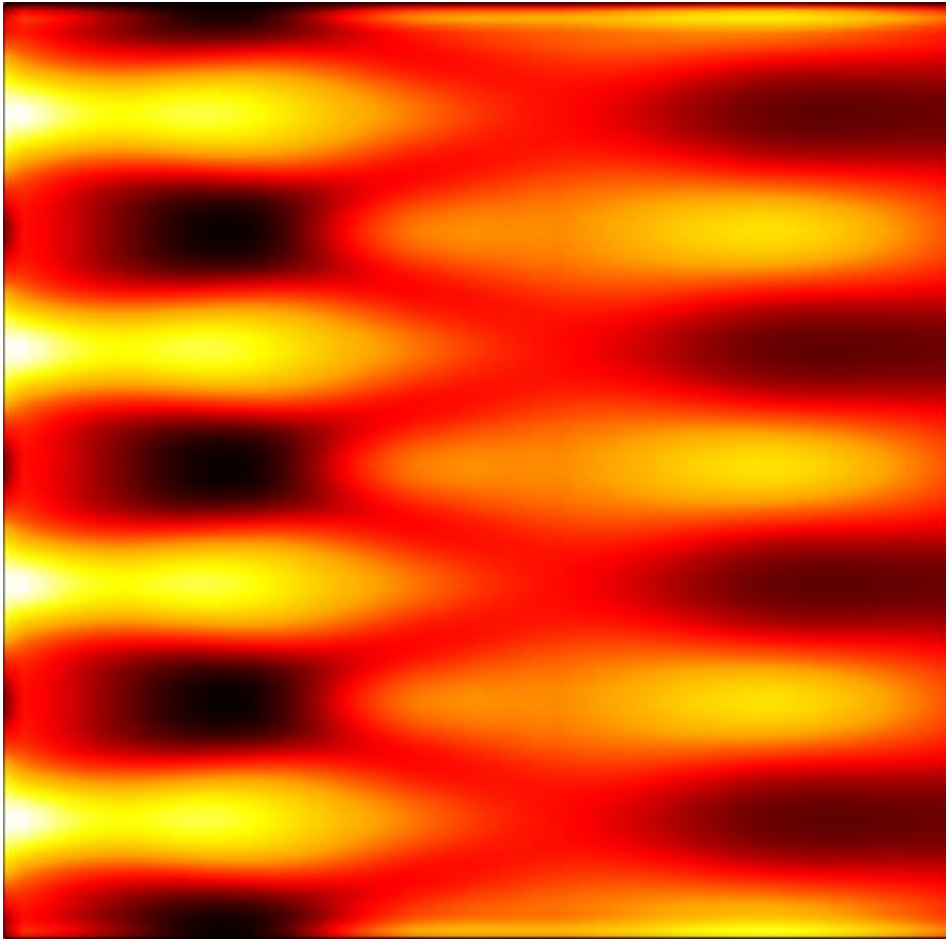


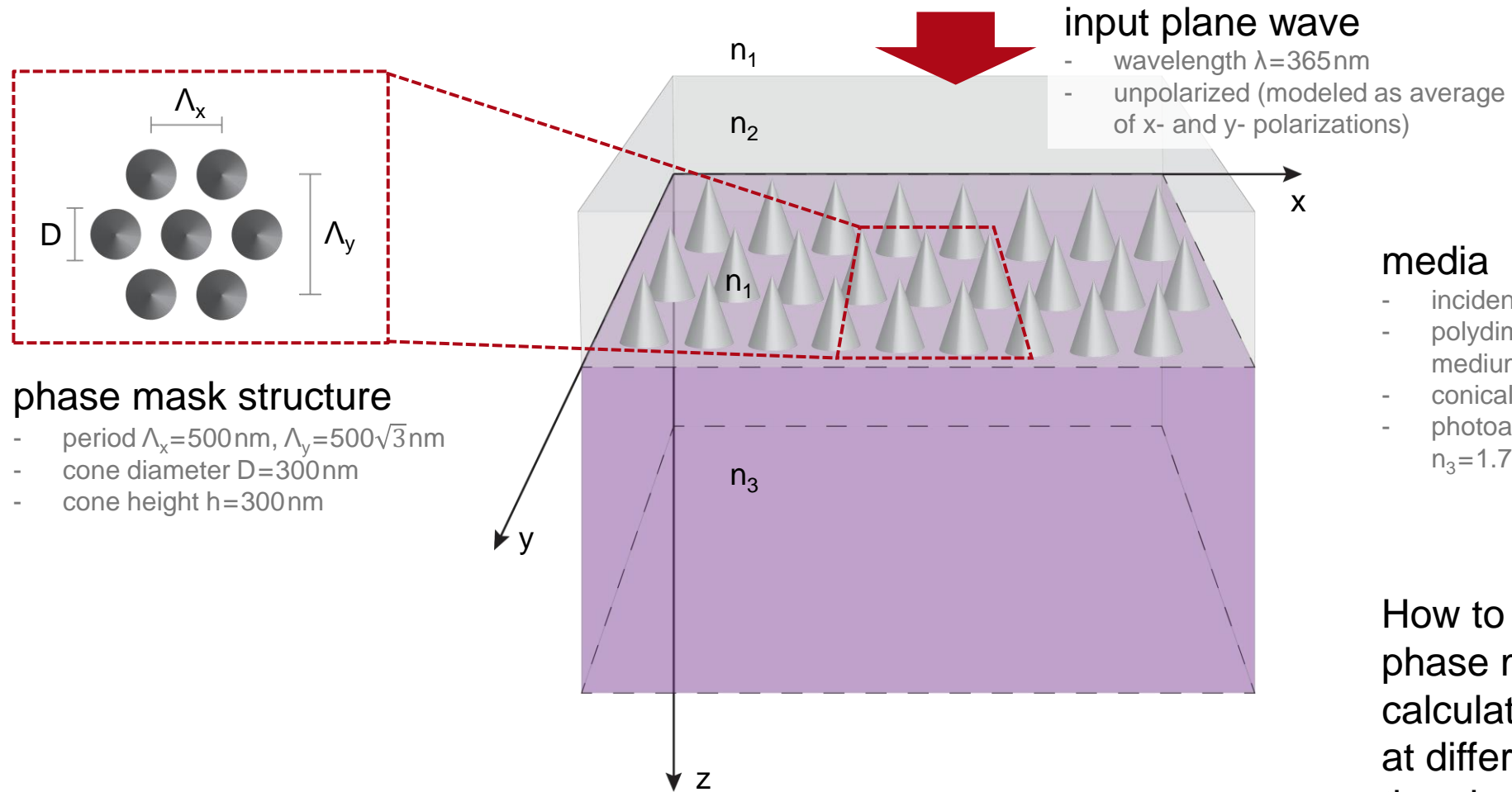
Talbot Images of A Conical Phase Mask

Abstract



In the conventional Talbot lithography, only one image is employed in the photoactive layer, however two images of the phase mask can be produced in a depth-wise manner with special phase mask. In this example, following the work of I.-H. Lee *et al.*, a phase mask with a layer of cones is modeled in VirtualLab Fusion by using the Fourier