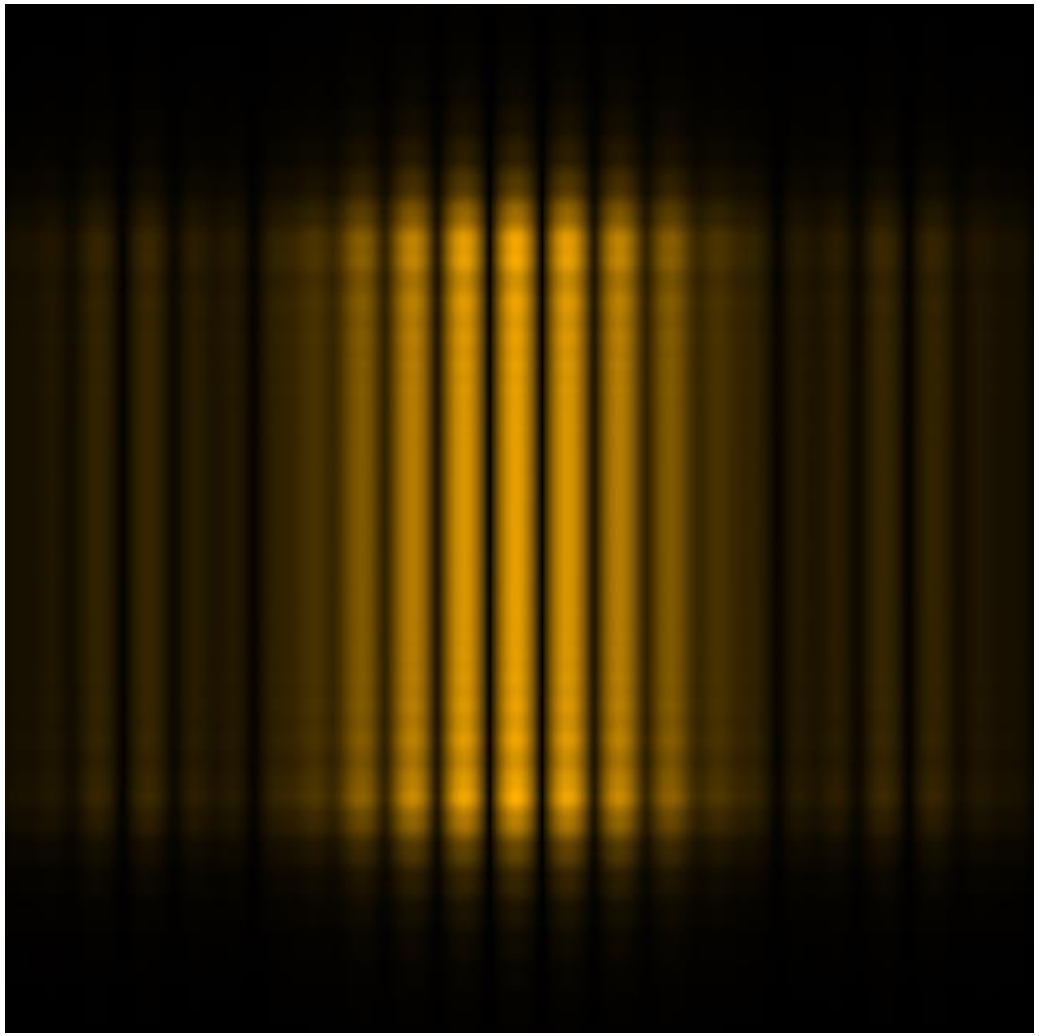
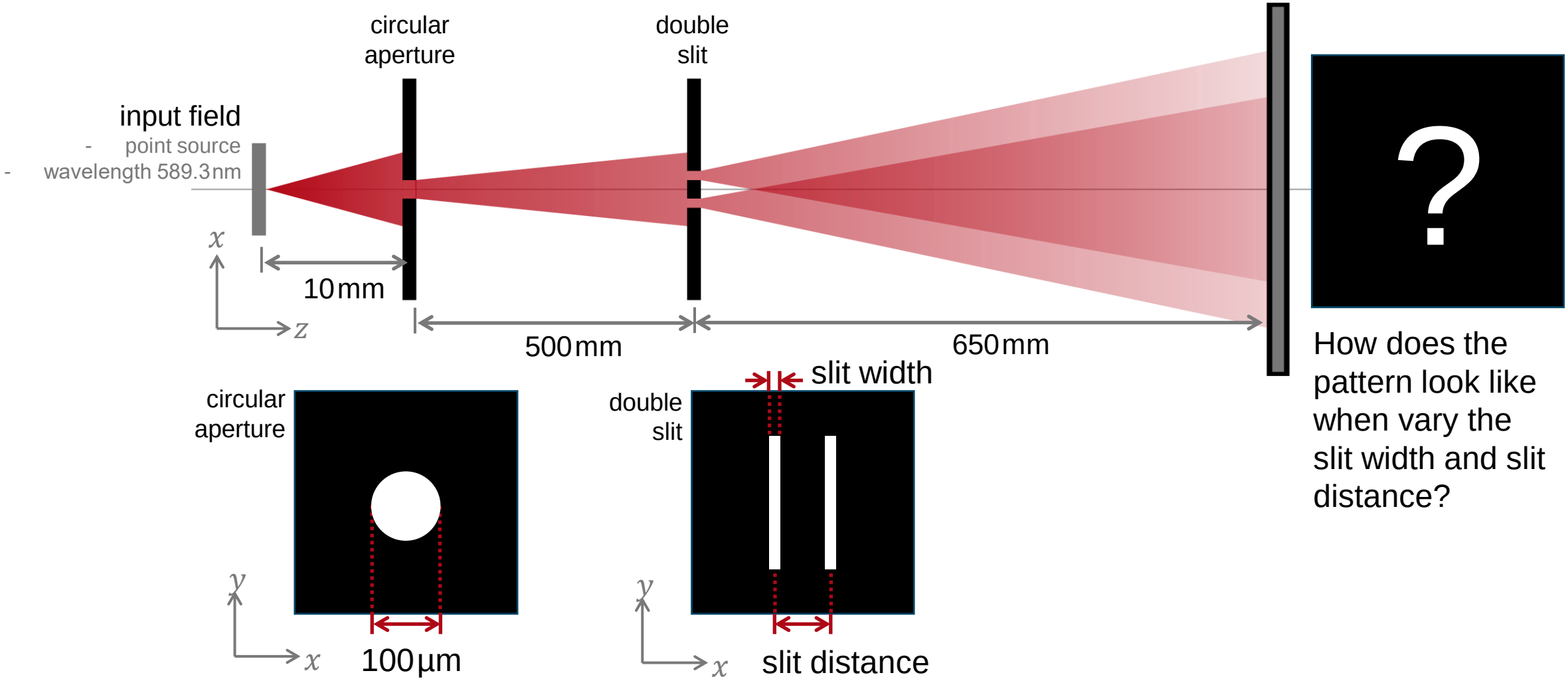
Young’s Interference Experiment

