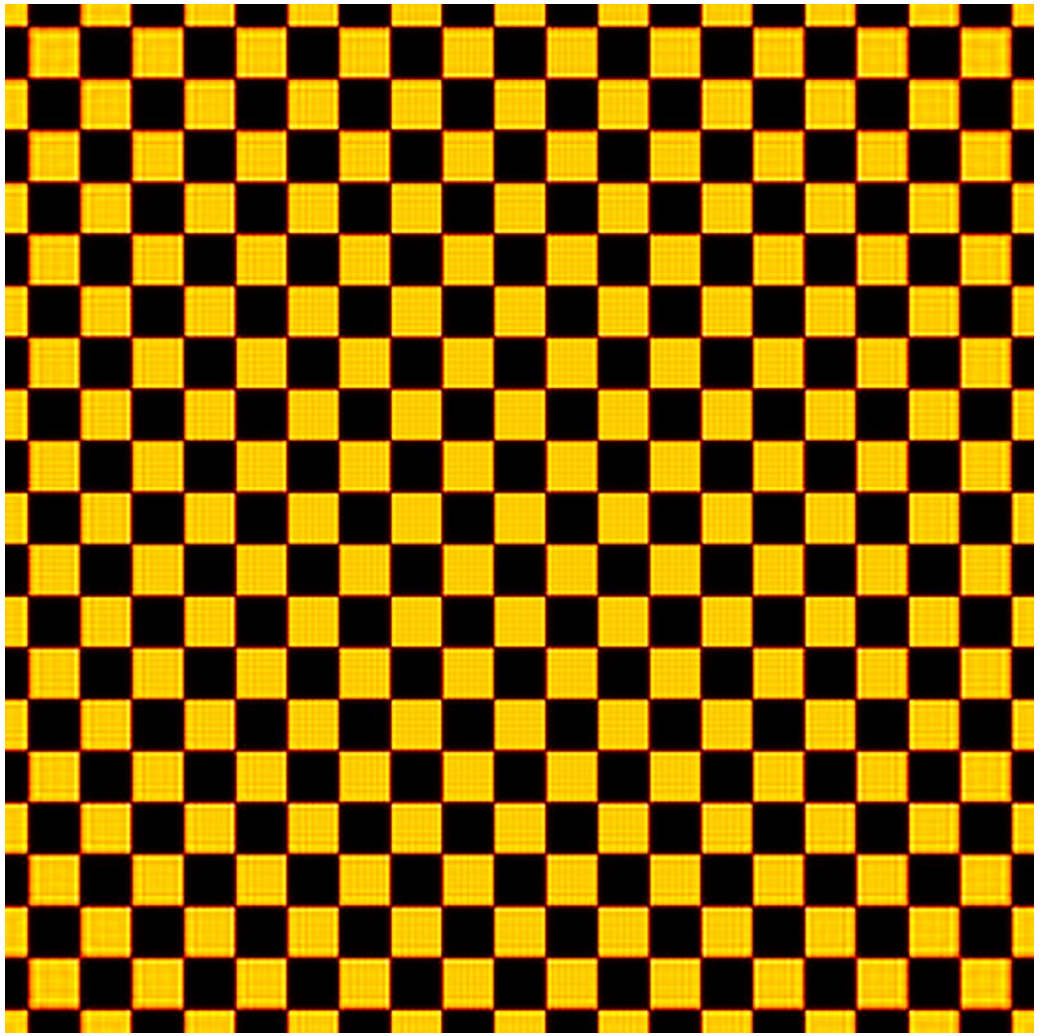
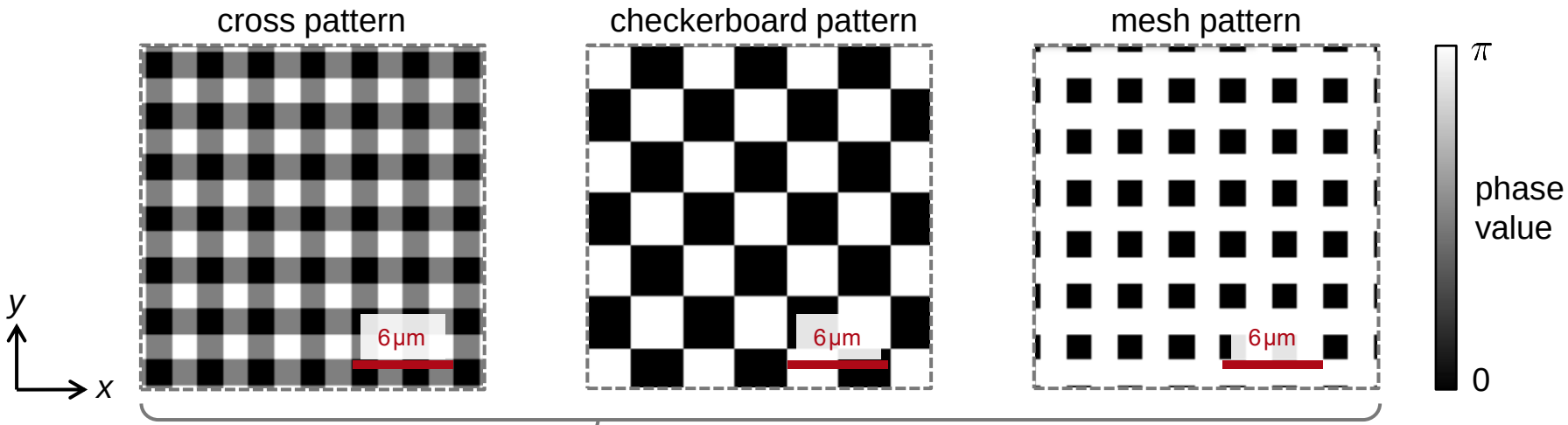
Single Grating Interferometer for X-Ray Imaging