modal method (FMM, also known as RCWA). Different Talbot images are detected such that the pillar patterns are in the primary image plane while the hole patterns in the secondary image plane.

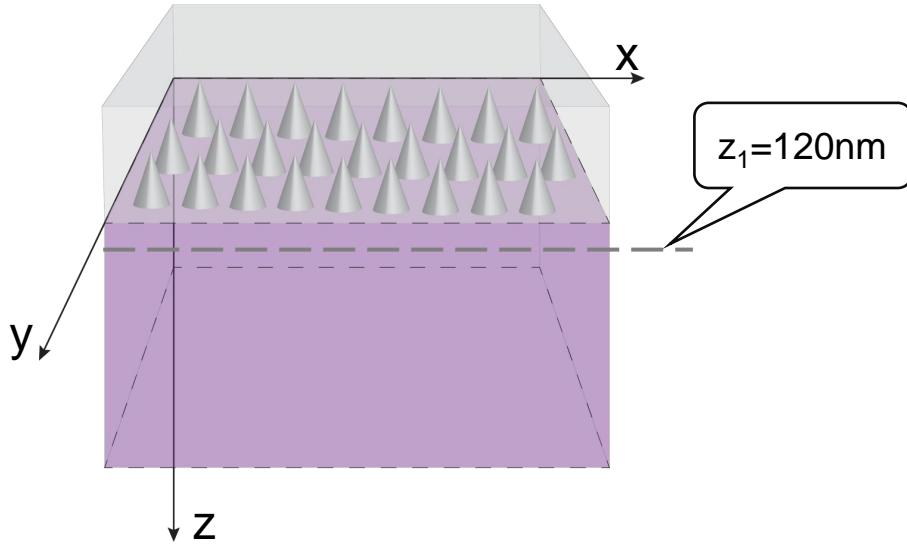
Modeling Task



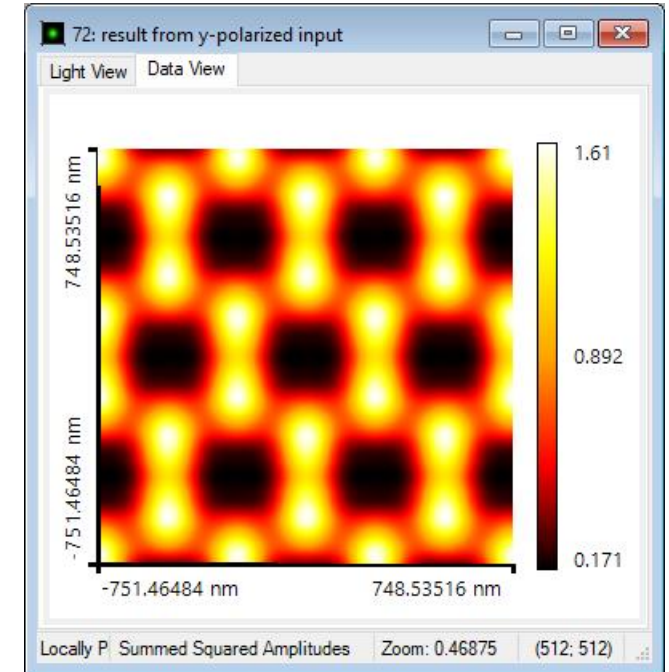
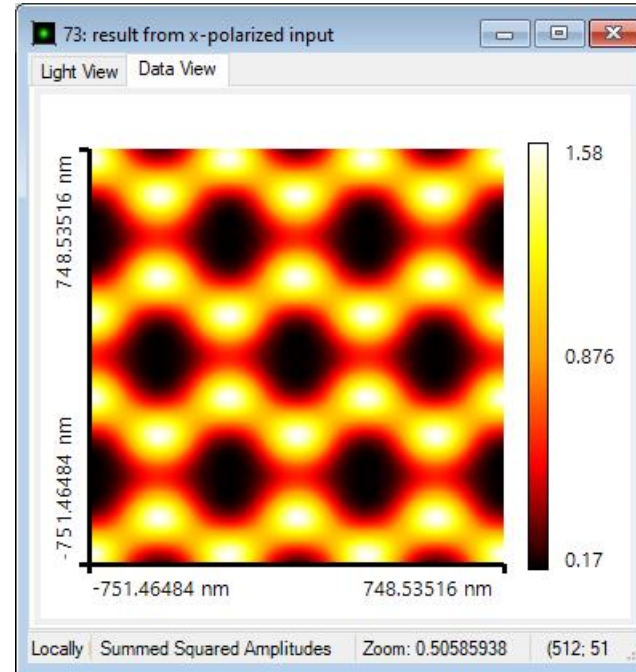
How to rigorously model the phase mask structure, and calculate the Talbot patterns at different positions within the photoactive medium?