Abstract

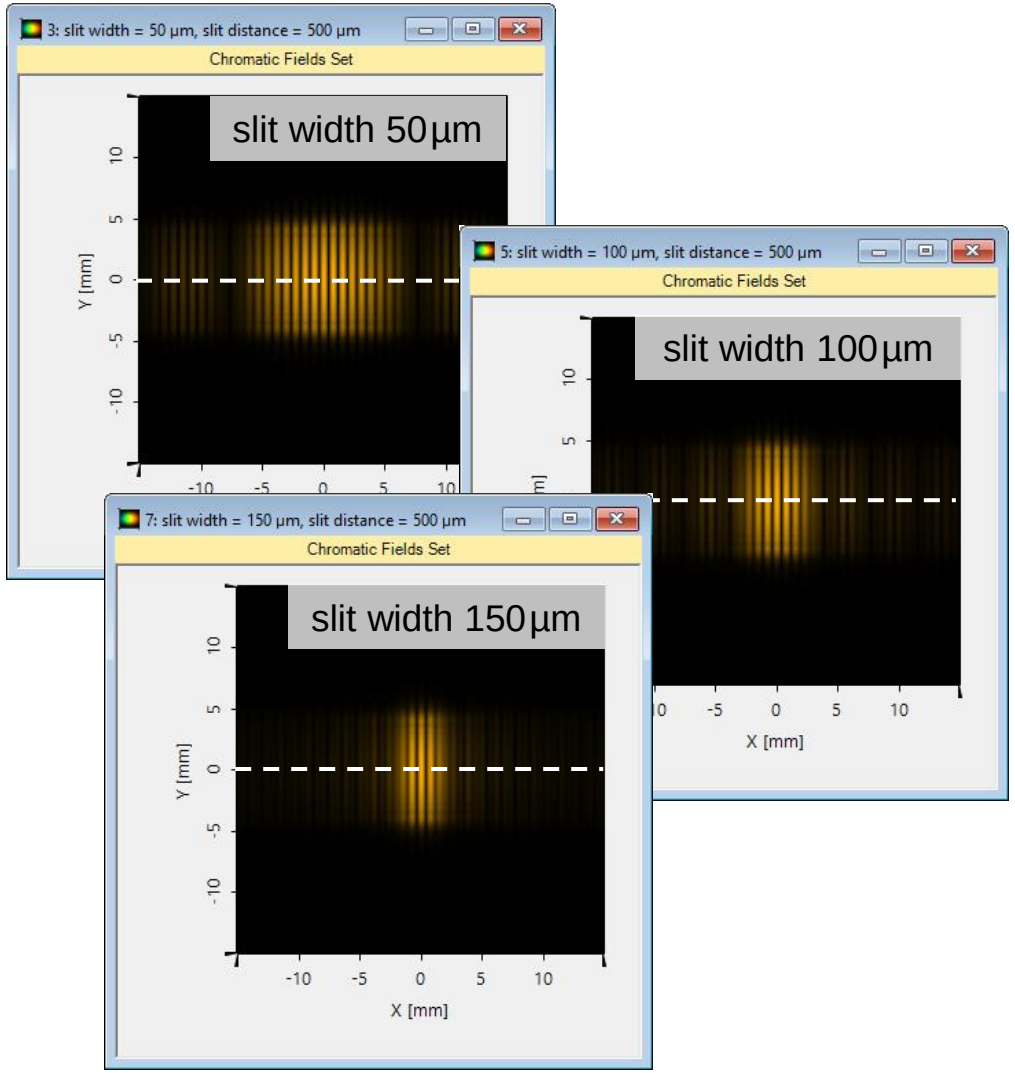


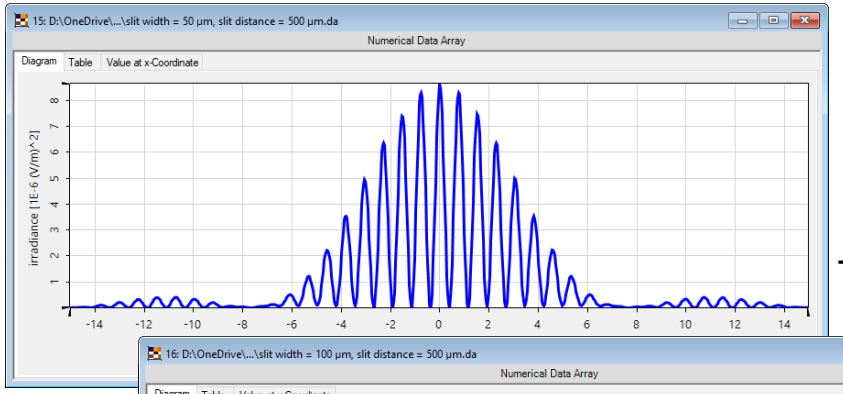
The Young’s interference experiment was one of the well-known experiments that shows the wave nature of light. It is the fundamental of several quantum optics experiments nowadays. We reproduce this famous experiment in VirtualLab Fusion, by using a double slit with adjustable slit width and slit distance. With a single point source, we examine the influence from the slit width and the slit distance on the interference; then with an extended source we observe how the interference contrast changes with the lateral extension of the source.

