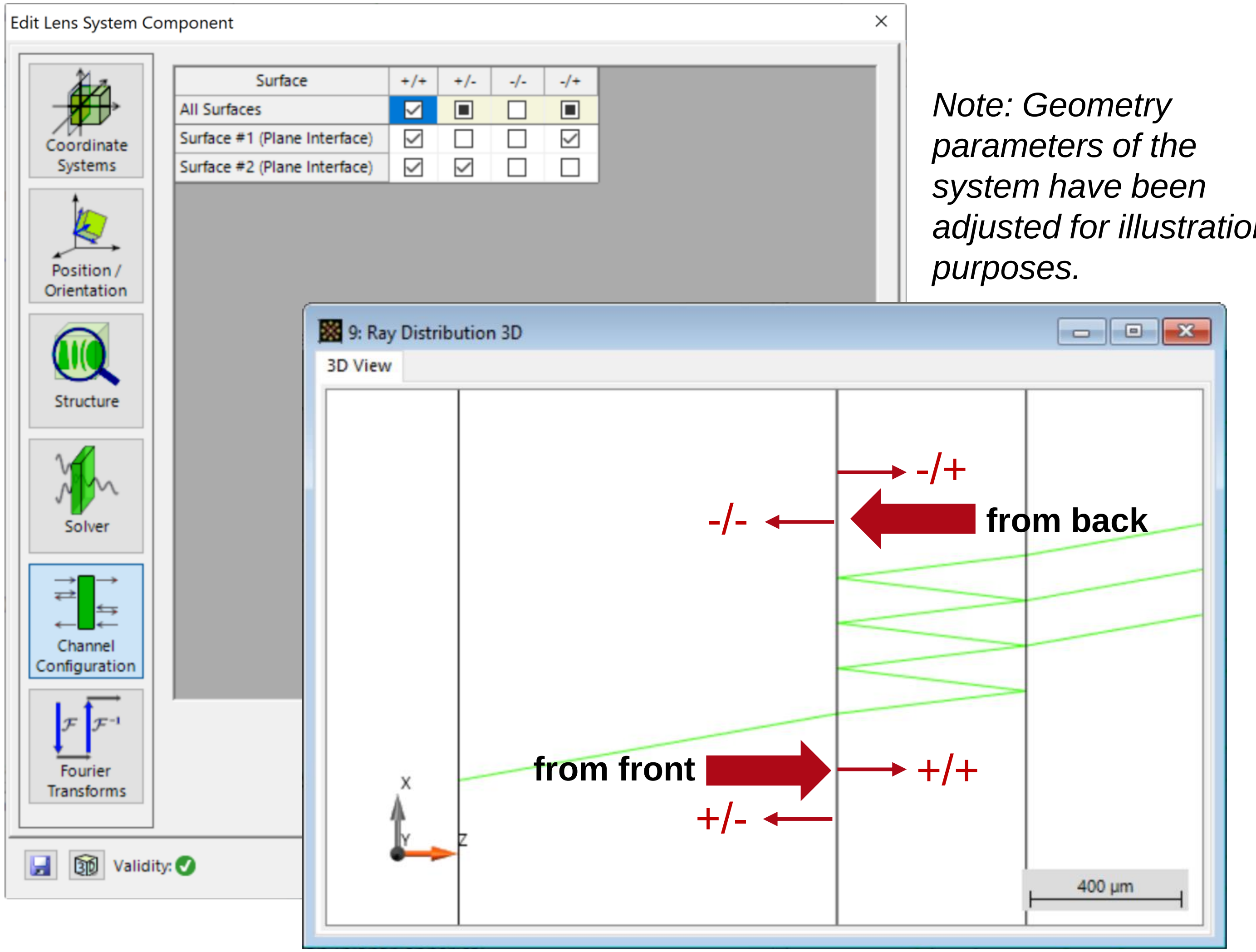
The *Lens System Component* allows for an easy definition of a component consisting of various interfaces. Among other types of surfaces, it is possible to include planar, spherical and cylindrical interfaces as well as to define the media between them.