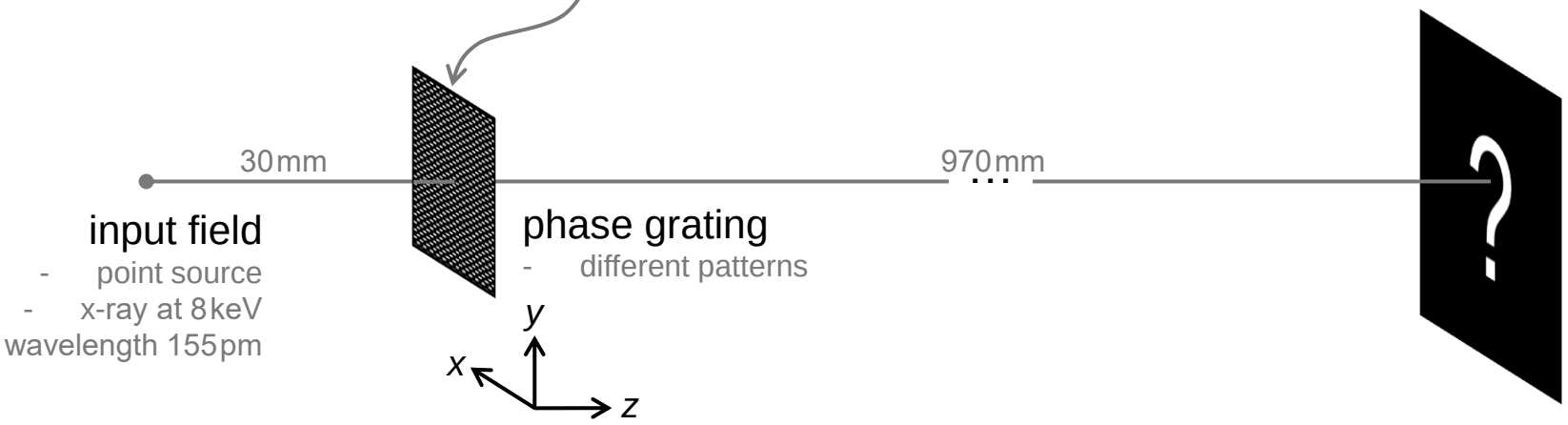
Abstract



X-ray imaging is often based on the Talbot effect and the self-image of gratings. Following the work of N. Morimoto *et al*., we selected three types of phase gratings, with cross, checkerboard, and mesh patterns. The gratings are employed in a single grating interferometer, modeled as phase-only transmission functions (because the x-ray wavelength is much smaller than the grating period), and their self-images are examined in VirtualLab Fusion.

Modeling Task

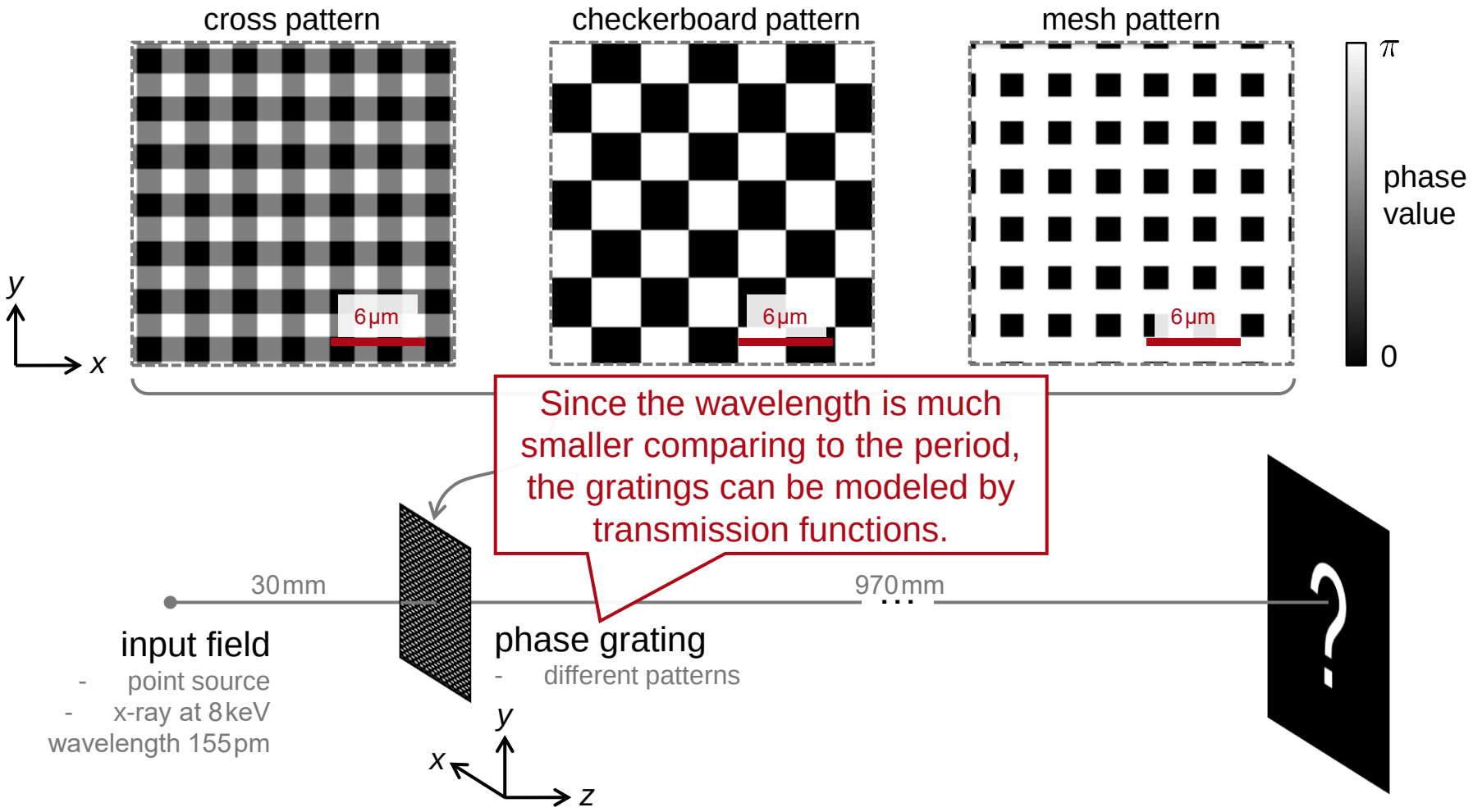




How to investigate the self-images behind phase gratings with different patterns for x-ray imaging?