Modeling Task – Single on-Axis Point Source

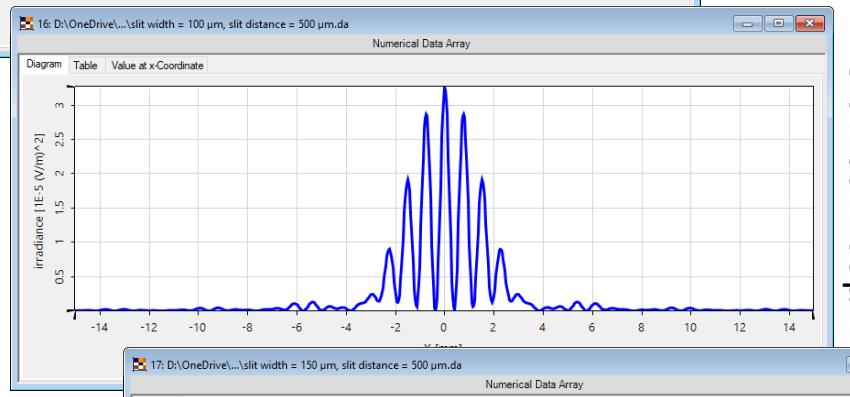


Fix Slit Distance (500 µm) and Vary Slit Width

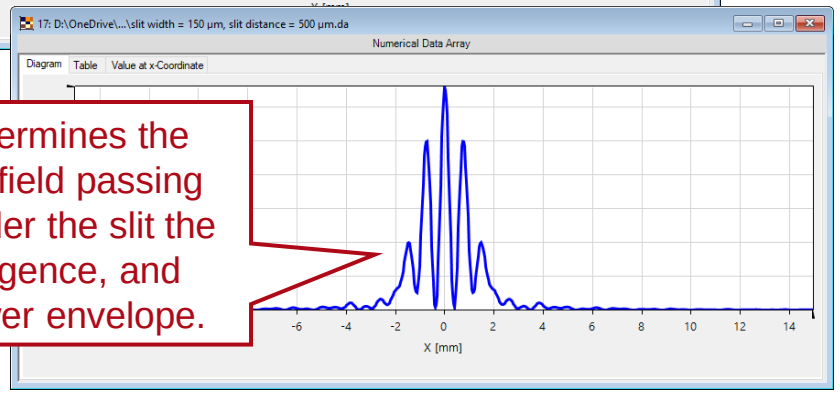




slit width 50 µm



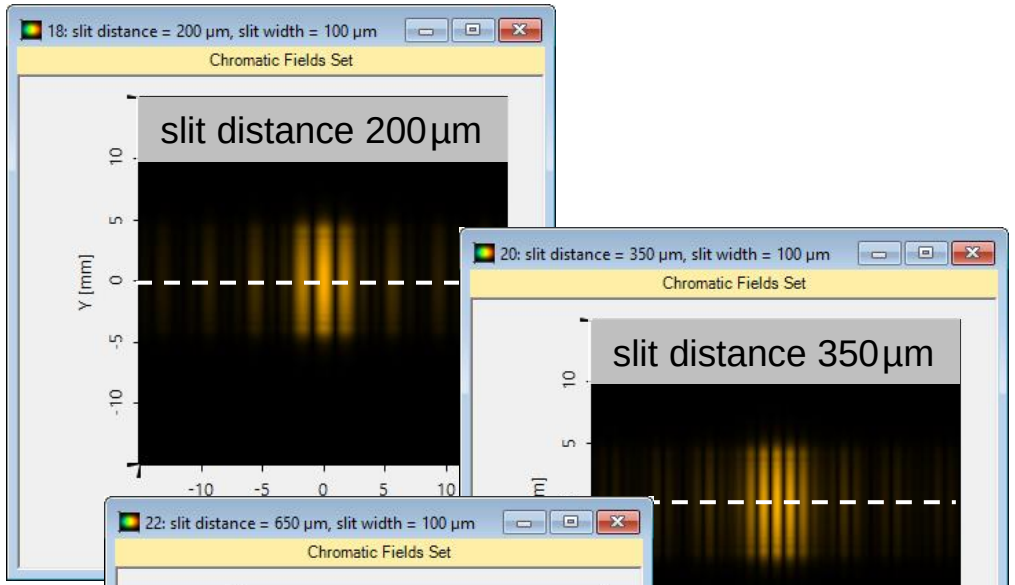
slit width 100 µm

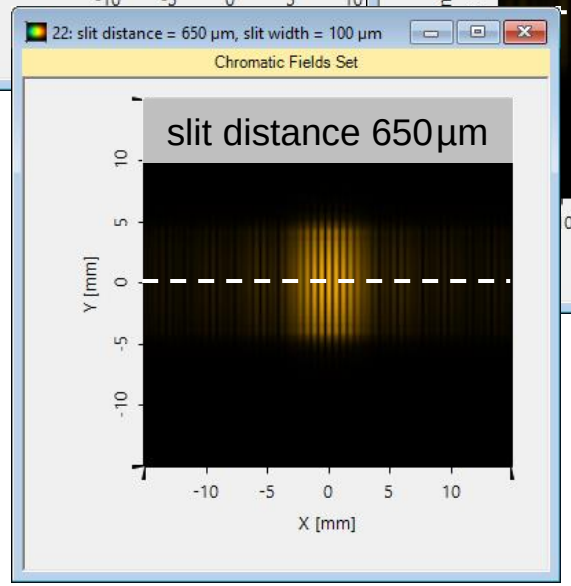


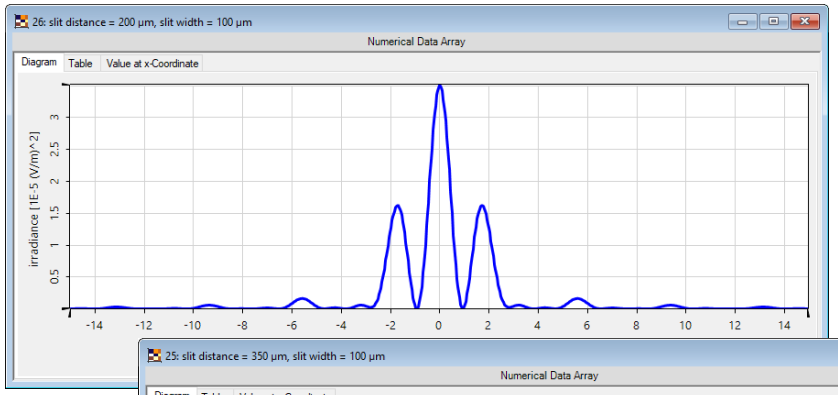
slit width 150 µm

The slit width determines the divergence of the field passing through it – the wider the slit the smaller the divergence, and therefore a narrower envelope.

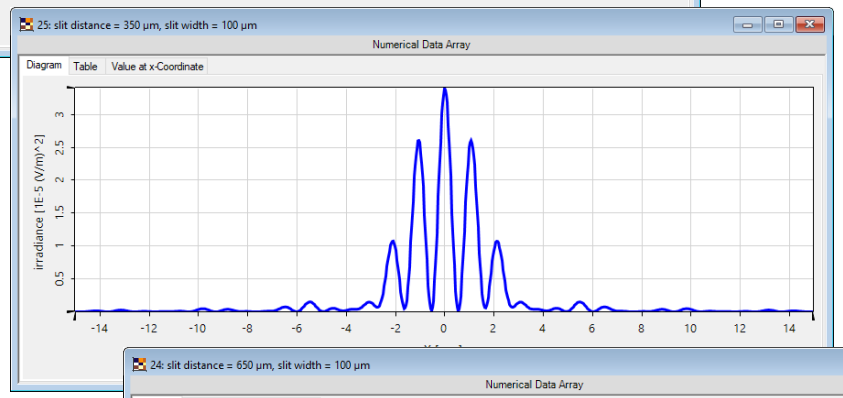
Fix Slit Width (100 µm) and Vary Slit Distance



