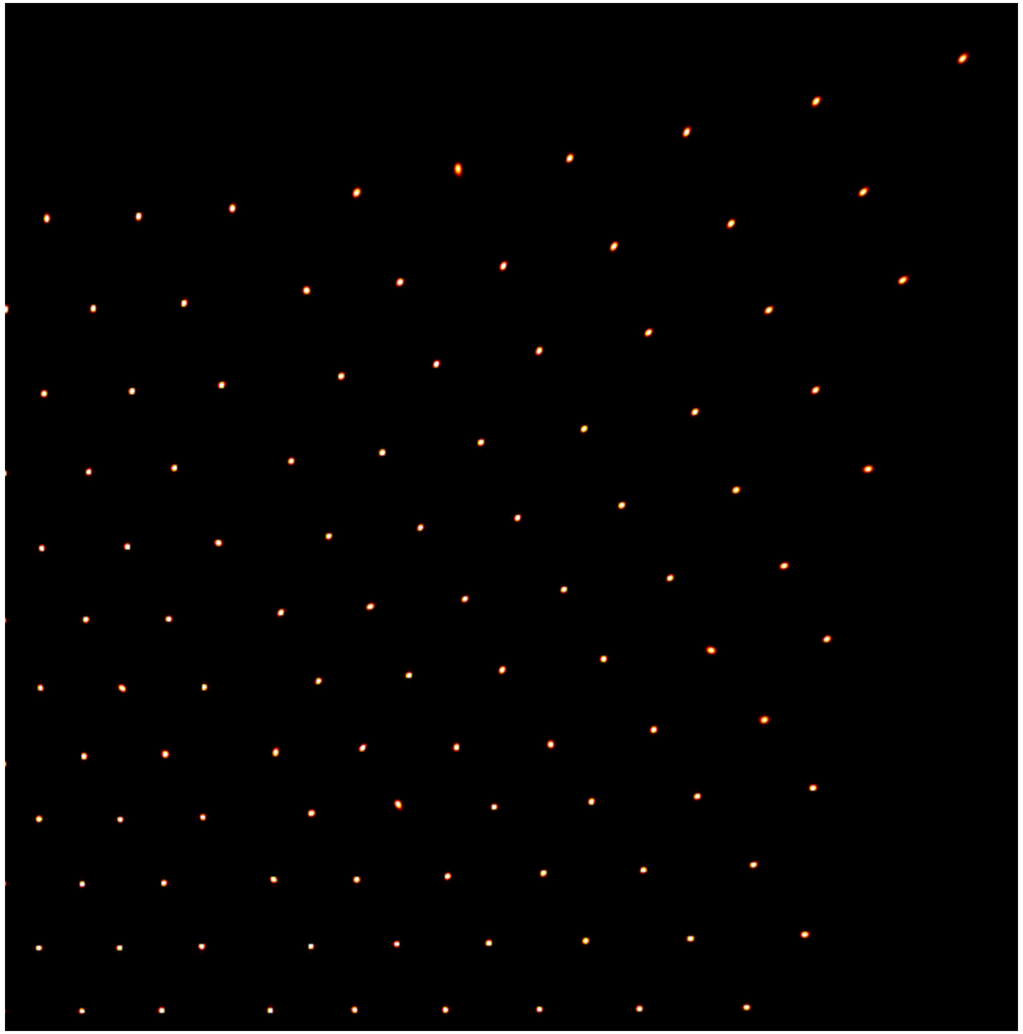
Demonstrating the Working Principle of Flash LiDAR

