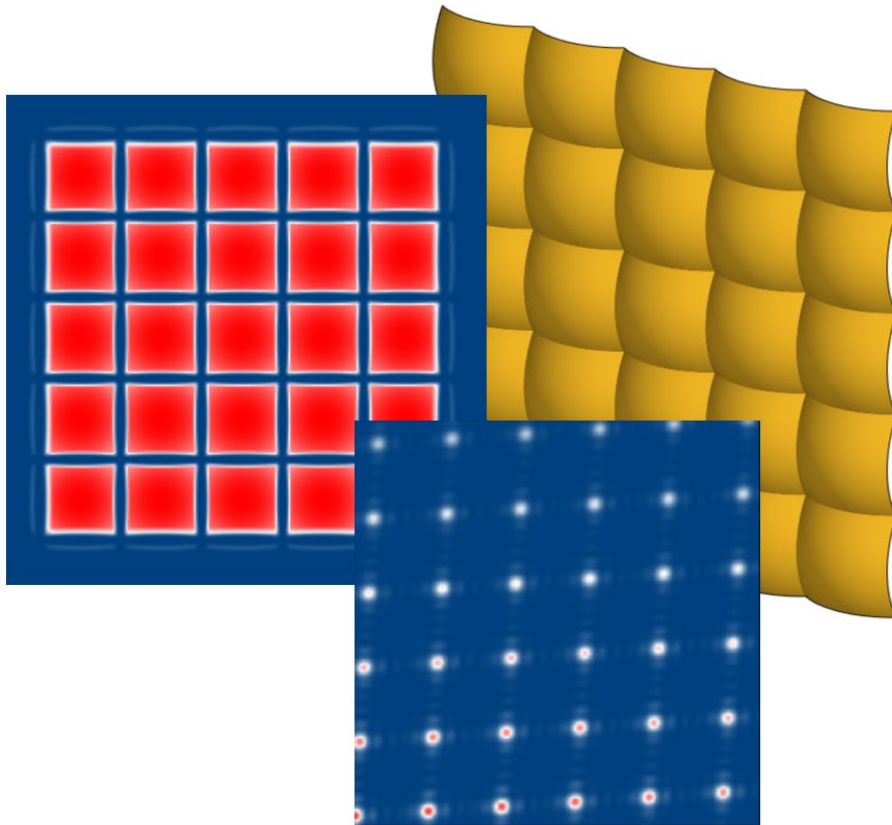


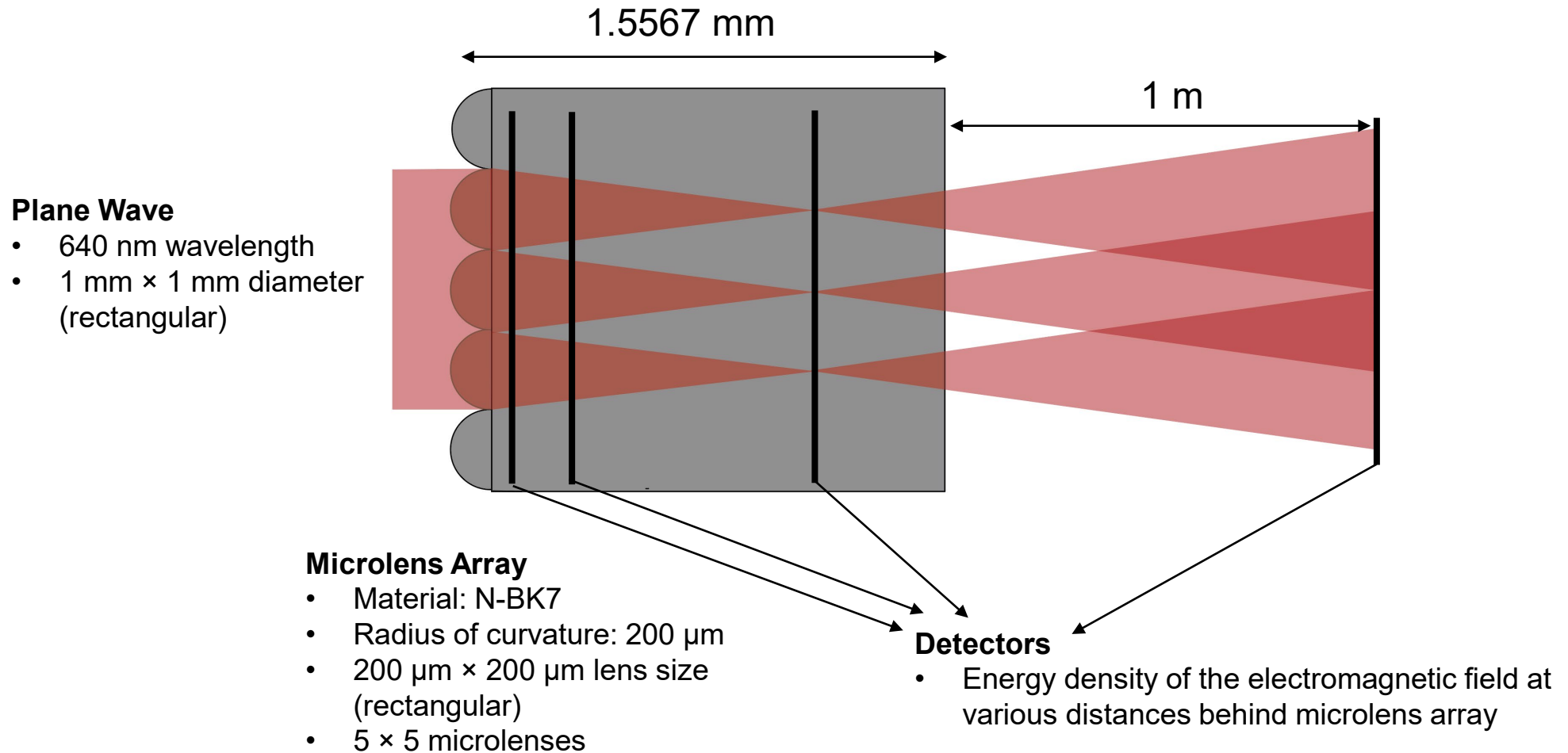
# Investigation of Propagated Light behind a Microlens Array