system parameters from N. Morimoto, *et al.*, Opt. Express 23, 29399-29412 (2015)

Modeling Task



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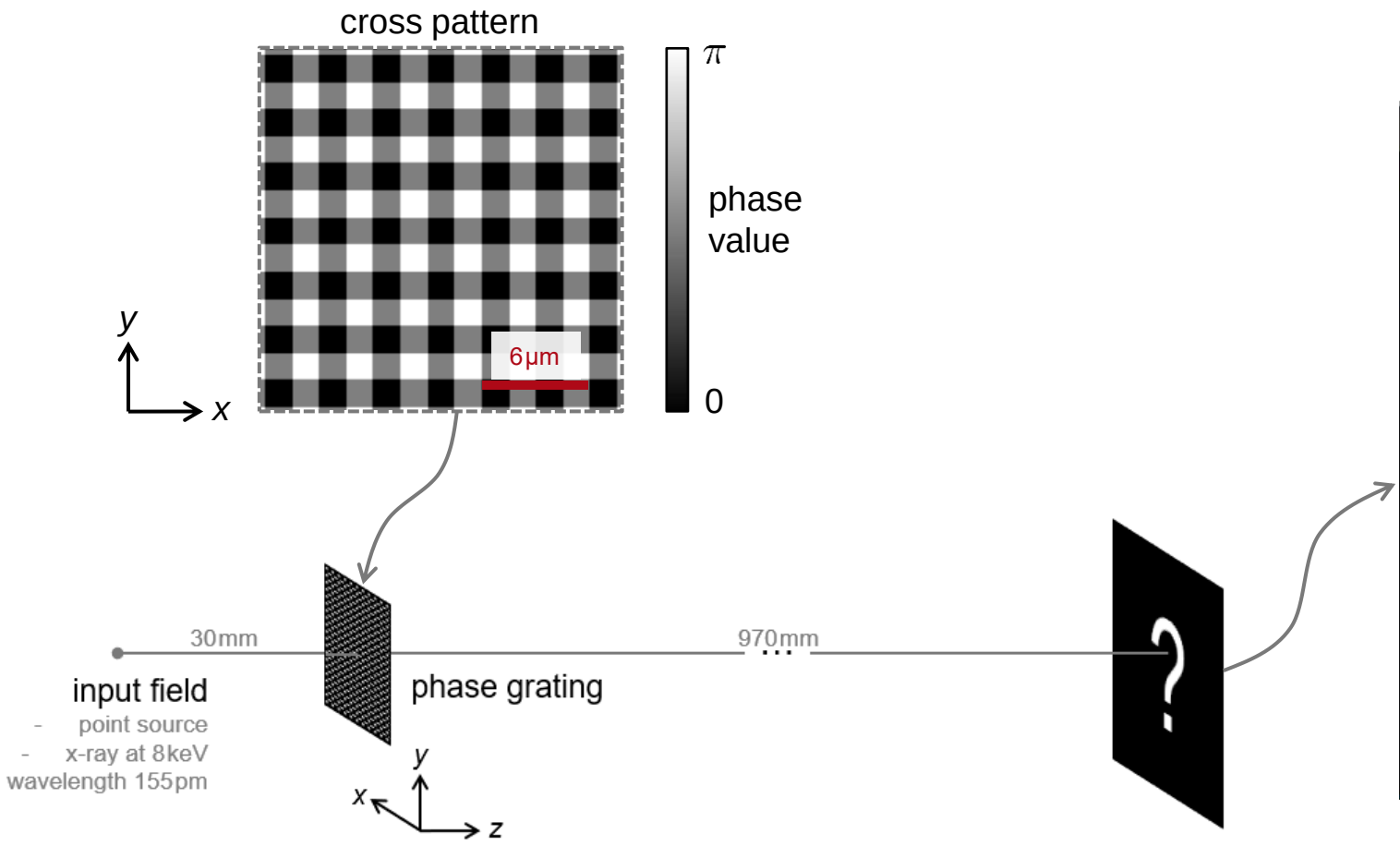
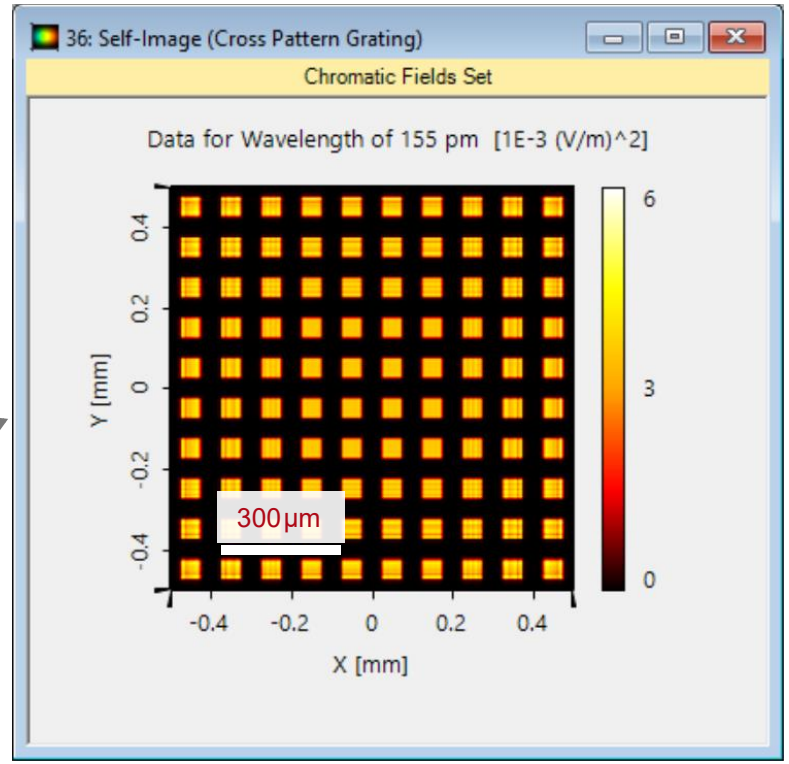
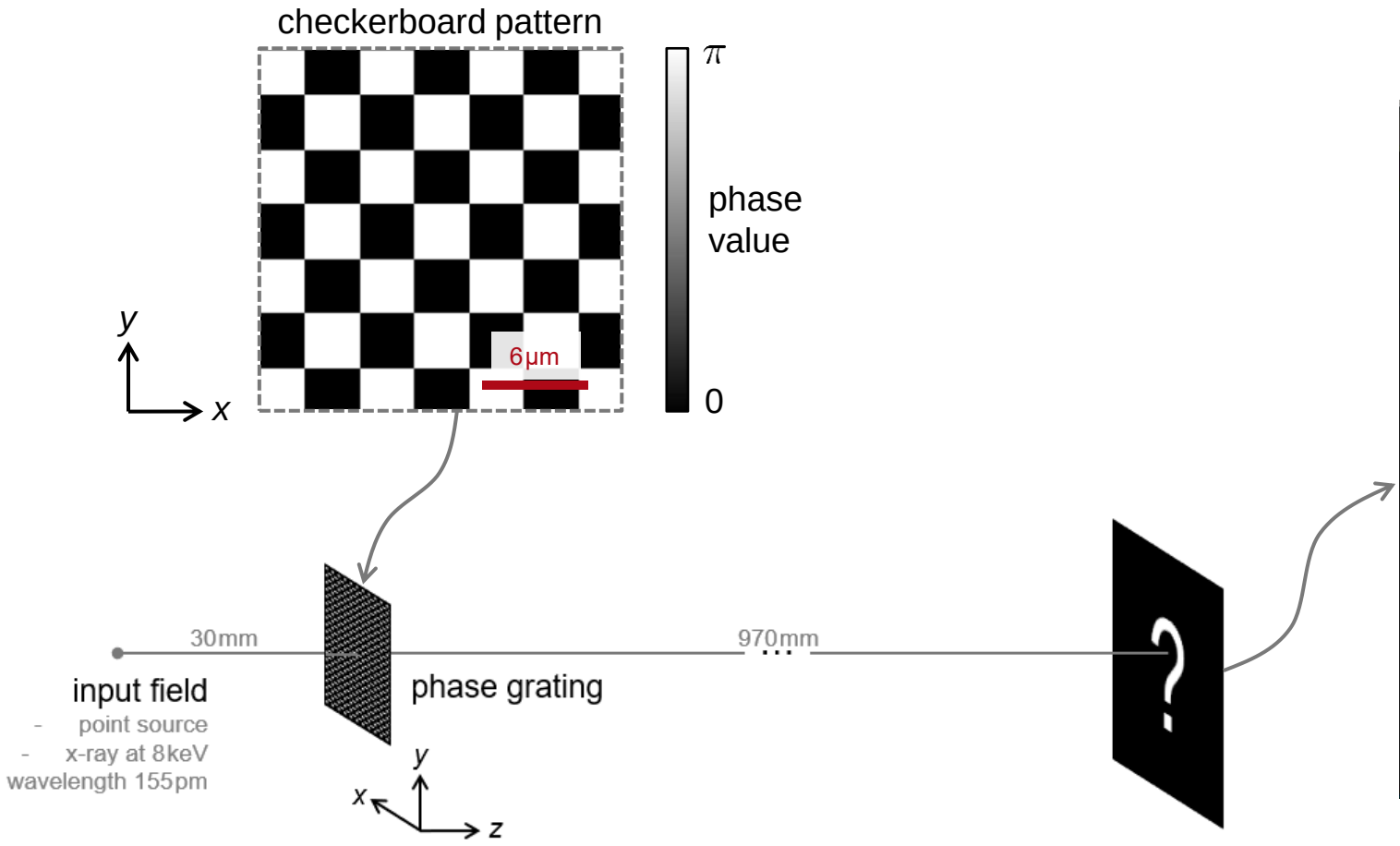
Cross-Pattern Phase Grating