Channel System for Nonsequential Modeling



In the *Manual Channel Configuration* mode, the user can control which light paths should be considered during the simulation. The detailed configuration can be found on the *Channel Configuration* page. Further information can be found here:

[Channel Configuration For Surfaces and Grating Regions]



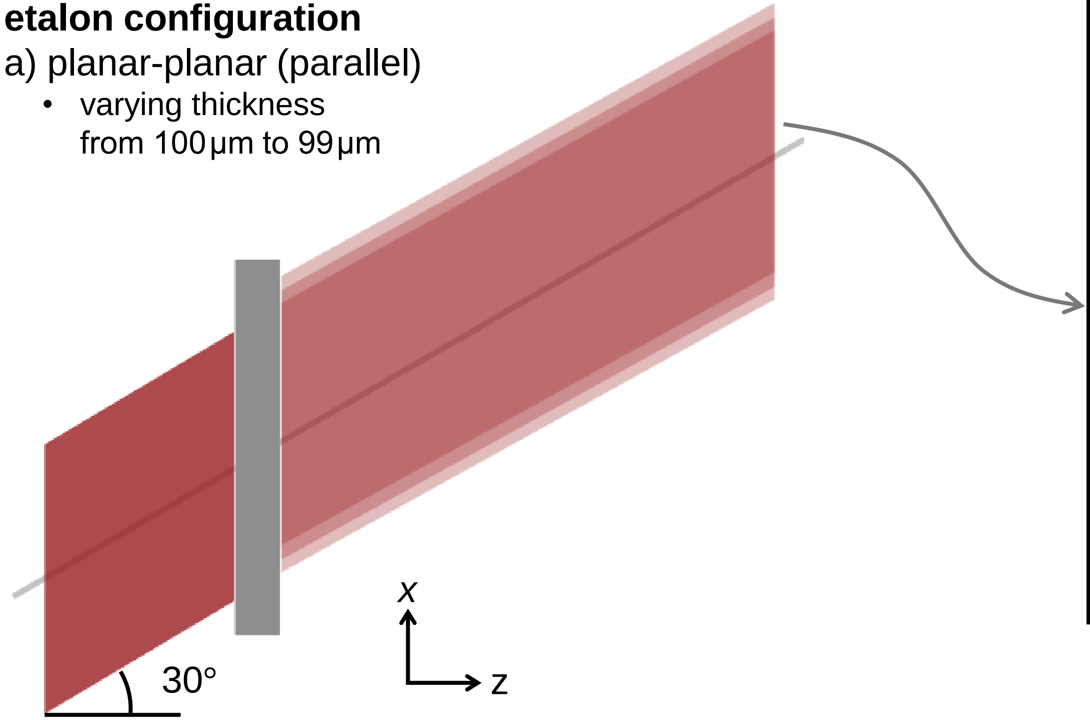
Note: Geometry parameters of the system have been adjusted for illustration purposes.

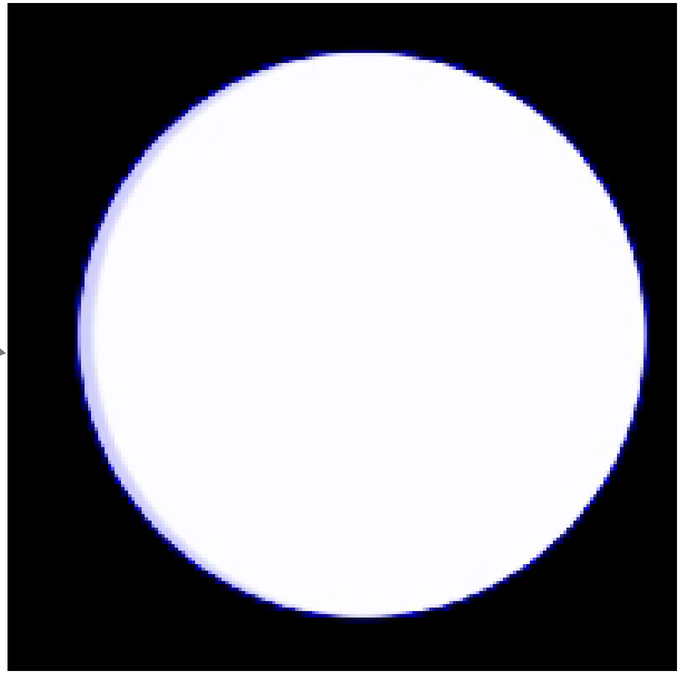
a) Parallel Planar-Planar Surfaces

etalon configuration

a) planar-planar (parallel)

