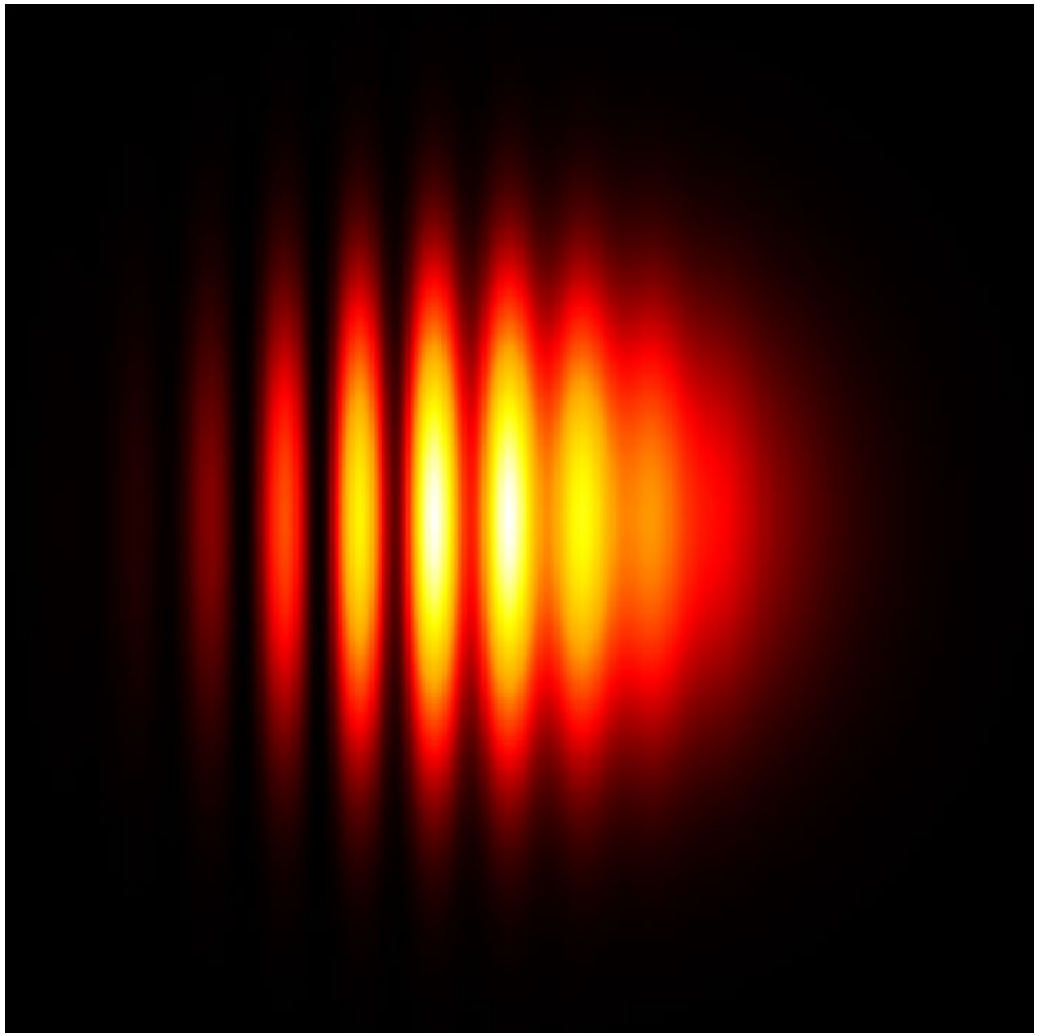
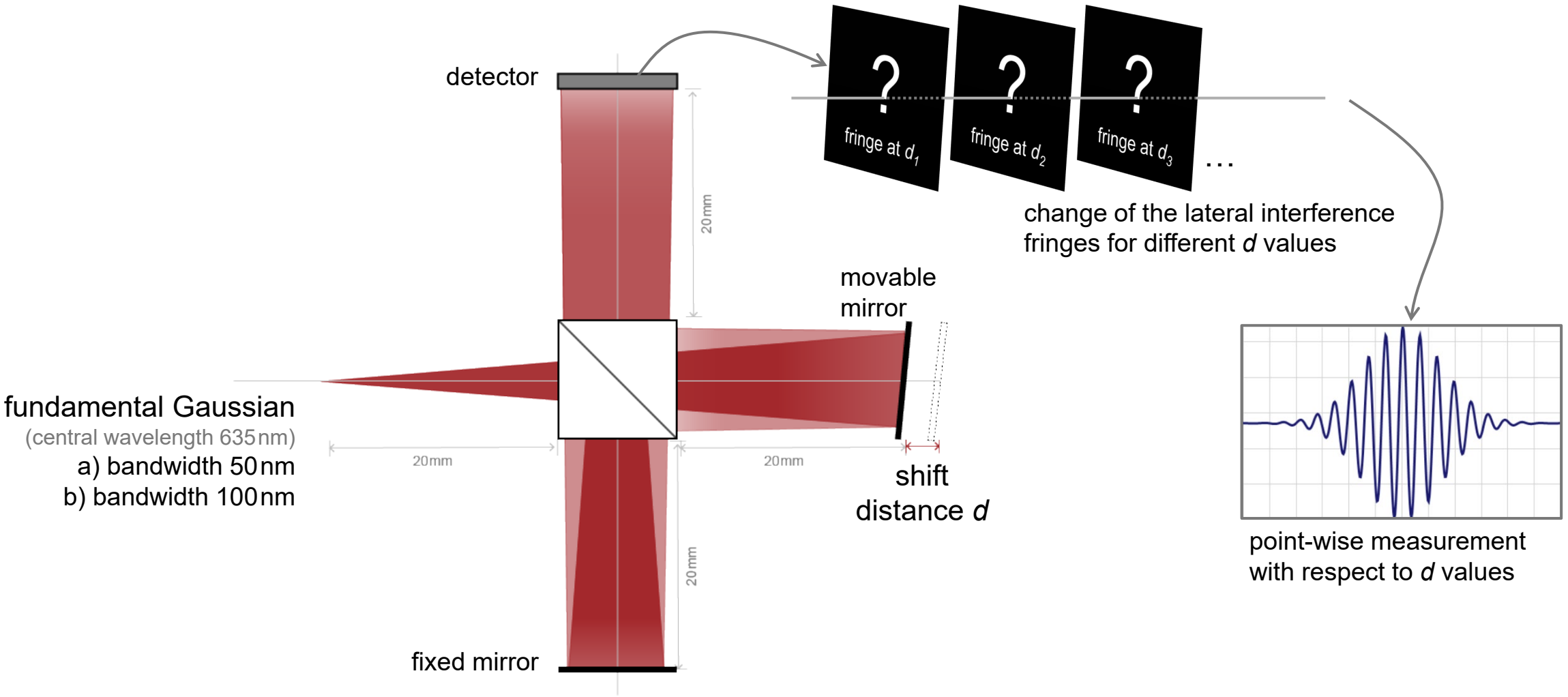
Coherence Measurement Using Michelson Interferometer and Fourier Transform Spectroscopy