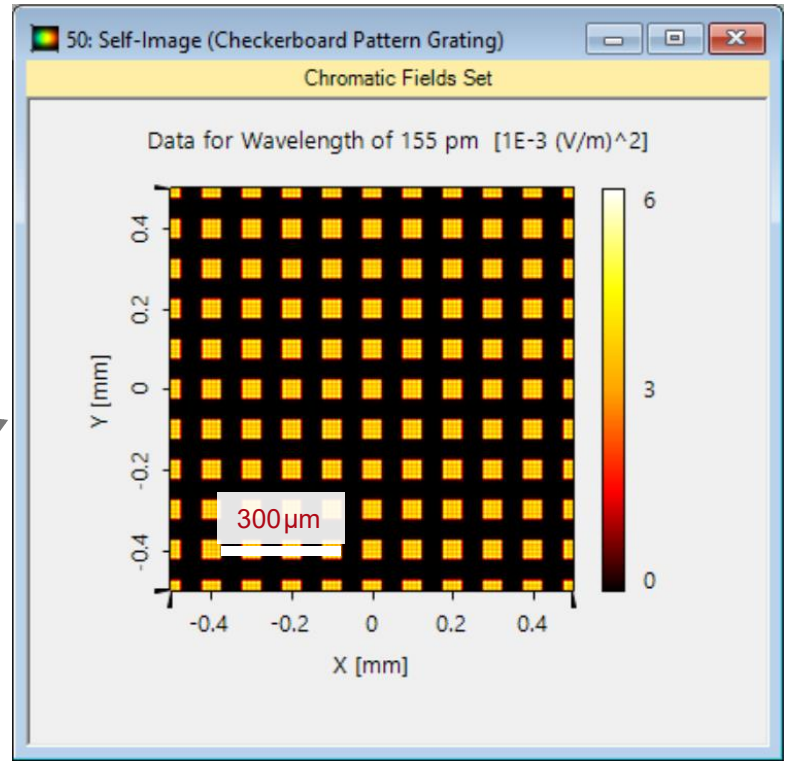
self-image of cross-pattern phase grating



