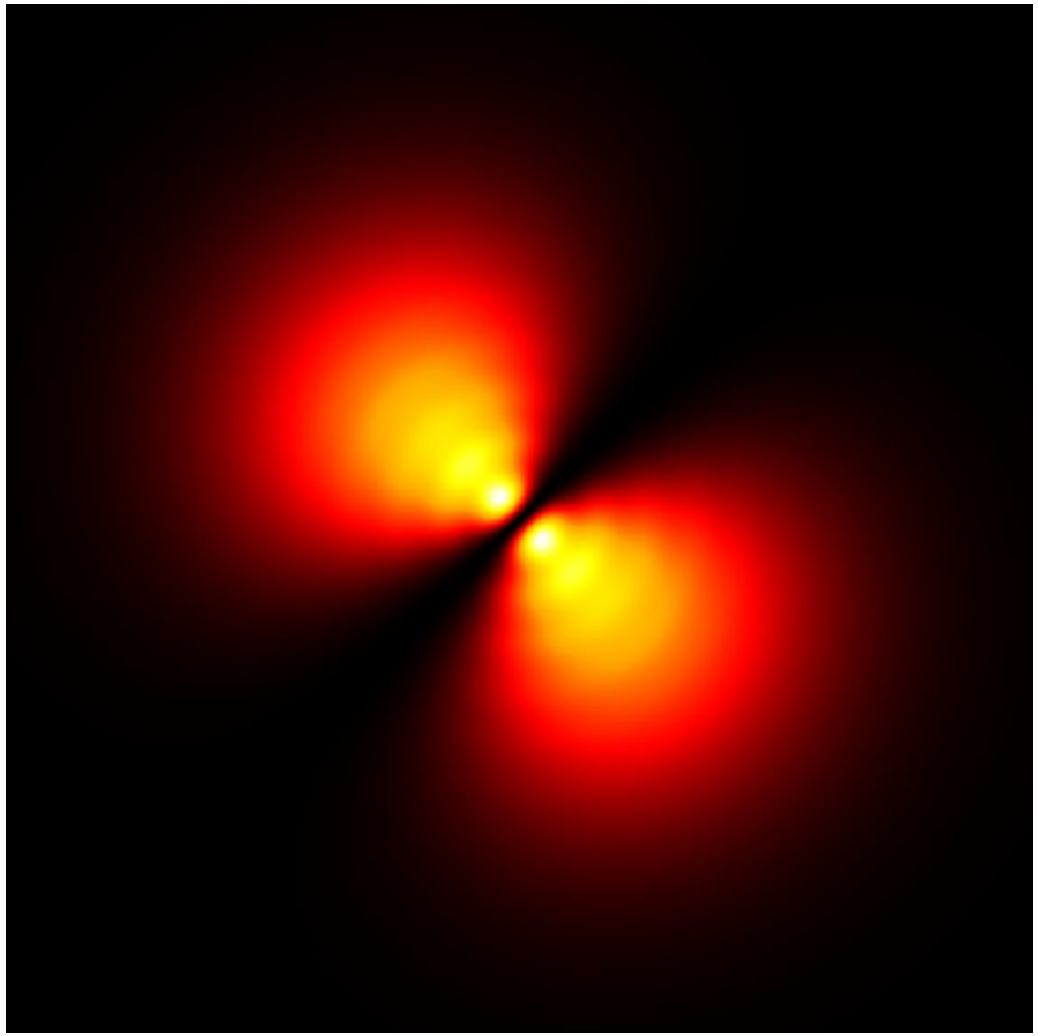
Vector Beam Generation with a SLM and a Common-Path Interferometer