structure and material parameters from I.-H. Lee, *et al.*, Opt. Express 23, 25866-25873 (2015)

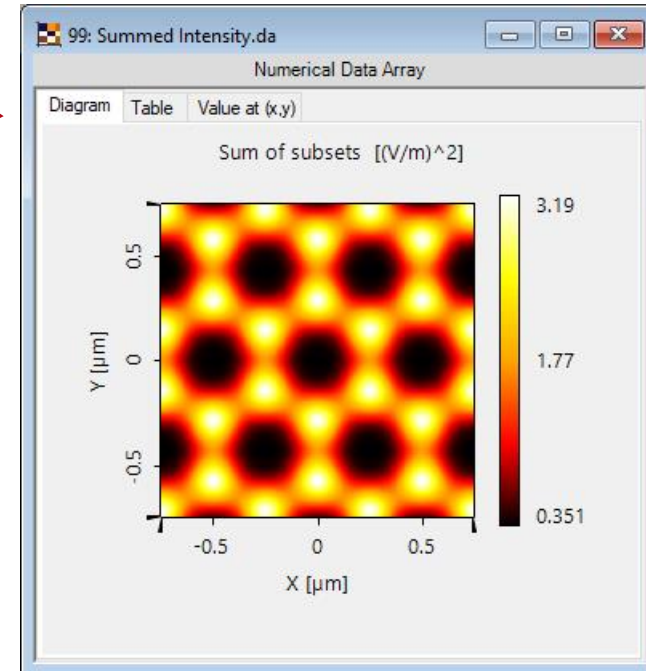
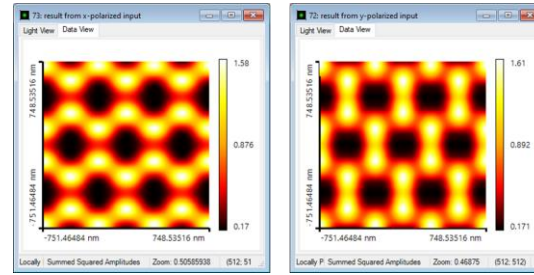
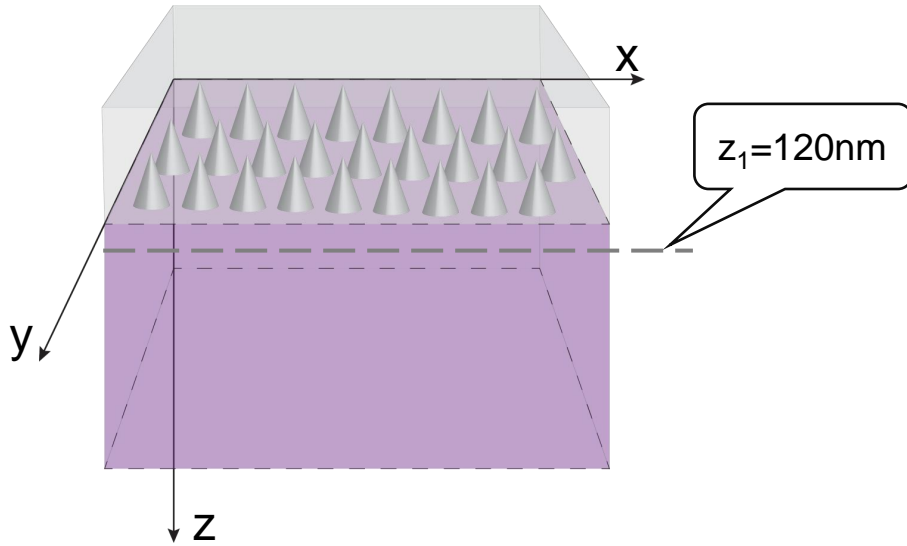
Talbot Pattern at a Certain Position



The intensity at a certain z-position is calculated separately for the input beams with different polarization states (linear x- and y-polarizations).