Abstract

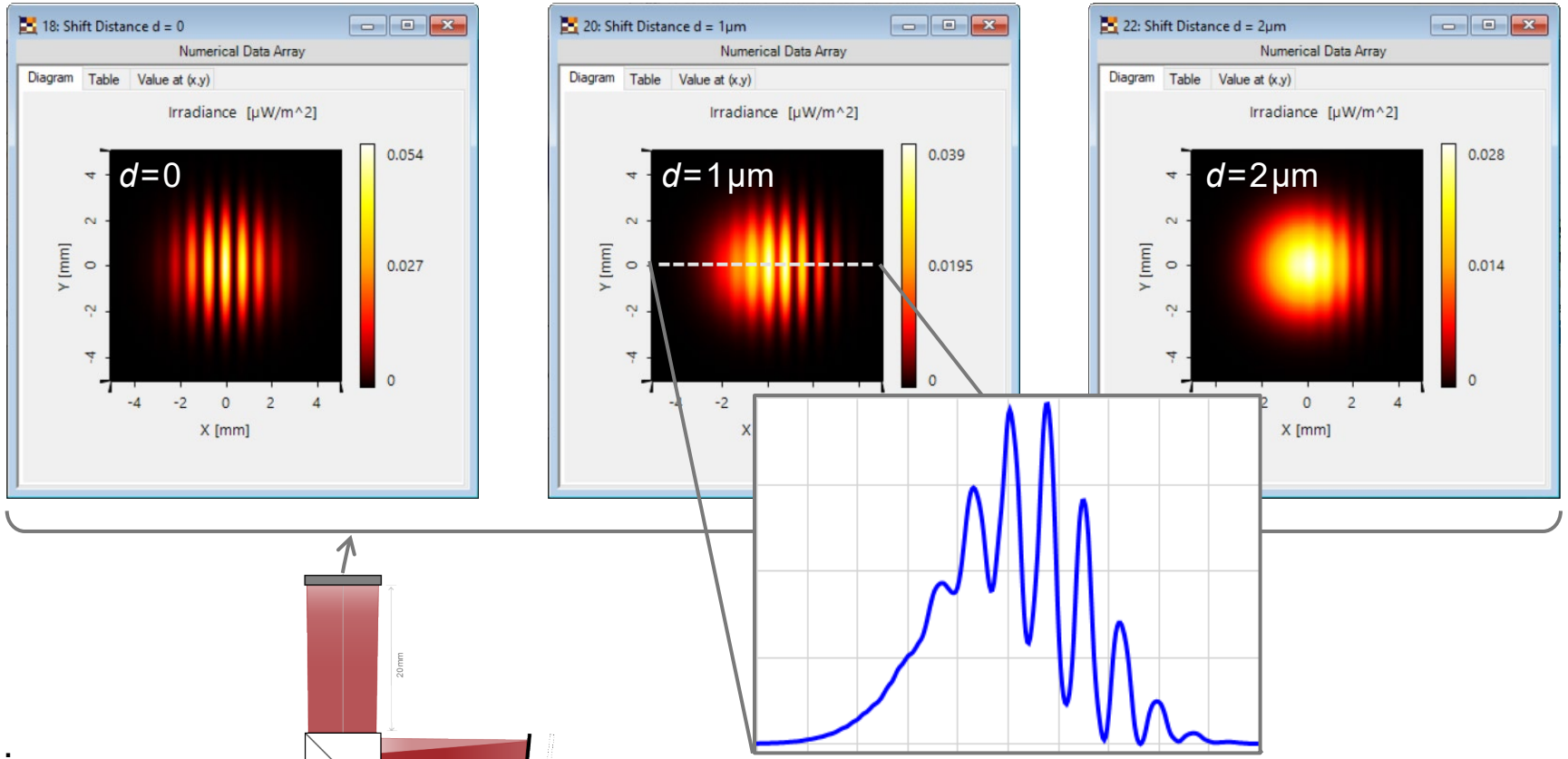


It is known that in an interferometer the fringe contrast may depend on the coherent property of light sources. For example, in a Michelson interferometer with a source of certain bandwidth, the interference fringe contrast varies with different the optical path difference. By