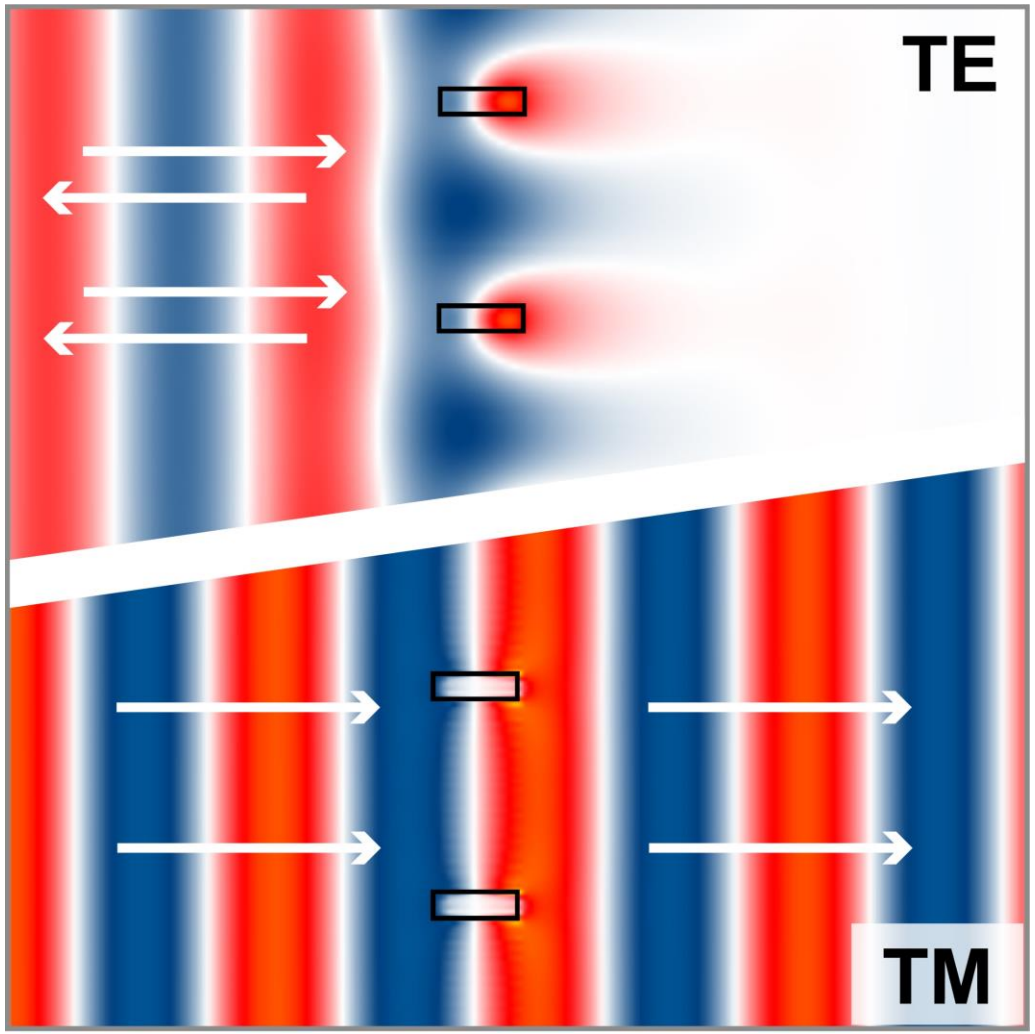
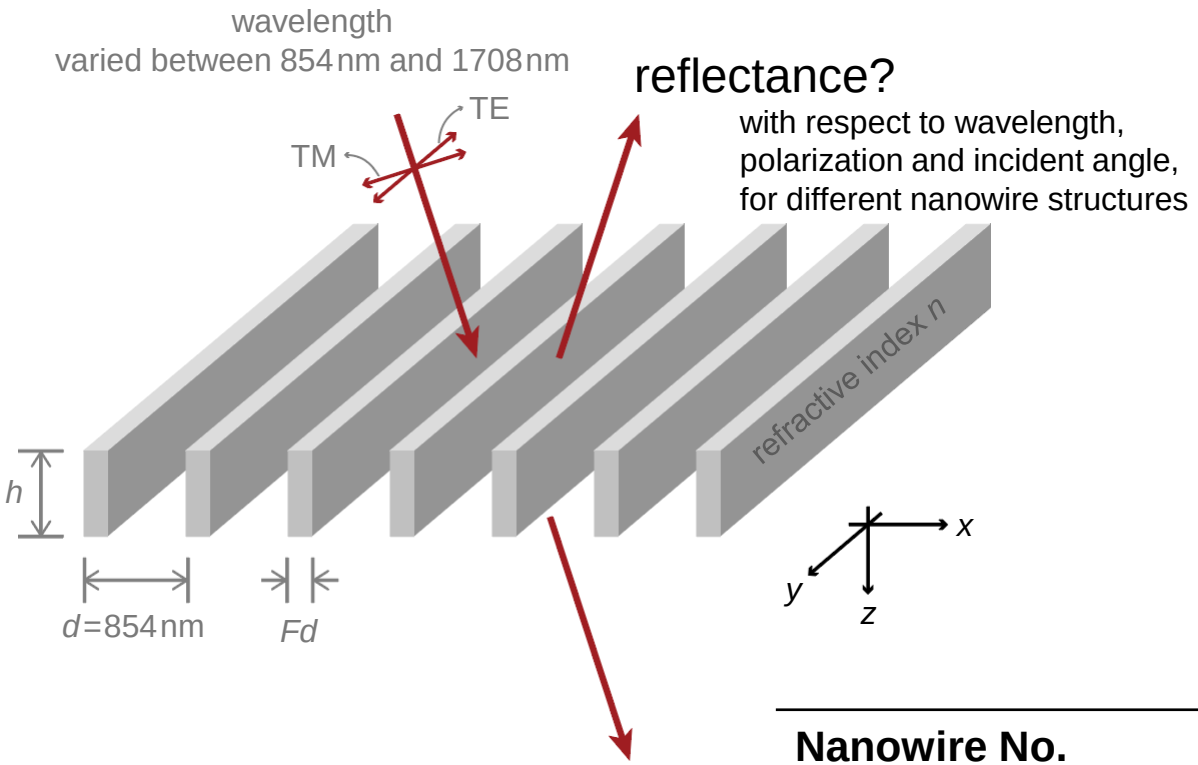
Ultra-Sparse Dielectric Nano-Wire Grid Polarizer

Abstract



Ultra-sparse dielectric nanowire grids show strongly polarization-dependent properties and can therefore be employed as wideband reflectors [J. W. Yoon *et al*., Opt. Express **23**, 28849-28856 (2015)]. The polarization-, wavelength-, and angle-dependent properties of selected nanowire grids are investigated by using the Fourier modal method (FMM, also known as RCWA). Visualization of the interaction between electric field and the nanowire grids are presented.