- varying thickness
  from 100 µm to 99 µm

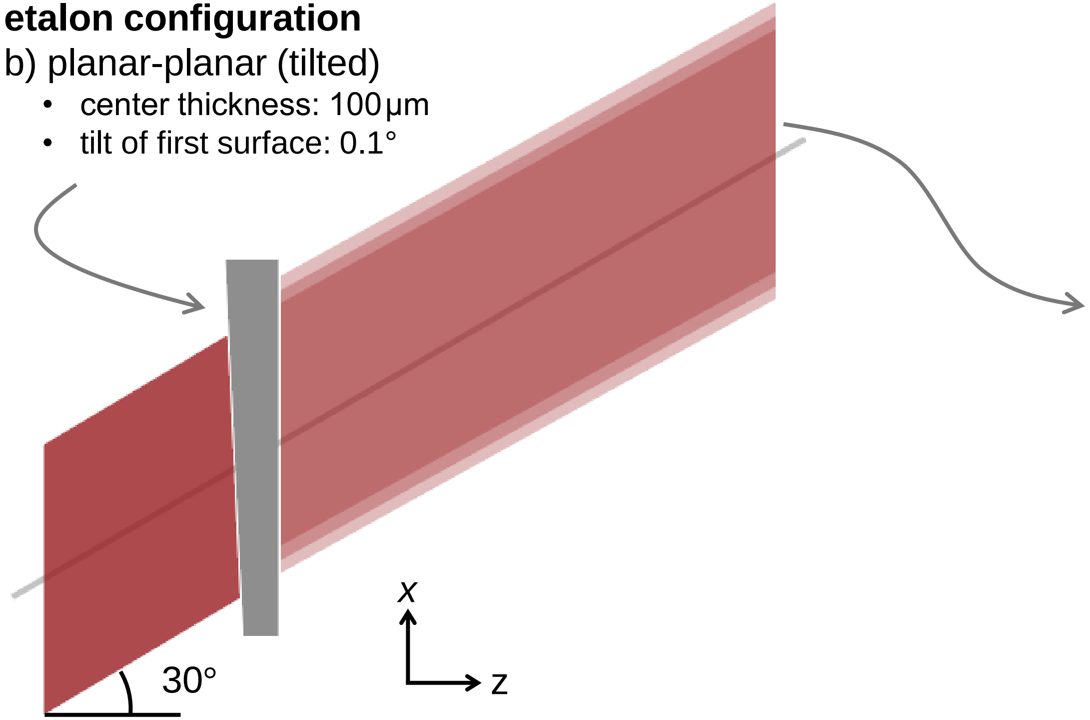


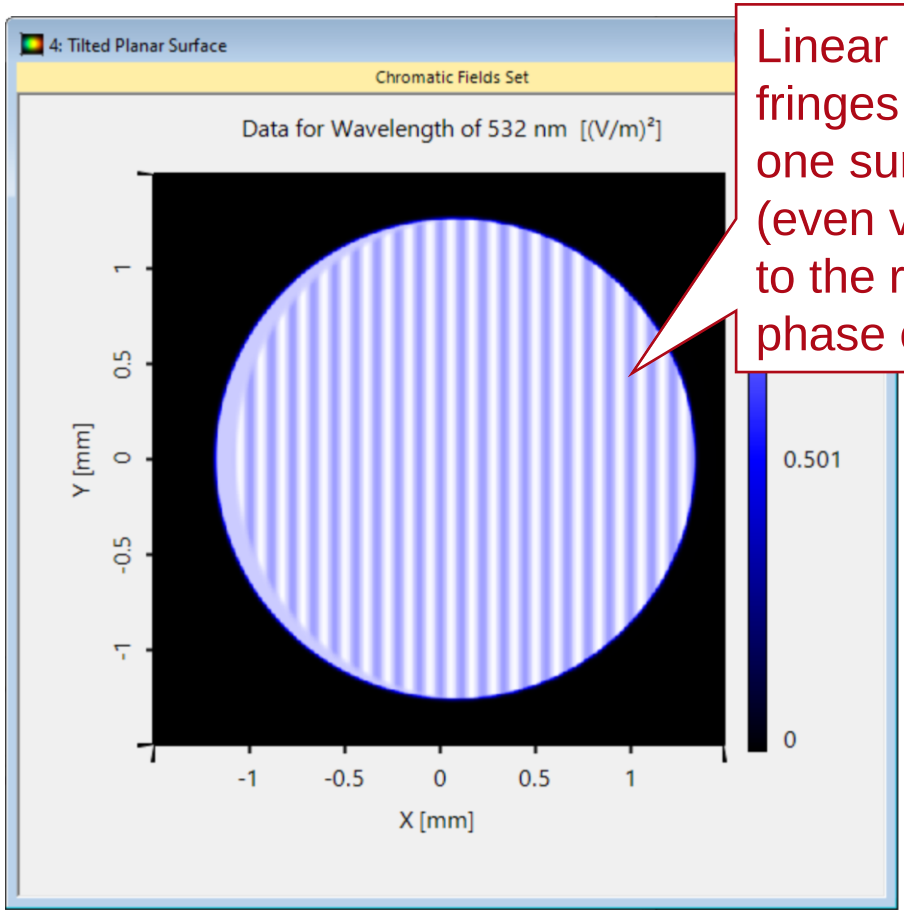


Constructive and destructive interference are alternating as the thickness of the etalon varies. Due to the perfect parallel and planar surfaces no fringes appear.

b) Tilted Planar-Planar Surfaces

etalon configuration
b) planar-planar (tilted)
- center thickness: 100 µm
- tilt of first surface: 0.1°