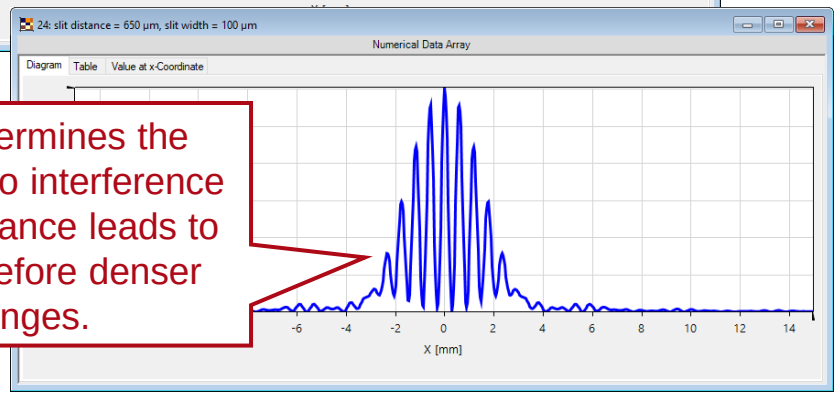




slit distance 200 µm



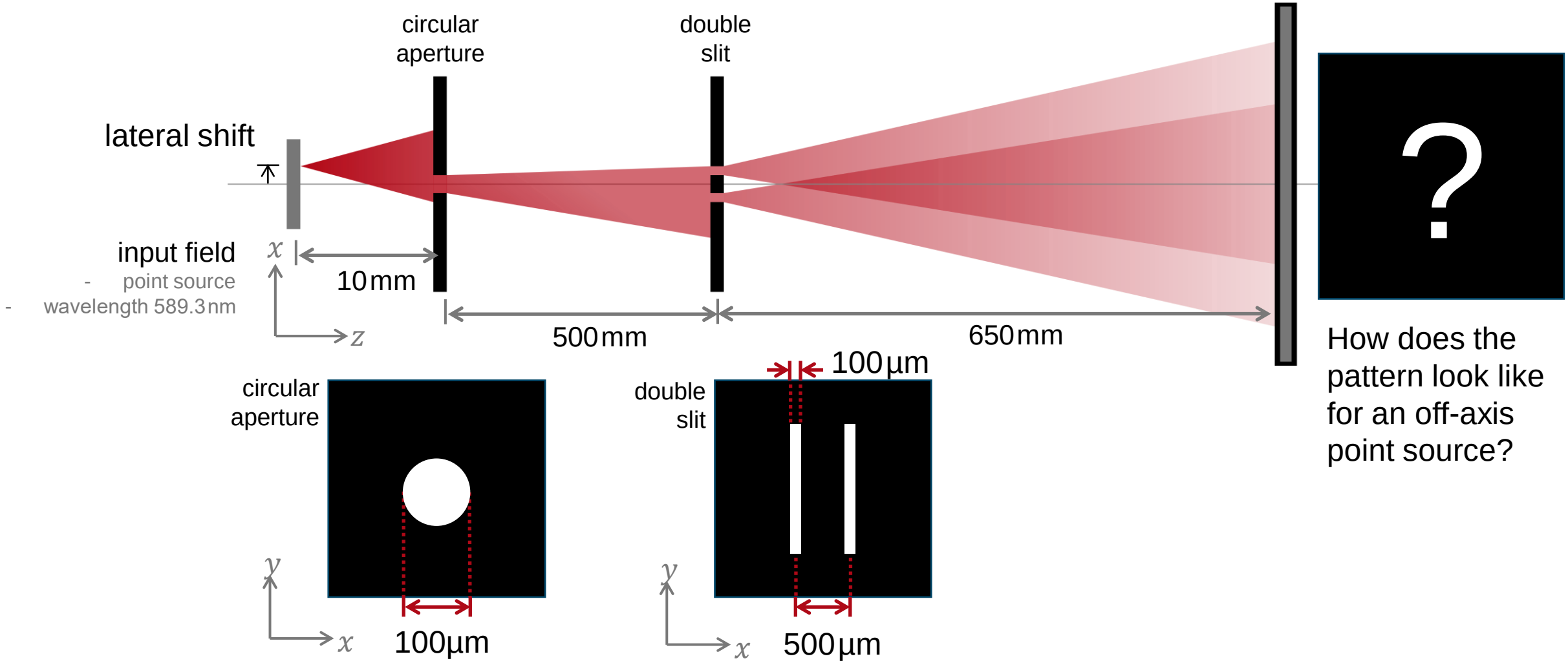
slit distance 350 µm



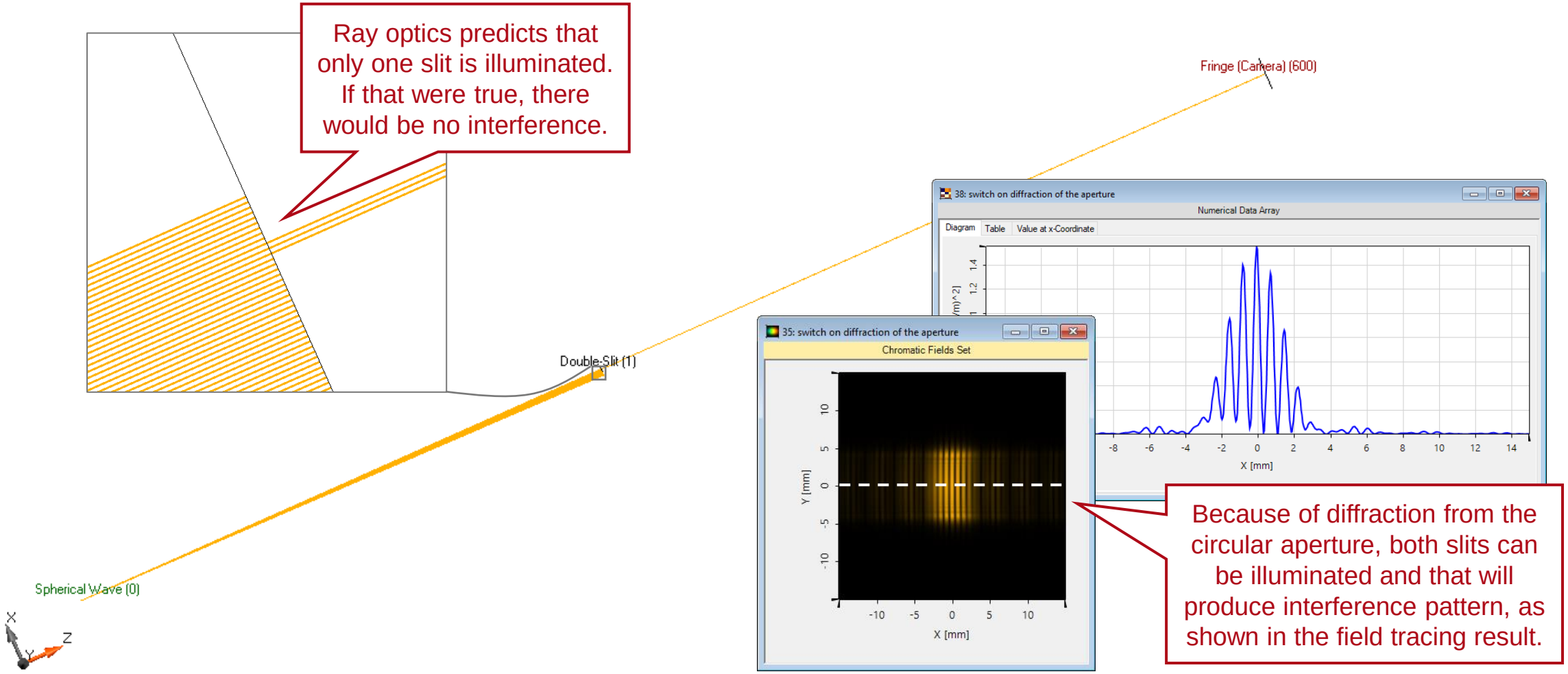
slit distance 650 µm

The slit distance determines the angles between the two interference beams. Larger slit distance leads to larger angle and therefore denser interference fringes.