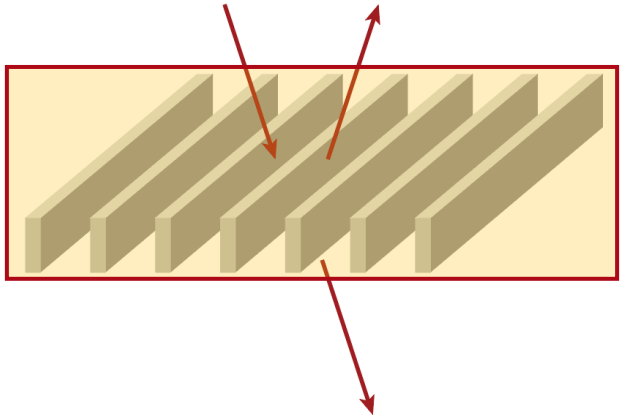
Modeling Task



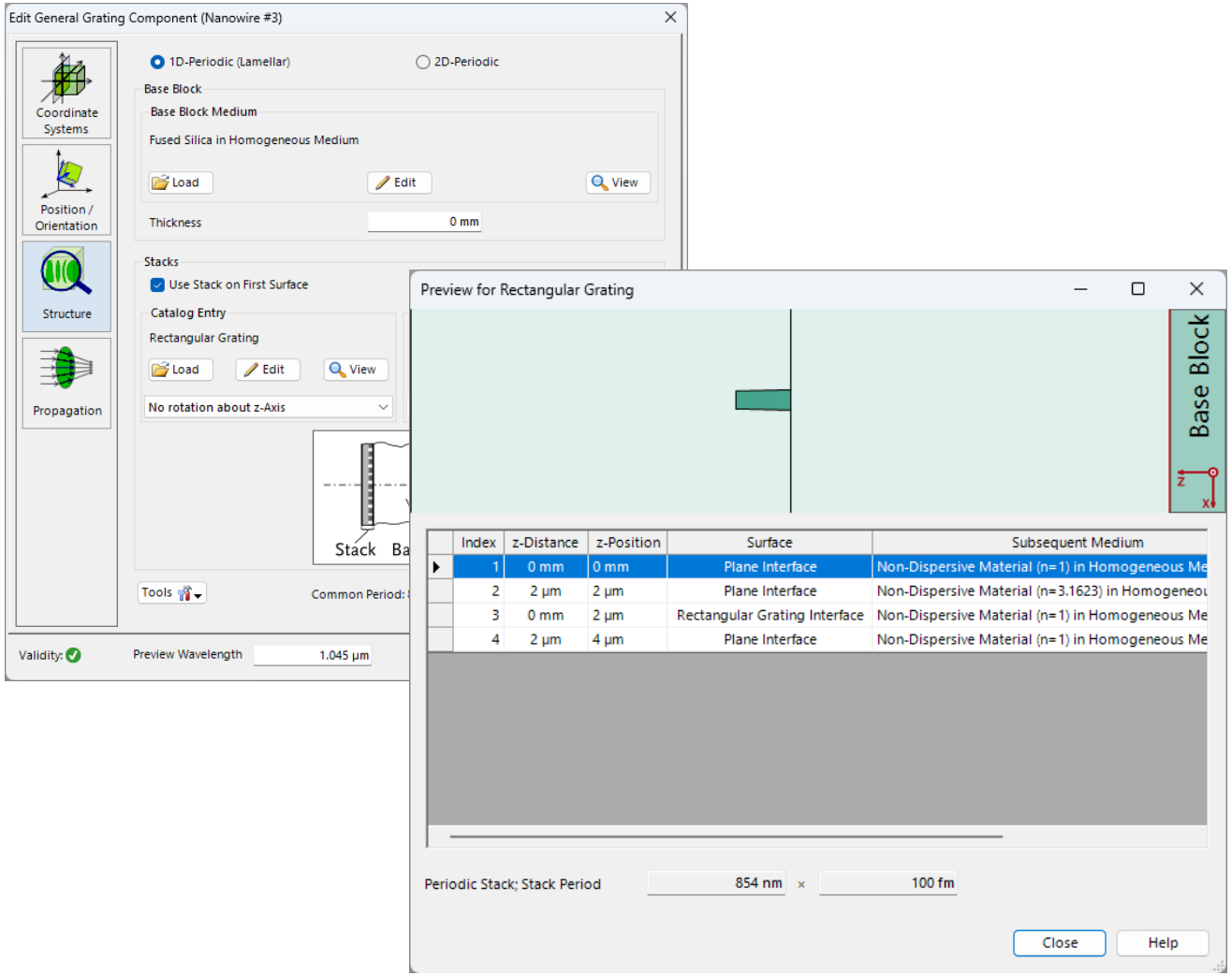
Nanowire No.	#1	#2	#3
refractive index *n*	10	7.07	3.16
height *h*	269 nm	270 nm	292 nm
filling factor *F*	0.01	0.02	0.1

Parameters are taken from reference paper: J. W. Yoon *et al.*, Opt. Express **23**, 28849-28856 (2015).