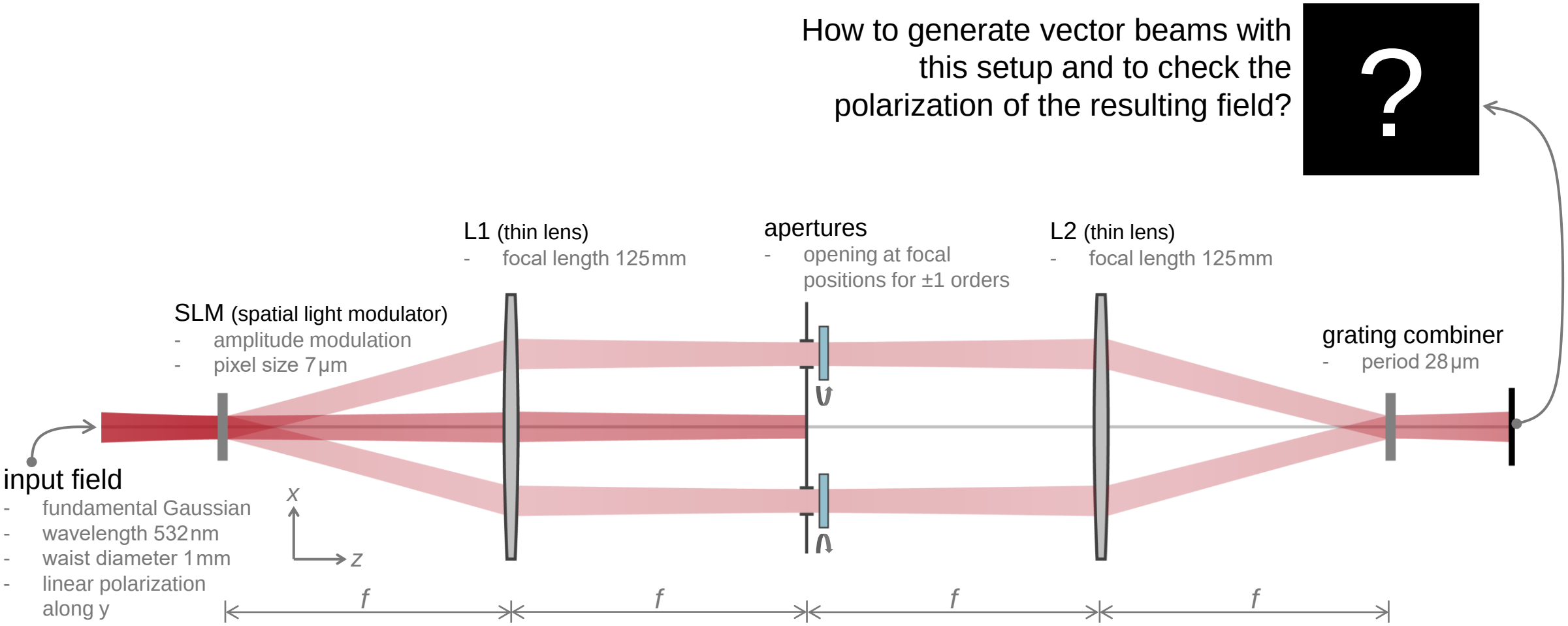
Abstract



Cylindrical vector beams are found to be of help in different applications. In this example, following the work of X.-L. Wang, *et al*. in Opt. Lett. 32, 3549-3551 (2007), we build up a common-path interferometric setup. It consists of SLM, apertures, quarter-waveplates, grating combiner, and lenses in a 4f setup. Using this setup, we simulate the generation of cylindrical vector beams. By changing selected parameters for the amplitude transmission loaded on the SLM, we compare the difference in the results as well.

Modeling Task

How to generate vector beams with this setup and to check the polarization of the resulting field?



concept of the setup follows from X.-L. Wang, *et al*., Opt. Lett. 32, 3549-3551 (2007)

Modeling Task

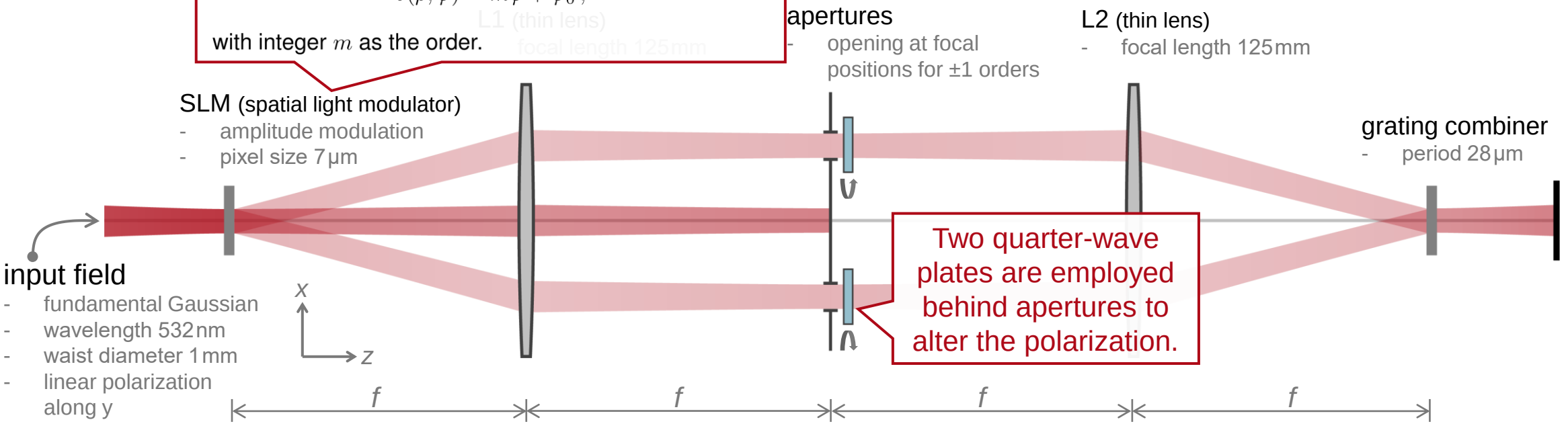
The amplitude modulation of the SLM is defined as

$$t(x, y) = 0.5\,[1 + \gamma \cos(2\pi x/d + \delta)]\ ,$$

where γ is a constant factor, δ is defined in the polar coordinate system, as

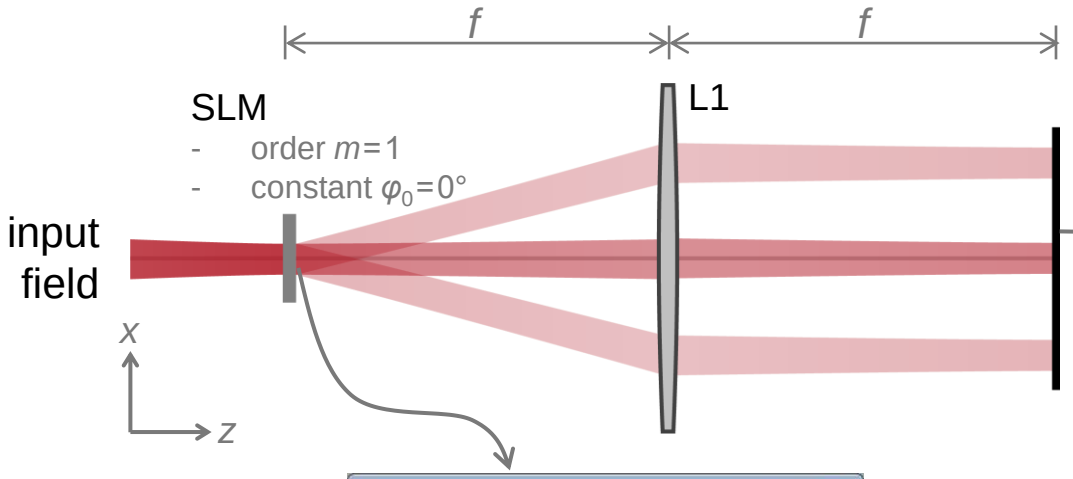
$$\delta(\rho, \varphi) = m\varphi + \varphi_0\ ,$$

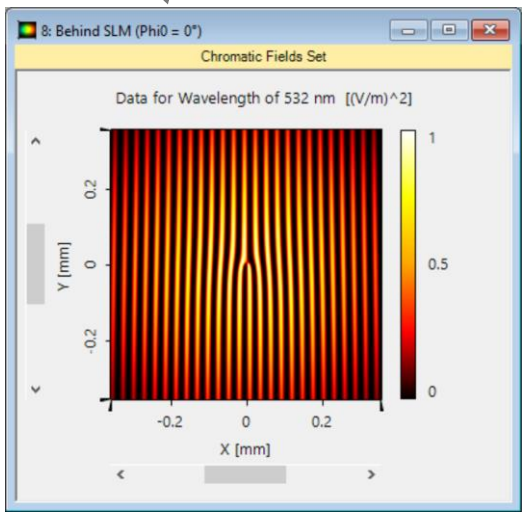
with integer m as the order.