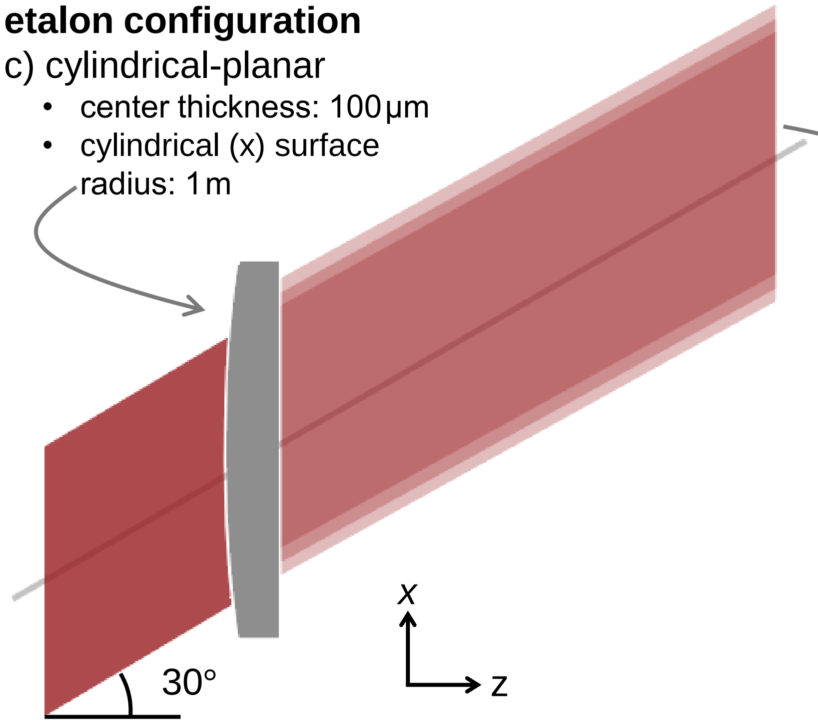


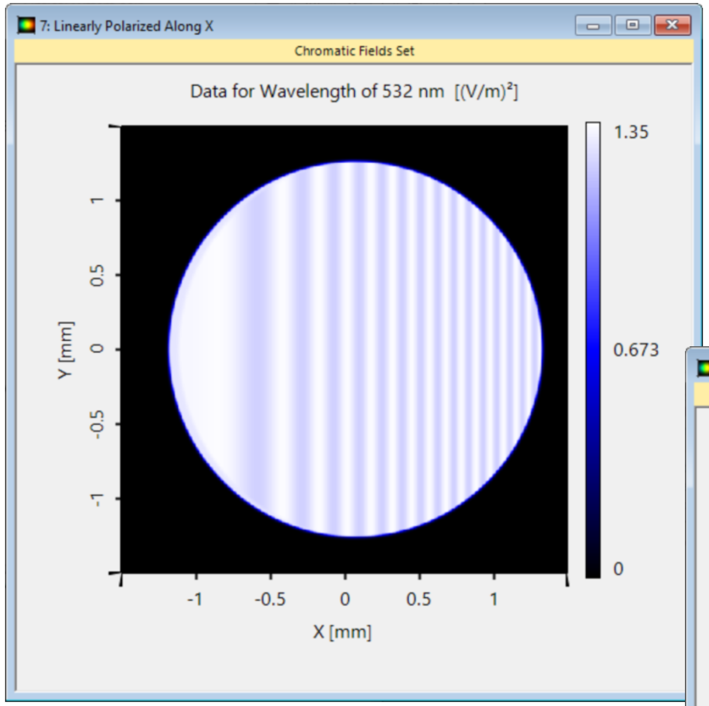
Linear interference fringes are introduced if one surface is tilted (even very slightly) due to the resulting linear phase of the light.

first surface tilt by 0.1°

c) Cylindrical-Planar Surfaces