Nanowire

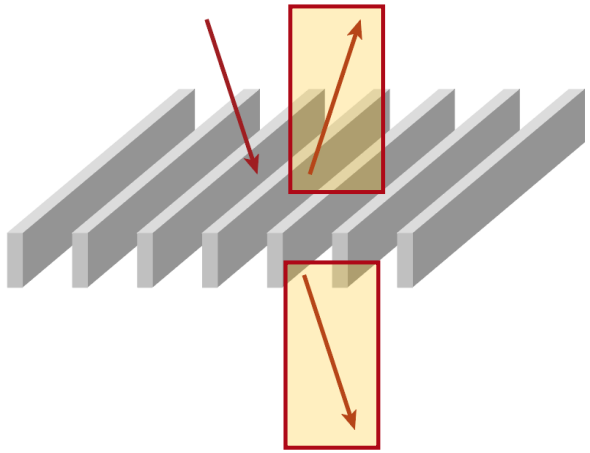


Arbitrary periodic structures (containing multiple surfaces) can be defined and saved as *Stacks*. These *Stacks* then can be added to a *General Grating Component* for analysis.



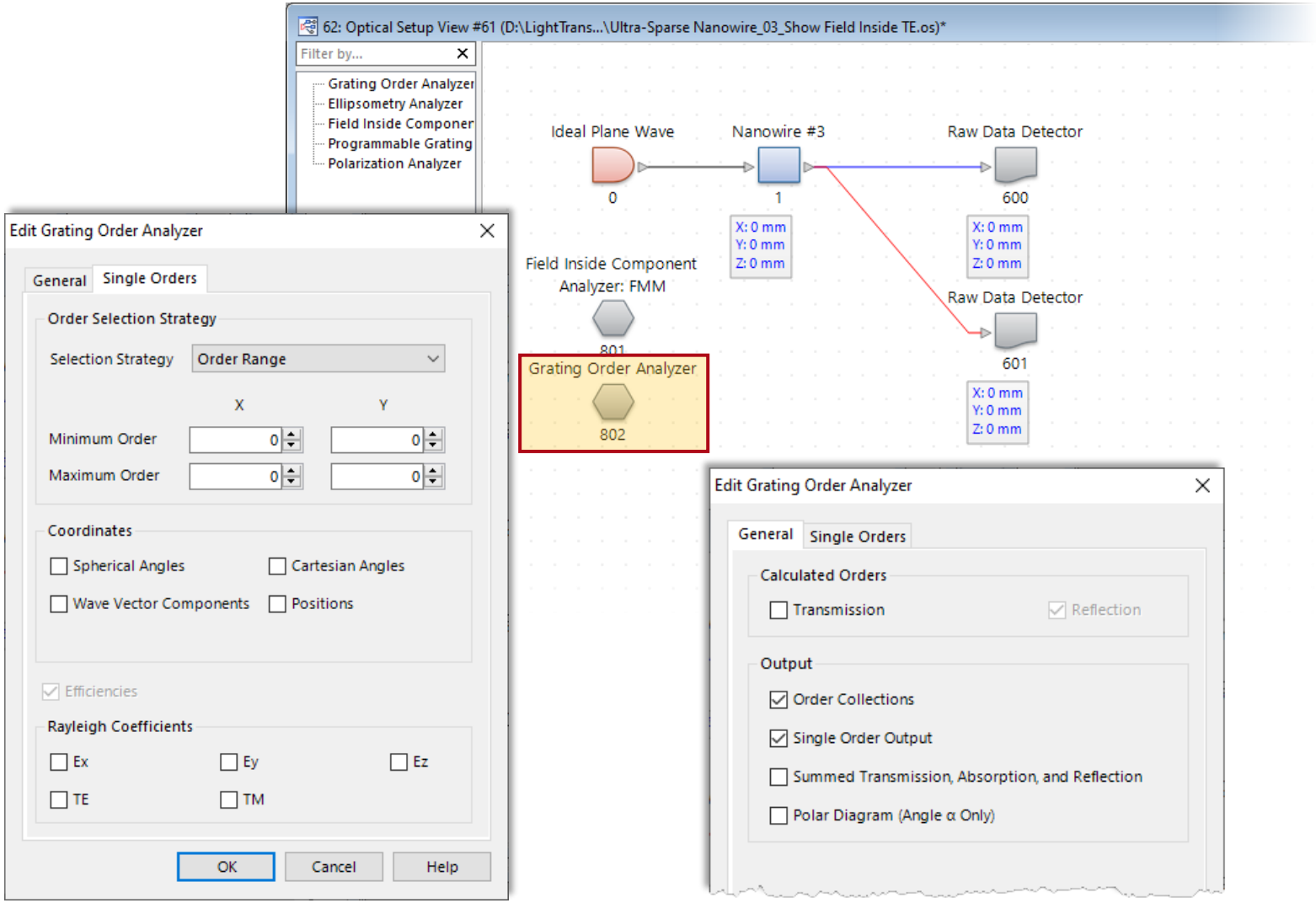
Configuration of Grating Structures by Using Interfaces

Grating Order Analyzer

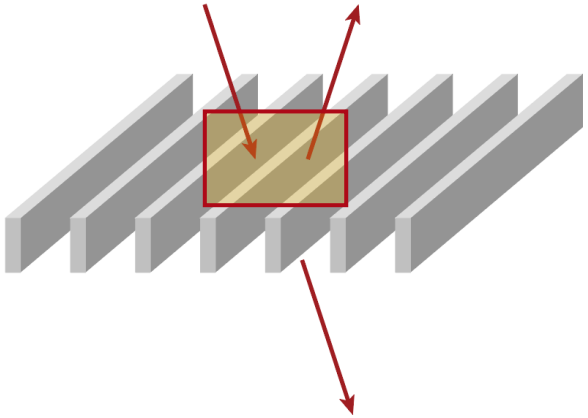


The *Grating Order Analyzer* is able to calculate the transmission/reflection efficiency of all/certain orders. For the periodic structure in this example, the selected output order is R0 and T0.

