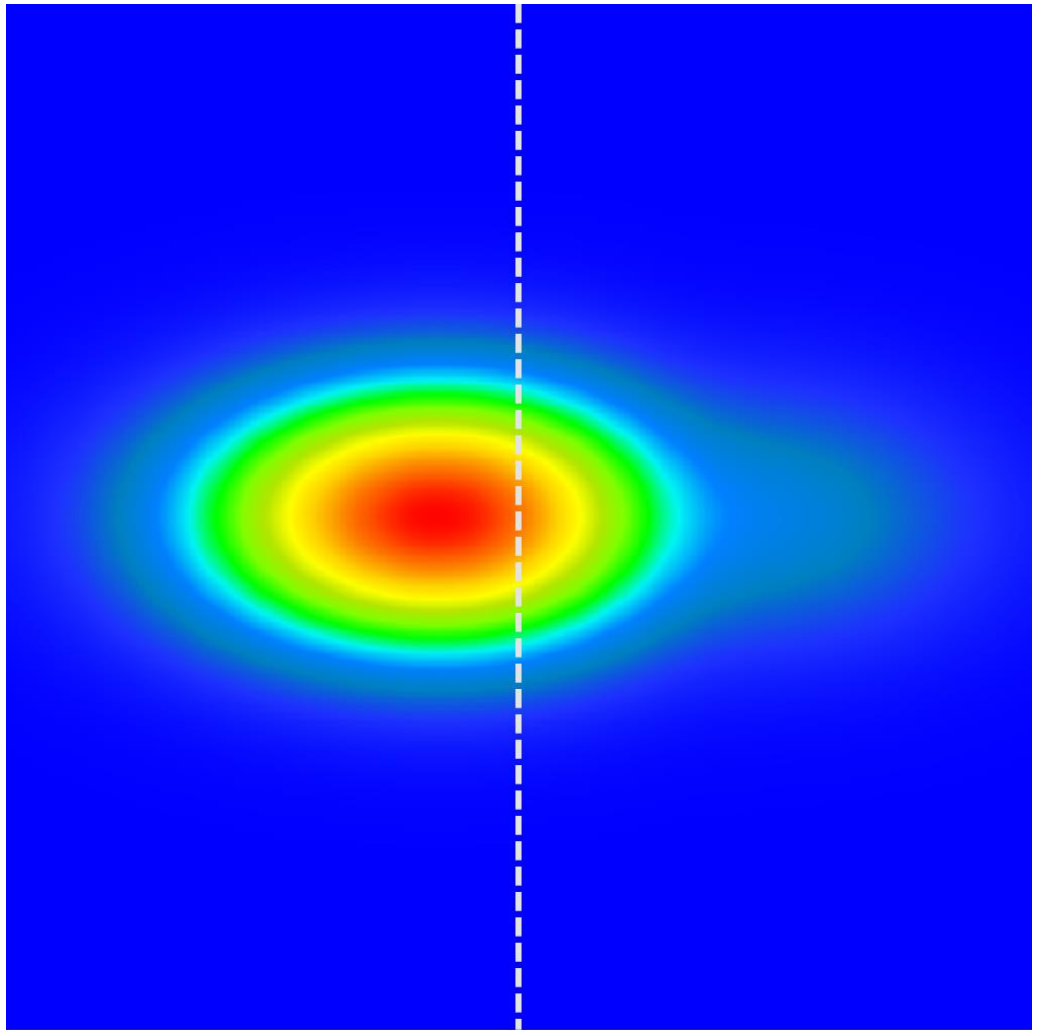
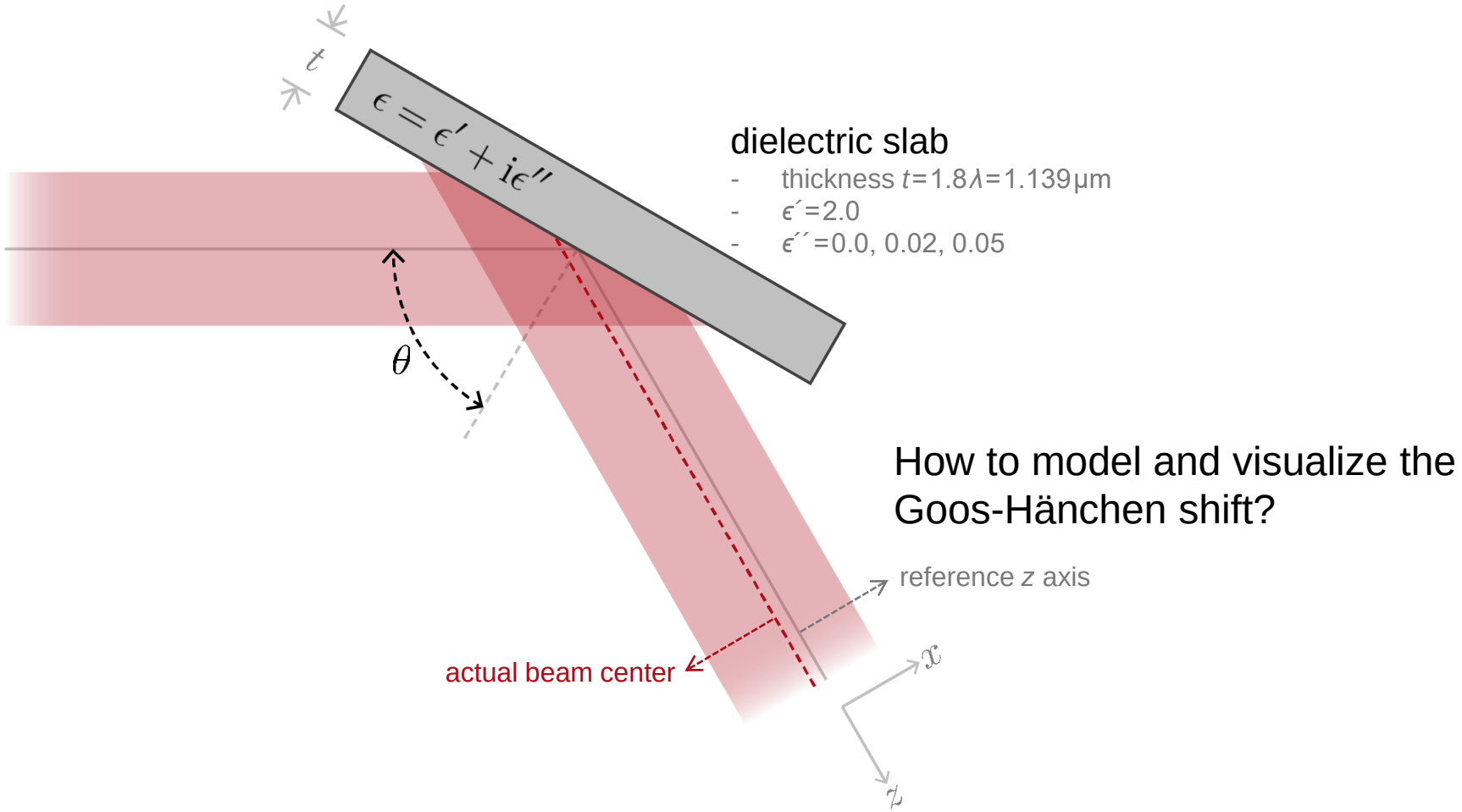
Precise Measurement of Goos-Hänchen Shift form Weakly Absorbing Slab