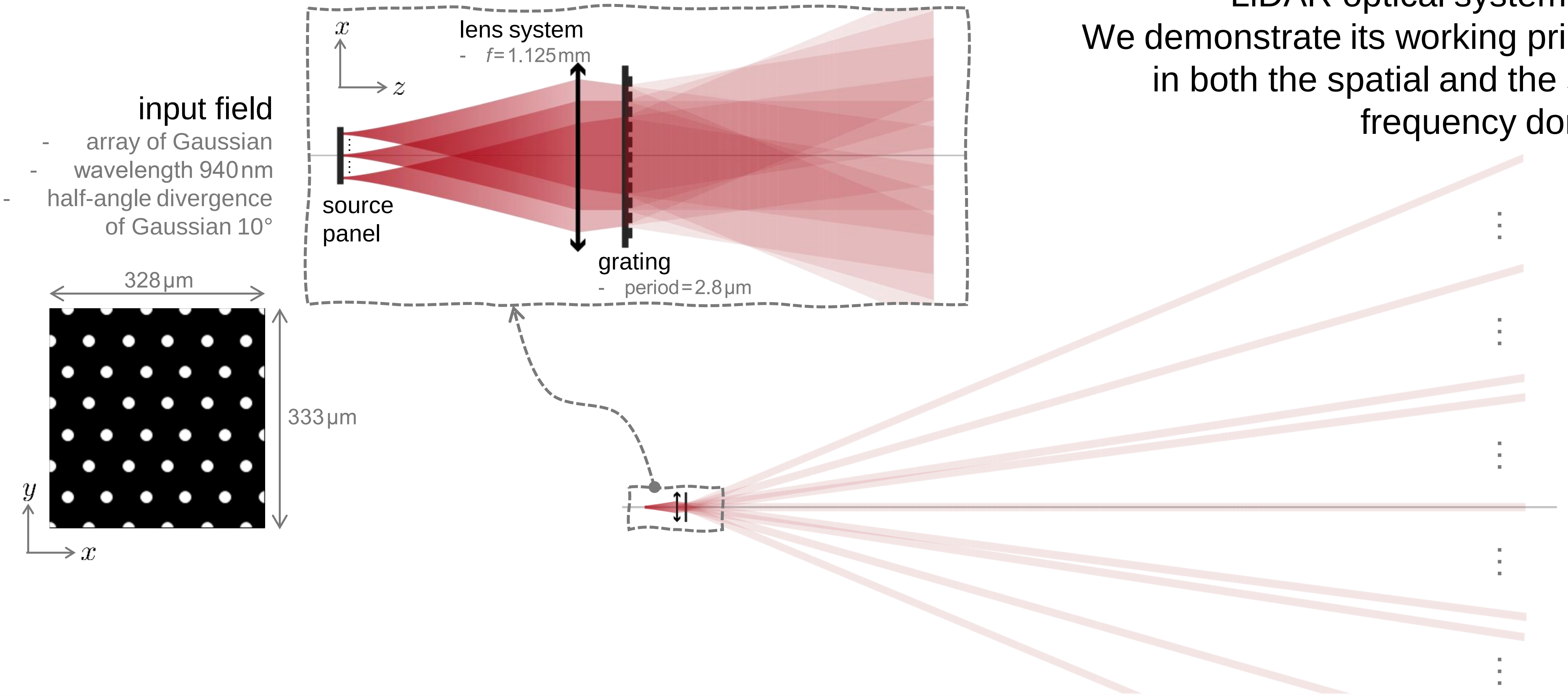
Abstract



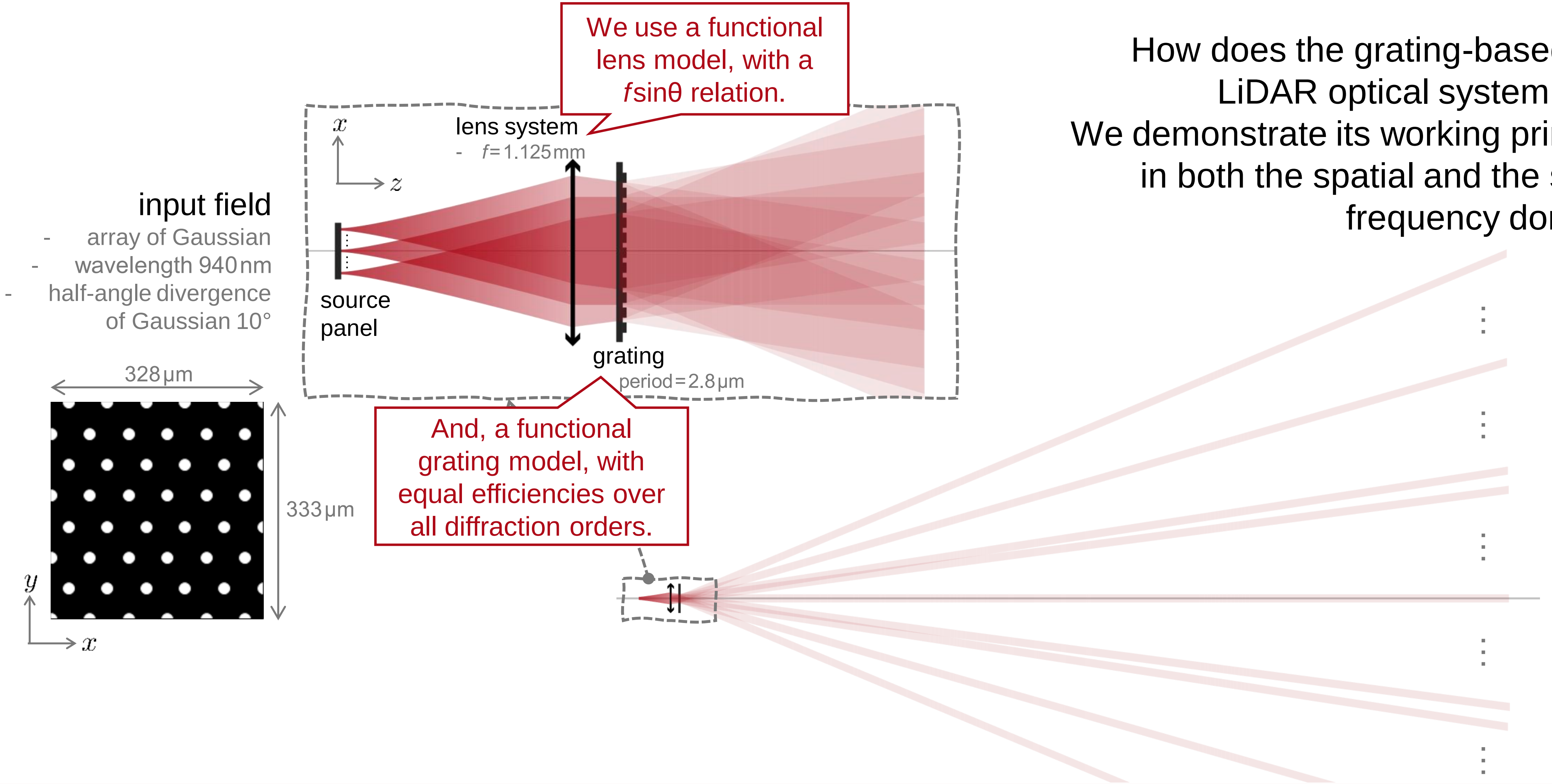
Nowadays, LiDAR technology has been applied in not only the professional areas but also in the consumer products. As an example, the flash LiDAR is found of great use in the smart devices because of their capability of fast and accurate 3D distance detection and measurement. In this example, we demonstrate the working principle of a typical flash LiDAR, which is composed of an array of sources, collimation lens system, and diffractive grating as beam splitter. Analysis is done in both the spatial and the spatial frequency domains.