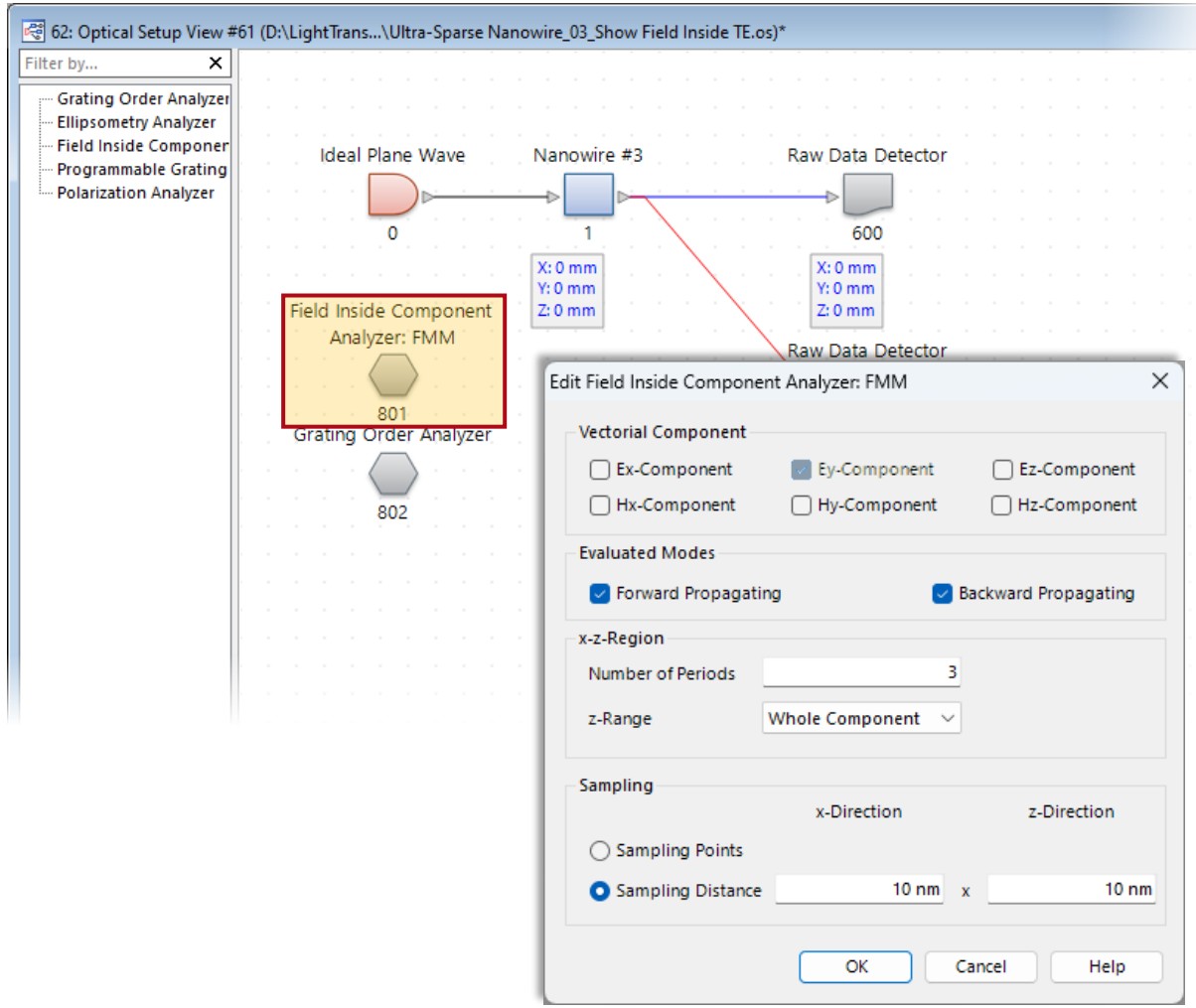
Grating Order Analyzer



Field Inside Analyzer

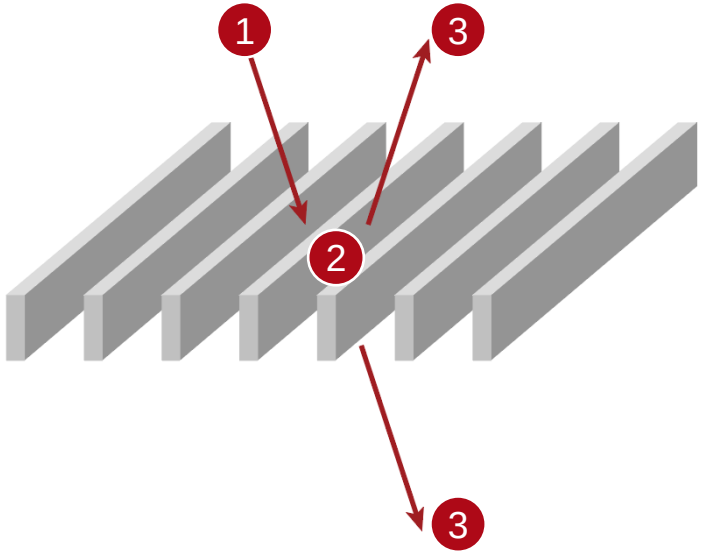


The *Field Inside Component: FMM Analyzer* visualizes the field propagation in the defined micro- or nanostructure. In this example, the propagation inside the nanowire structure is investigated. For the output, the forward propagating modes, the backward propagating modes or all modes together can be selected.



Field Inside Component Analyzer: FMM

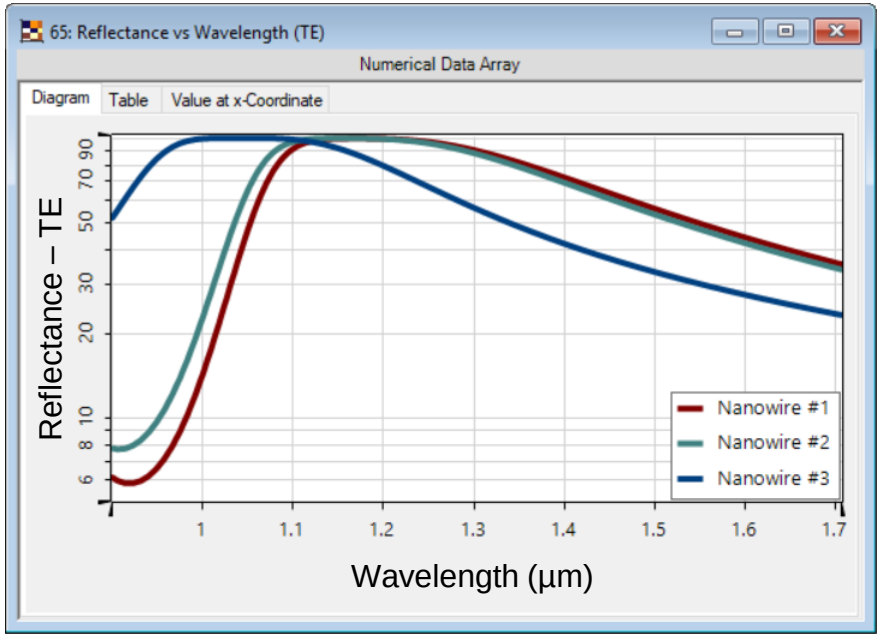
Summary – Components...