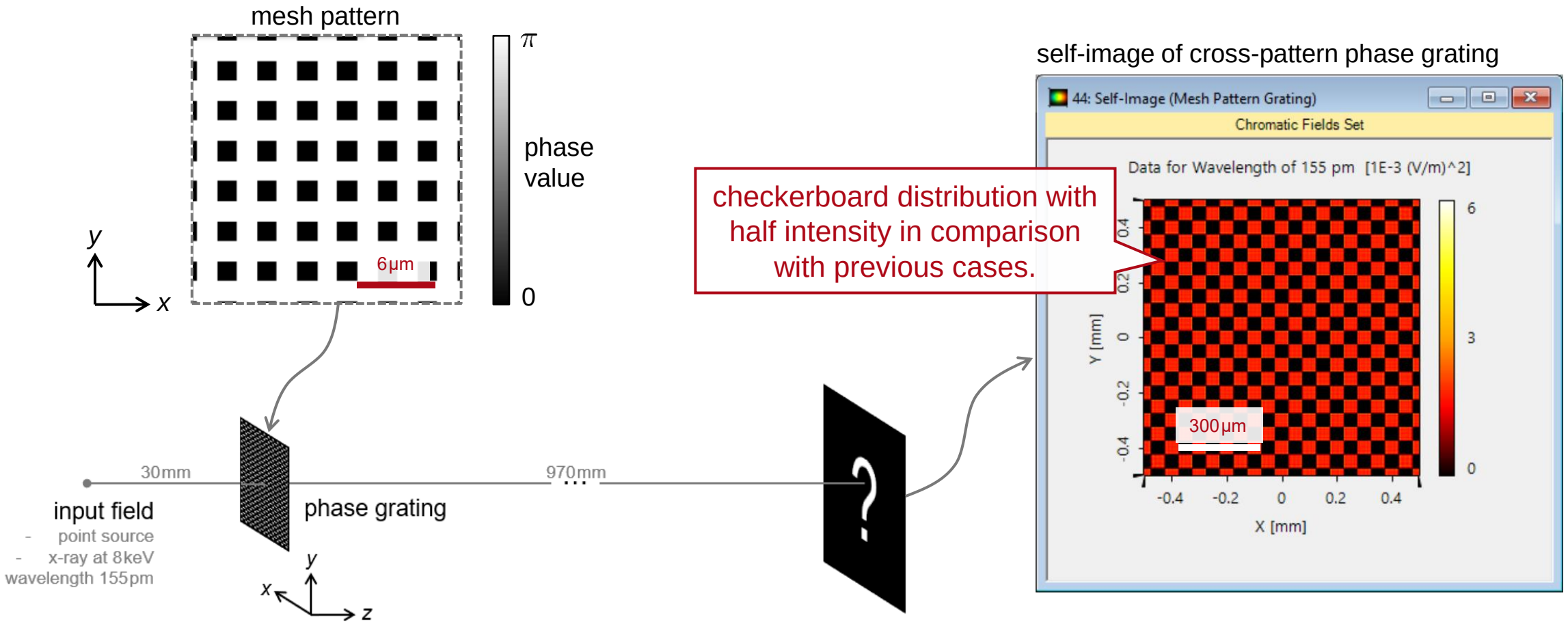
Checkerboard-Pattern Phase Grating



self-image of checkerboard phase grating

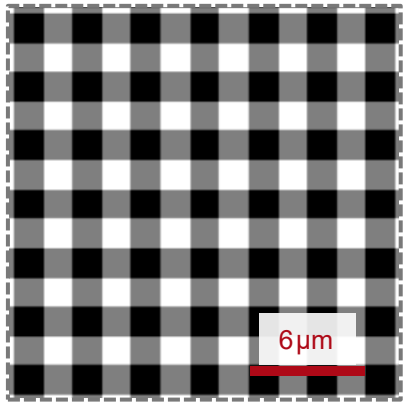


Mesh-Pattern Phase Grating

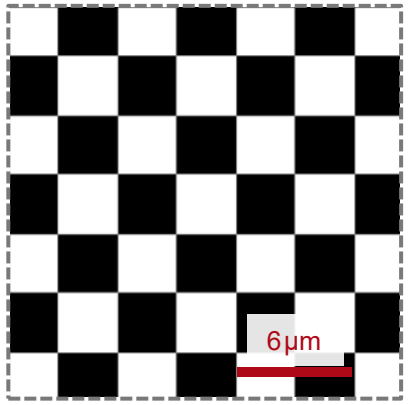


Comparison of Different Cases

