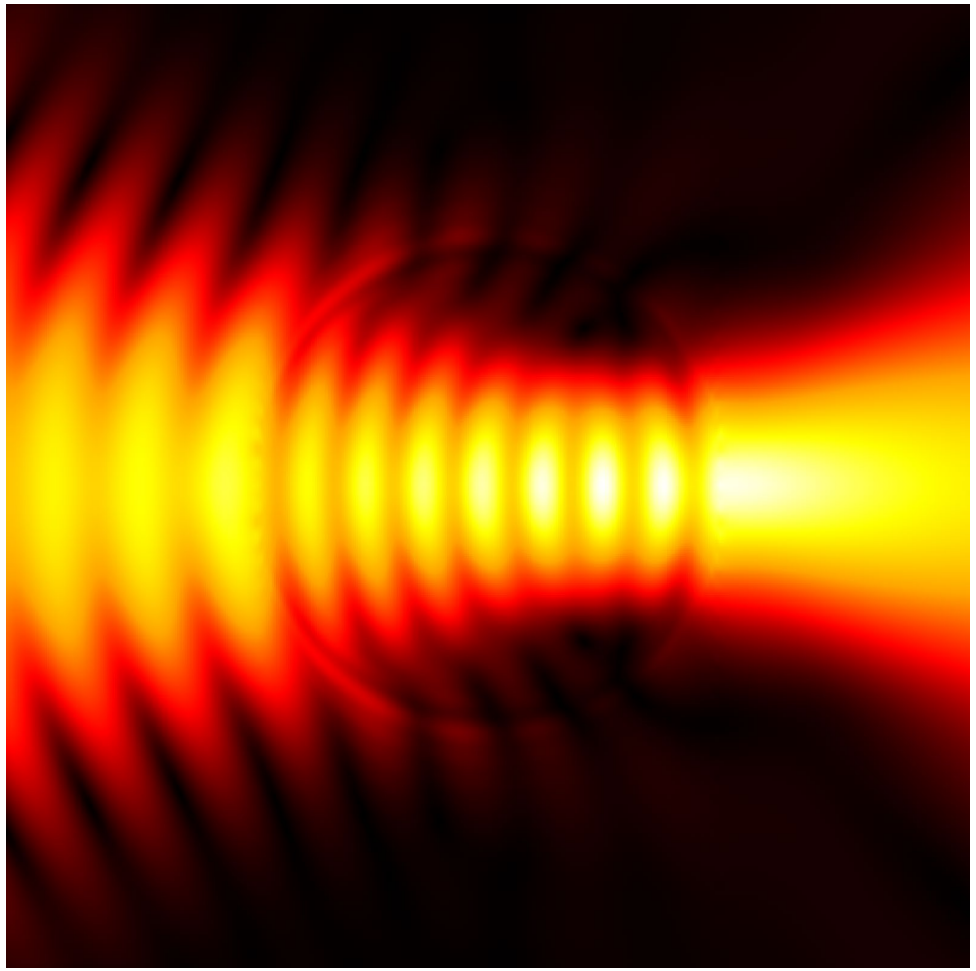
Electromagnetic Field Interaction with Nanocylinders