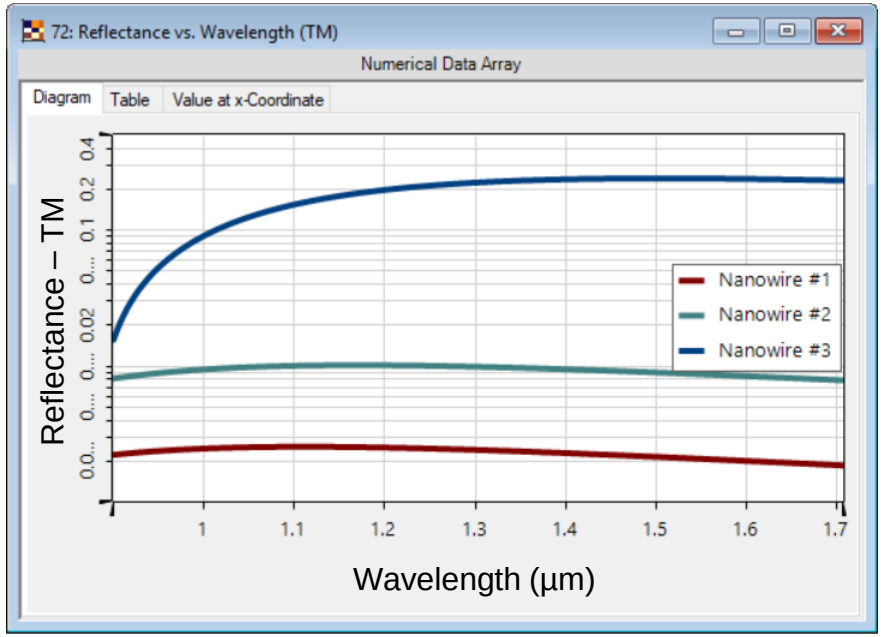


… of Optical System	… in VirtualLab Fusion	Model/Solver/Detected Value
1. source	*Ideal Plane Wave*	ideal Plane Wave
2. nanowire	*General Grating Component*	Fourier Modal Method (FMM) / Rigorous Coupled Wave Analysis (RCWA)
3. detector	*Grating Order Analyzer*	Fresnel coefficients & efficiencies

Parameter Scanning (1D)

Results of Fourier modal method (FMM) simulation in VirtualLab





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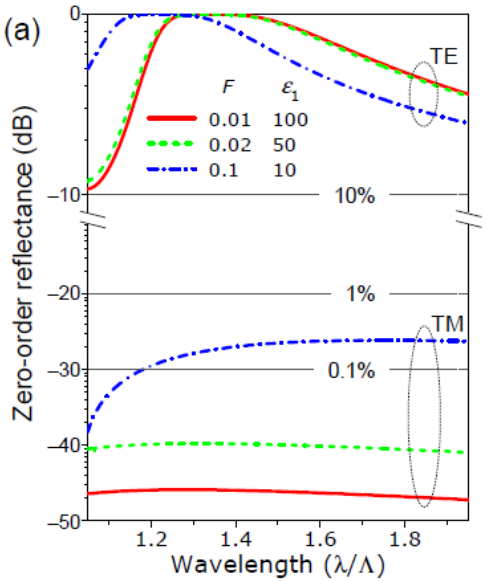
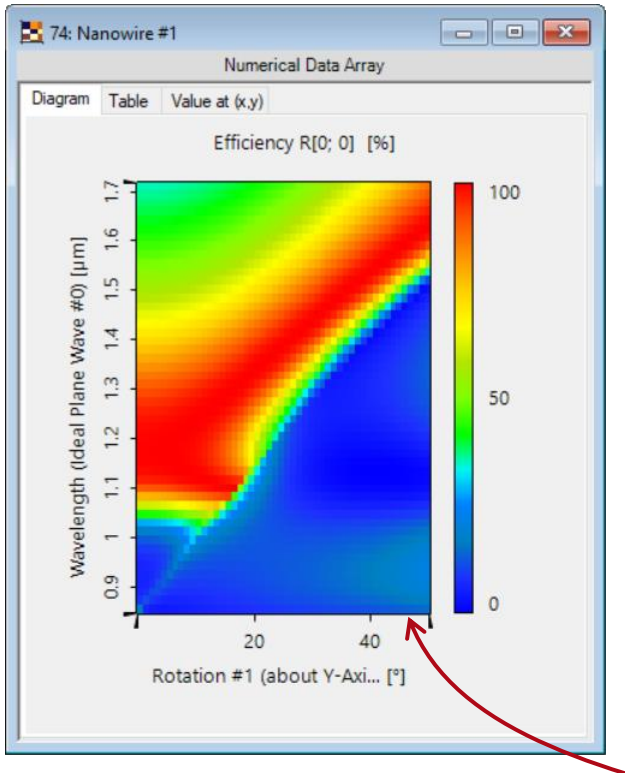
reference results from the literature

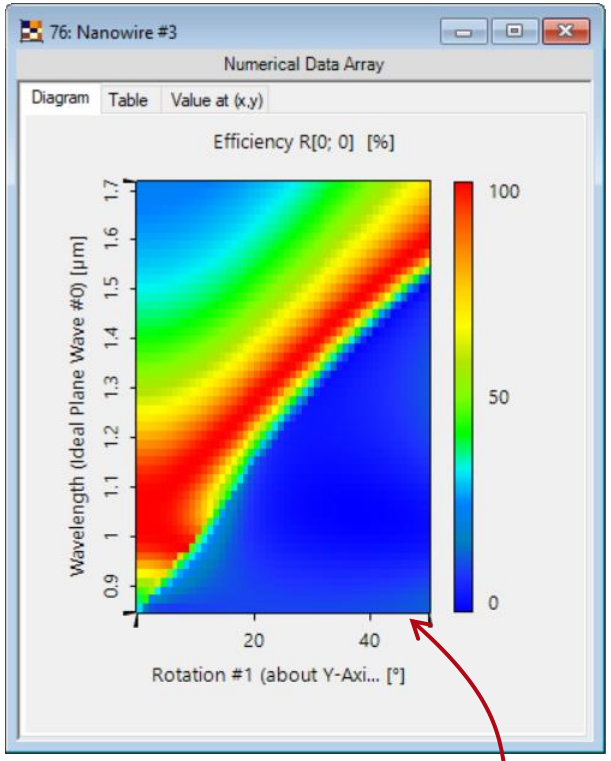


J. W. Yoon *et al.*, Opt. Express **23**, 28849-28856 (2015).

Parameter Scanning (2D)