measuring the interferogram contrast at different positions of the movable mirror, the coherence length of the source can be concluded. Typical Fourier-transform spectroscopy is usually based on such type of optical setup.

Modeling Task



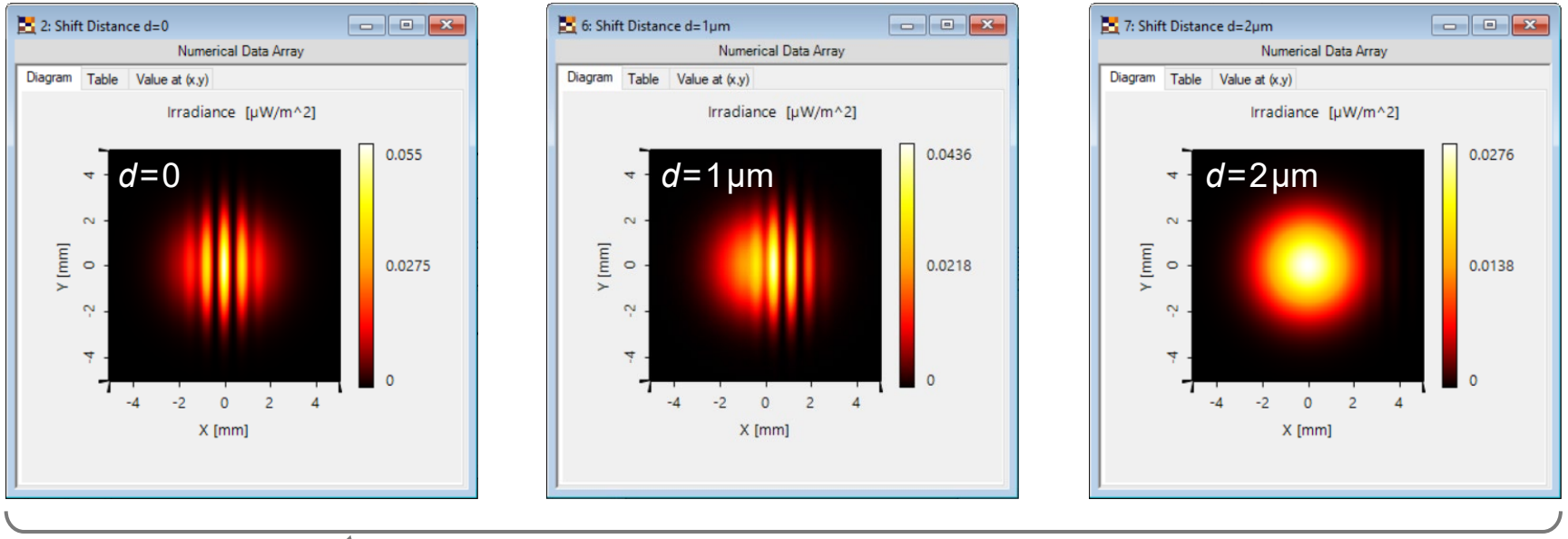
Lateral Interference Fringes – 50 nm Bandwidth