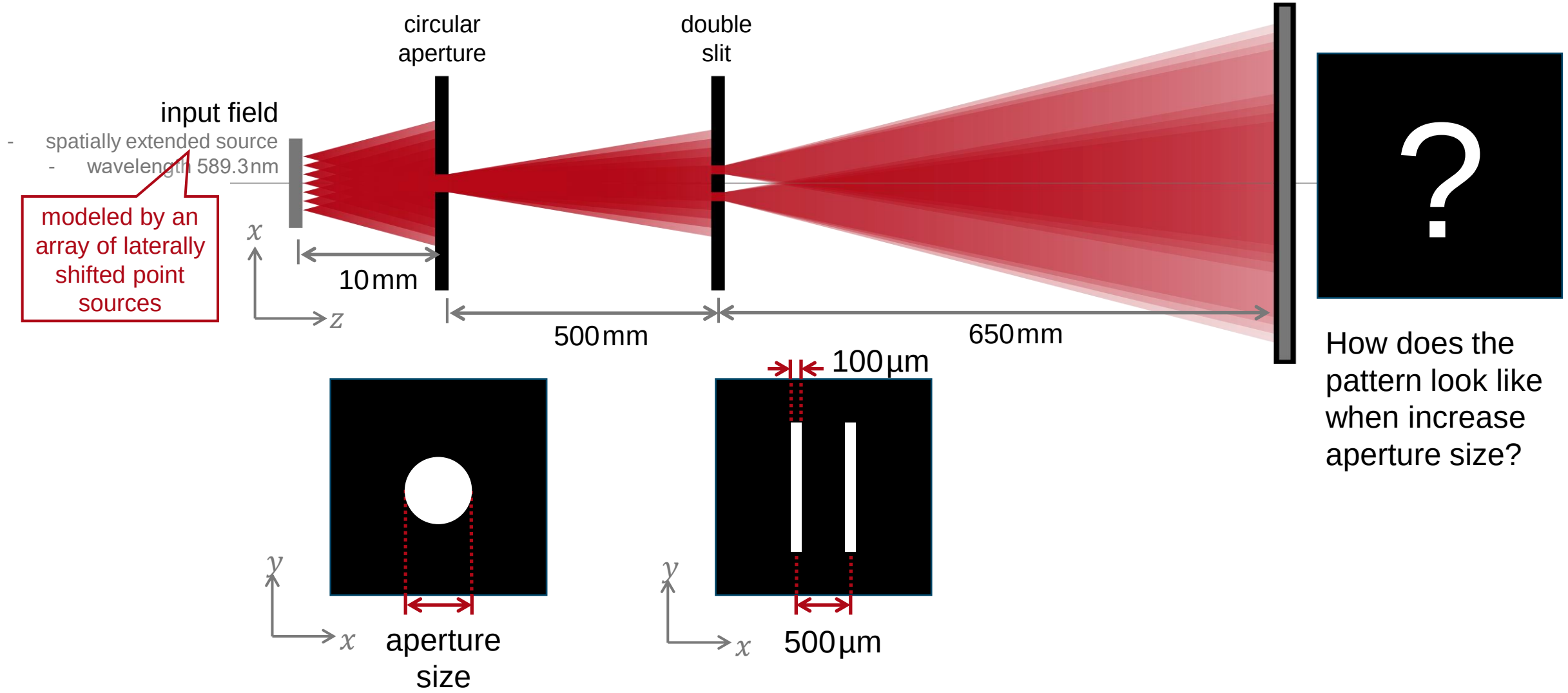
Modeling Task – Single off-Axis Point Source



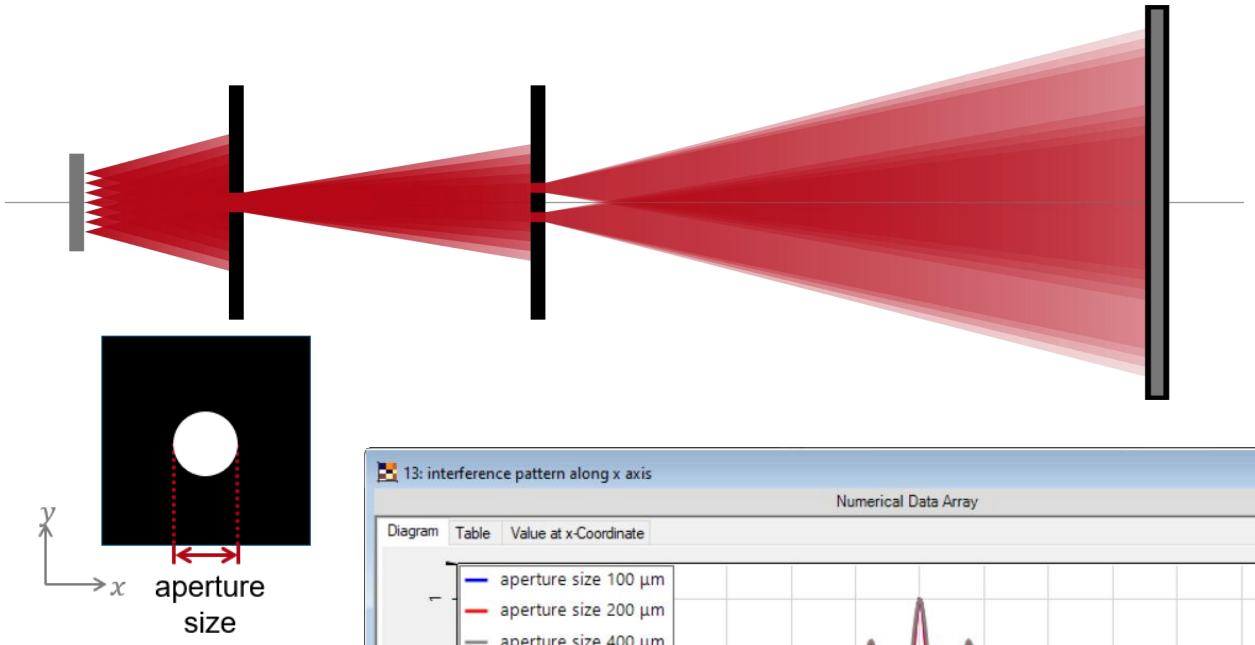
Result for an Off-Axis Point Source (Lateral Shift X 60 µm)