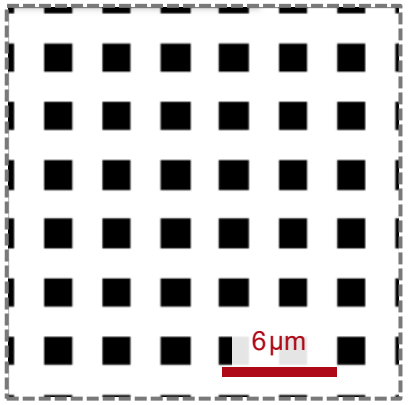
cross pattern

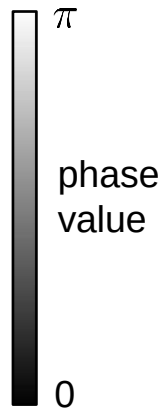


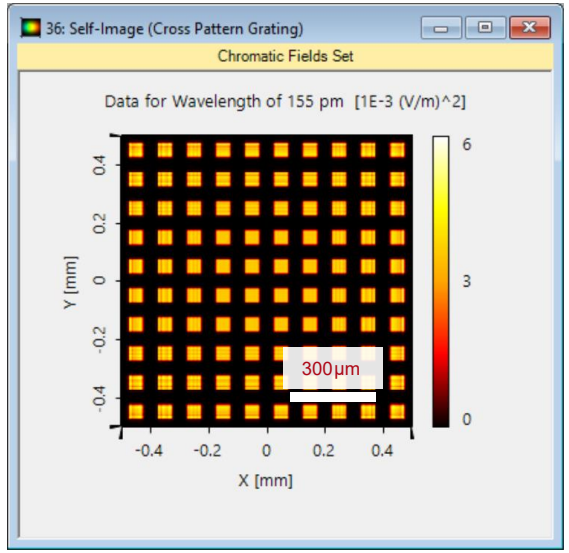
checkerboard pattern

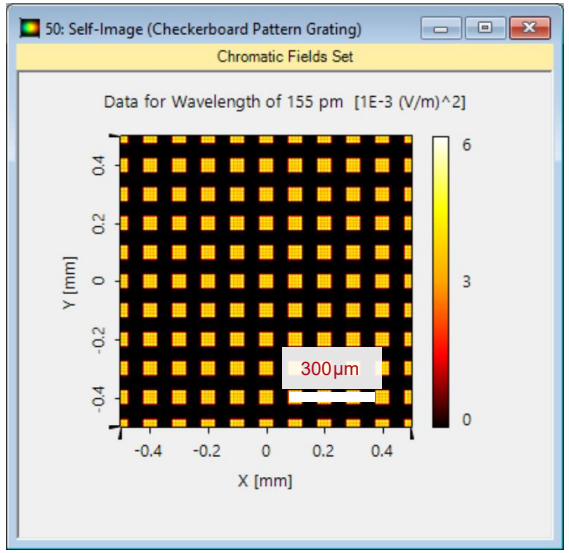


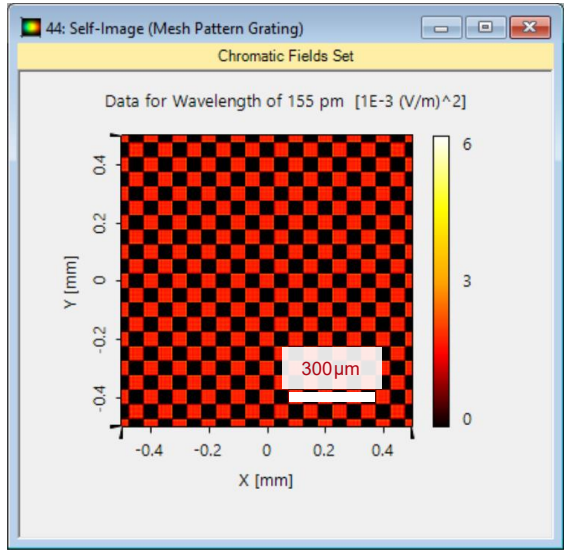