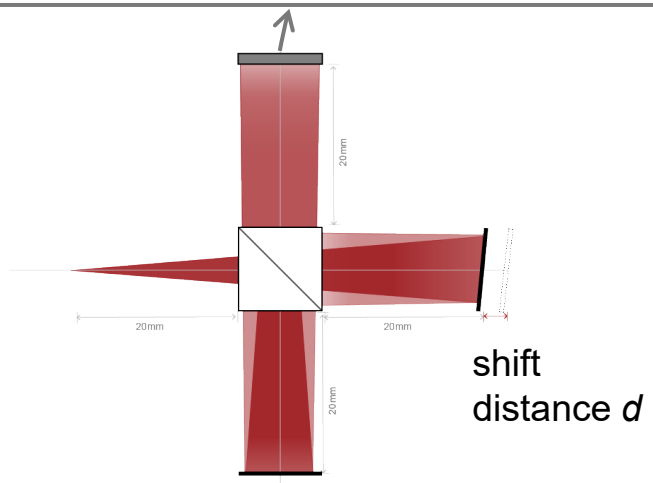
fundamental Gaussian
(central wavelength 635 nm)
a) bandwidth 50 nm

shift
distance *d*

Lateral Interference Fringes – 100 nm Bandwidth



fundamental Gaussian
(central wavelength 635 nm)
b) bandwidth: 100 nm

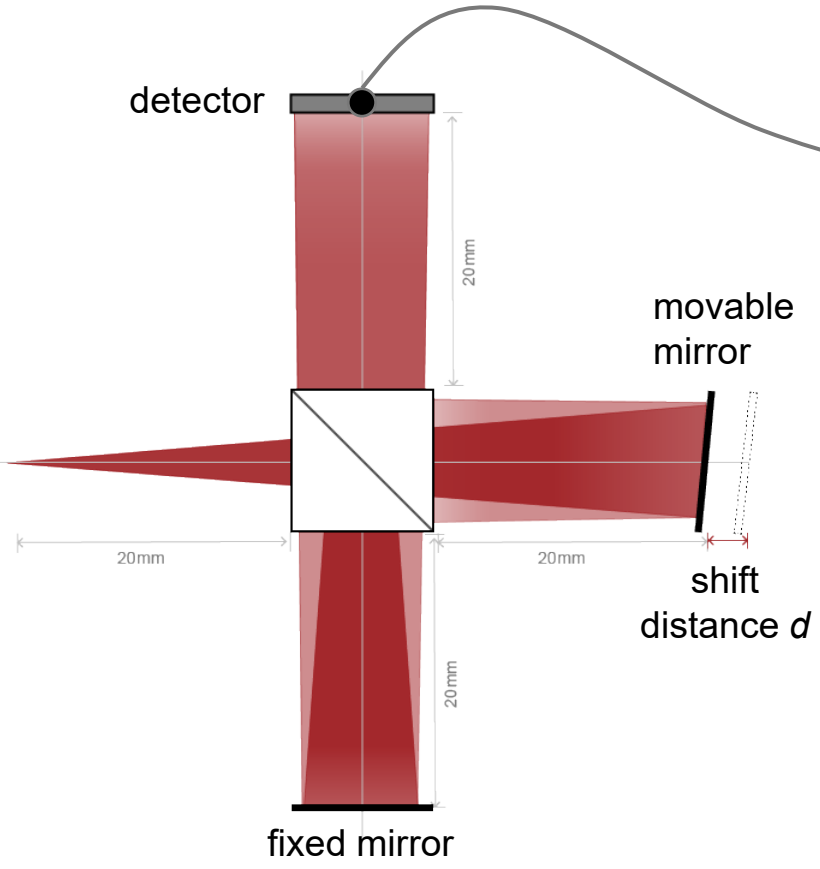


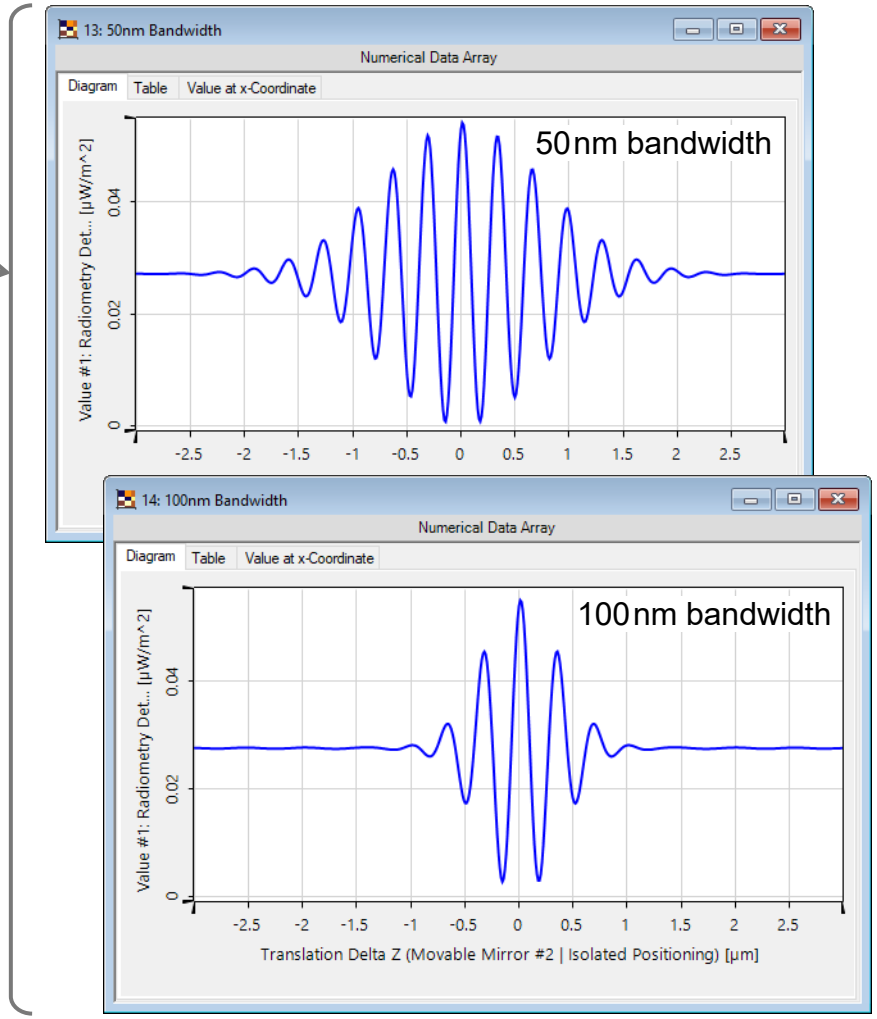
shift