Results of Fourier modal method (FMM) simulation in VirtualLab Fusion (TE polarized light)





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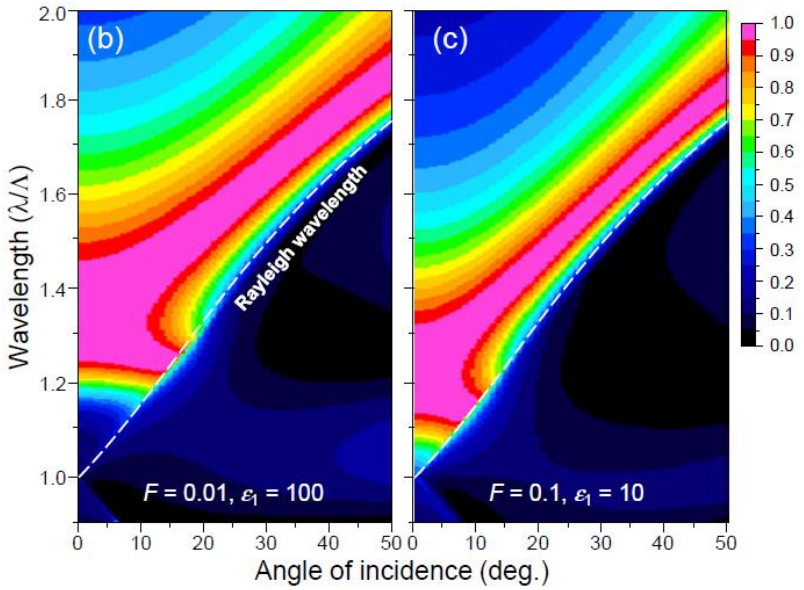
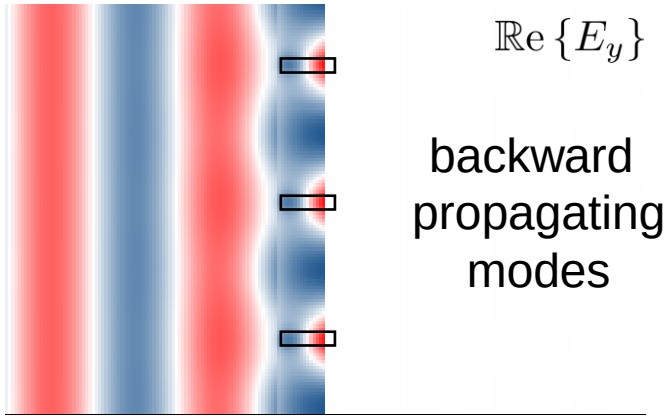


J. W. Yoon *et al.*, Opt. Express **23**, 28849-28856 (2015).

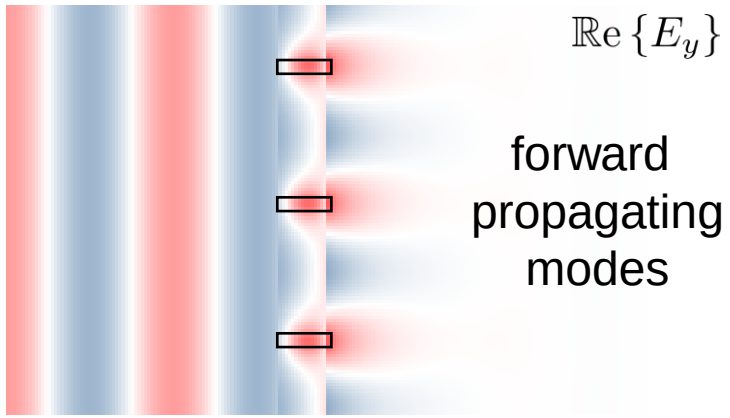
Visualization of Field Inside Grating - TE

Results of Fourier modal method (FMM) simulation in VirtualLab Fusion (@1045 nm wavelength)



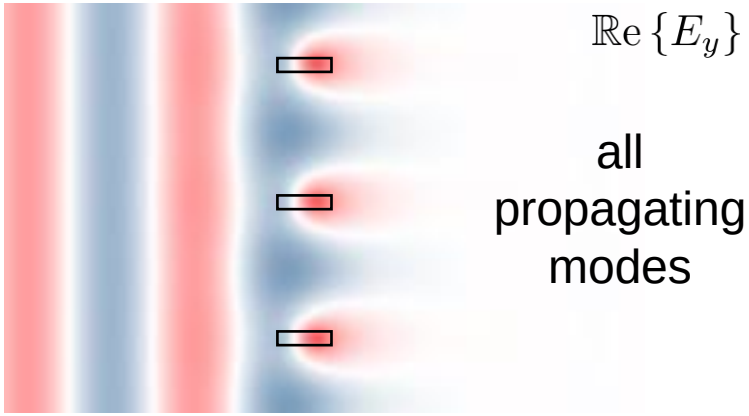
backward propagating modes

[animation]



forward propagating modes

[animation]



all propagating modes

[animation]

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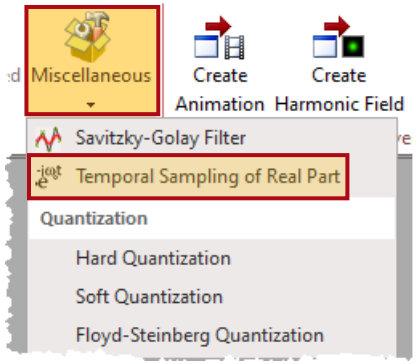
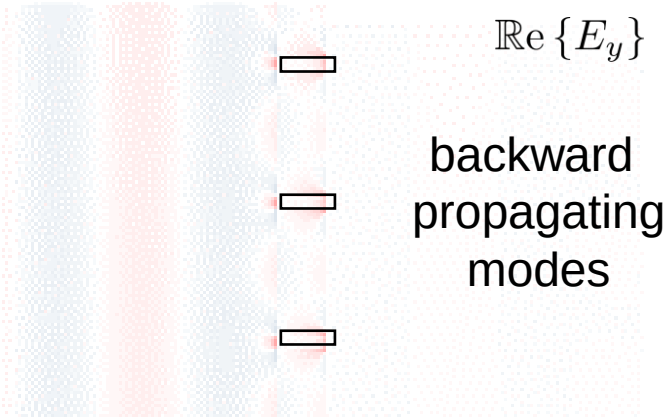


Note: The *Temporal Sampling of Real Part* function of the *Miscellaneous* section in *Manipulations* can be used to visualize the propagation of the field in the component.