# Abstract

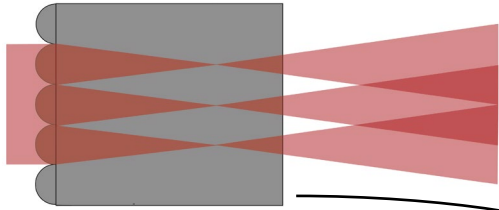


With the advent of modern technologies in the area of optical projection systems and laser material processing units, the request of more specialized optical components becomes more and more pressing. One type of component that is frequently used in these areas are microlens arrays. To fully understand the optical characteristics of such components, the simulation of the propagated light at various positions behind the microlens array is necessary. In this use case we investigate the field after the component in the near field, the focal zone, and the far field.

# System Configuration



# System Building Blocks – Components



The *Microlens Array* component allows an easy definition of an arbitrarily shaped microlens array. The material and size are defined via the *Solid* tab, while the microlens shape is configured via the stack concept accessible on the separate *Surface Add-Ons* tab.

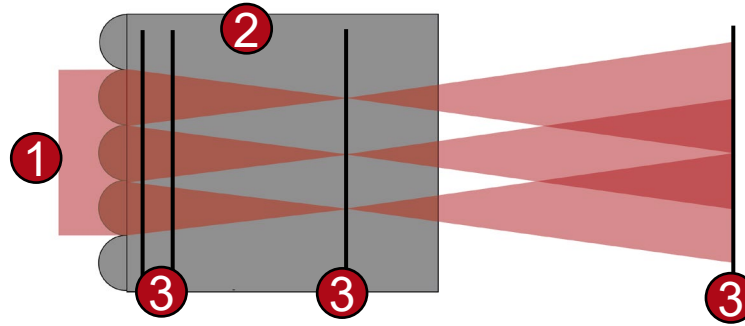
The component enables the simulation through the entire structure or through an individual microlens.

The screenshot shows the 'Edit Micro Lens Array Component' window. The 'Solid' tab is active, showing settings for the component's domain and material. The 'Surface Add-Ons' tab is also visible. A separate 'Edit Stack' dialog is open, showing a 3D view of a 'Base Block' with a conical surface. Below the 3D view is a table with the following data:

Index	z-Distance	z-Position	Surface	Subsequent Medium	Com
1	0 mm	0 mm	Conical Surface	Fused_Silica in Homog	Enter your commer

The 'Edit Stack' dialog also shows 'Validity: ✓' and 'Periodicity & Aperture' settings, including 'Periodic' selected, 'Stack Period is' set to 'Dependent from the Period of Surface' with Index 1, and 'Stack Period' set to 250 μm x 250 μm.