distance *d*

Broader spectral bandwidth leads to shorter coherent length; and therefore the interference fringe starts to vanish sooner in comparison to the case with narrower bandwidth.

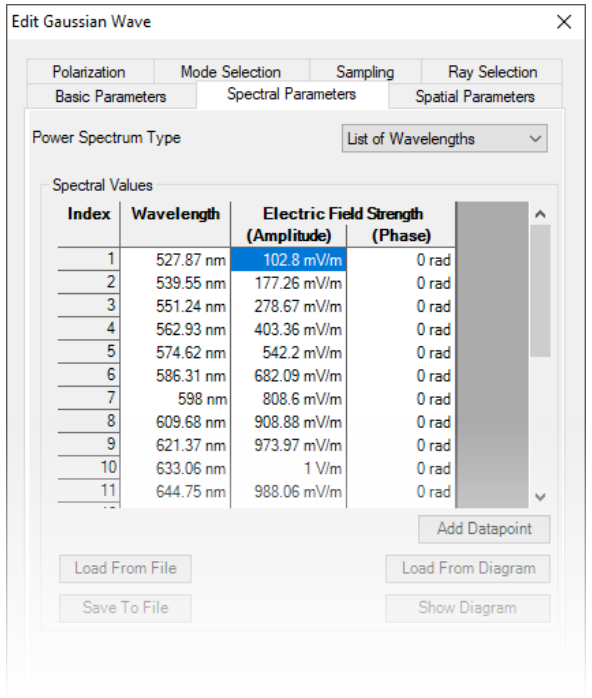
Pointwise Measurement

fundamental Gaussian
(central wavelength 635 nm)
a) bandwidth 50 nm
b) bandwidth 100 nm