Abstract



For a linearly polarized light, when total internal reflection takes place, the reflected beam undergoes a small lateral shift, which is known as the Goos-Hänchen shift. In this example, we demonstrate similar effects for a weakly absorbing dielectric slab, following the theoretical work of L. Wang, *et al*., but using the numerical modeling technologies in VirtualLab Fusion. The influence from the absorption of the slab medium is investigated. For different medium absorptions, we measure the center of the reflected beam with respect to the incidence angle, and we compare the result with the reference.

Modeling Task



input field
- wavelength λ=632.8 nm
- collimated Gaussian
- waist radius 1 mm
- linearly polarized along y

dielectric slab
- thickness t=1.8λ=1.139 μm
- ϵ'=2.0
- ϵ''=0.0, 0.02, 0.05

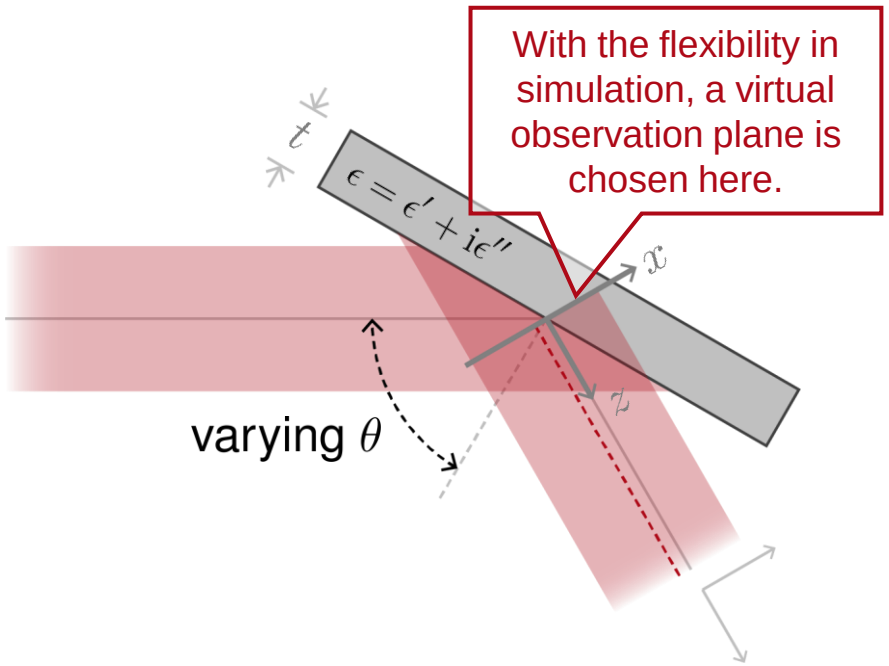
How to model and visualize the Goos-Hänchen shift?

system parameters adapted from L. Wang, *et al*., Opt. Lett. 30, 2936-2938 (2005)

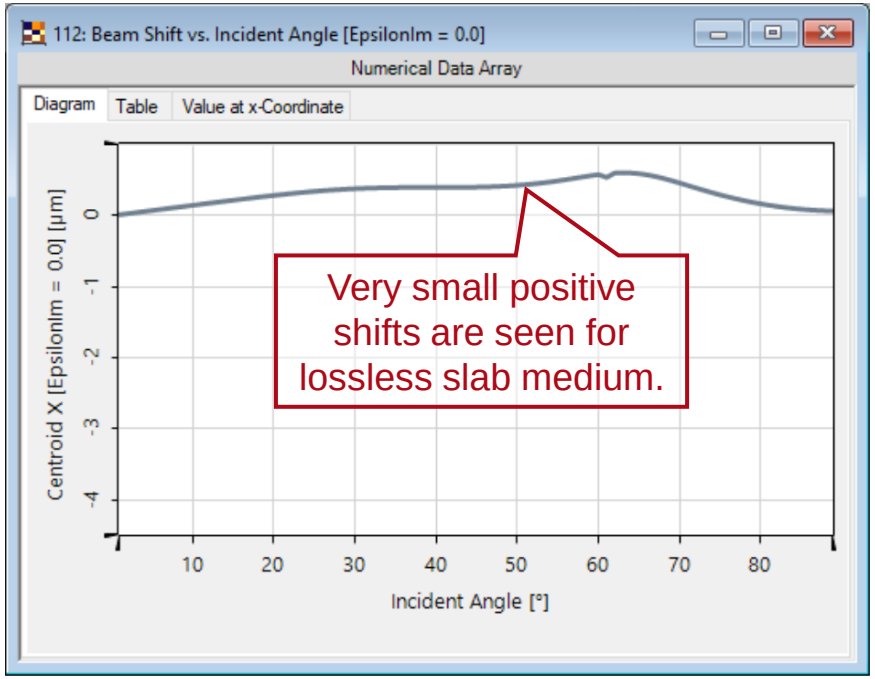
Beam Shift vs. Incident Angle

input field

- wavelength λ=632.8 nm
- collimated Gaussian
- waist radius 1 mm
- linearly polarized along *y*



beam shift vs. incident angle ($\epsilon'' = 0$)