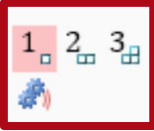
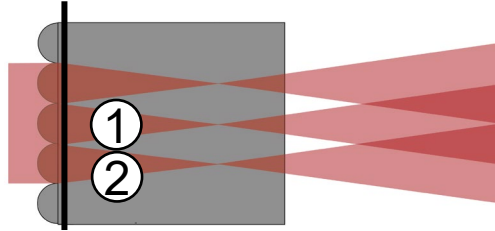
# Summary – Components...



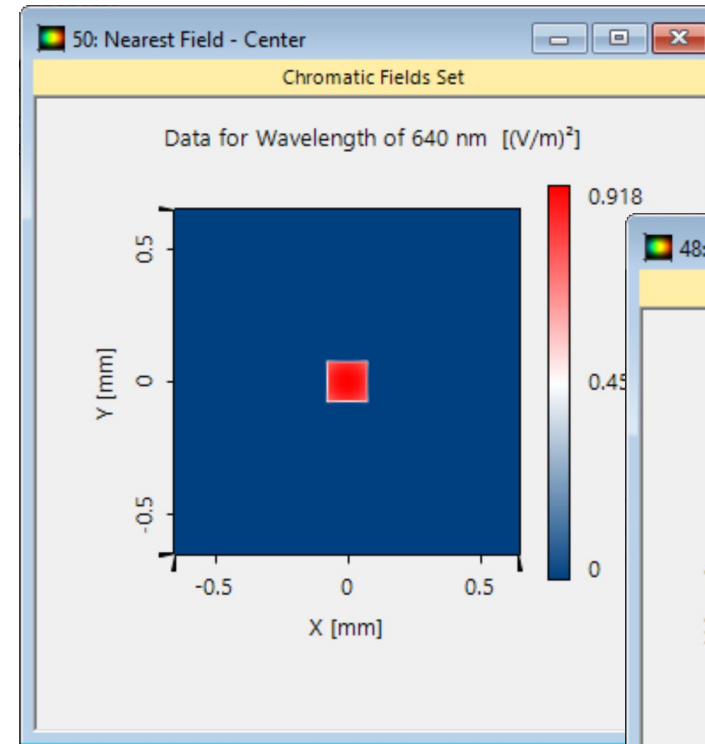
... of Optical System	... in VirtualLab Fusion	Model/Solver
1. Source	<i>Plane Wave Source</i>	Truncated Ideal Plane Wave
2. Micro lens array	<i>Micro Lens Array Component</i>	Local Plane Interface Approximation
3. Detector	<i>Camera Detector</i>	Energy density