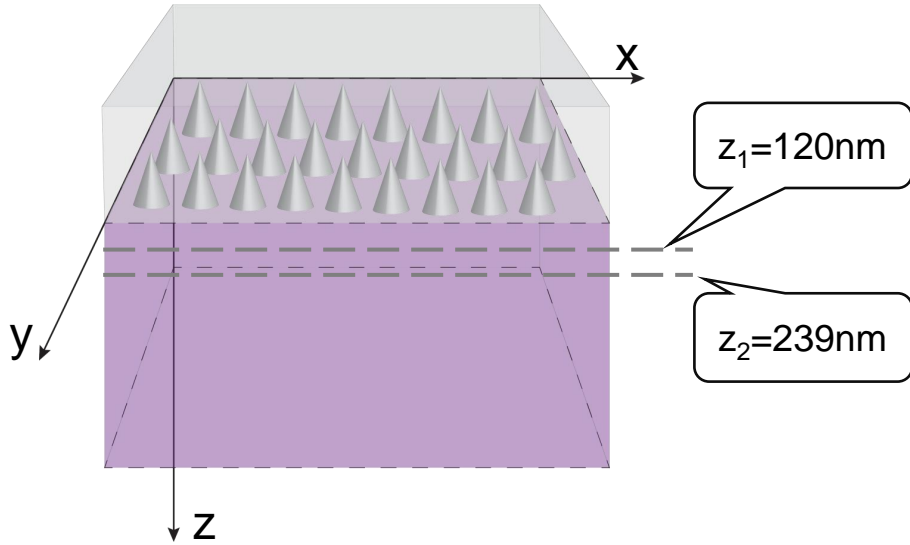


Talbot Pattern at a Certain Position

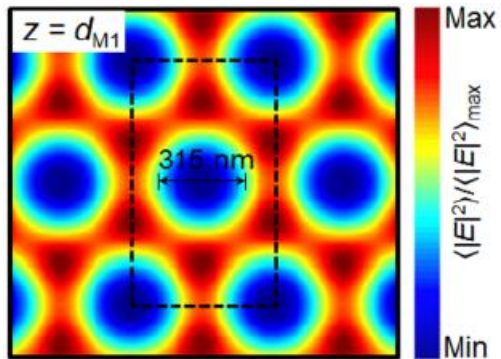
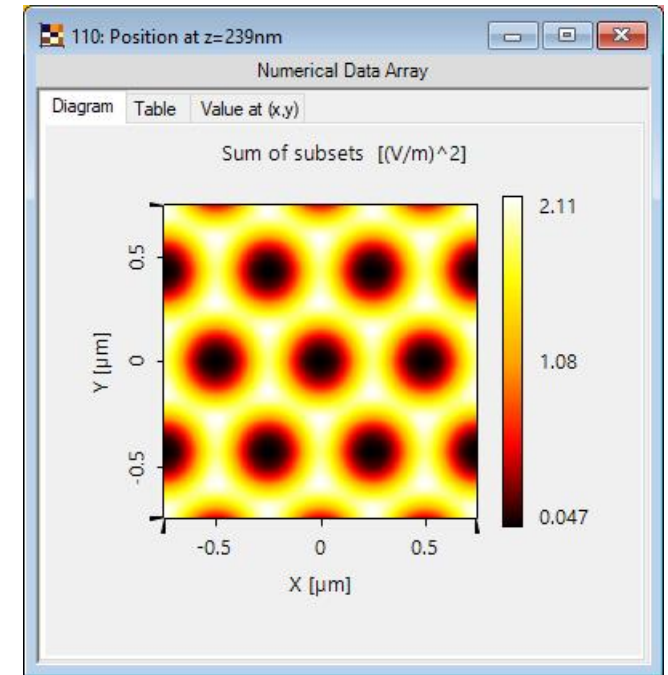
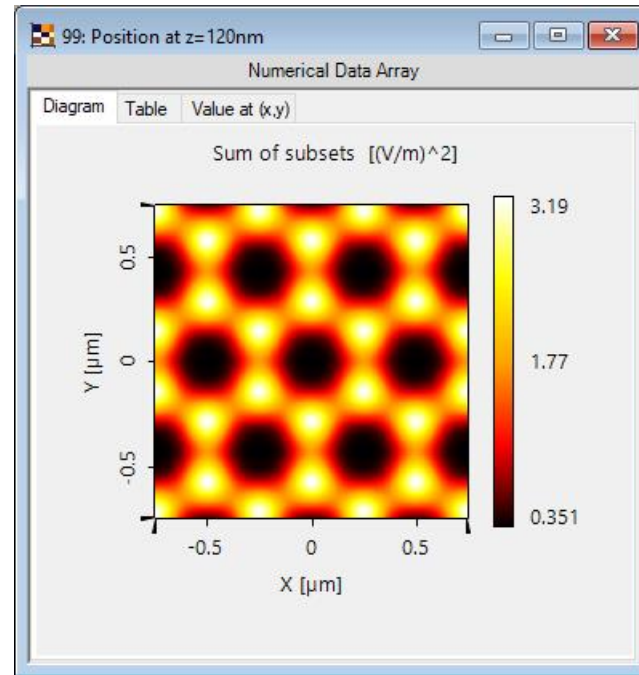


The total intensity is obtained by an incoherent average between the results from the linear x- and y-polarizations.