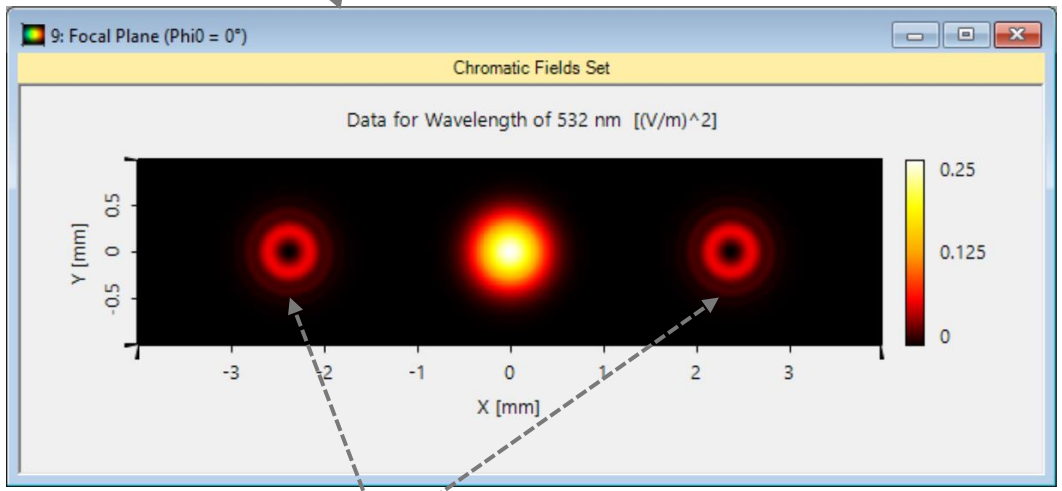
concept of the setup follows from X.-L. Wang, *et al.*, Opt. Lett. 32, 3549-3551 (2007)