mesh pattern





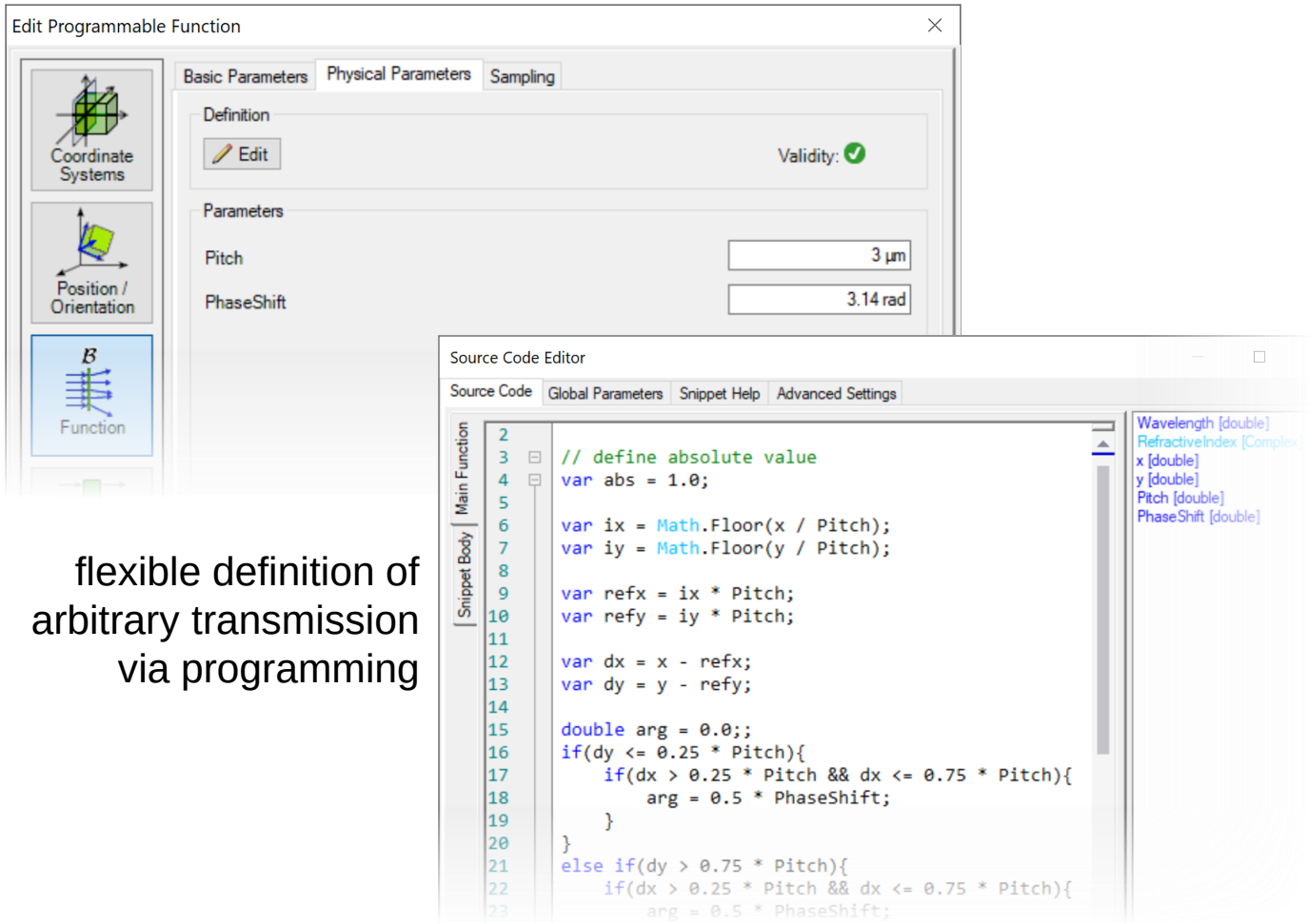






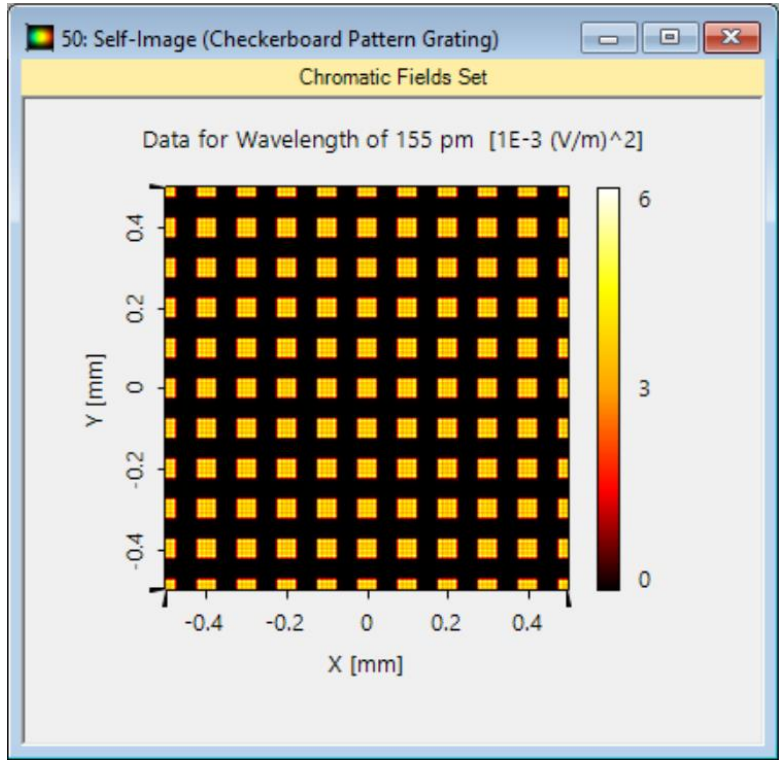
self-image

Peek into VirtualLab Fusion



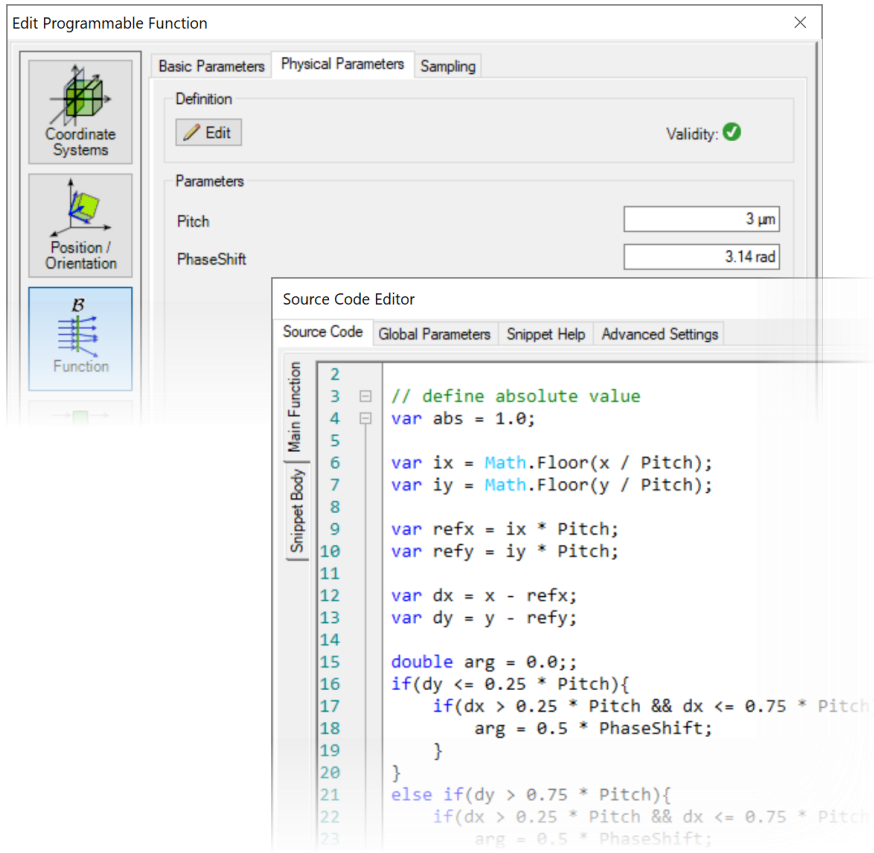
flexible definition of arbitrary transmission via programming