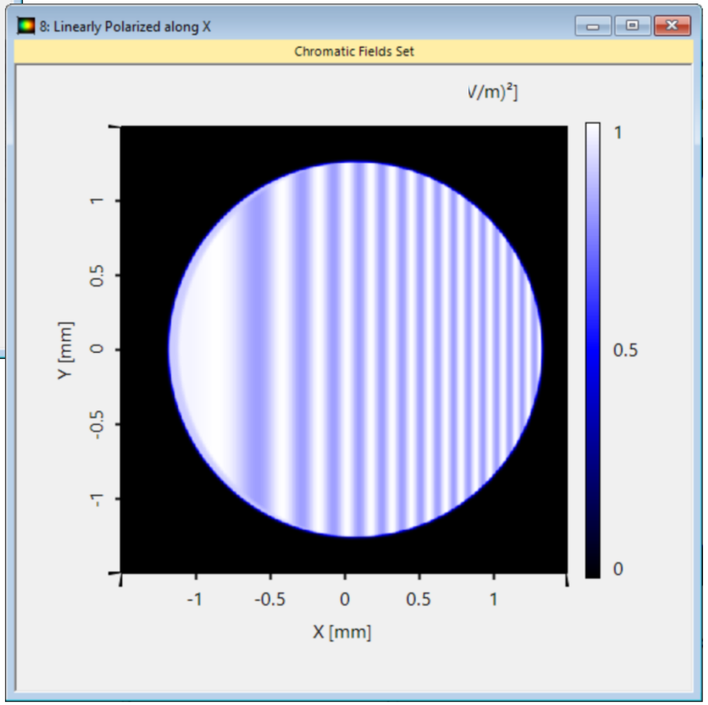
etalon configuration
c) cylindrical-planar
- center thickness: 100 µm
- cylindrical (x) surface radius: 1 m





input polarization along x

Polarization-dependent effects on the interference are considered in the simulation.