Visualization of Field Inside Grating - TM

Results of Fourier modal method (FMM) simulation in VirtualLab Fusion (@1045 nm wavelength)



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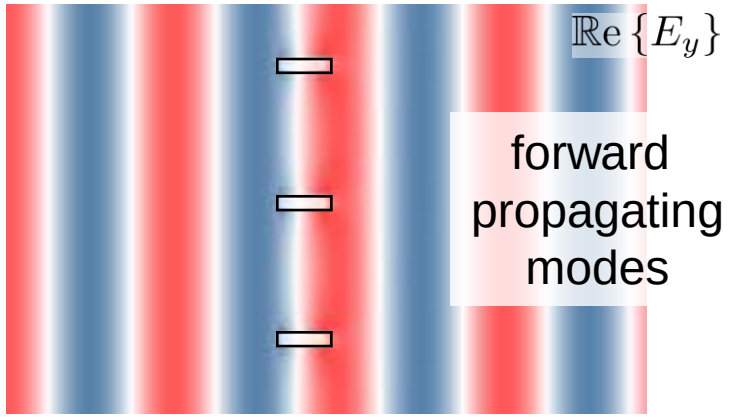

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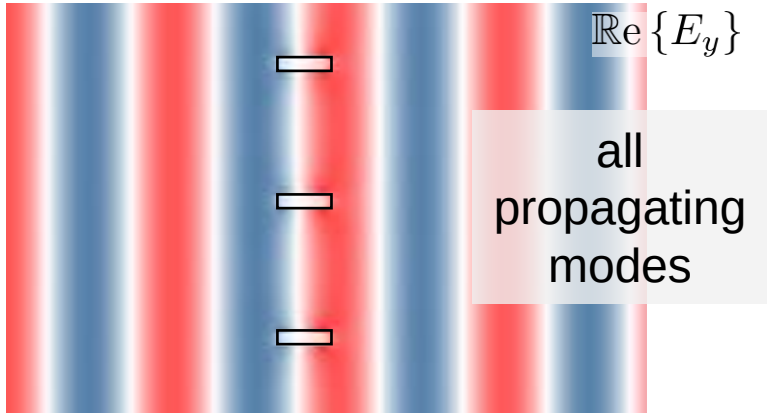

[animation]

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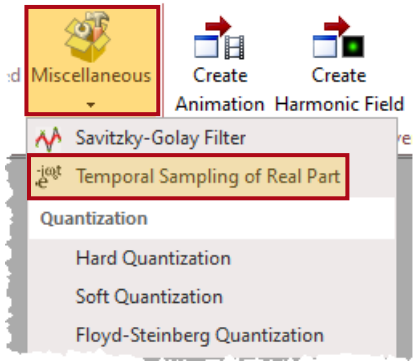

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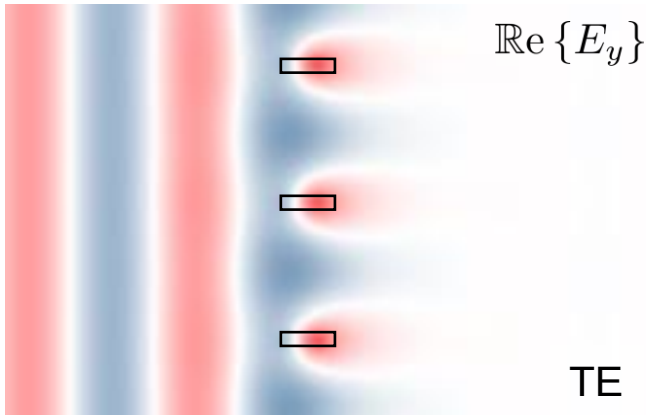
Comparison with reference

Results of Fourier modal method (FMM) simulation in VirtualLab Fusion (@1045 nm wavelength)



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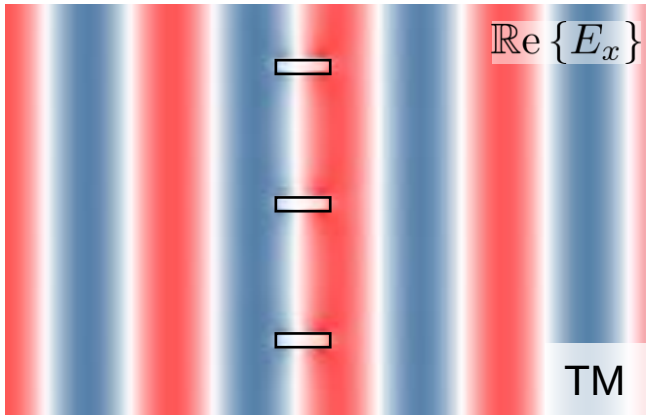
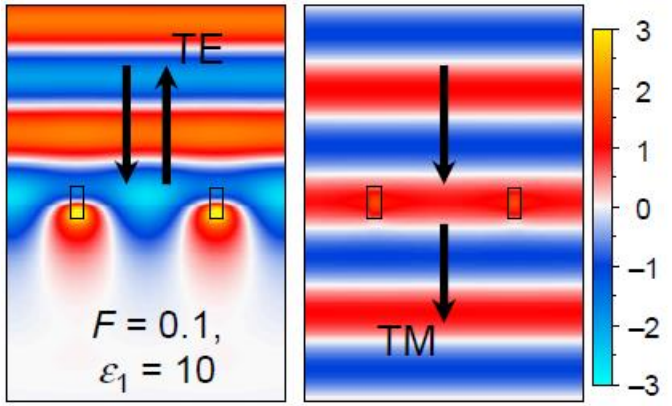