diffraction-included calculation and convenient result visualization

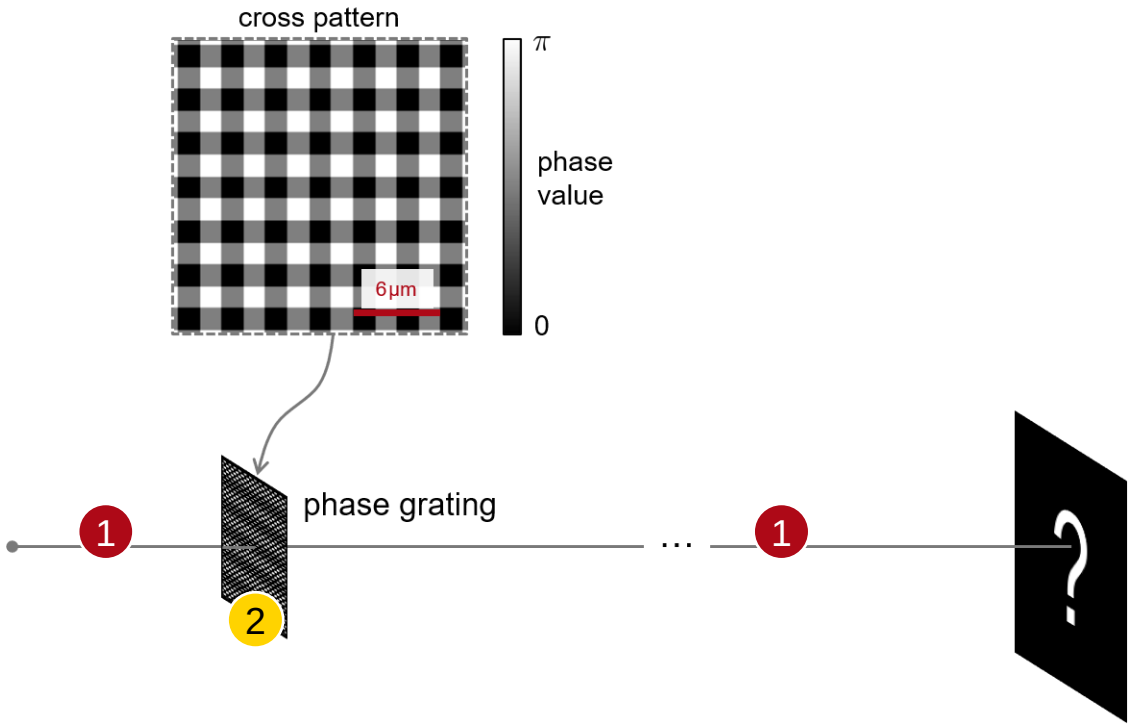


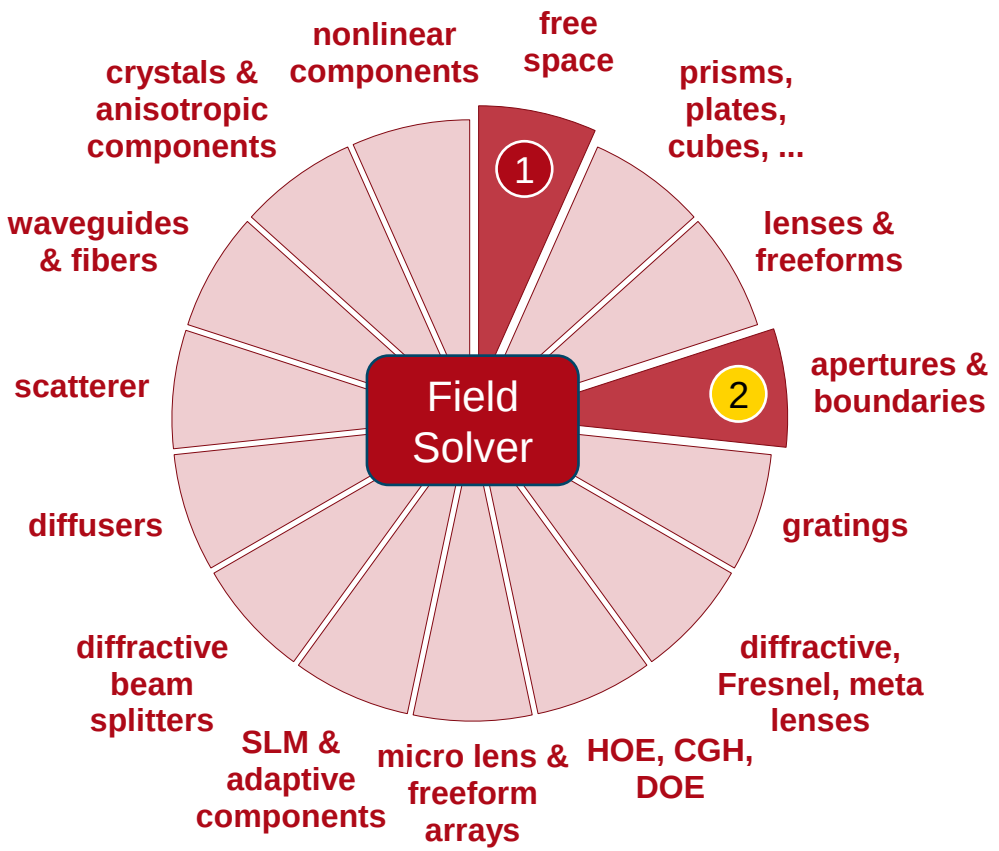
Workflow in VirtualLab Fusion

- Specify or customize transmission functions
  - How to Work with the Programmable Function & Example (Cylindrical Lens) [Use Case]
- Select proper detector for field visualization
  - Electromagnetic Field Detector [Use Case]
- Set the Fourier transforms properly
  - Fourier Transform Settings – Discussion at Examples [Use Case]



VirtualLab Fusion Technologies





Document Information

title	Single Grating Interferometer for X-Ray Imaging
document code	MISC.0079
version	2.0
edition	VirtualLab Fusion Basic
software version	2020.2 (Build 1.116)
category	Application Use Case
further reading	- Modeling of the Talbot Effect - Fourier Transform Settings – Discussion at Examples - Diffraction Patterns behind Different Apertures