Beam Shift vs. Incident Angle

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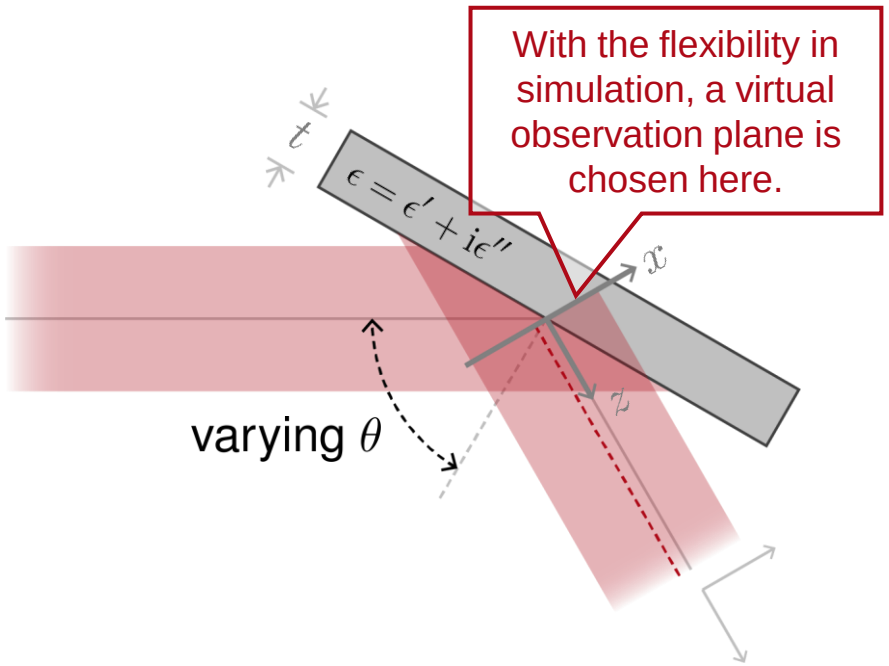
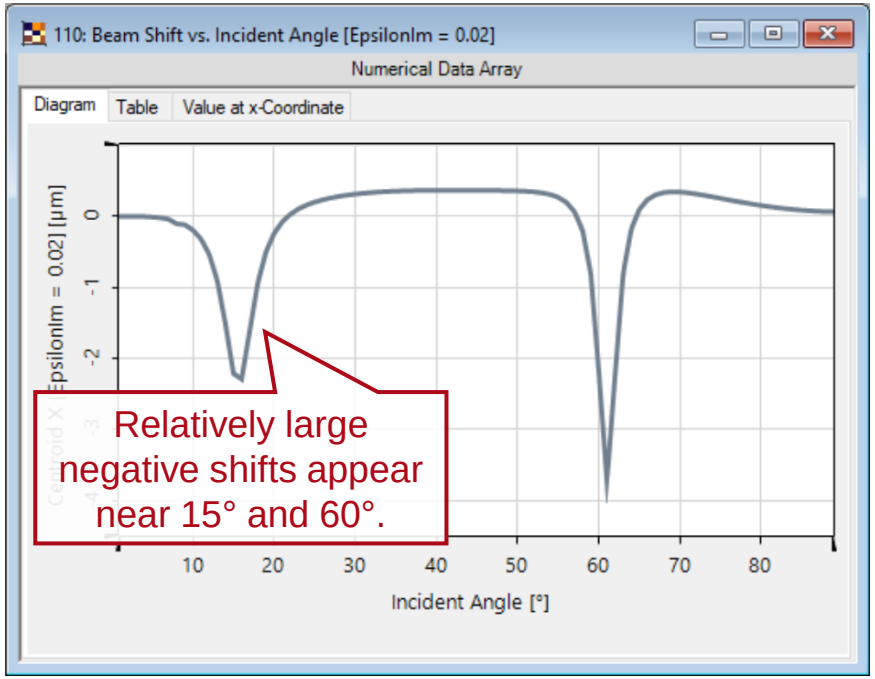


beam shift vs. incident angle ($\epsilon'' = 0.02$)