Function of Spatial Light Modulator



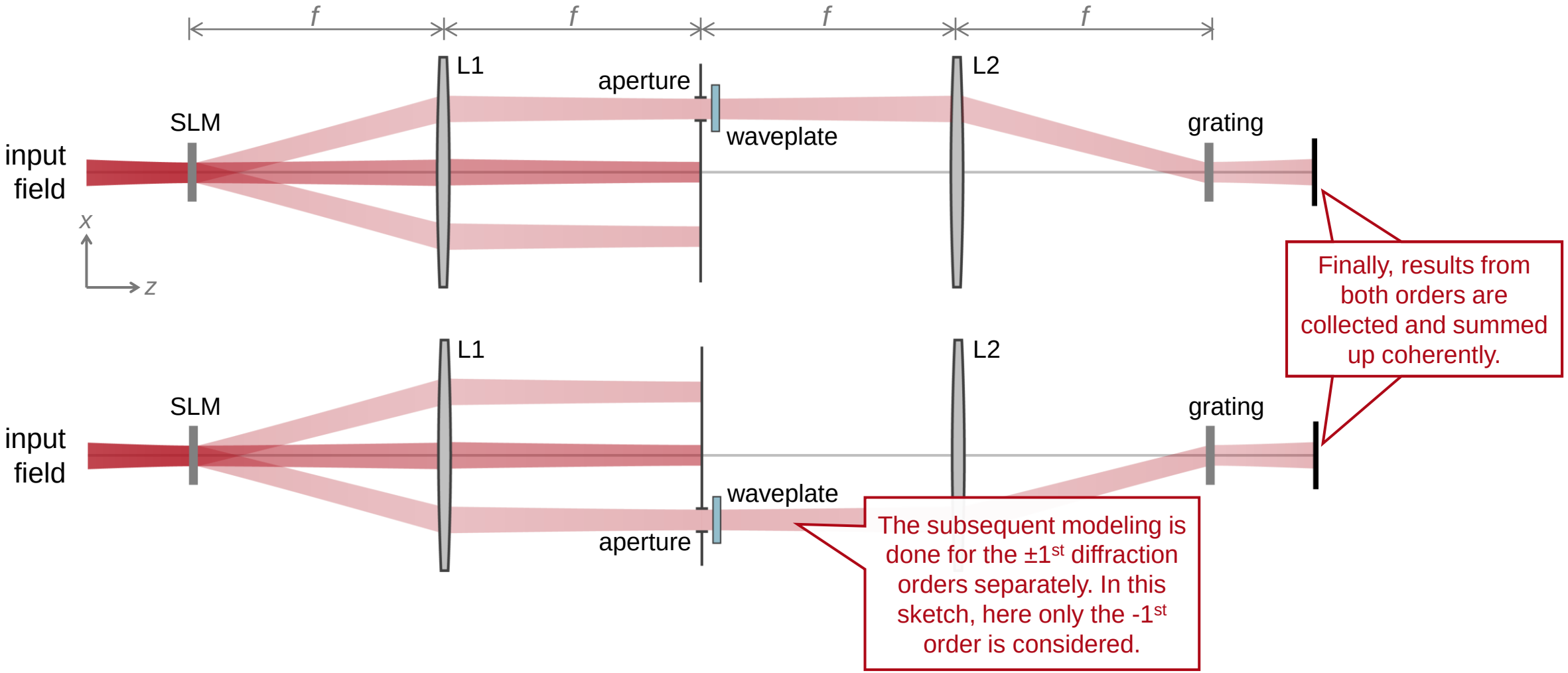


distribution in the focal behind L1

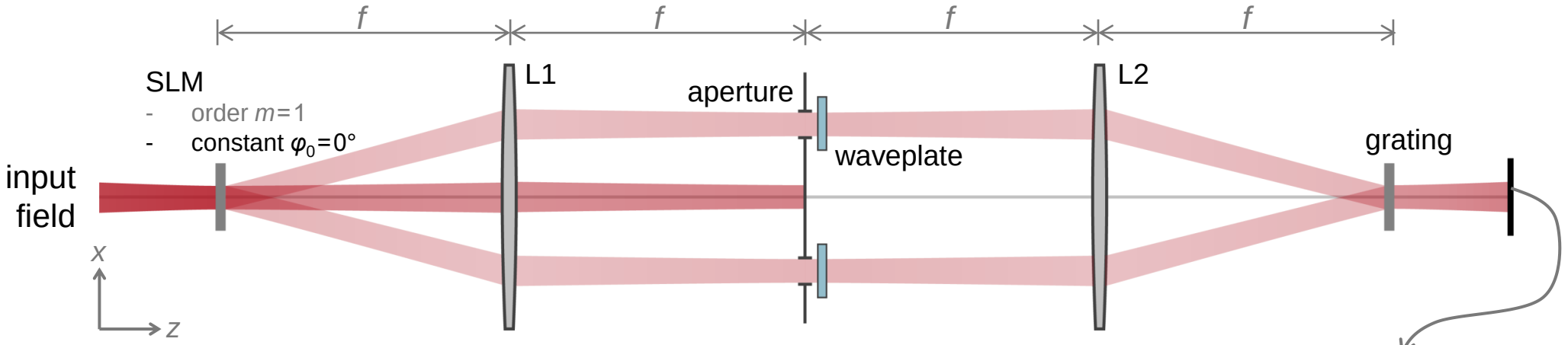


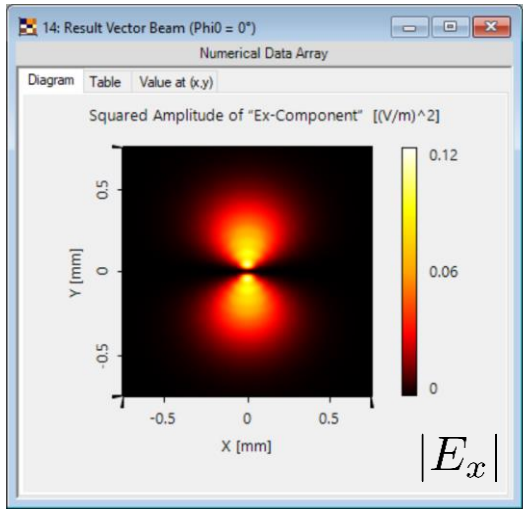
±1 diffraction orders

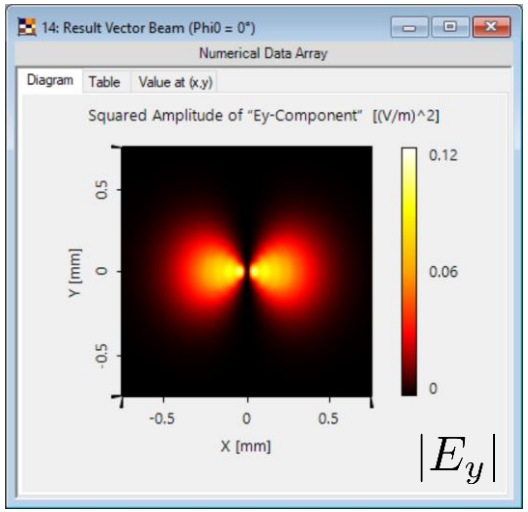
Separate Modeling of ±1st Diffraction Orders



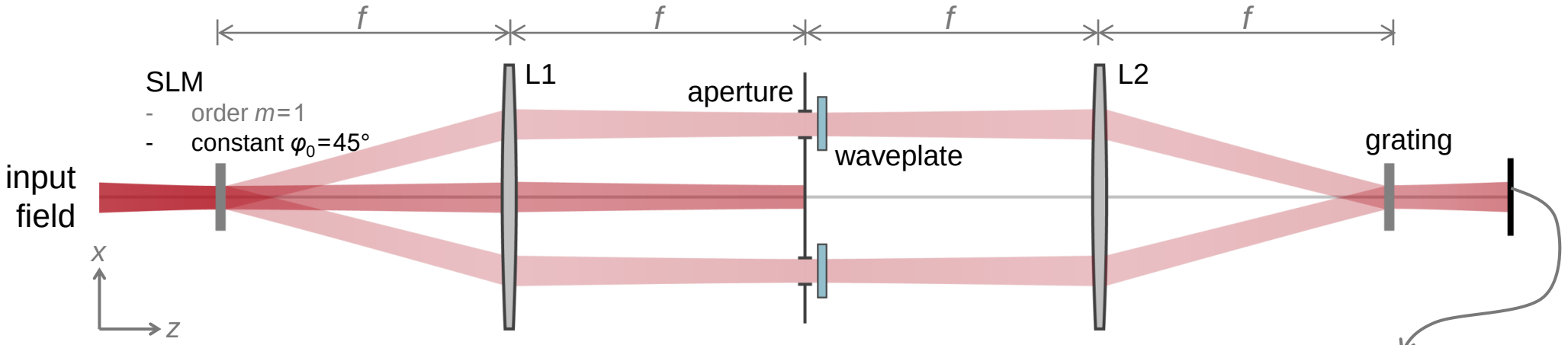
Resulting Vector Beam (φ_0=0°)