Talbot Pattern at Different Positions



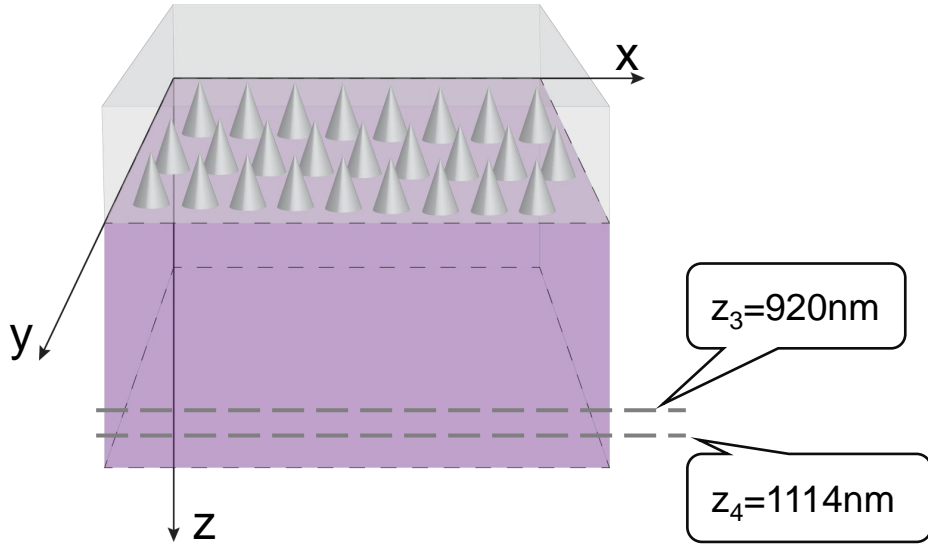
simulation result in VirtualLab Fusion



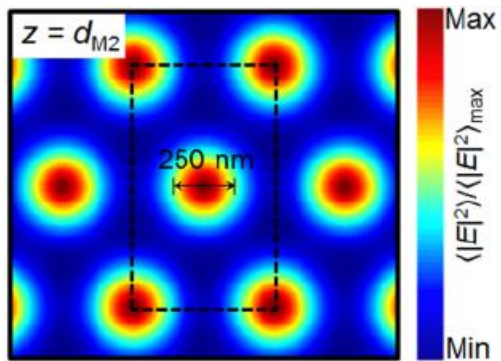
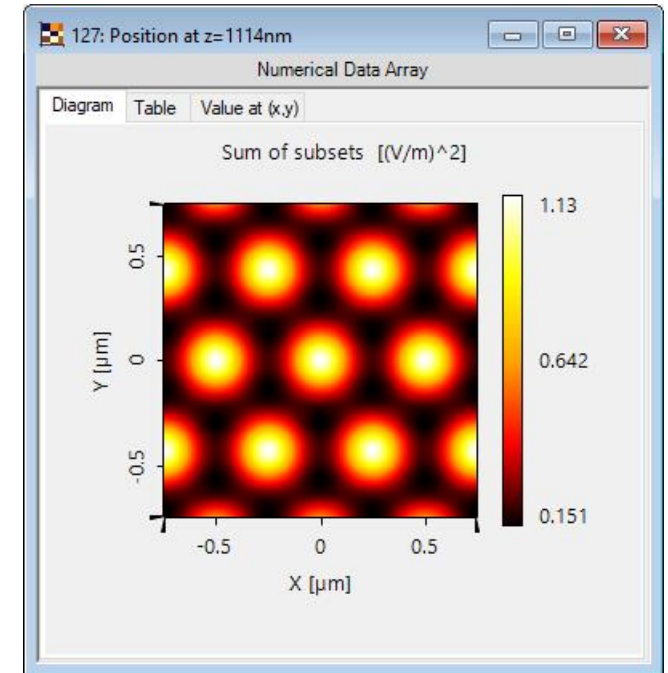
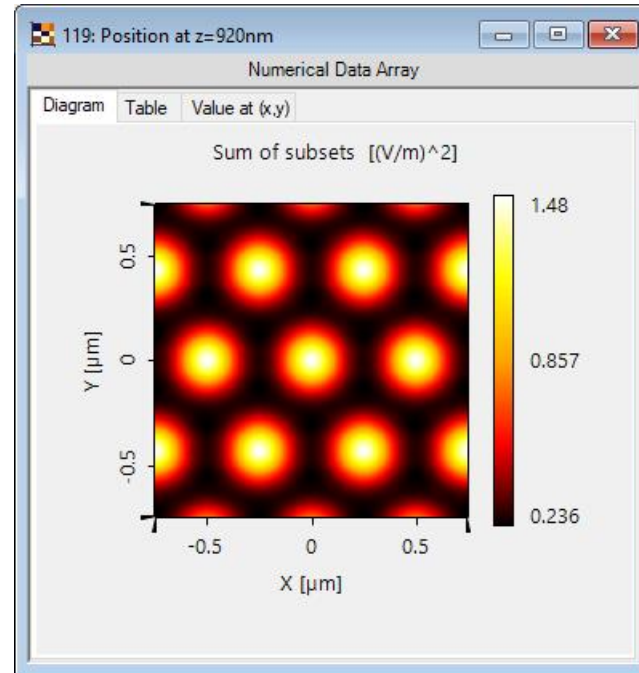
simulation result from reference:

I.-H. Lee, *et al.*, Opt. Express 23, 25866-25873 (2015). [Fig. 2 (b)]

Talbot Pattern at Different Positions



simulation result in VirtualLab Fusion

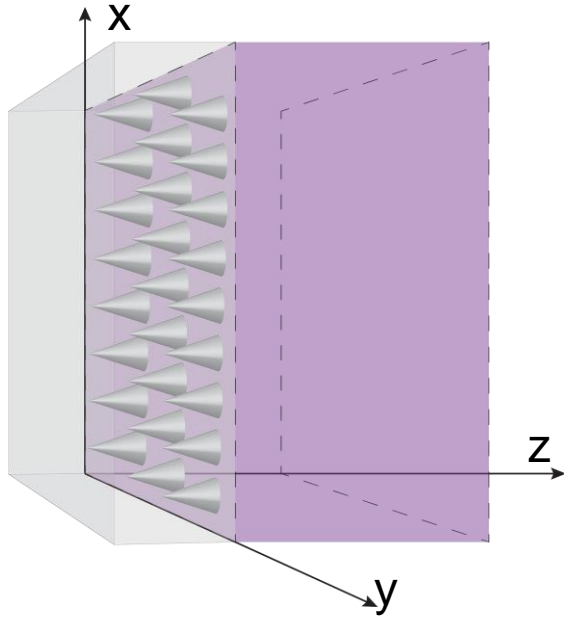


(c)