Beam Shift vs. Incident Angle

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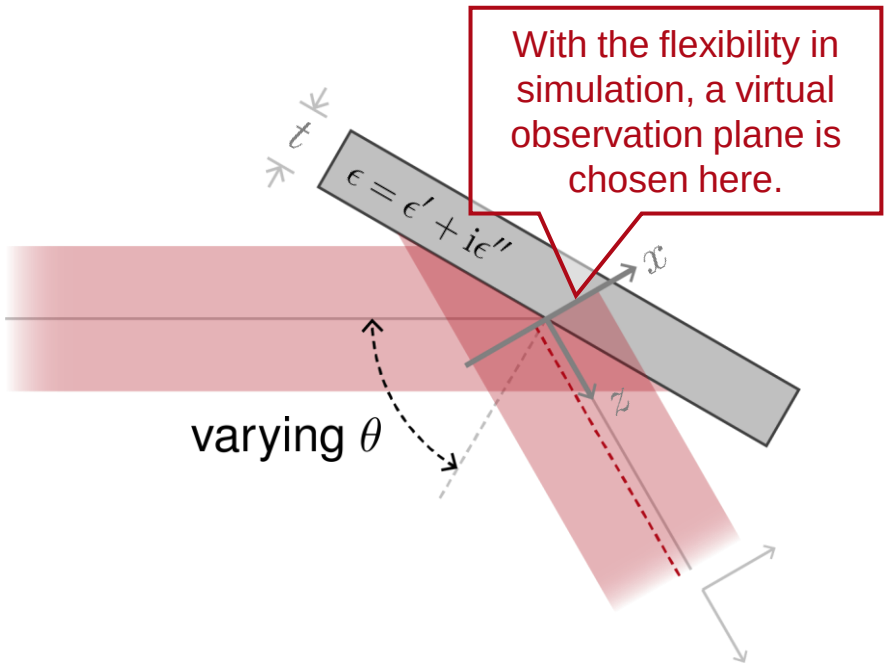
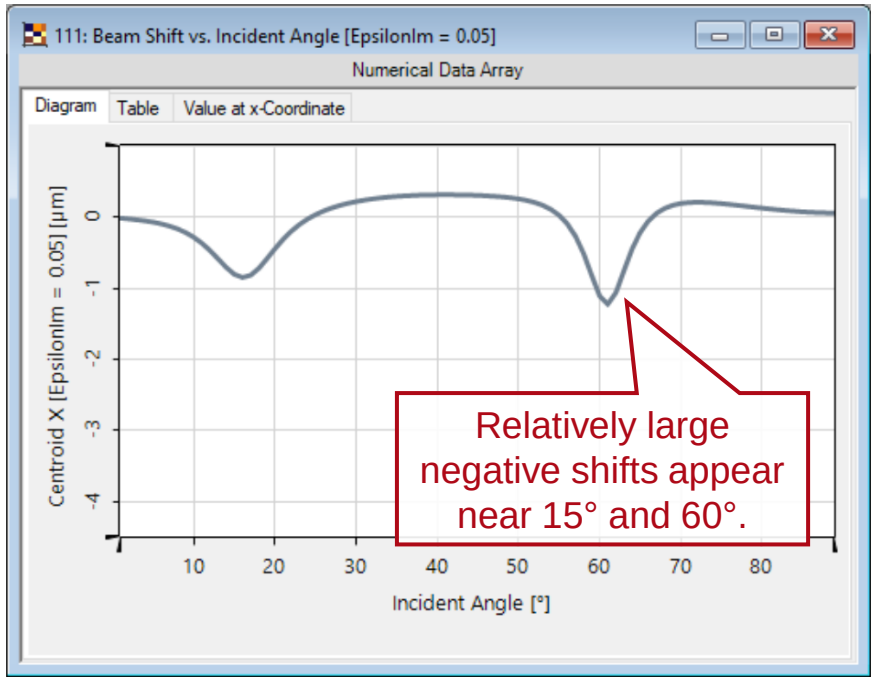


beam shift vs. incident angle ($\epsilon'' = 0.05$)



Beam Shift vs. Incident Angle

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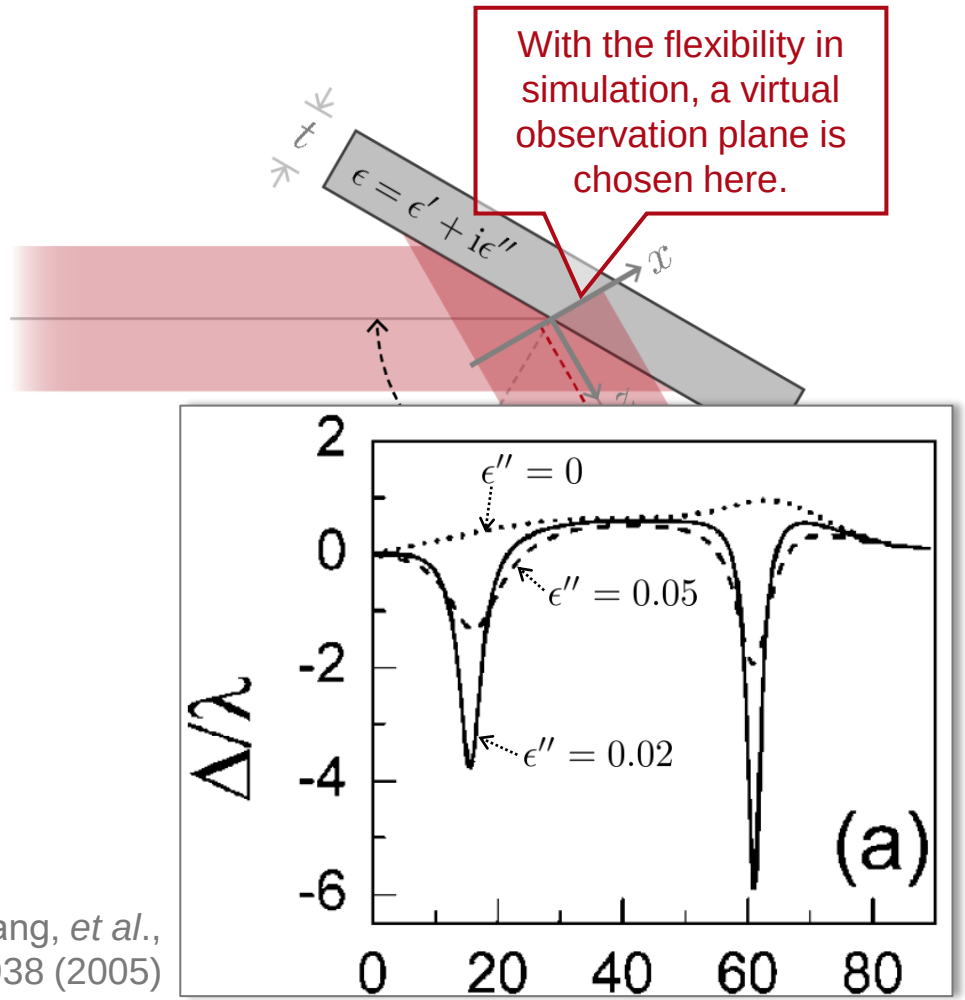
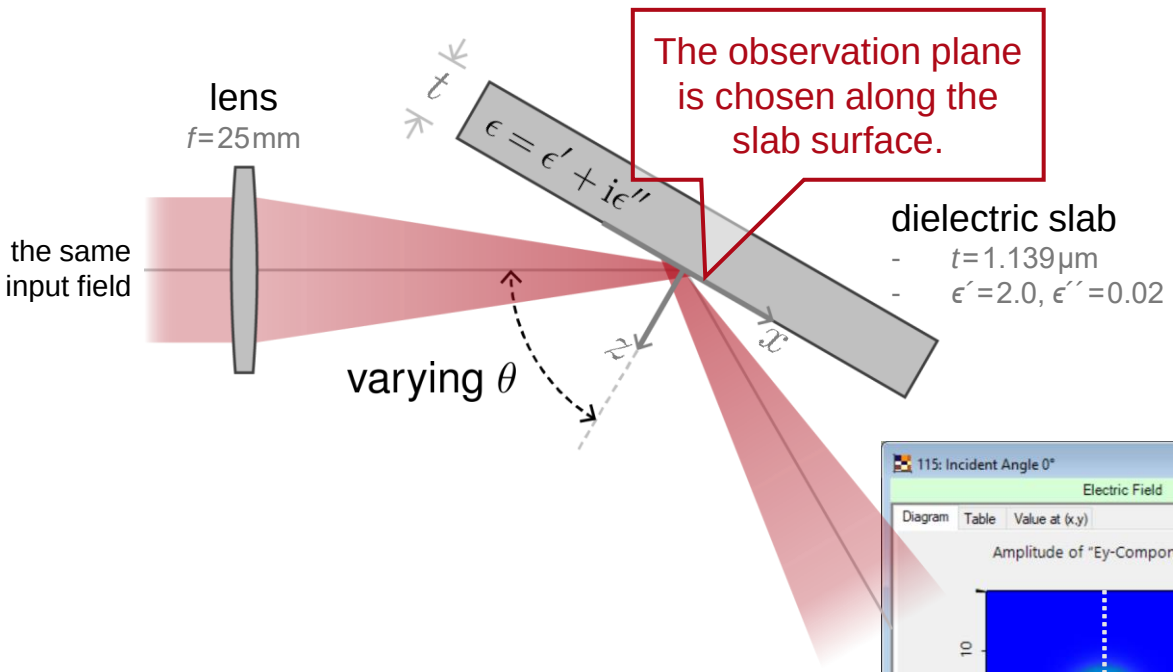
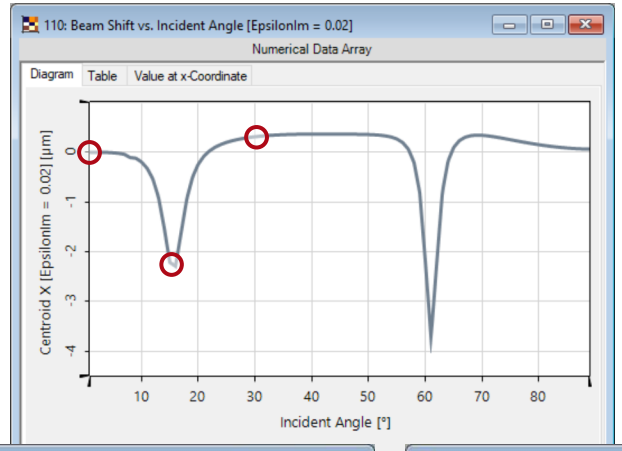