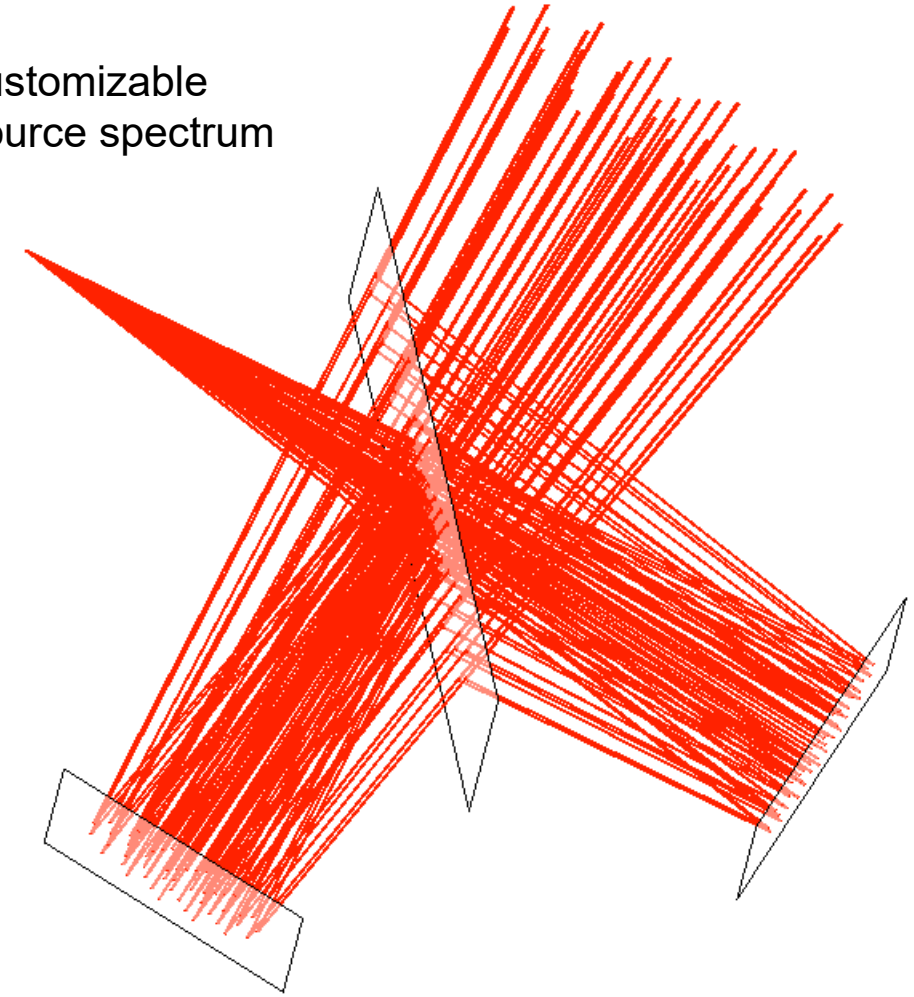


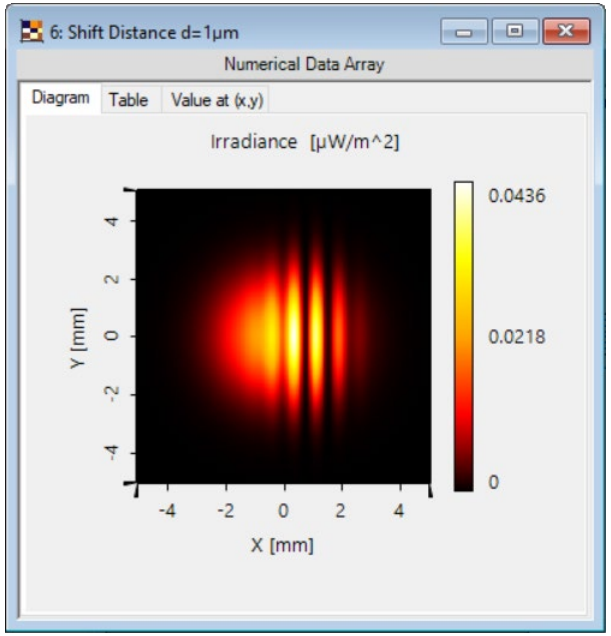


Peek into VirtualLab



customizable
source spectrum