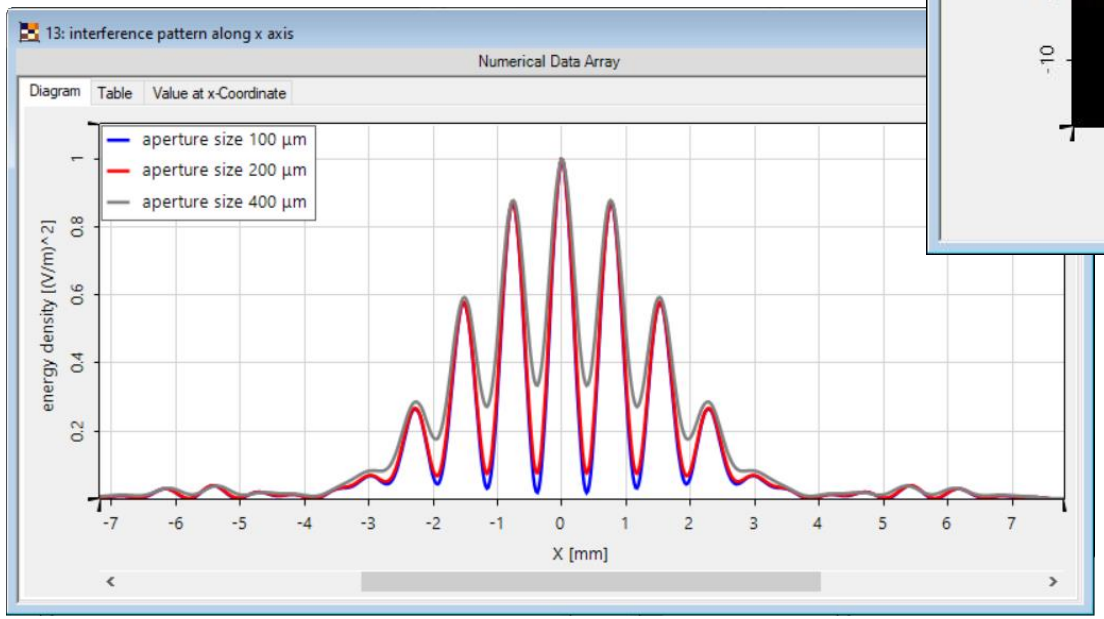


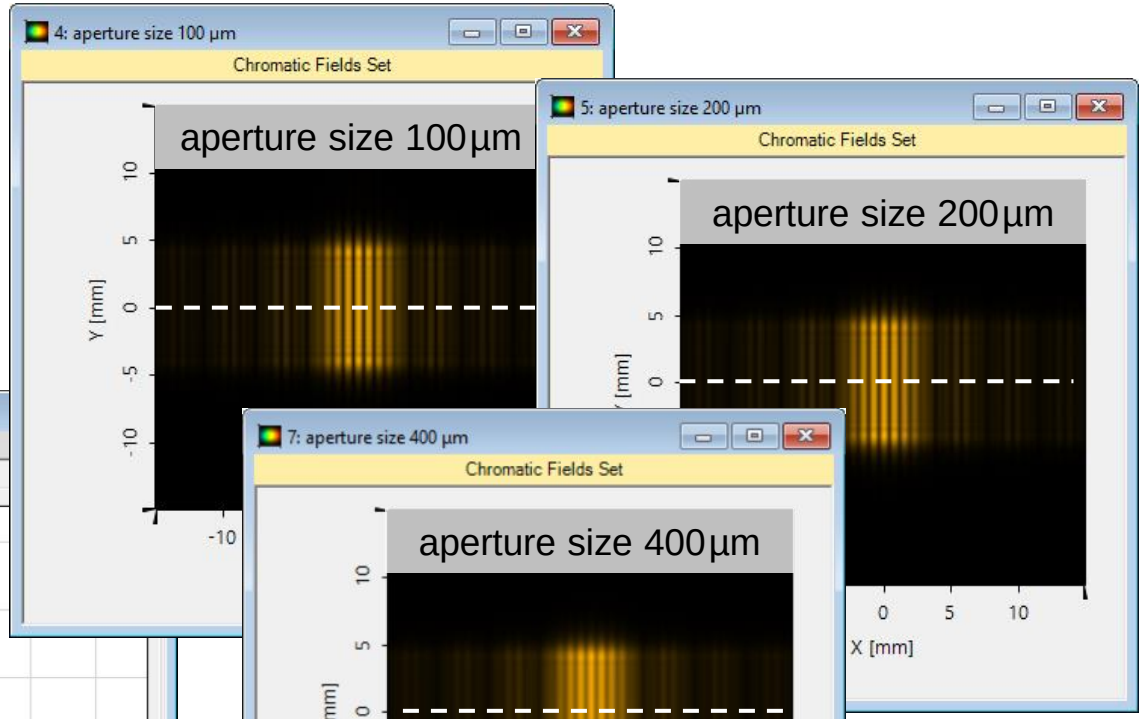
Modeling Task – Extended Source

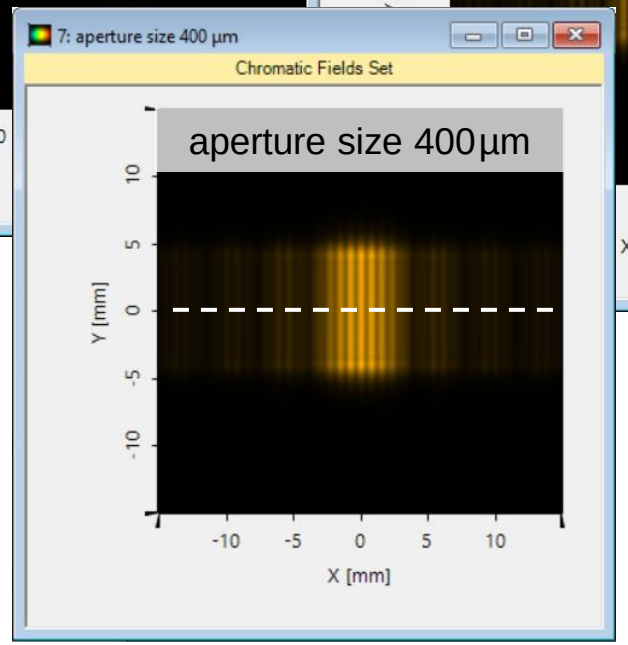