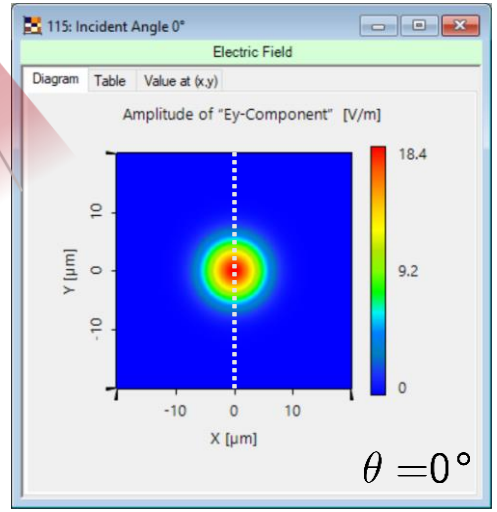
Fig. 2(a) from L. Wang, *et al*., Opt. Lett. 30, 2936-2938 (2005)

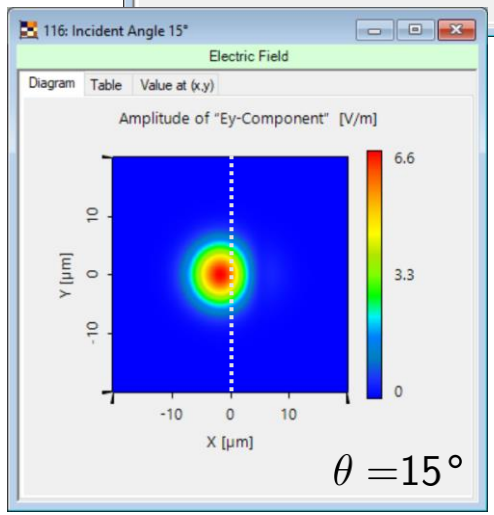
beam shift in λ for different values of ϵ''