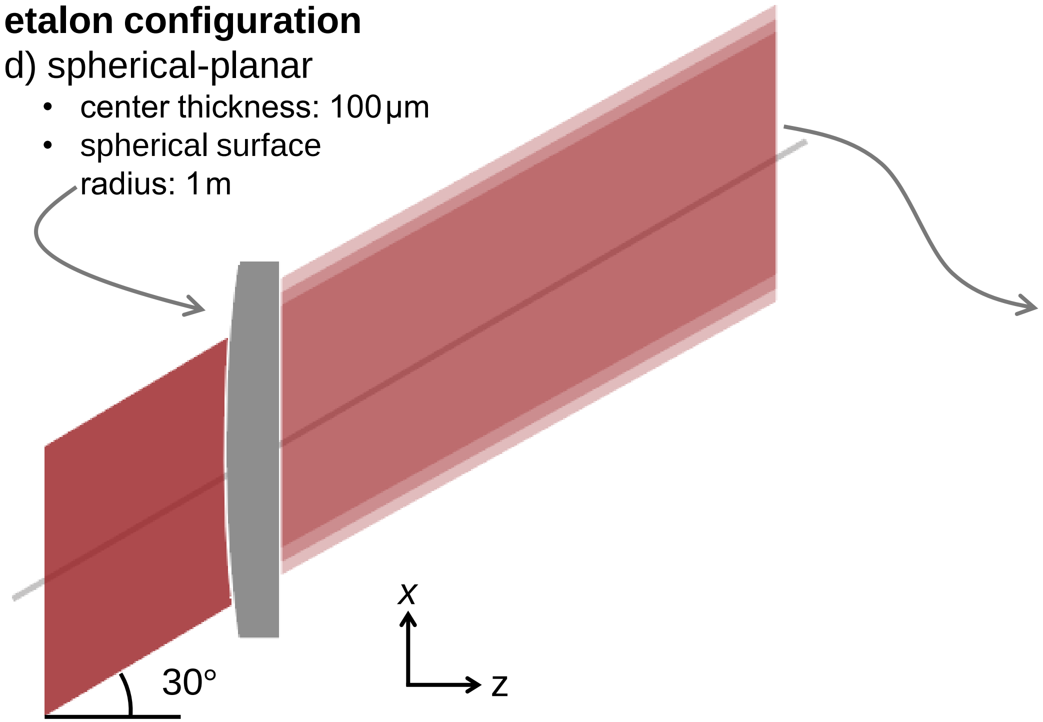
input polarization along y

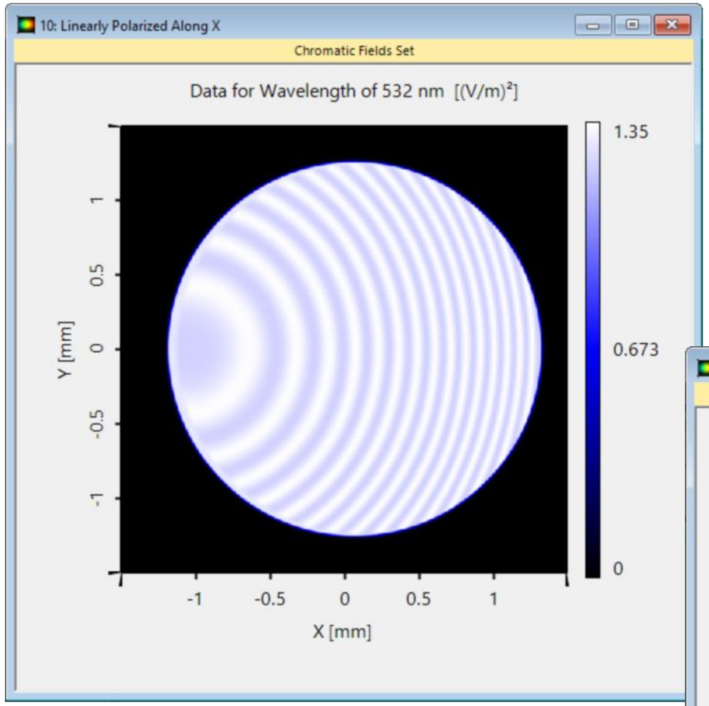
d) Spherical-Planar Surfaces

etalon configuration

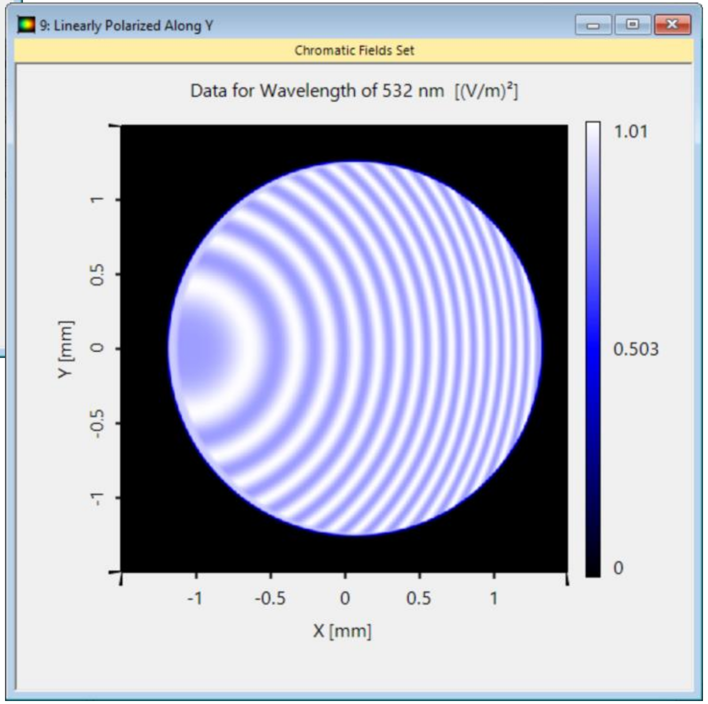