Interference with Extended Source



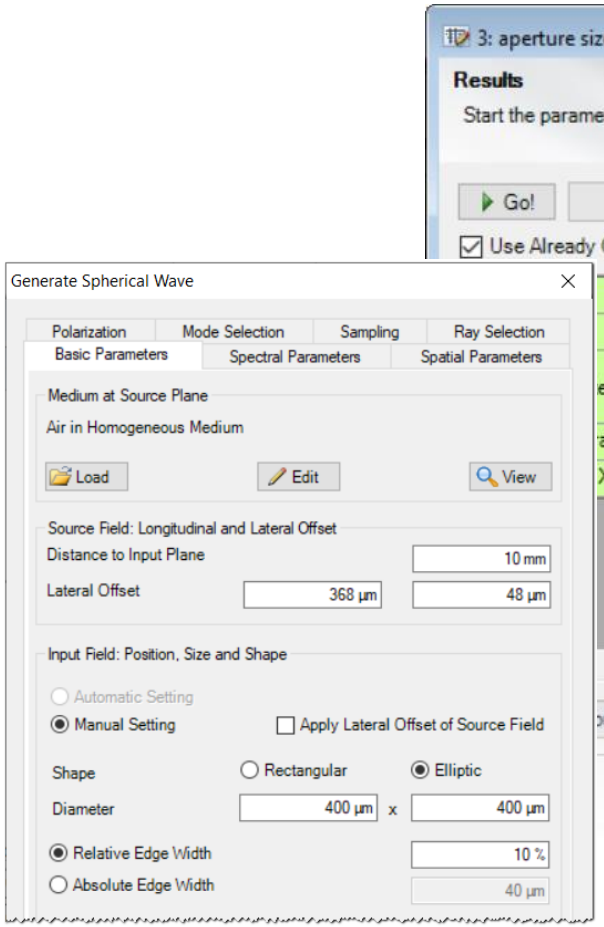




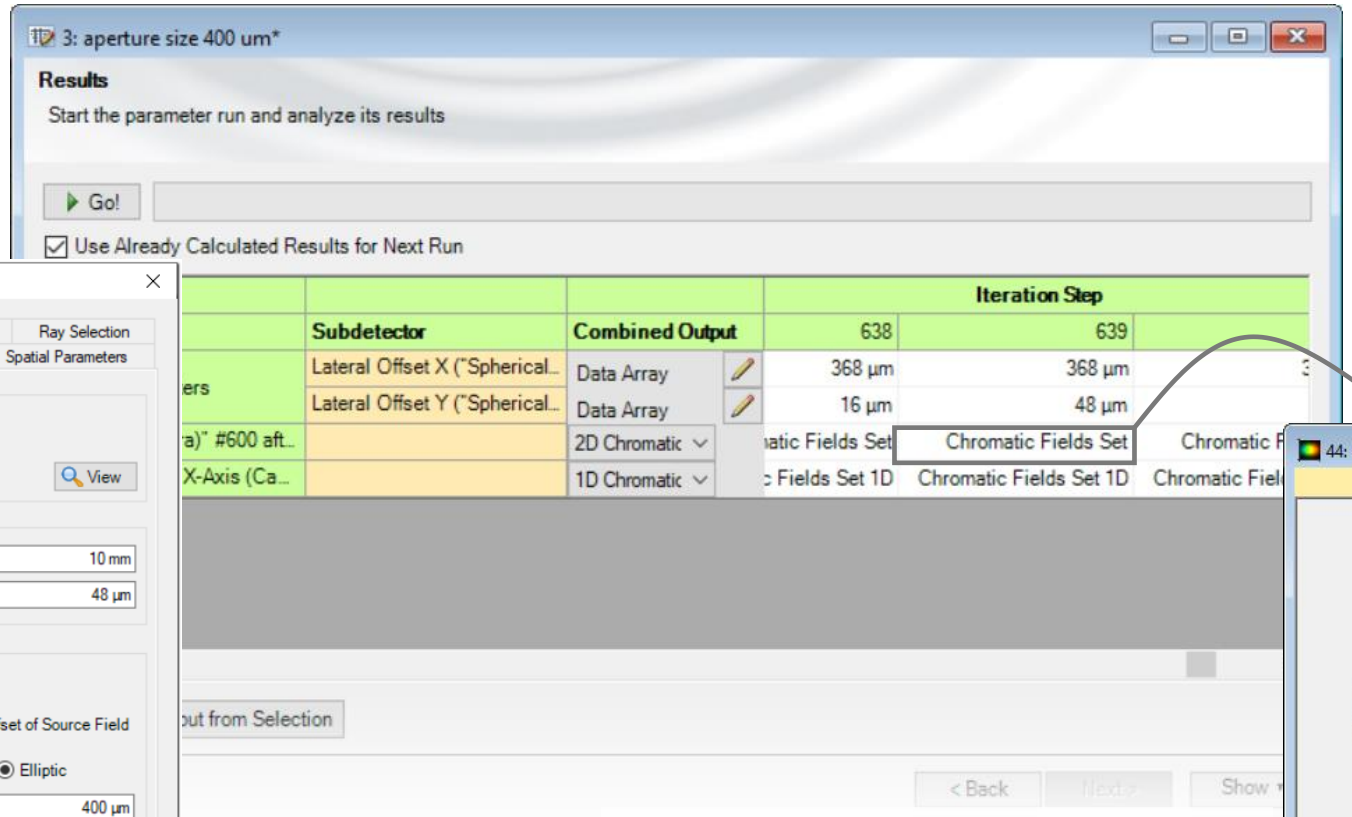


The interference contrast decreases when aperture size increases.