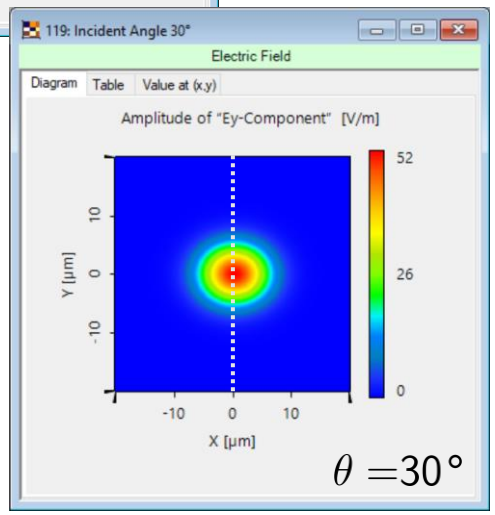
Observation with Focused Gaussian Beam



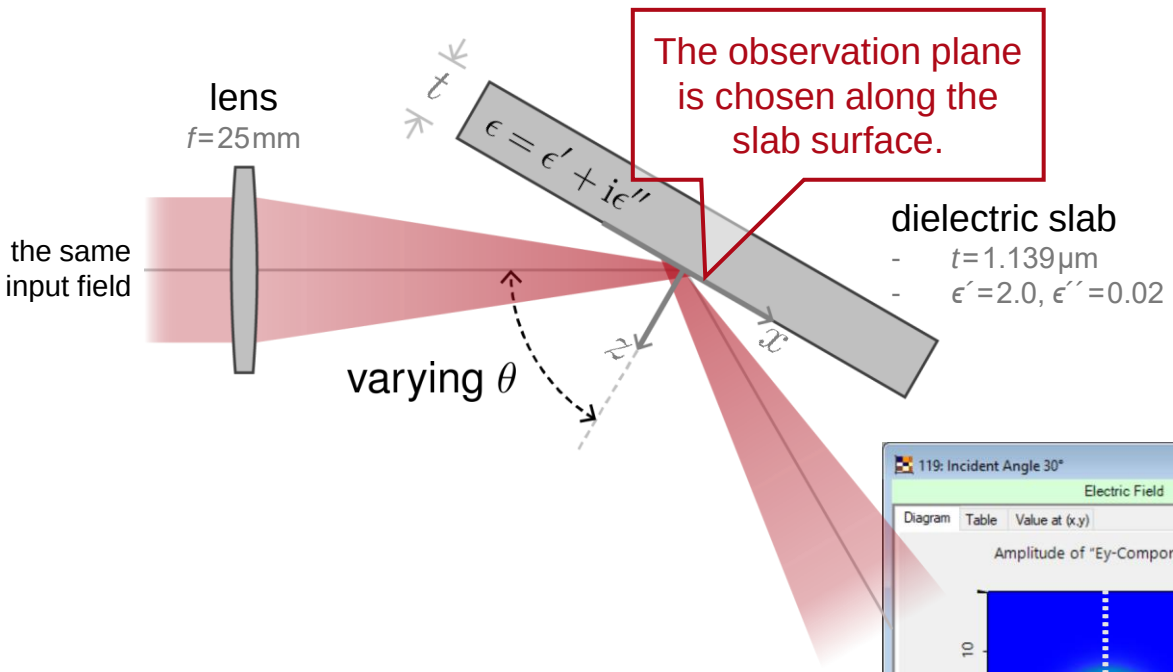


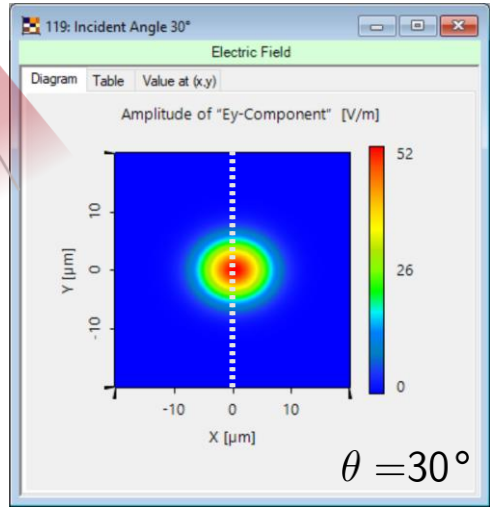


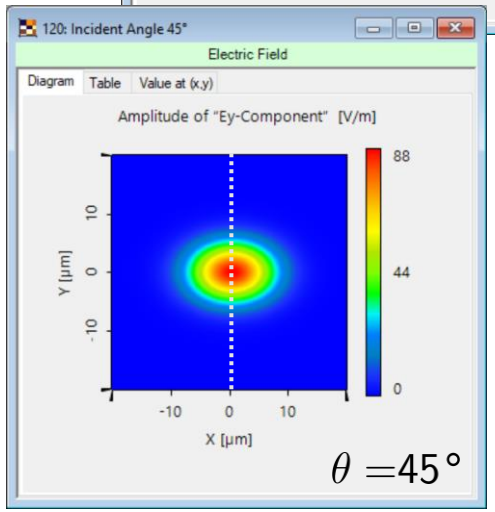


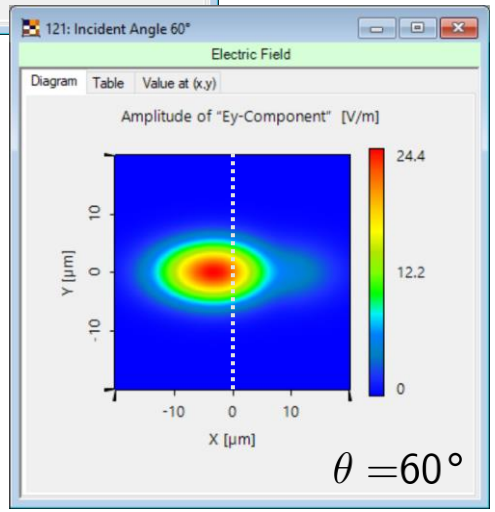


Observation with Focused Gaussian Beam