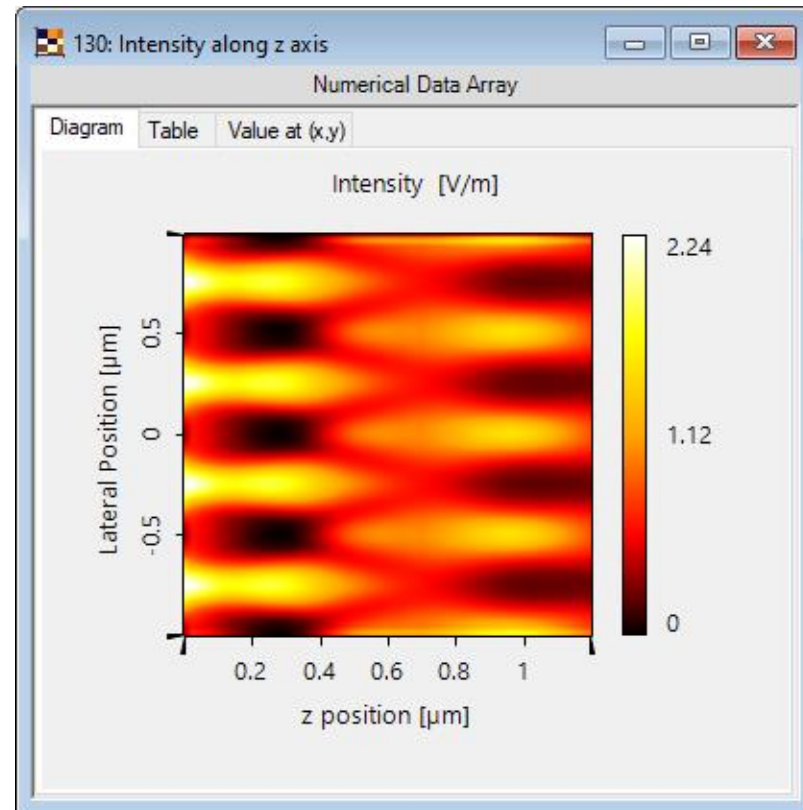
simulation result from reference:

I.-H. Lee, *et al.*, Opt. Express 23, 25866-25873 (2015). [Fig. 2 (c)]

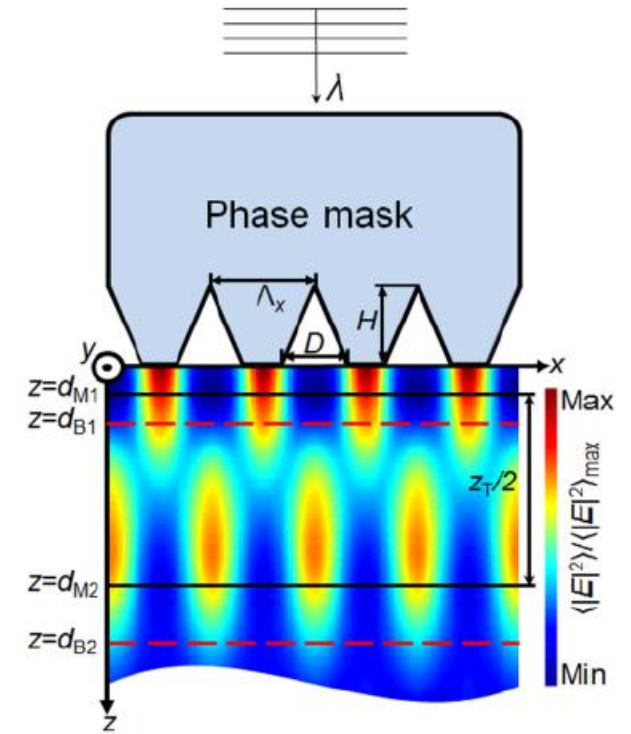
Intensity along Z-Axis



simulation result in VirtualLab Fusion



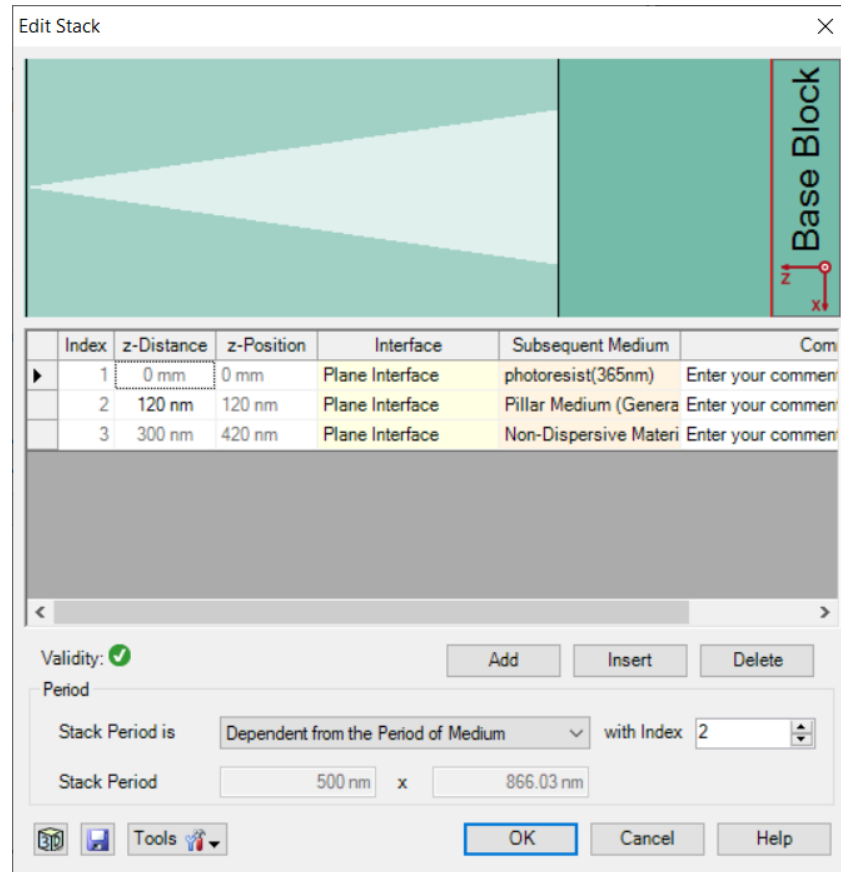
simulation result from reference:
I.-H. Lee, *et al.*, Opt. Express 23, 25866-25873
(2015). [Fig. 2 (a)]