d) spherical-planar

- center thickness: 100 µm
- spherical surface radius: 1 m



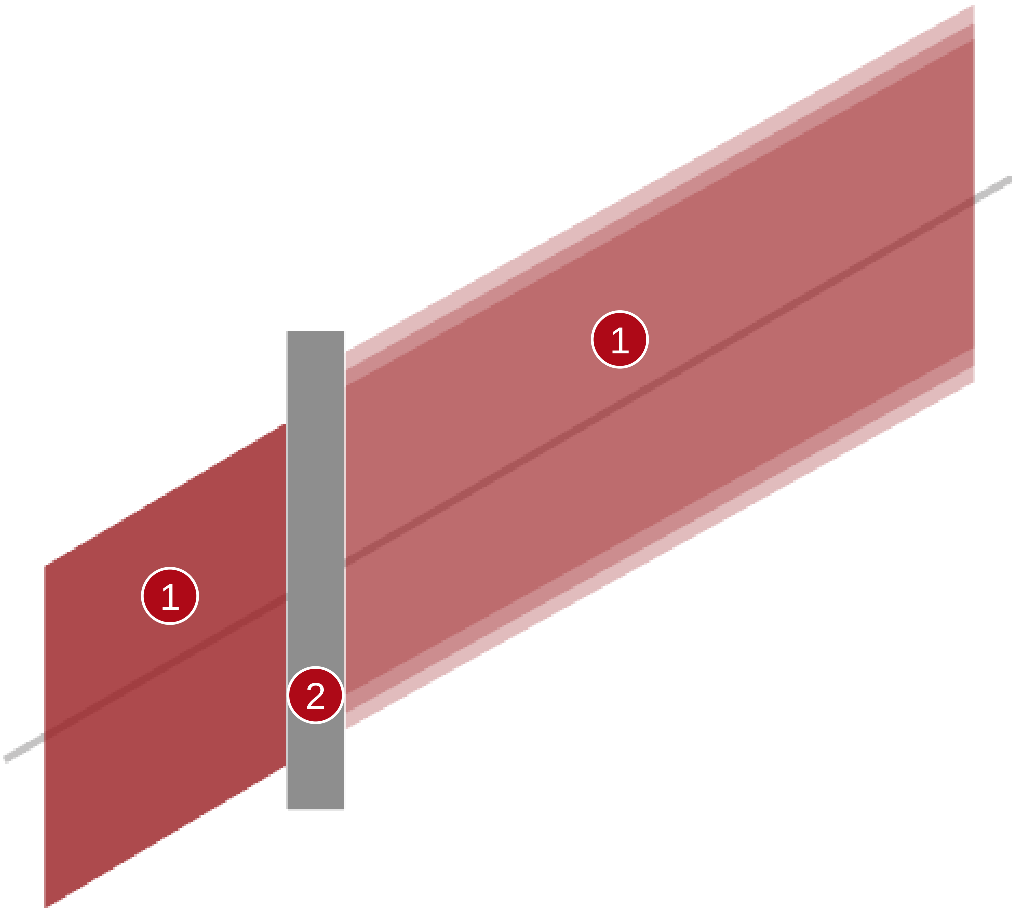


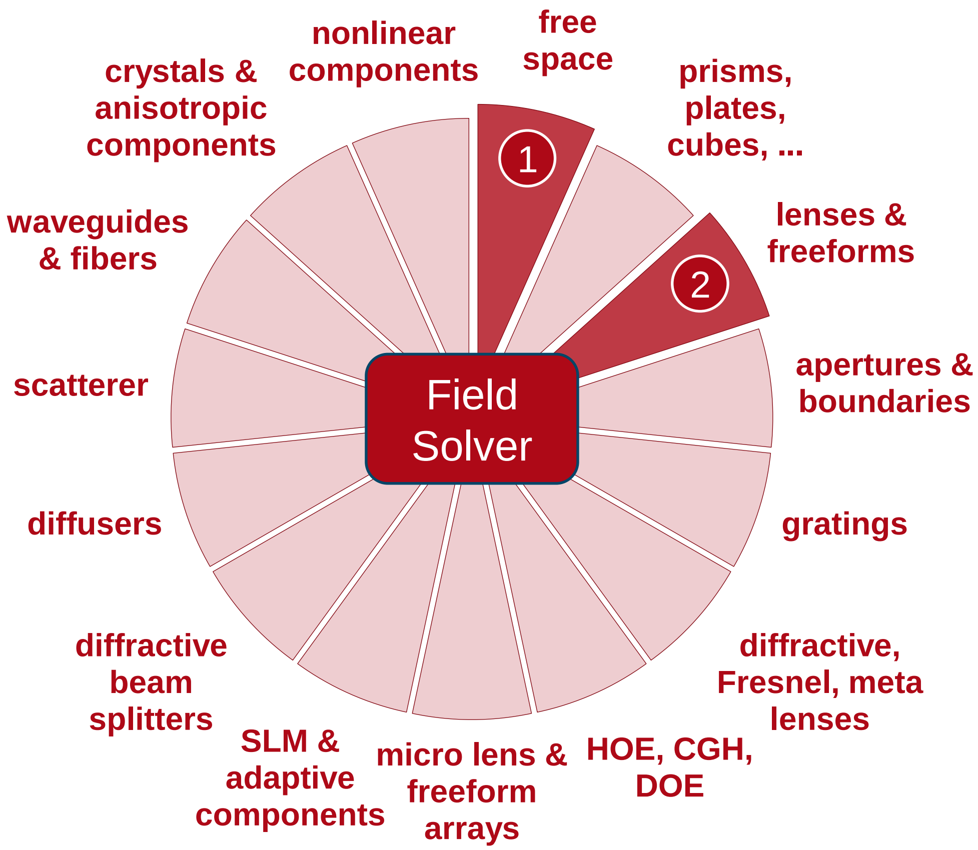
input polarization along x



input polarization along y

VirtualLab Fusion Technologies





Document Information

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document code	IFO.0011
document version	1.3
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