Modeling Task

How does the grating-based flash LiDAR optical system work?
We demonstrate its working principle, in both the spatial and the spatial frequency domains.



Modeling Task



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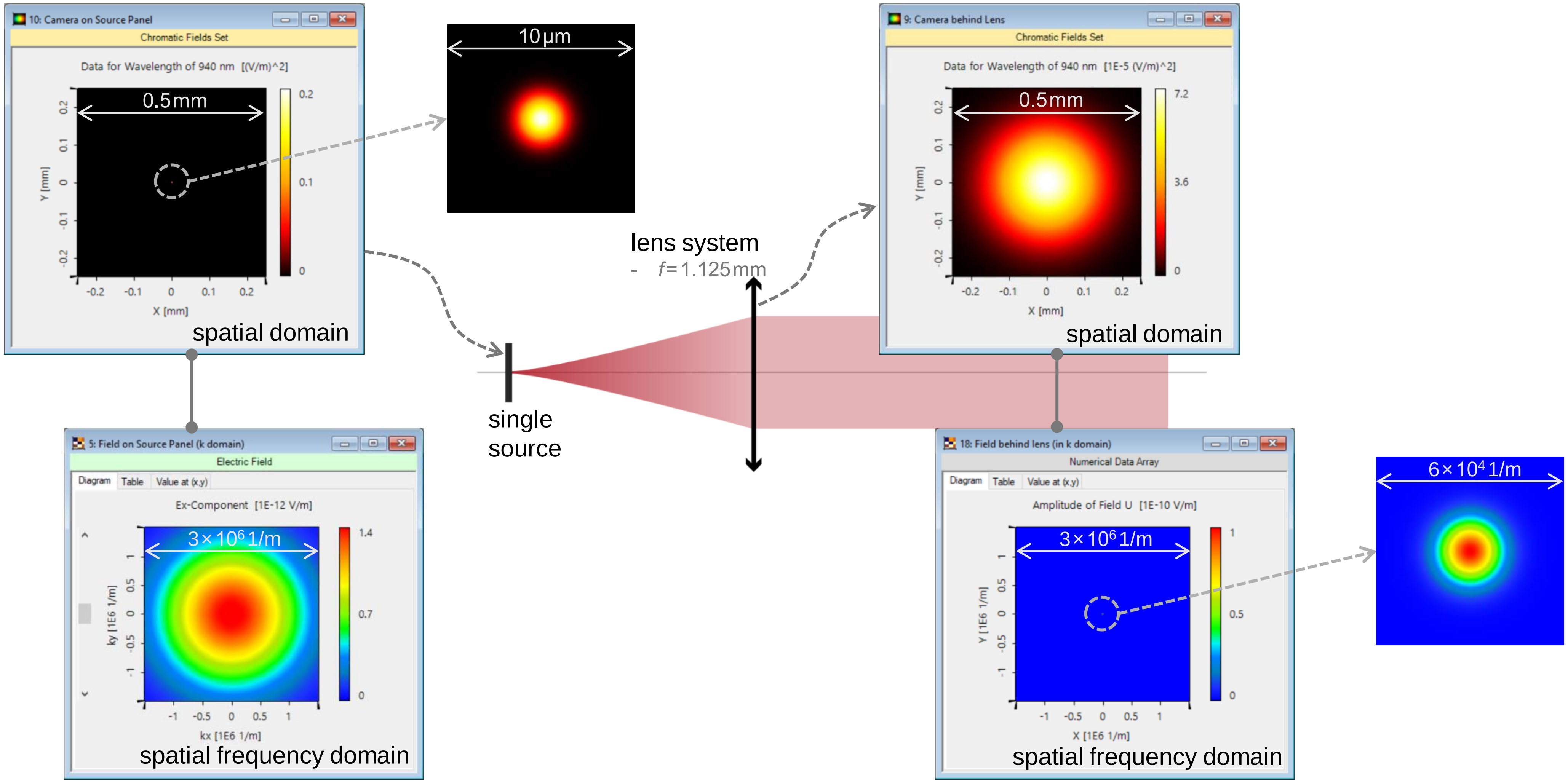
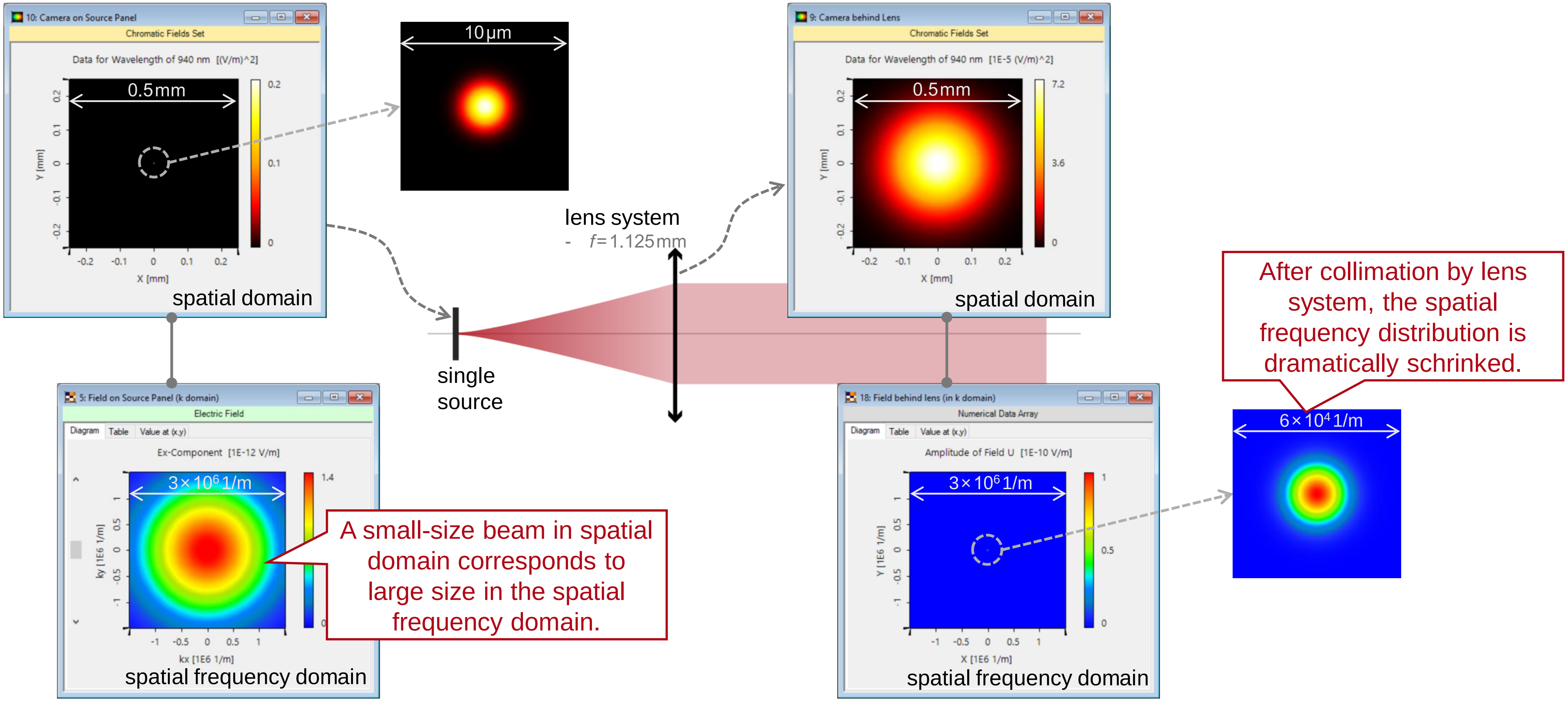
We demonstrate its working principle, in both the spatial and the spatial frequency domains.