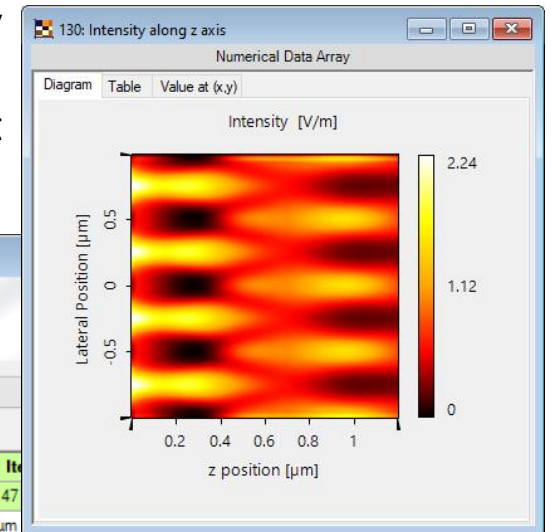
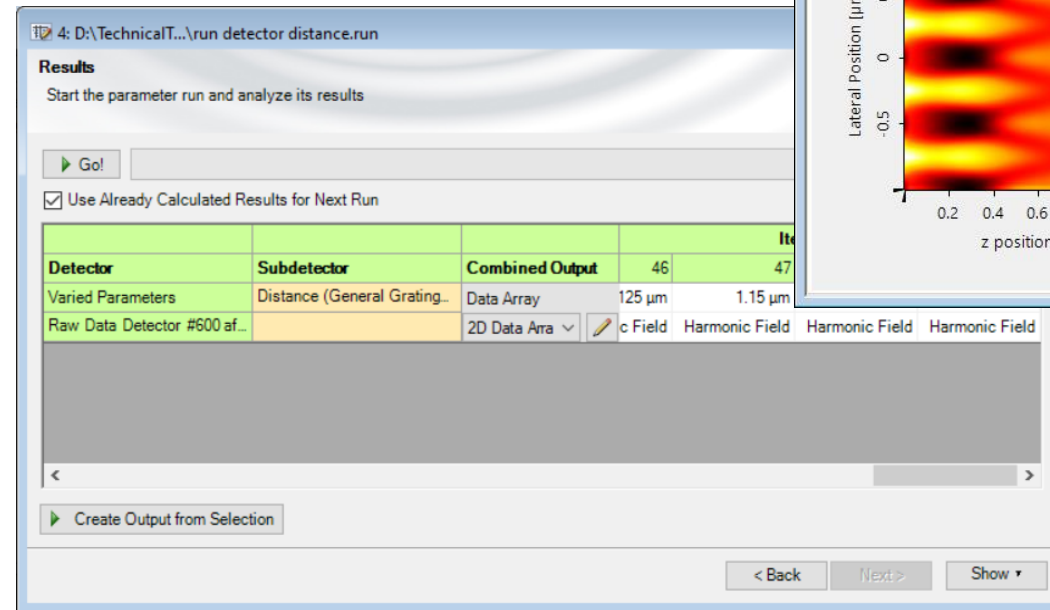
(a)

Peek into VirtualLab Fusion

configuration of phase mask structures



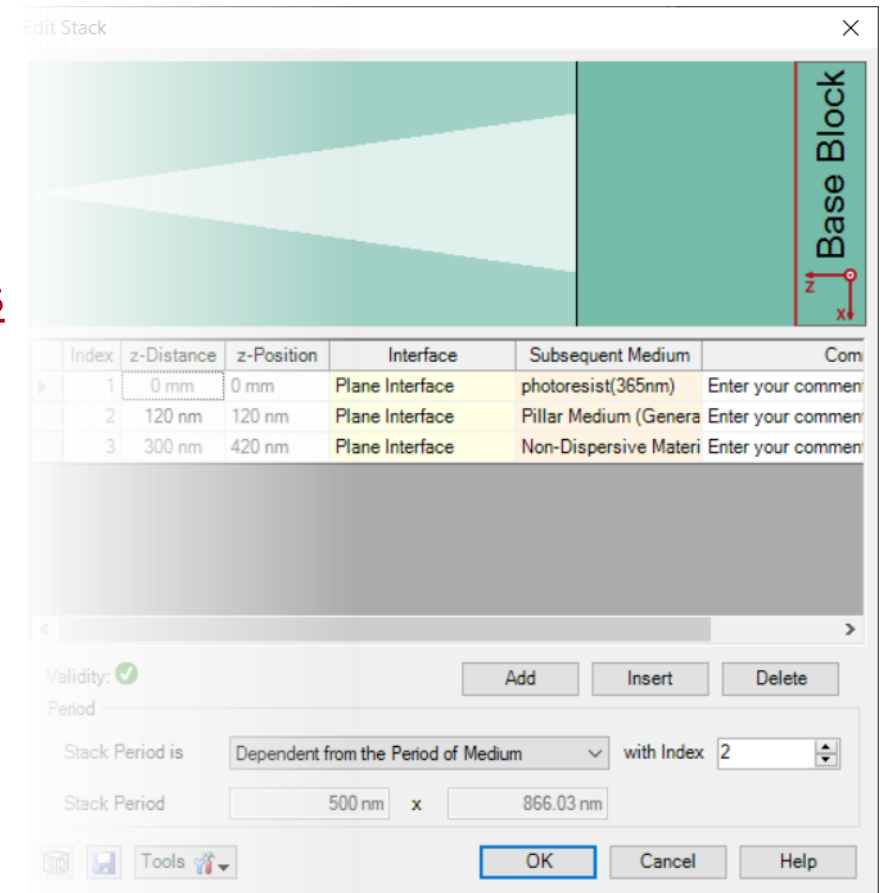
intensity
visualization in
photoresist
medium