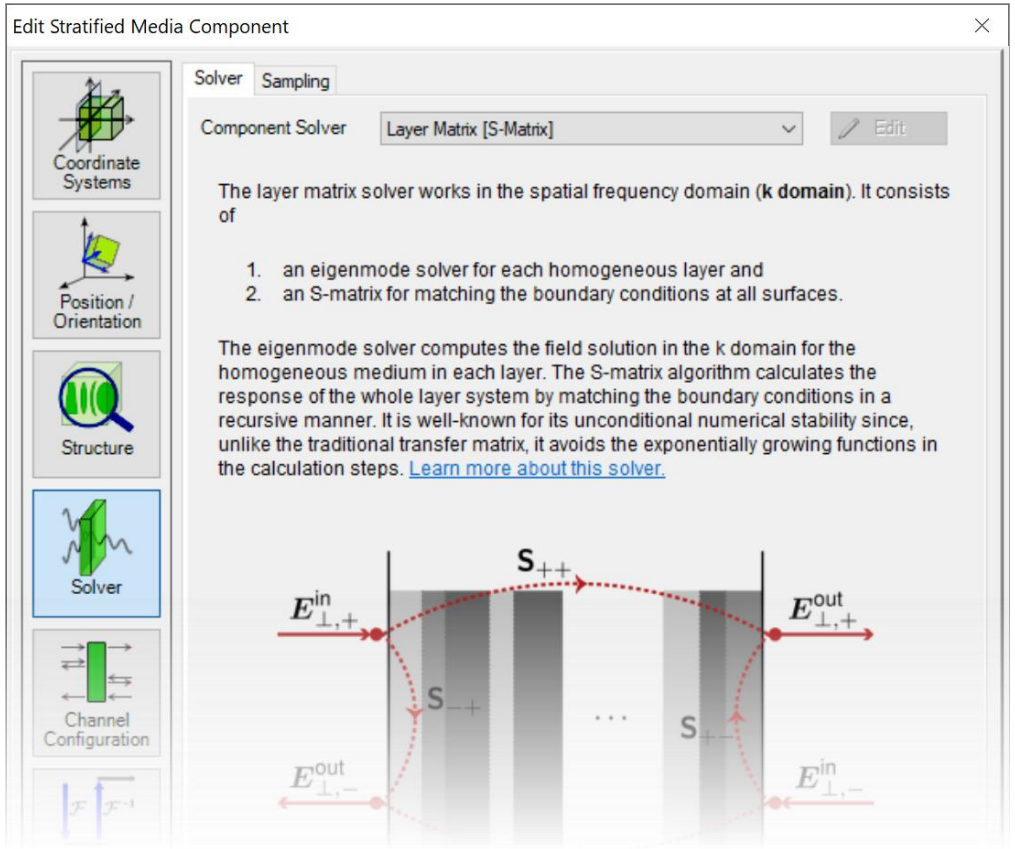




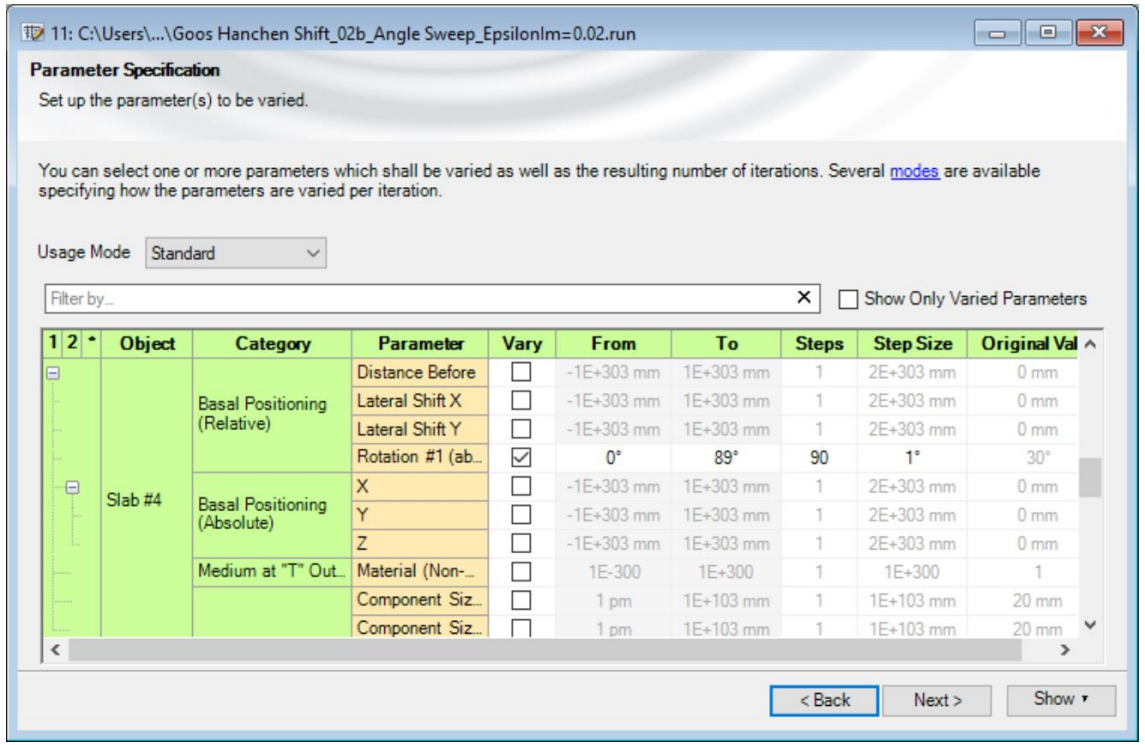


Peek into VirtualLab Fusion

S-Matrix modeling in the k domain for stratified medium

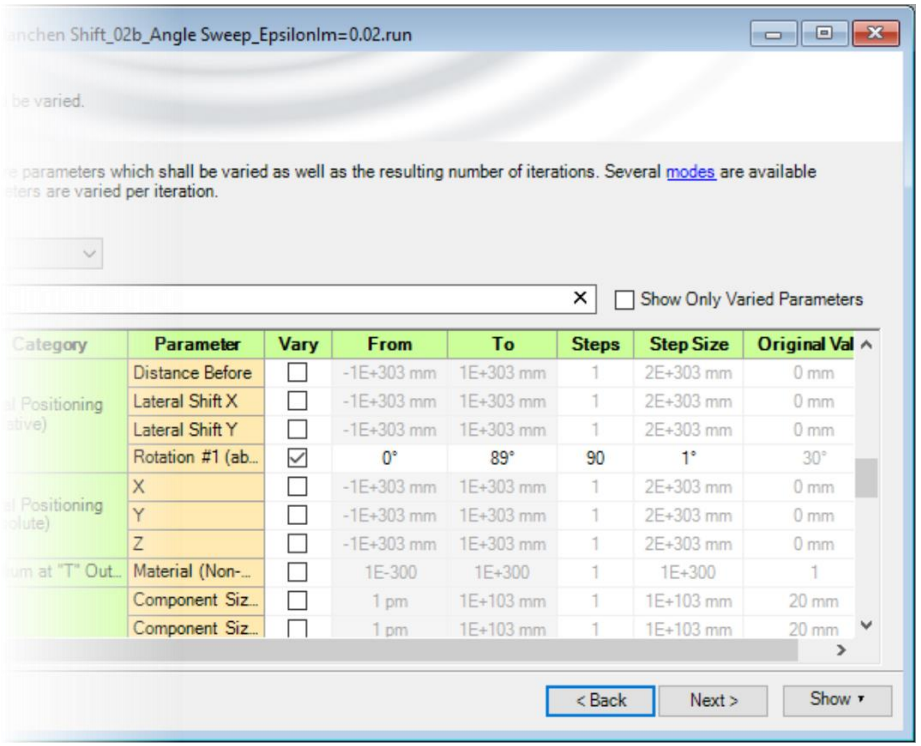


convenient sweeping over selected parameter(s)