# Simulation Results

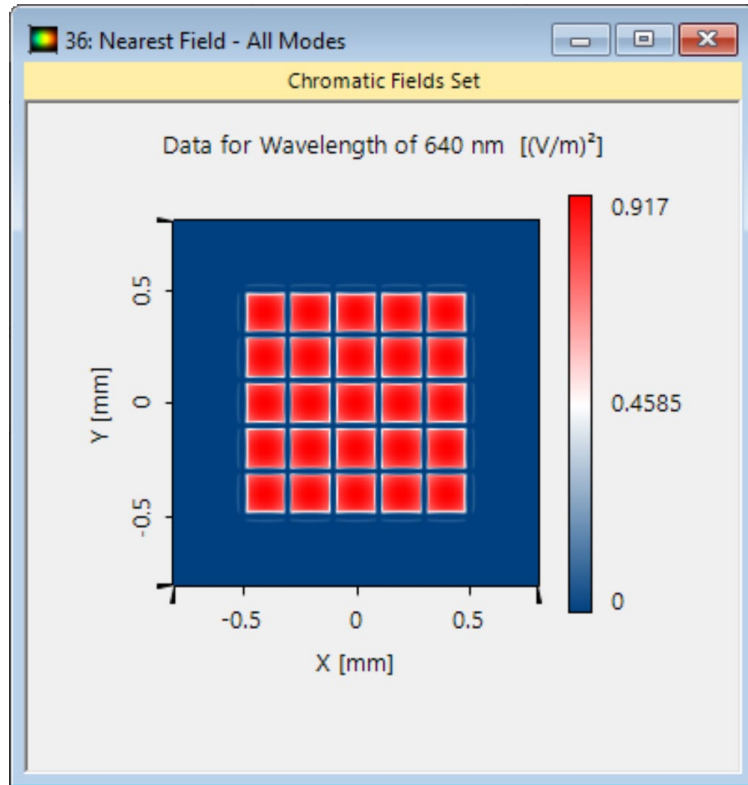
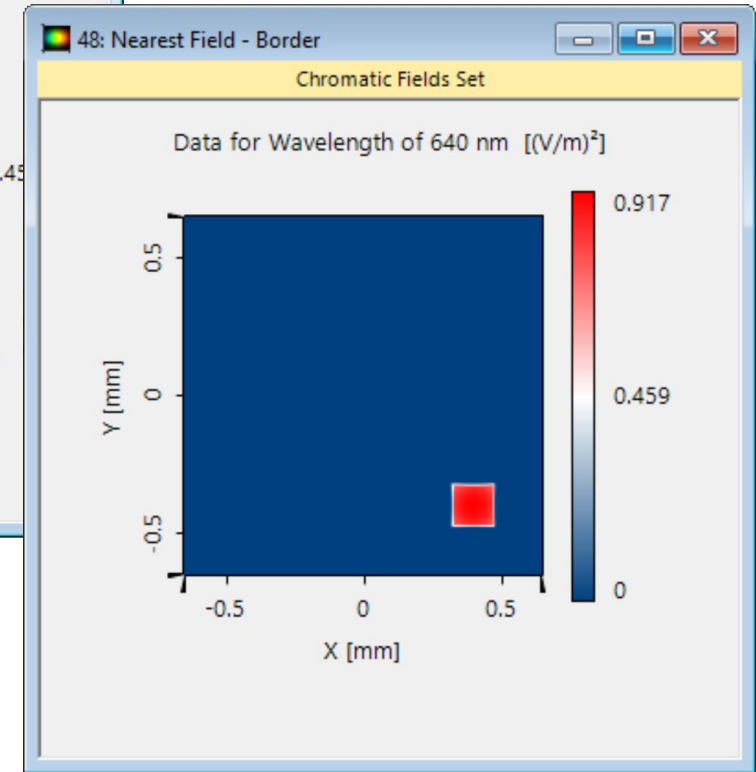
# Field Tracing Results – Near Field



① Only central mode

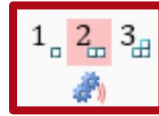
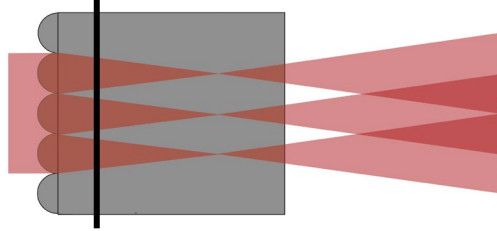


② Only border mode

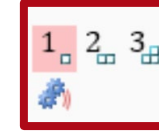


As we use a focusing microlens array, the light modes from each microlens do not overlap in the near field.