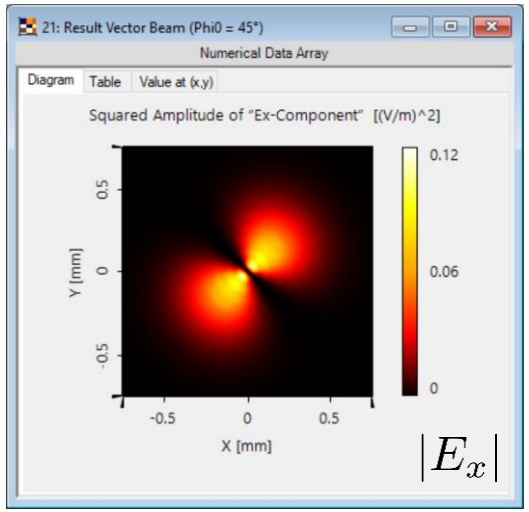


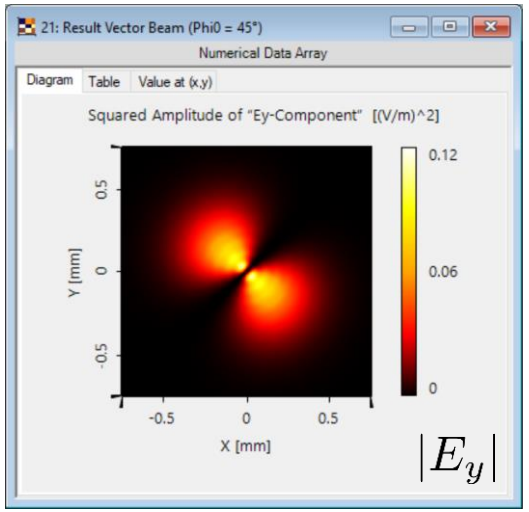




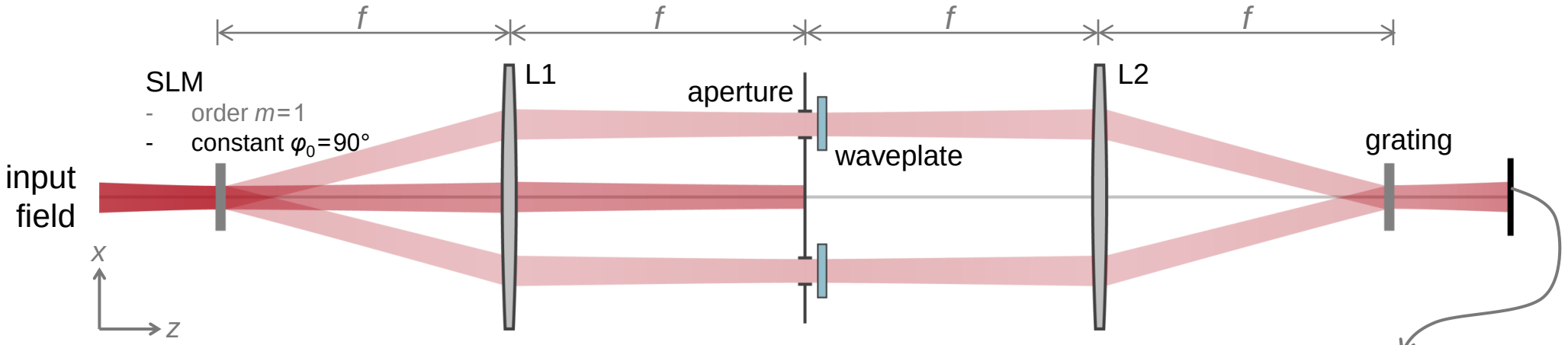
Resulting Vector Beam (φ_0=45°)

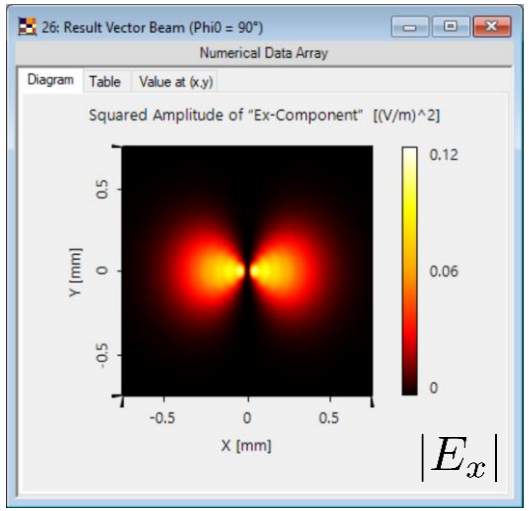


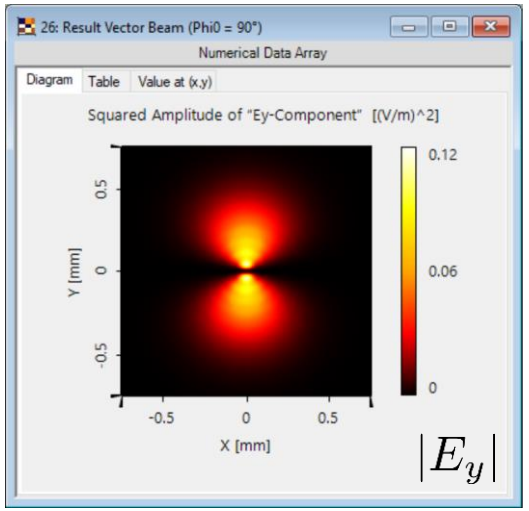




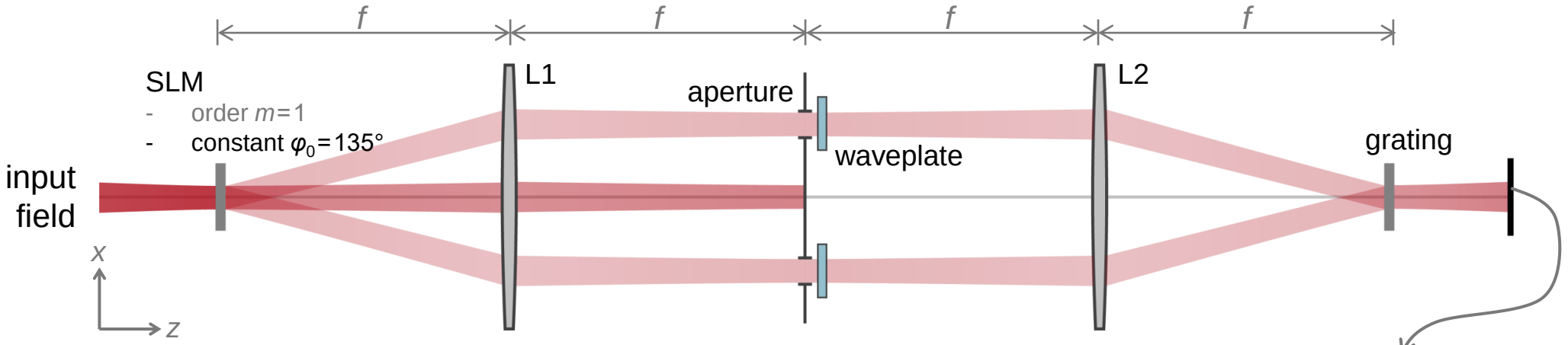
Resulting Vector Beam (φ_0=90°)