Abstract

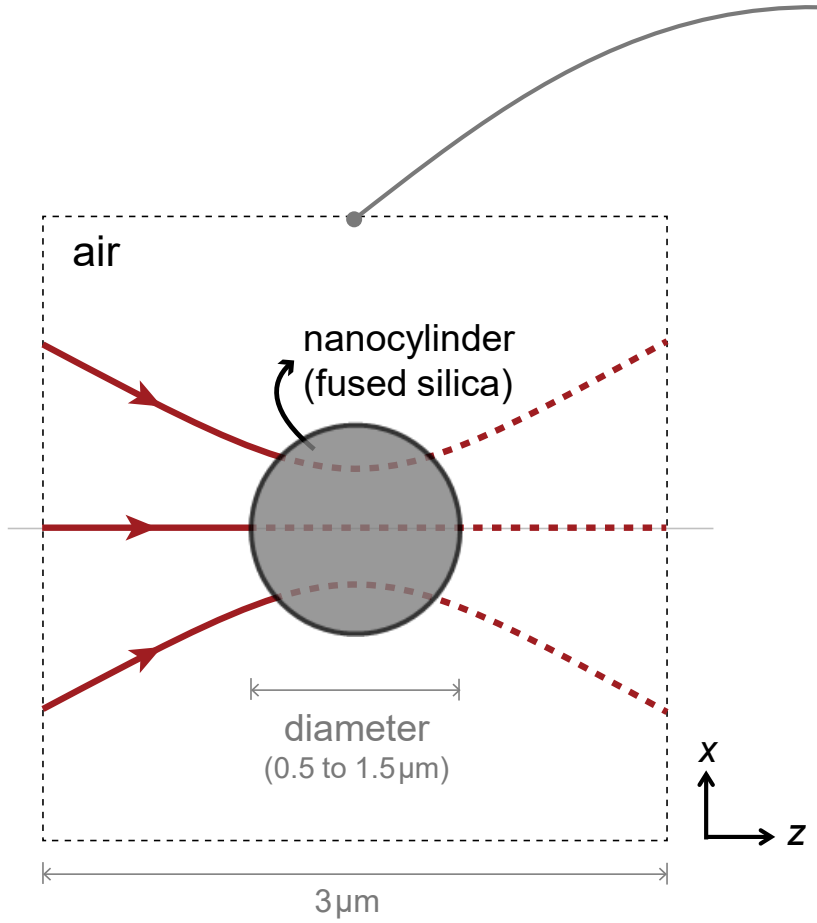


Interaction between electromagnetic fields and nanostructures in the size of wavelength of the light must be studied with rigorous Maxwell solvers. By integrating the perfectly matched layers (PMLs) technique with the Fourier modal method (FMM), the modeling of aperiodic nanostructures is enabled in VirtualLab Fusion. As an example, the interaction between a focused Gaussian beam and nanocylinders with varying diameters is investigated, and the polarization-dependent effect is shown.

Modeling Task

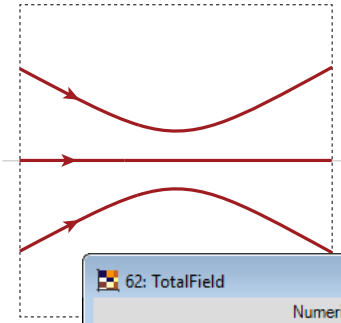
input field

- focused Gaussian
- wavelength 633 nm
- waist diameter 1 µm (located at the center of the cylinder)
- 45° linearly polarized

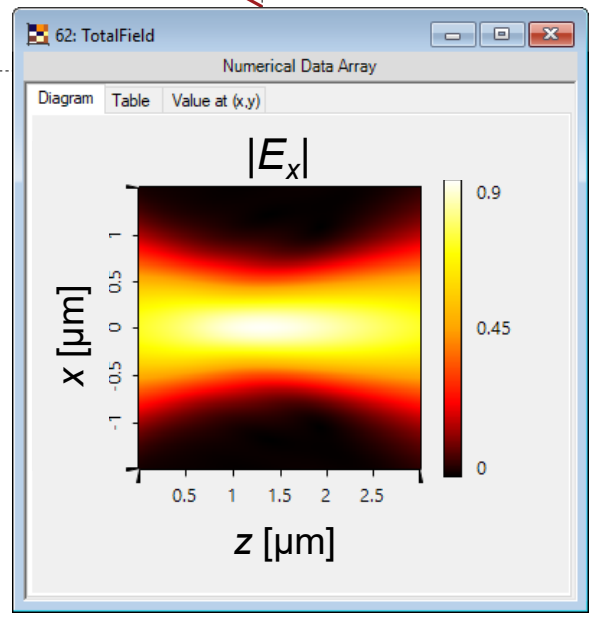


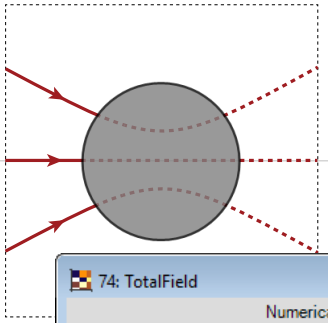
How does the electromagnetic field interact with the nanocylinder?

Comparison – Free Space vs. with Nanocylinder

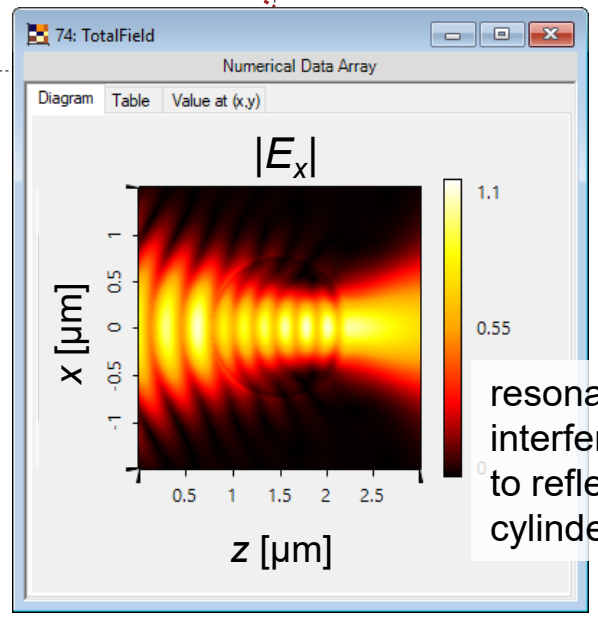


free space
(without nanocylinder)