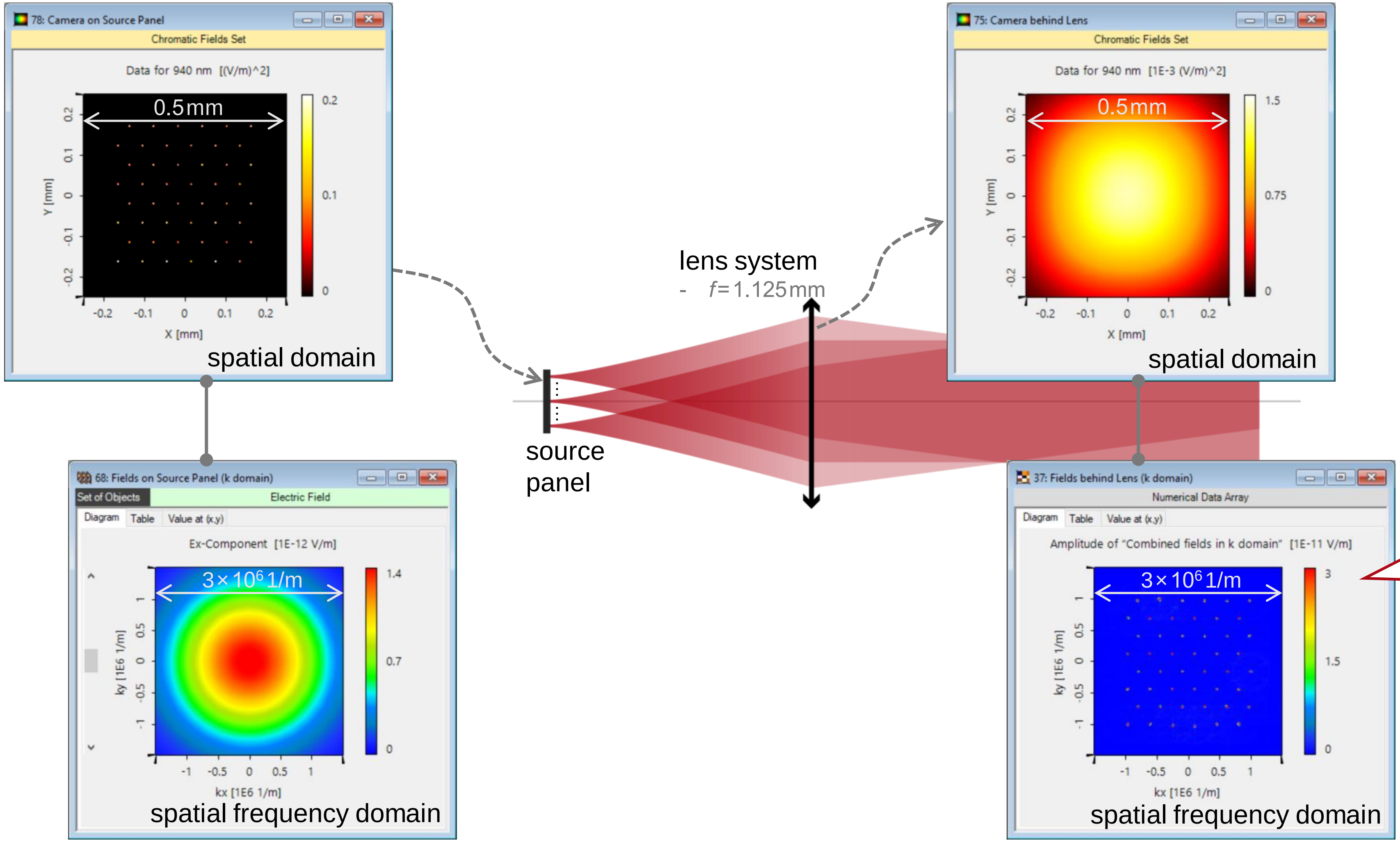
Single Source + Collimation Lens



Single Source + Collimation Lens

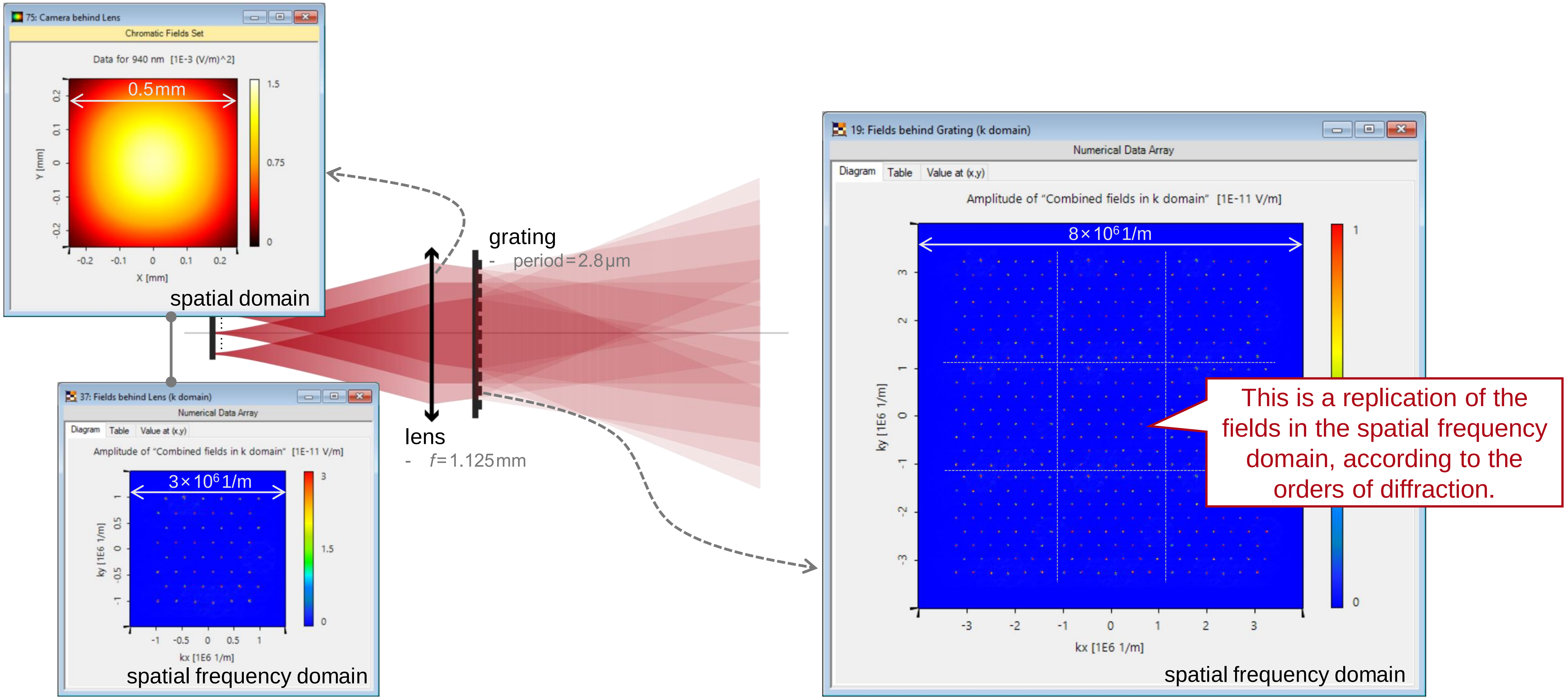