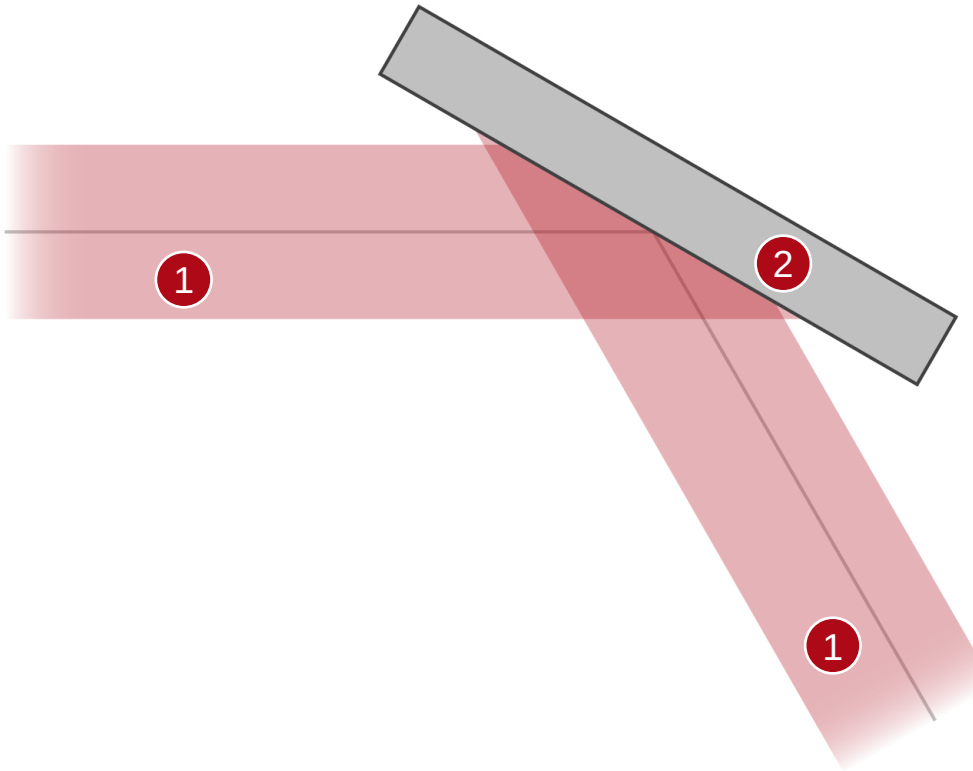


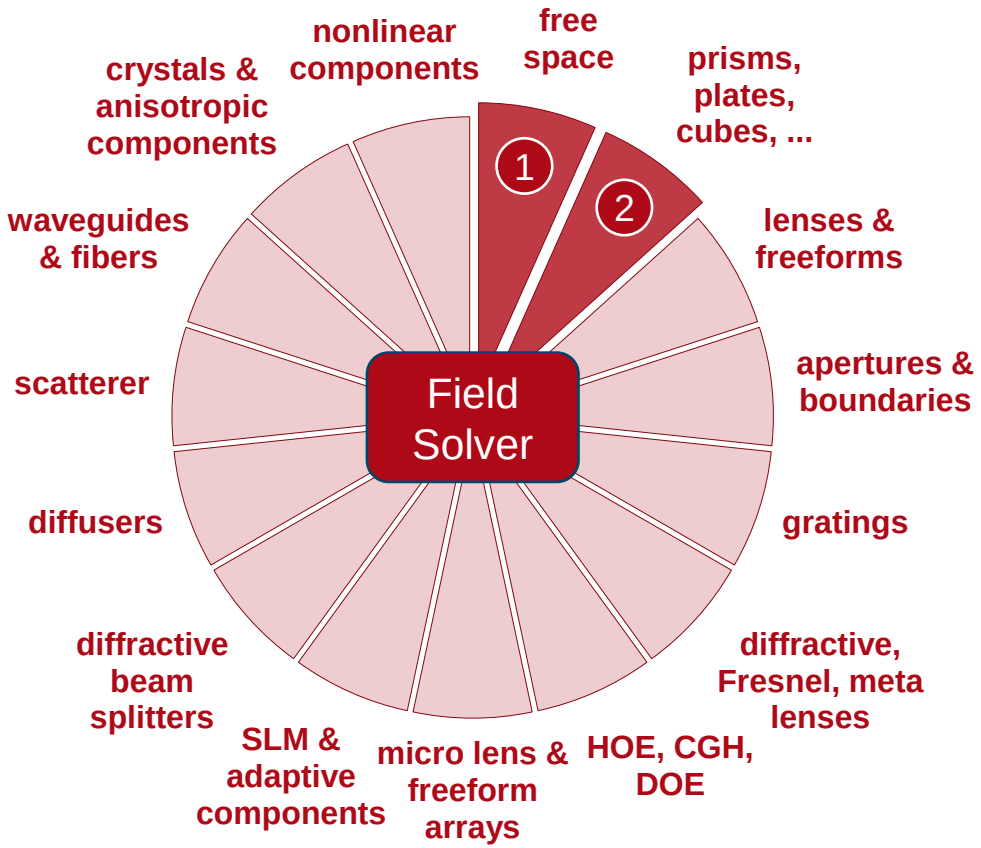
Workflow in VirtualLab Fusion

- Set the position and orientation of components
  - LPD II: Position and Orientation [Tutorial Video]
- Construct a stratified medium
- Check influence from selected parameters with Parameter Run
  - Usage of the Parameter Run Document [Use Case]



VirtualLab Fusion Technologies





Document Information

title	Precise Measurement of Goos-Hänchen Shift form Weakly Absorbing Slab
document code	MISC.0084
version	1.0
edition	VirtualLab Fusion Basic
software version	2020.1 (Build 1.238)
category	Application Use Case
further reading	- VirtualLab Fusion Technology – Layer Matrix [S-Matrix] - VirtualLab Fusion Technology – Fresnel Matrix