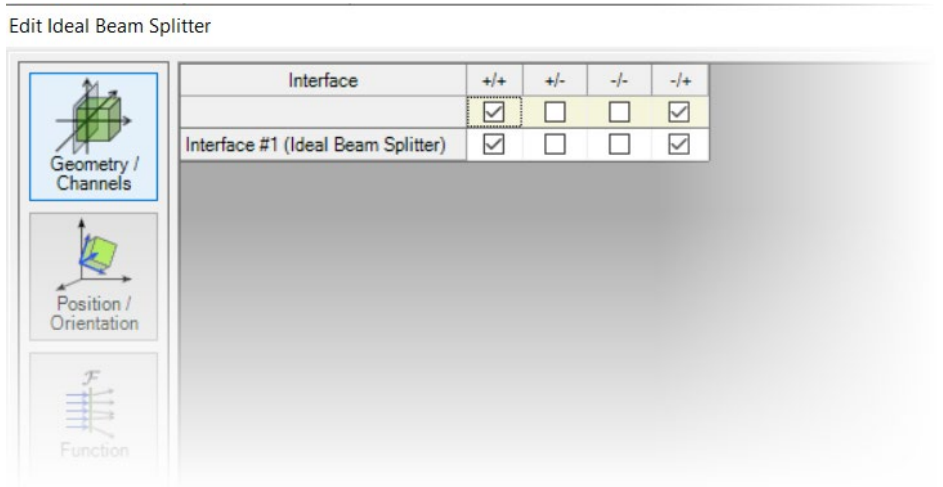




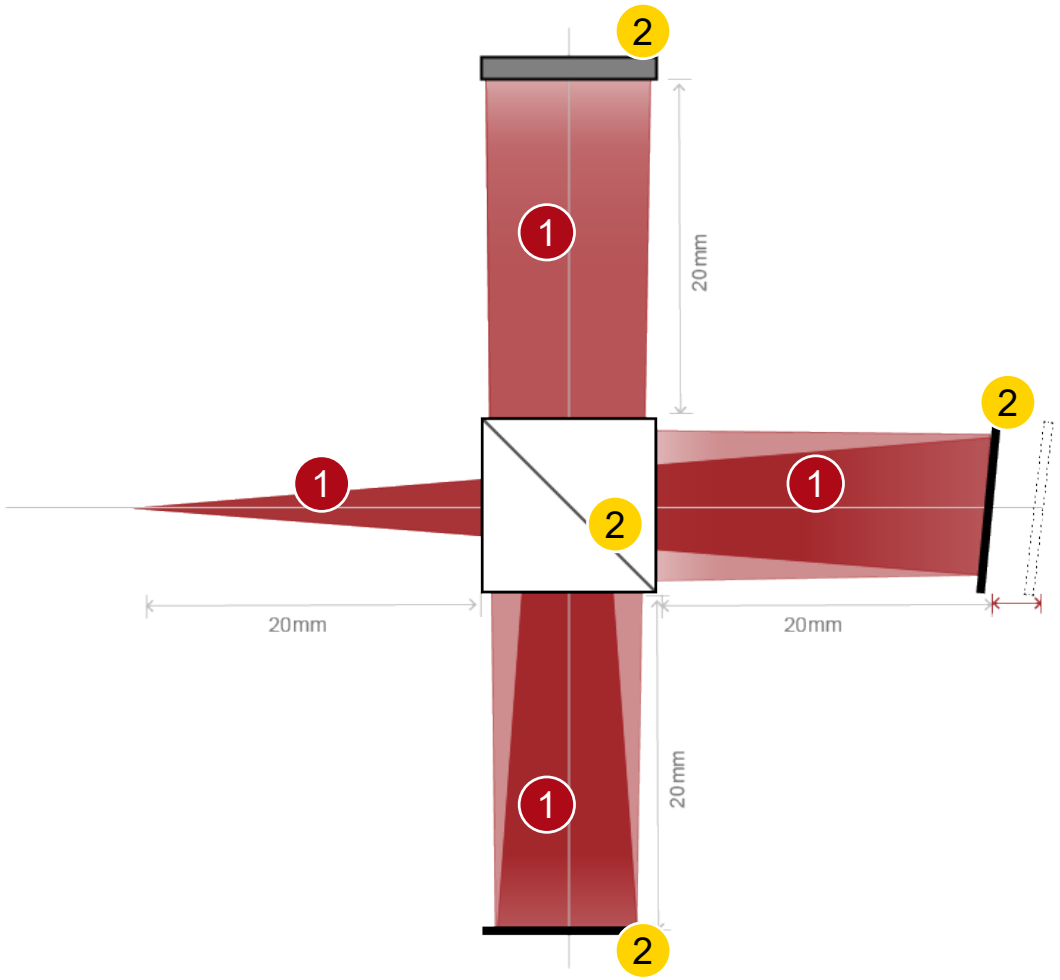
detector with coherence
property taken into account