Source Array + Collimation Lens

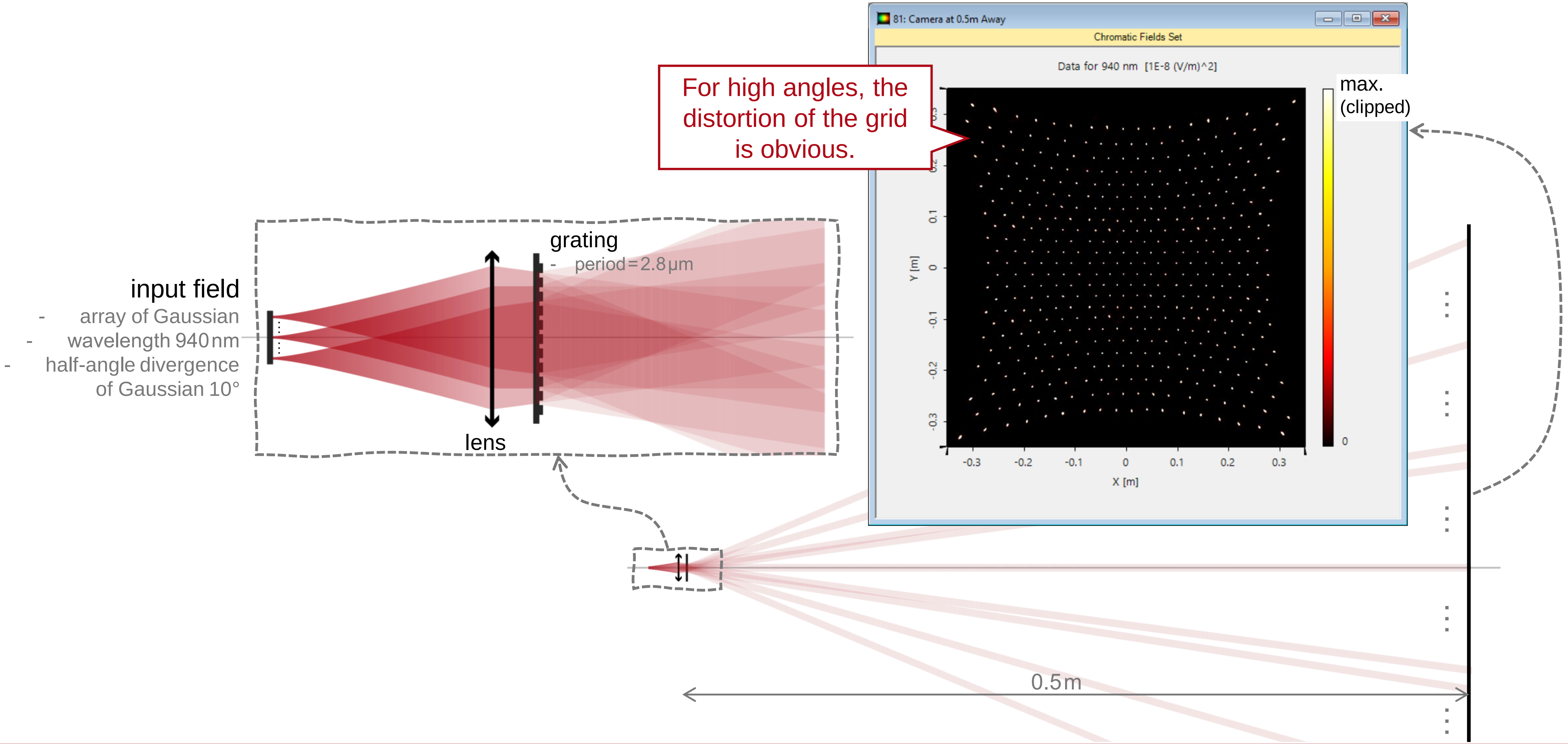


Behind the lens, the pattern of the source array is (almost) reproduced in the spatial frequency domain.