Peek into VirtualLab Fusion

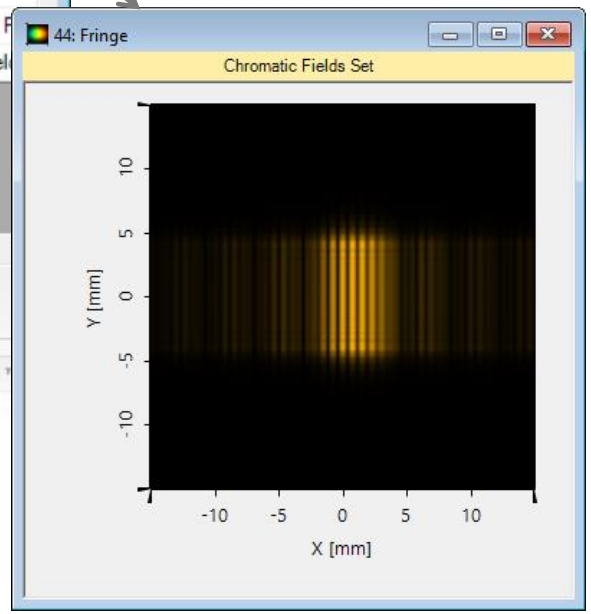


convenient settings for point source



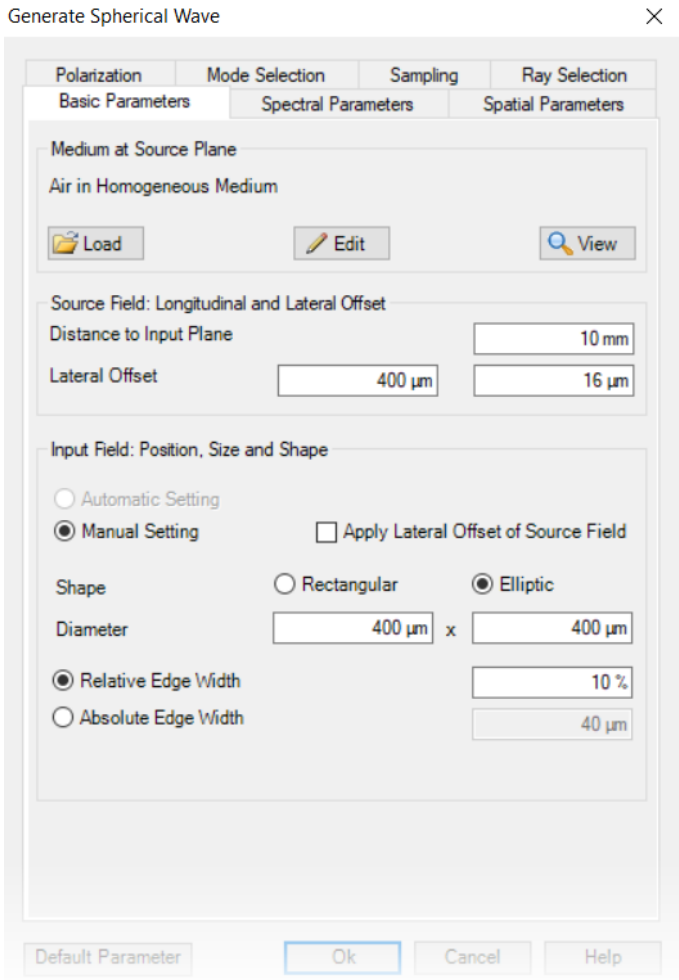
Parameter Run for different off-axis point source

result pattern

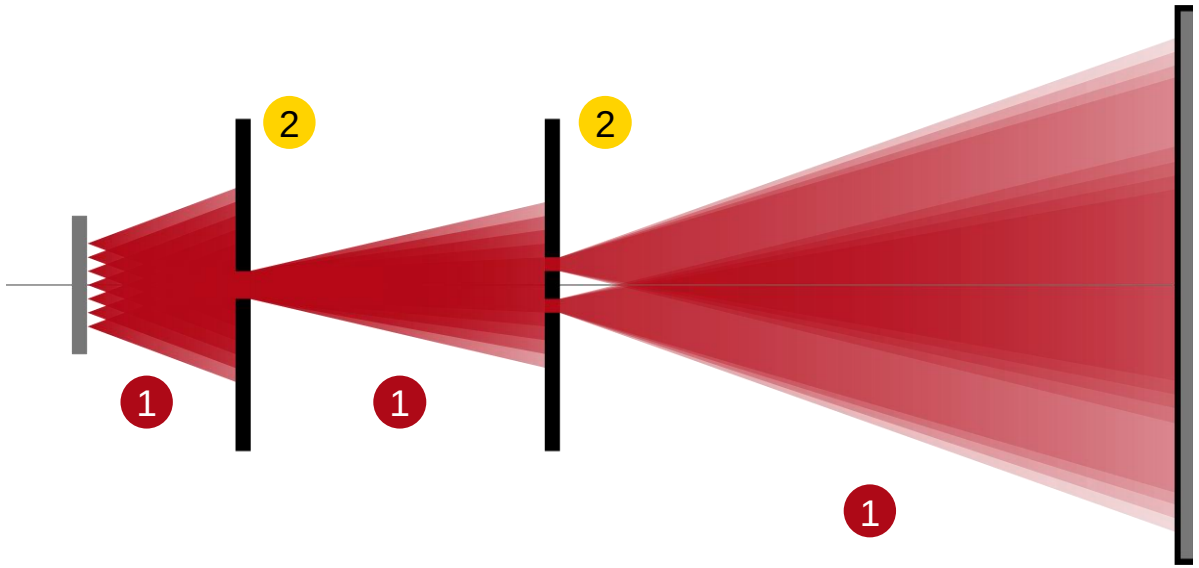


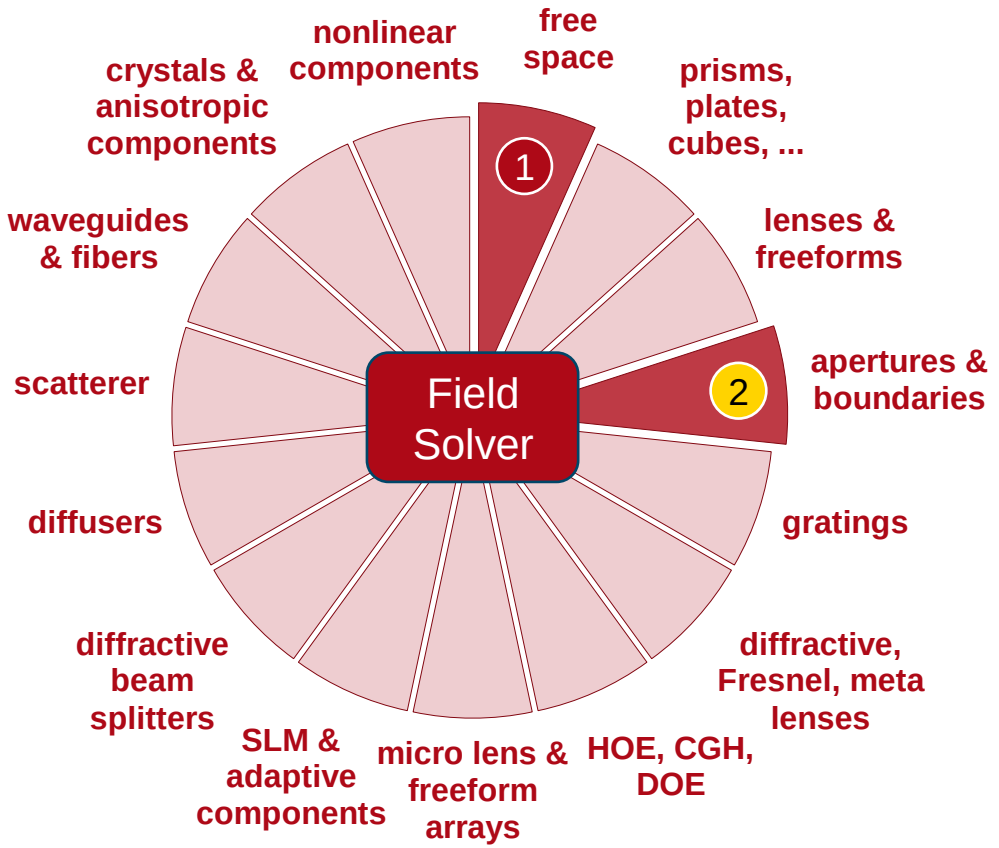
Workflow in VirtualLab Fusion

- Programming a double-slit function
  - Programming a Double-Slit Function [Use Case]
- Check influence from different parameters with Parameter Run
  - Usage of the Parameter Run Document [Use Case]
  - Scanning Mode of Parameter Run [Use Case]
- Model partially coherent source by shifted elementary-field method



VirtualLab Fusion Technologies





Document Information

title	Young’s Interference Experiment
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category	Application Use Case
further reading	- White-Light Michelson Interferometer - Mach-Zehnder Interferometer