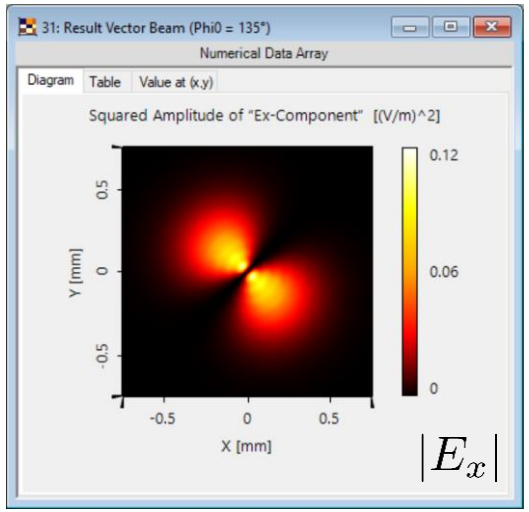


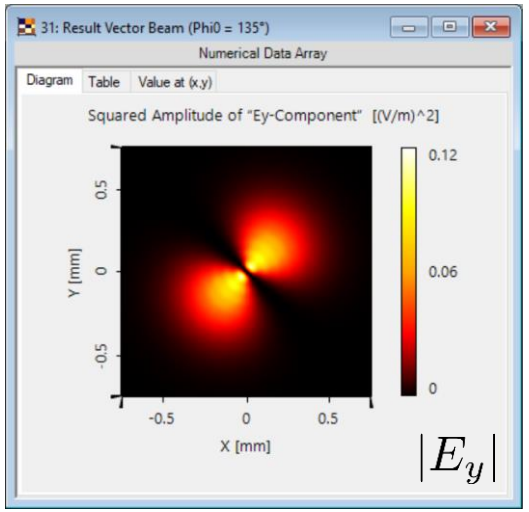




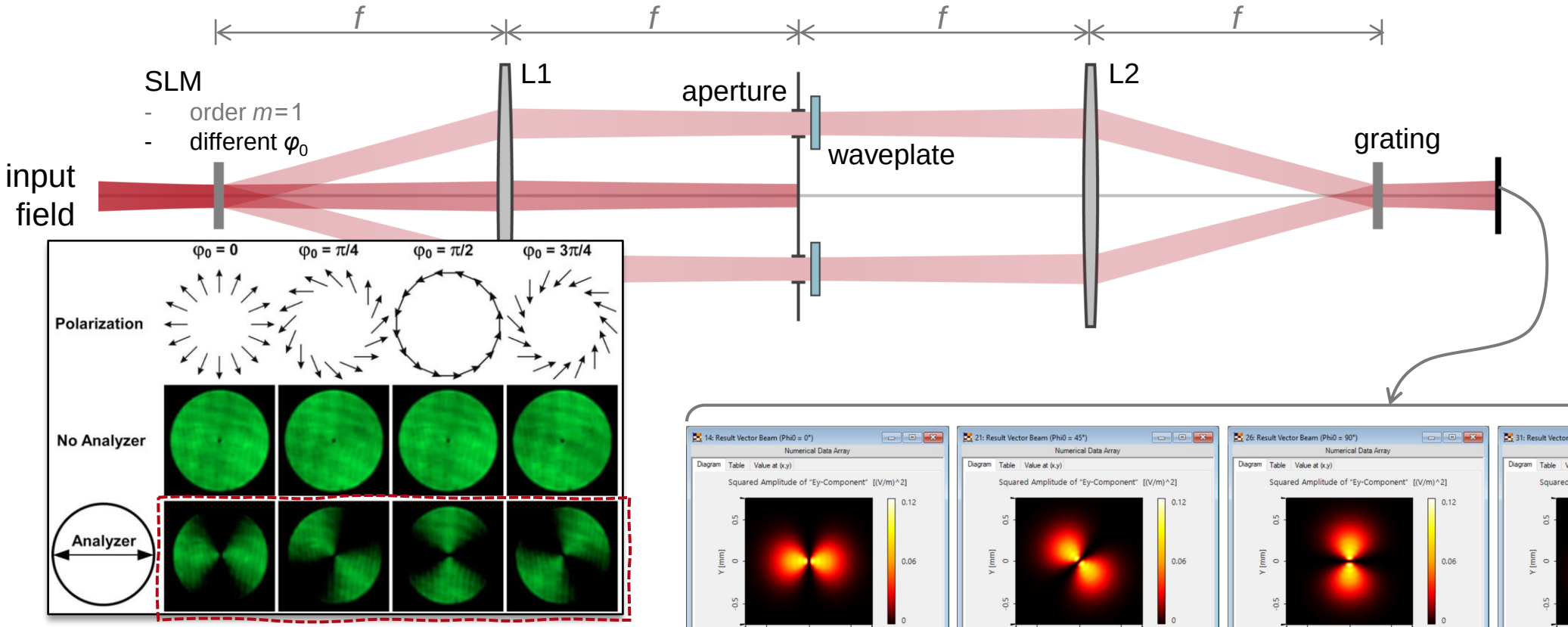
Resulting Vector Beam (φ_0=135°)