Source Array + Collimation Lens + Diffractive Grating



Source Array + Collimation Lens + Diffractive Grating



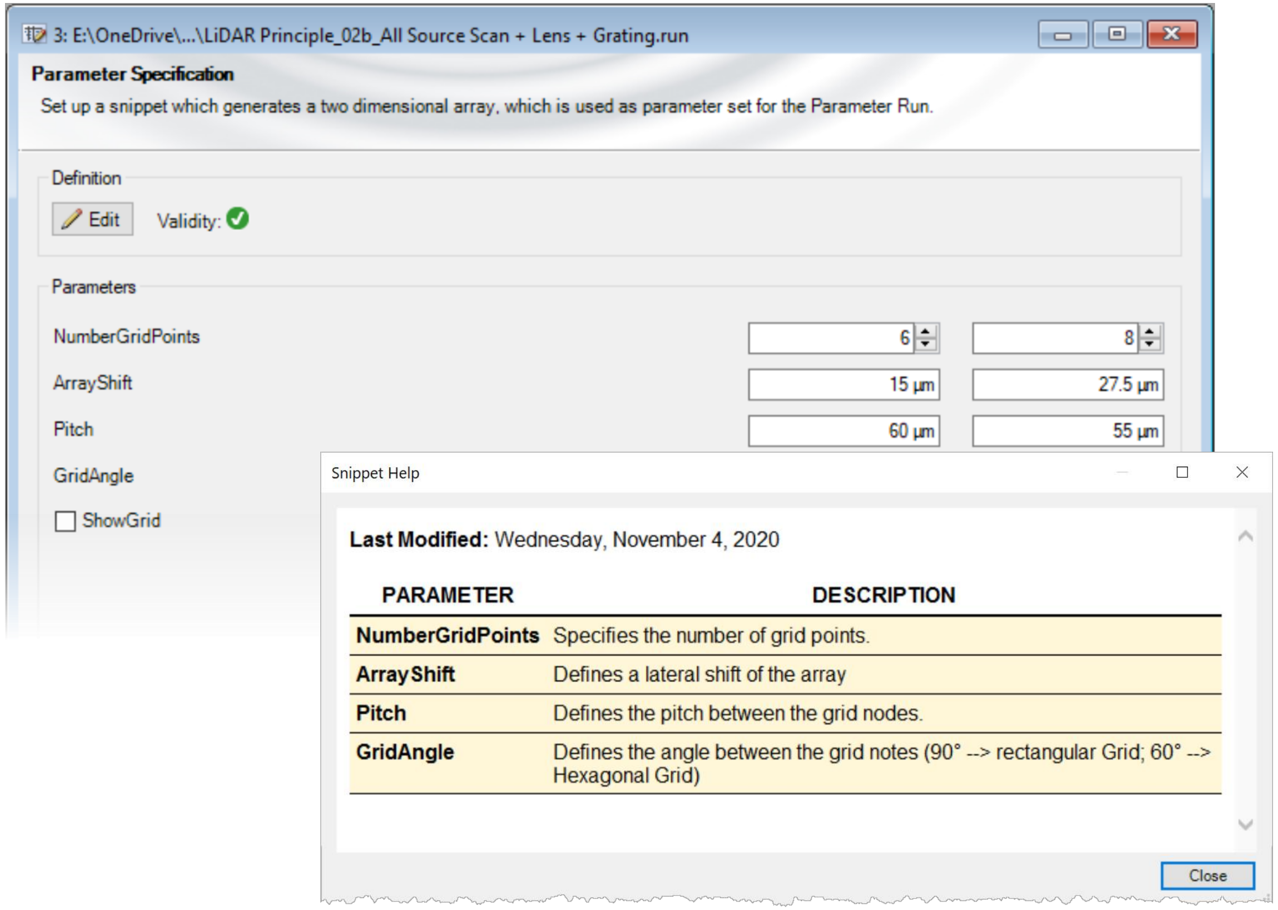
Note on Simulation Settings

- Modeling array of source
  - The optical setup contains only one Gaussian source, and the array of sources is realized by using a programmable Parameter Run.
  - In the Parameter Run, a grid is defined and each time the Gaussian source is laterally shifted onto a grid point.

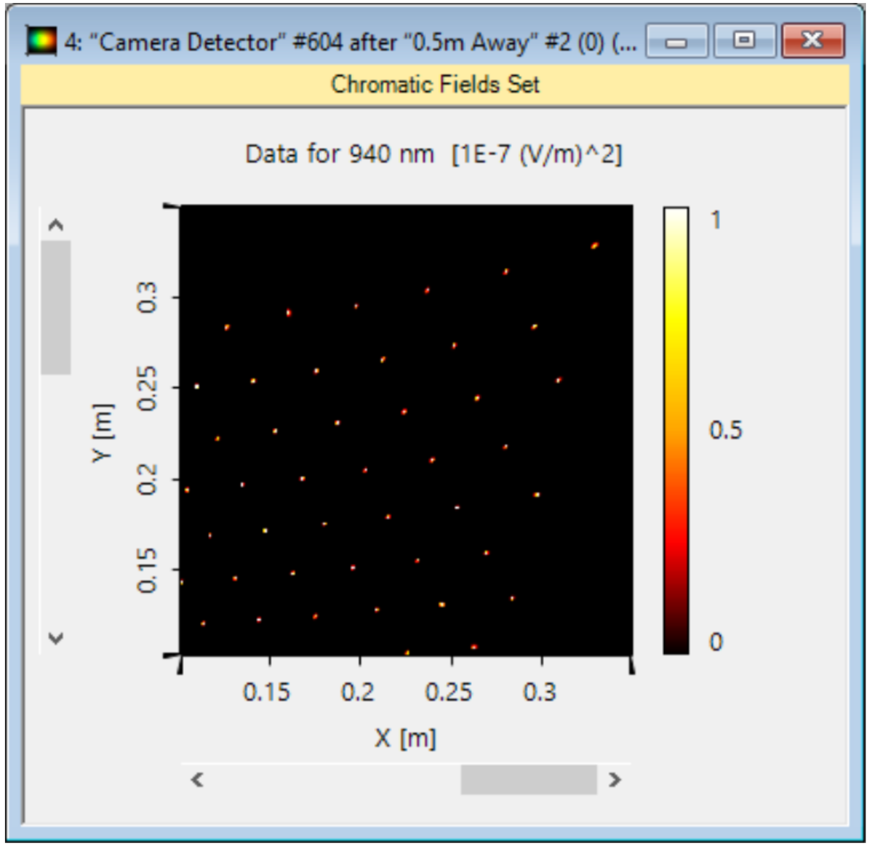
- Visualization in k domain
  - The electromagnetic field detector has the option of showing the field in the k domain i.e. the spatial frequency domain as single document.
  - To combine all the results and display to display them in a common window, a VirtualLab Module is designed and provided along with this example.
    (Appx - Module for Combining EM Fields.cs)