[animation]

reference results from the literature



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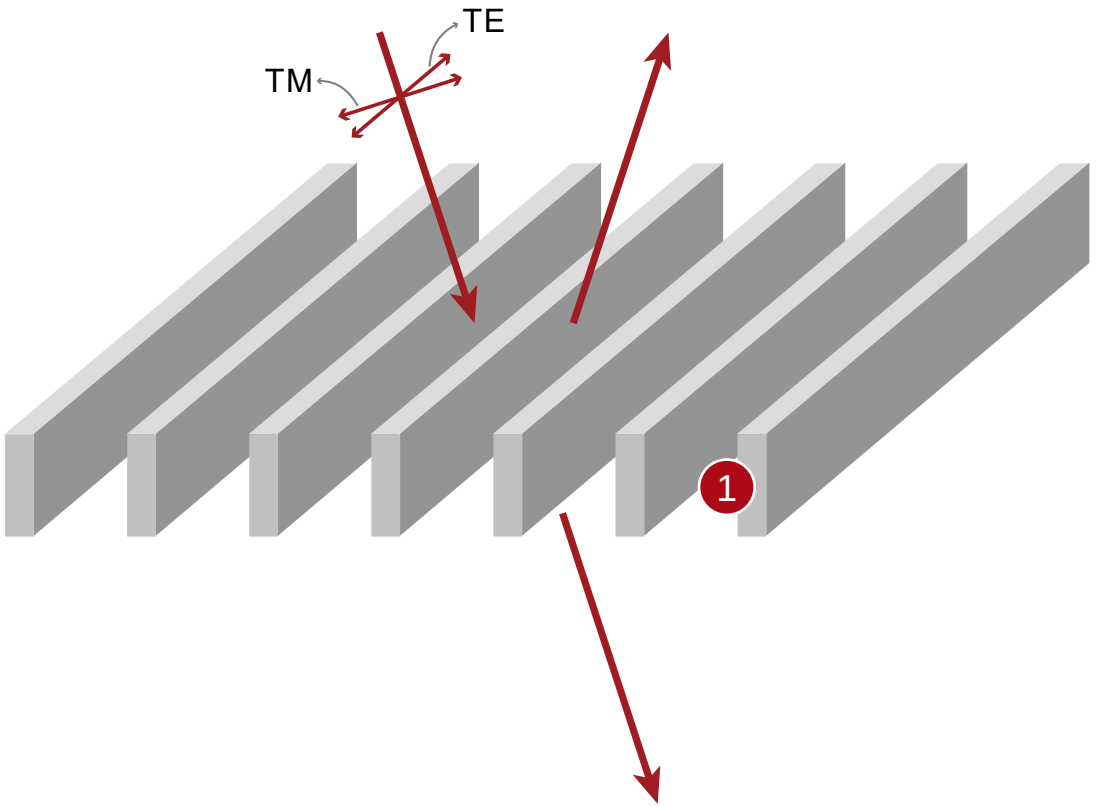
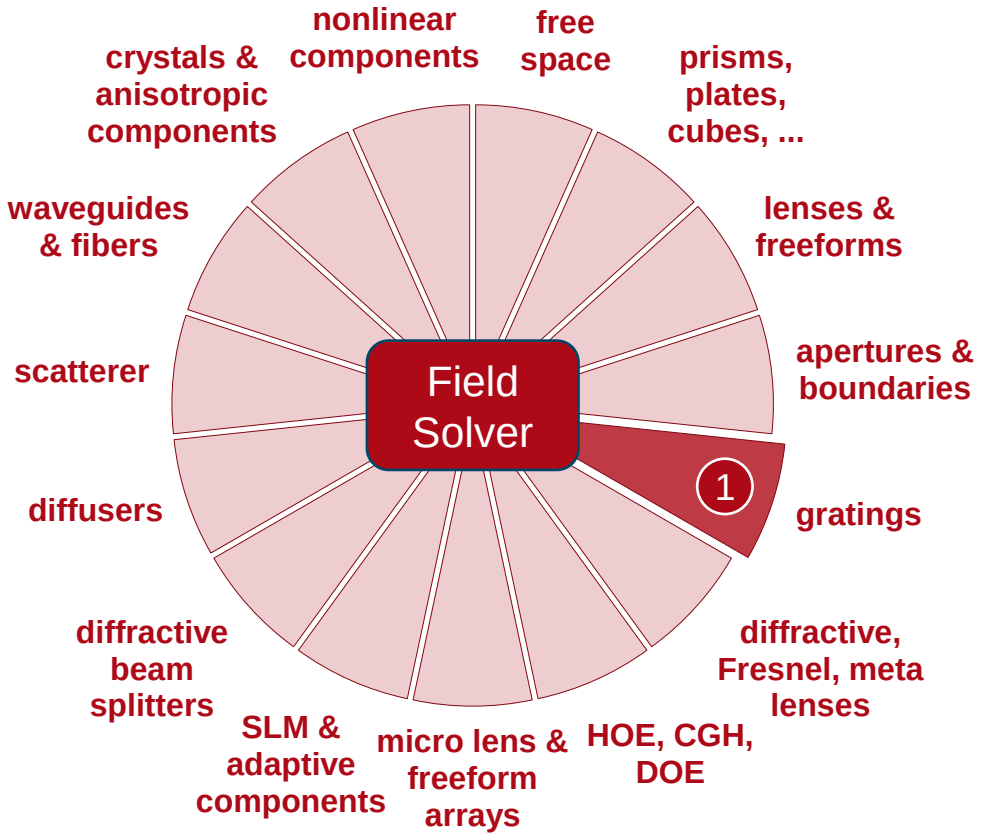
VirtualLab Fusion Technologies





Document Information

title	Ultra-Sparse Dielectric Nano-Wire Grid Polarizers
document code	GRT.0006
document version	2.0
software edition	VirtualLab Fusion Advanced
software version	2023.1 (Build 1.556)
category	Application Use Case
further reading	• Grating order analyzer • Rigorous Analysis and Design of Anti-Reflective Moth-Eye Structures • Rigorous Analysis of Nanopillar Metasurface Building Block