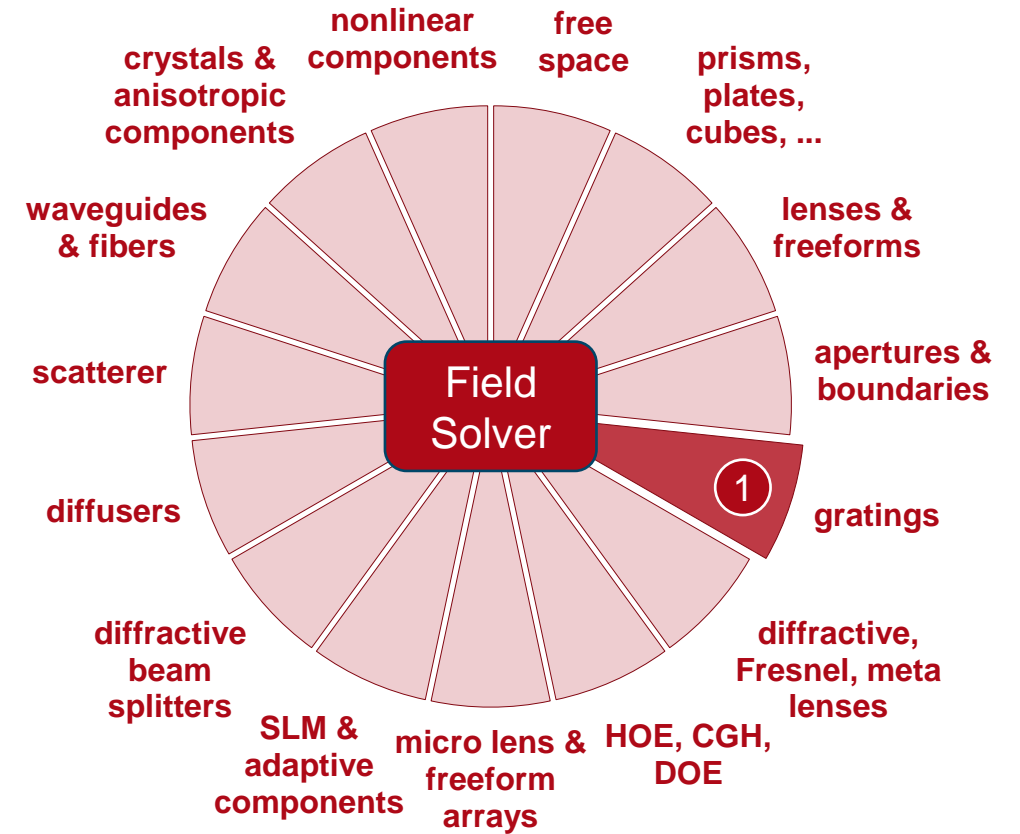
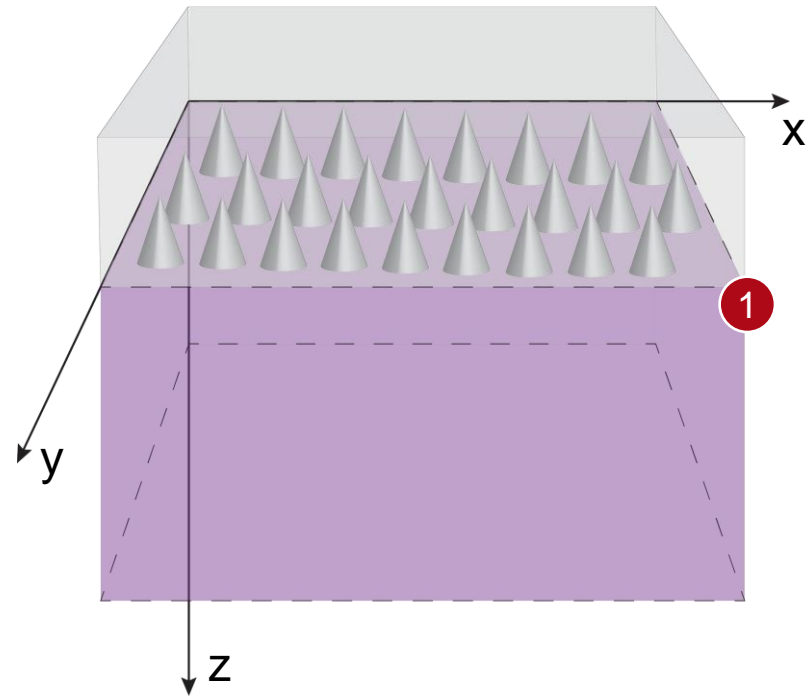
analysis of intensity vs. depth in photoresist medium

Workflow in VirtualLab Fusion

- Construct grating structure
 - [Configuration of Grating Structures by Using Special Media](#) [Use Case]
 - [Metagrating Construction – Discussion at Examples](#) [Use Case]
- Calculate intensity at different position with Parameter Run
 - [Usage of the Parameter Run Document](#) [Use Case]



VirtualLab Fusion Technologies



Document Information

title	Talbot Images of A Conical Phase Mask
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further reading	<ul style="list-style-type: none">- Ultra-Sparse Dielectric Nano-Wire Grid Polarizers- Grating Order Analyzer- Modeling of the Talbot Effect