nanocylinder
diameter 1.5 µm

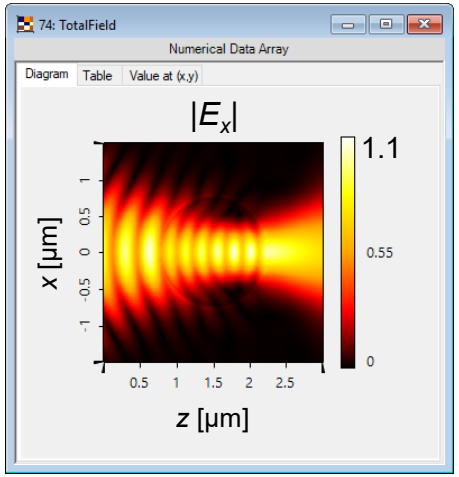


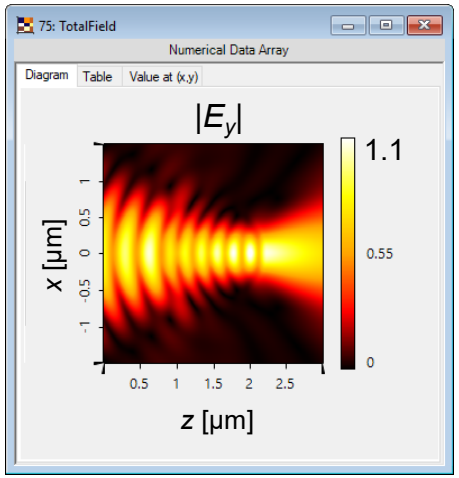
Fourier modal method (FMM) combined with perfectly matched layers (PMLs) enables the simulation of aperiodic nano structures. See reference in M. Pisarenco, *et al.*, J. Opt. Soc. Am. A 27, 2423-2431 (2010).

resonance and interference due to reflections on cylinder surface

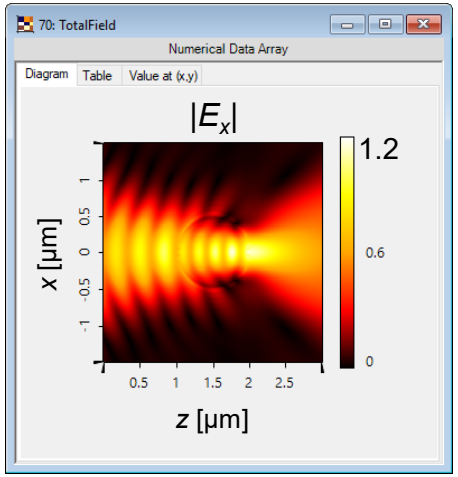
Comparison – Nanocylinders with Different Diameters

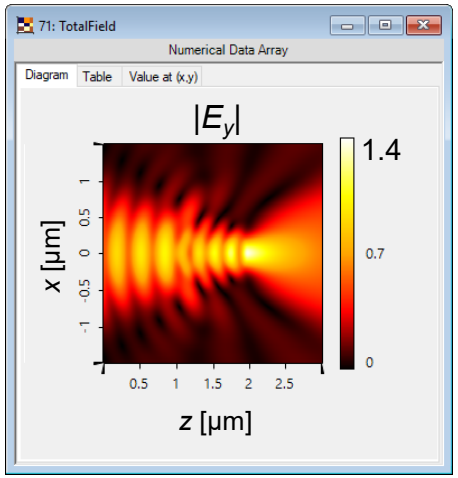
diameter 1.5 µm



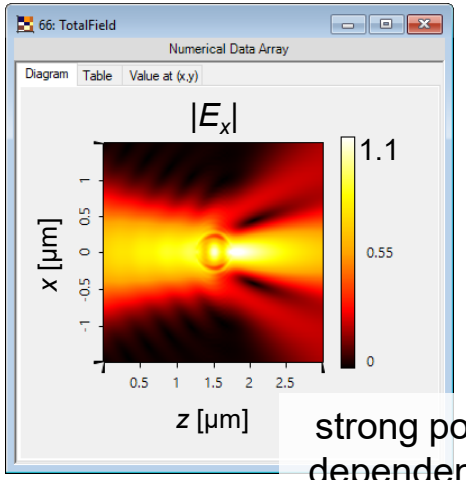


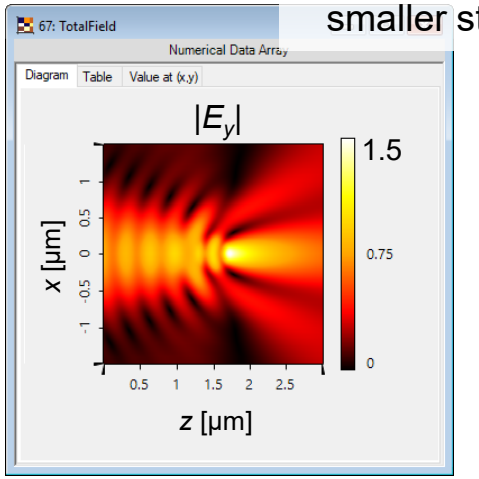
diameter 1.0 µm





diameter 0.5 µm





strong polarization-dependent effect for smaller structures

Document Information

title	Electromagnetic Field Interaction with Nanocylinders
document code	MISC.0045
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VL version used for simulations	7.5.0.158
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further reading	- Mie Solution to Maxwell's Equations for Scattering of an Electromagnetic Plane Wave