Resulting Vector Beams and Comparison

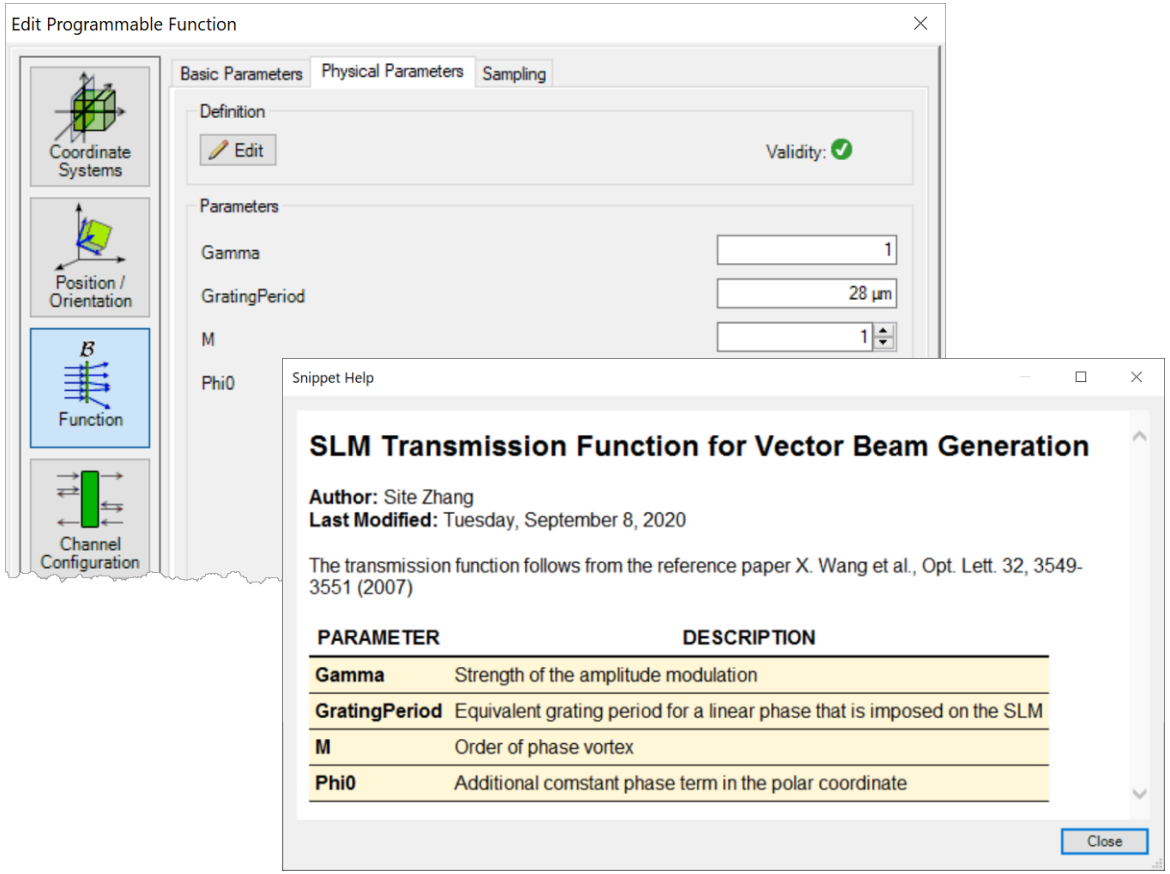


measurement results in Fig. 2 from X.-L. Wang, *et al.*, Opt. Lett. 32, 3549-3551 (2007)