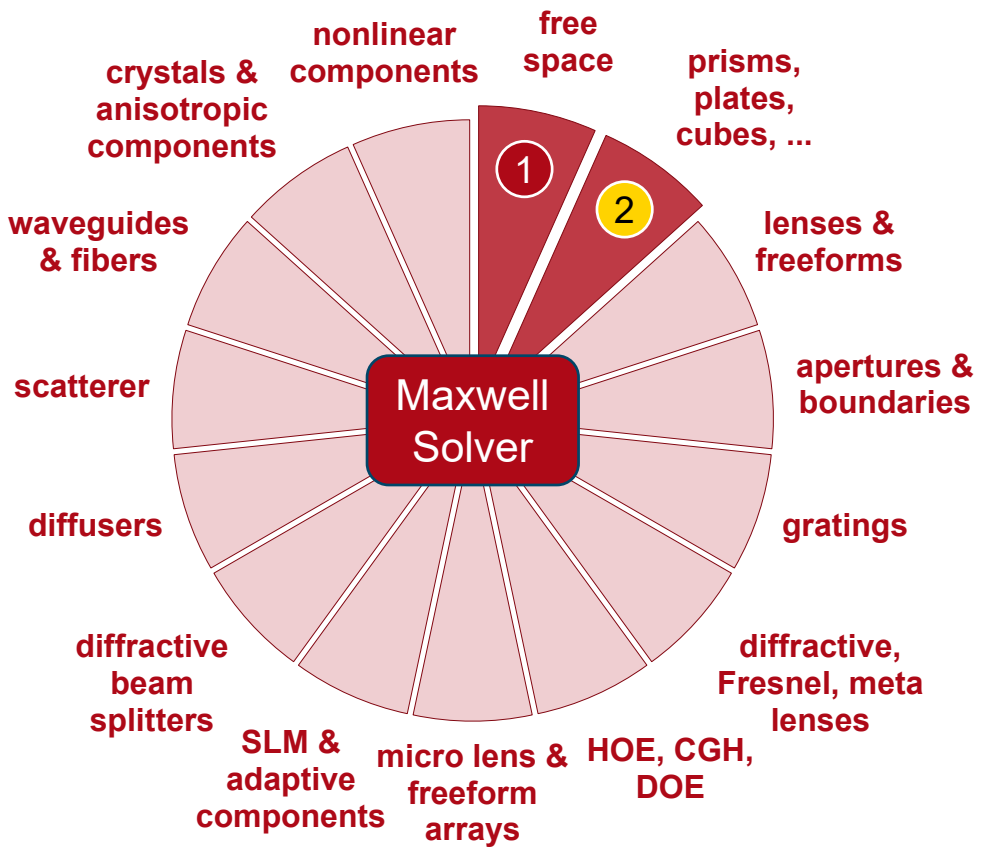
Workflow in VirtualLab

- Set up input Gaussian field
  - Basic Source Models
- Set the position and orientation of components
  - LPD II: Position and Orientation
- Set the non-sequential channels of components
  - Channel Setting for Non-Sequential Tracing



VirtualLab Technologies





idealized component

Document Information

title	Coherence Measurement and Fourier Transform Spectroscopy
document code	IFO.0002
version	1.0
toolbox(es)	Starter Toolbox (Non-Sequential Extension)
VL version used for simulations	7.4.0.49
category	Application Use Case
further reading	- Laser-Based Michelson Interferometer and Interference Fringe Exploration - Mach-Zehnder Interferometer - Fizeau Interferometer for Optical Testing