Peek into VirtualLab Fusion

programmable Parameter Run for source array modeling

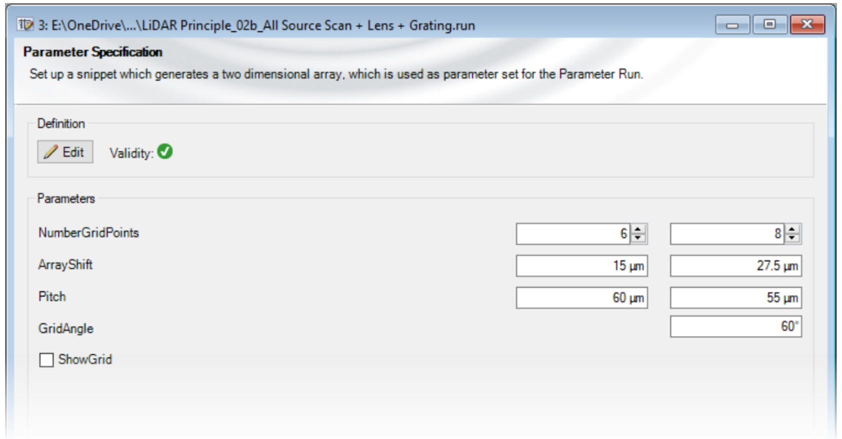


easy-to-use detectors for result visualization

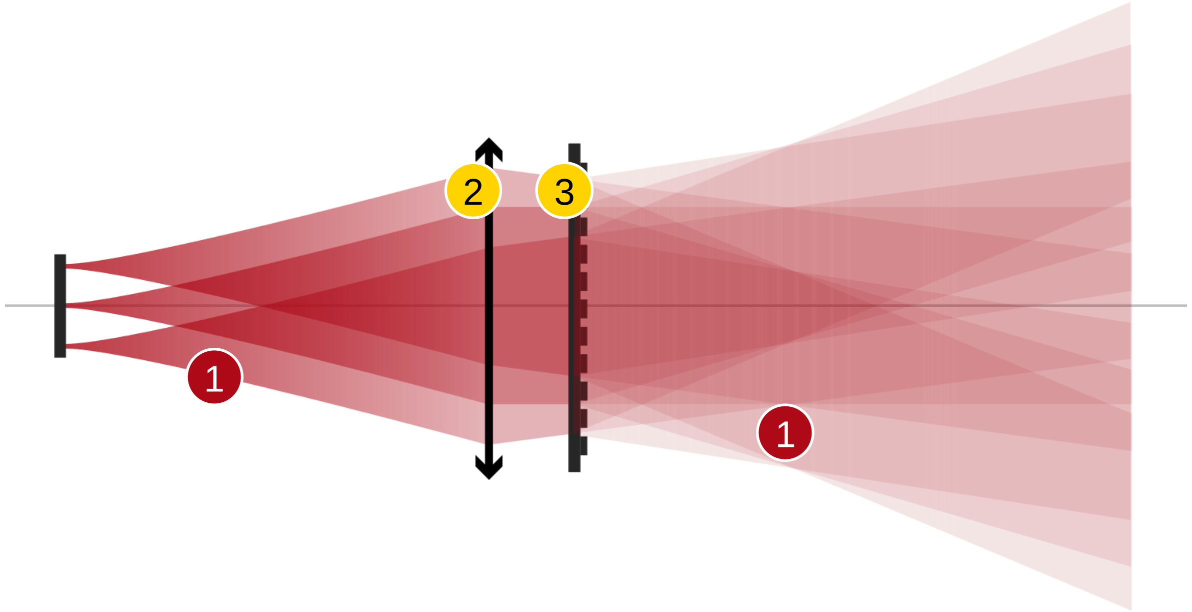


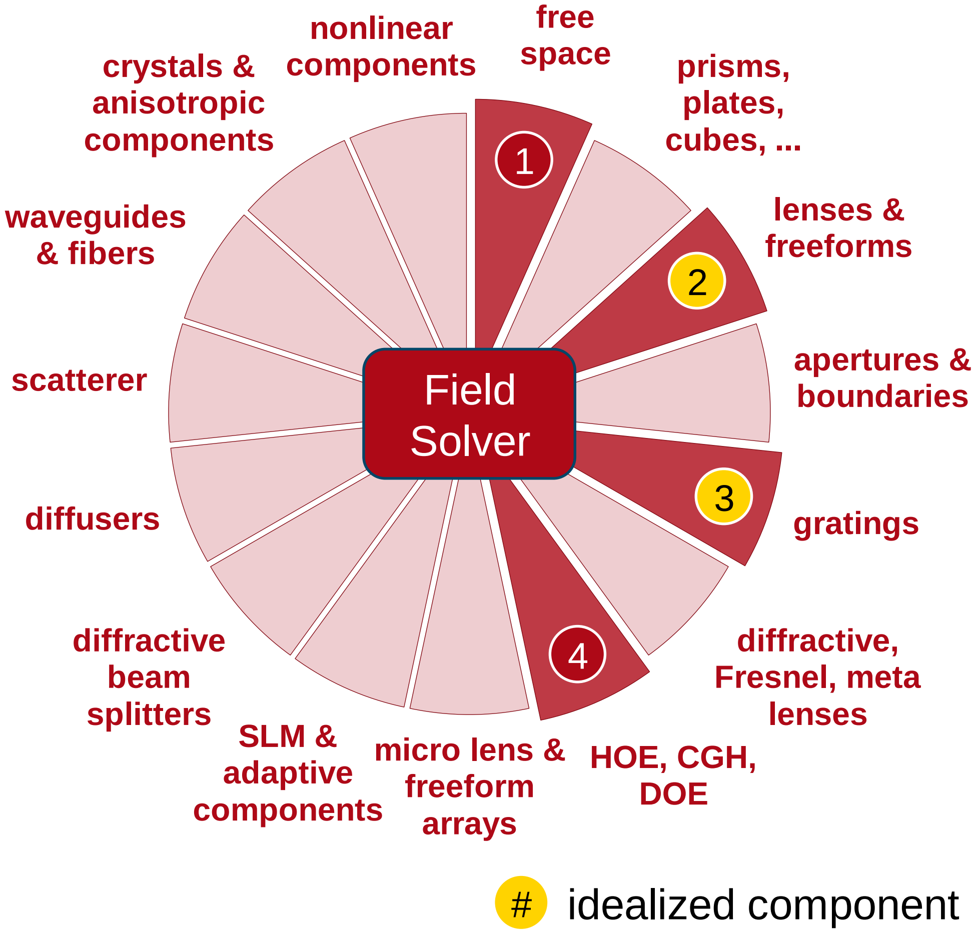
Workflow in VirtualLab Fusion

- Source array modeling via Parameter Run
  - Application of the Programmable Mode of a Parameter Run [Use Case]
- Set the Fourier transforms properly
  - Fourier Transform Settings – Discussion at Examples [Use Case]
- Set the functional grating component
  - VirtualLab Fusion Technology – Idealized Grating Functions [Technology White Paper]



VirtualLab Fusion Technologies





Document Information

title	Demonstrating the Working Principle of Flash LiDAR
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software version	2020.1 (Build 3.4)
category	Application Use Case
further reading	- Working Principle Demonstration of the Dot Projector with Physical Optics Modeling - Design of 2D Non-Paraxial Beam-Splitting Metagrating - Design of a High-NA Beam Splitter with 24000 Dots Random Pattern