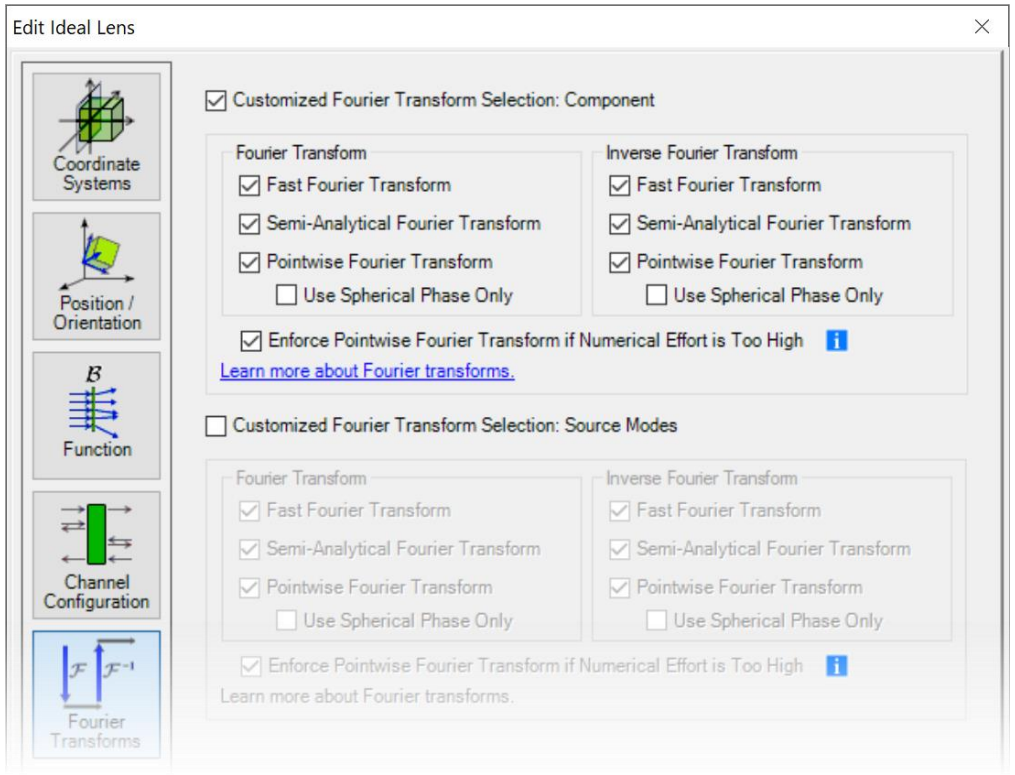
φ_0=0° φ_0=45° φ_0=90° φ_0=135°

Peek into VirtualLab Fusion

flexible definition of arbitray transmission functions

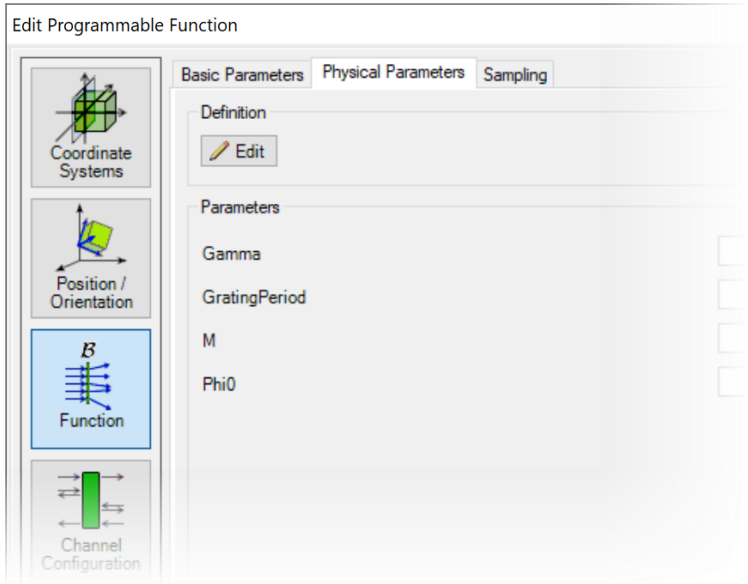


Fourier transform settings for diffraction consideration



Workflow in VirtualLab Fusion

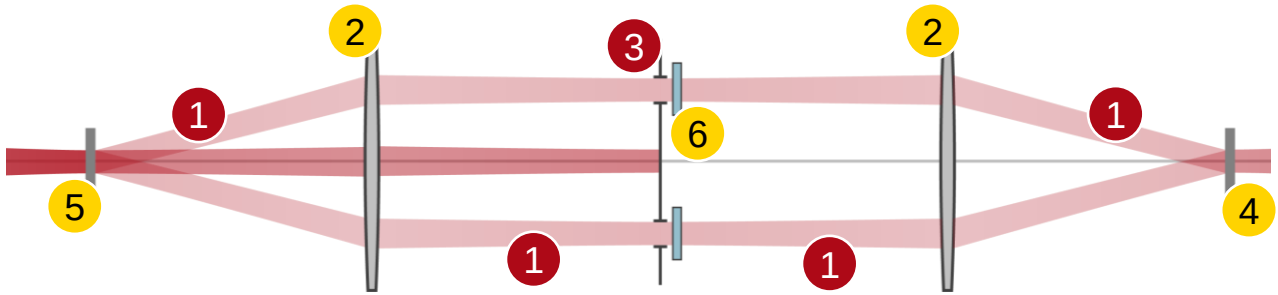
- Specify or customize transmission functions
  - How to Work with the Programmable Function & Example (Cylindrical Lens) [Use Case]

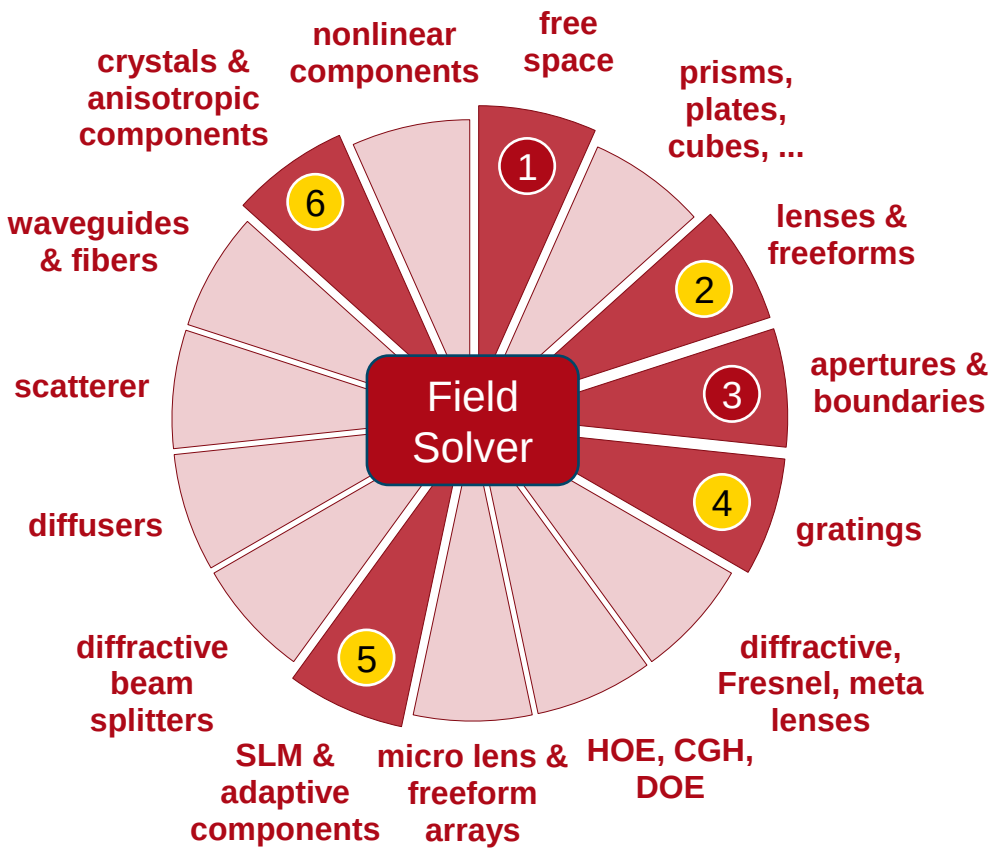


- Set the Fourier transforms properly
  - Fourier Transform Settings – Discussion at Examples [Use Case]

- Use idealized grating function in the modeling
  - VirtualLab Fusion Technology – Idealized Grating Functions [Technology Whitepaper]

VirtualLab Fusion Technologies





idealized component

Document Information

title	Vector Beam Generation with a SLM and a Common-Path Interferometer
document code	IFO.0014
version	1.0
edition	VirtualLab Fusion Basic
software version	2020.2 (Build 2.22)
category	Application Use Case
further reading	- Generation of Spatially Varying Polarization by Interference with Polarized Light