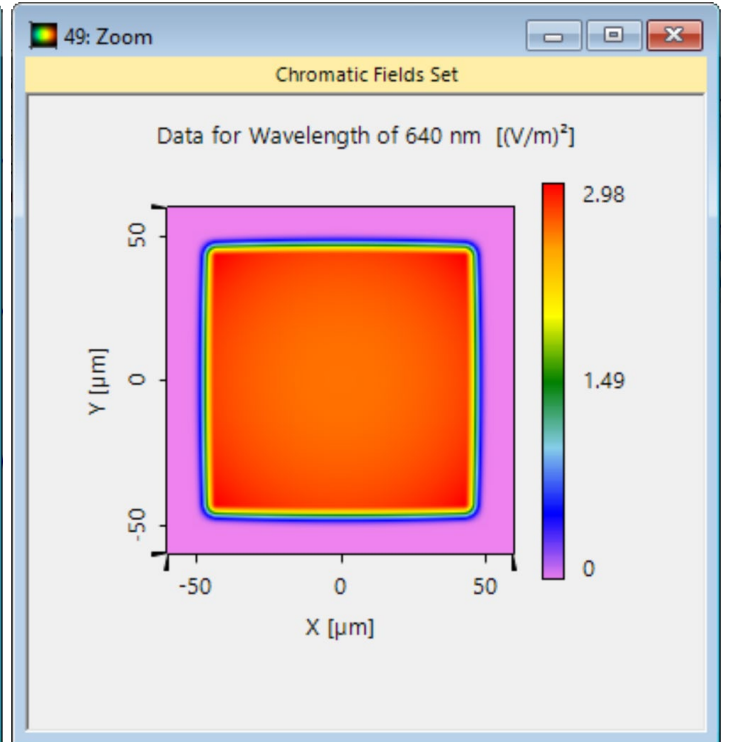
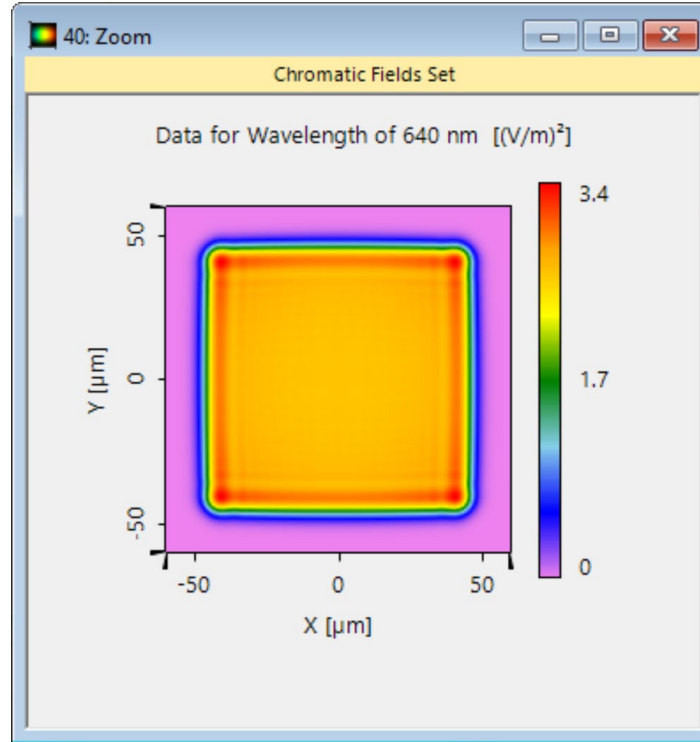
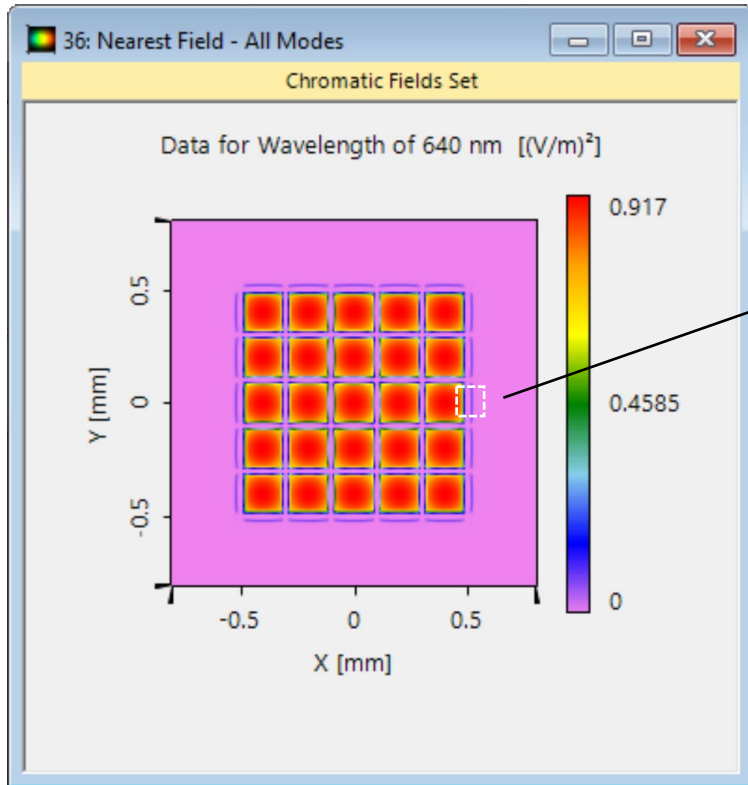
# Field Tracing Results – Near Field



With diffraction



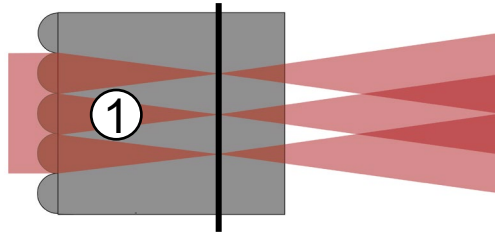
Without diffraction



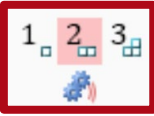
Diffraction effects can be considered everywhere in the system.



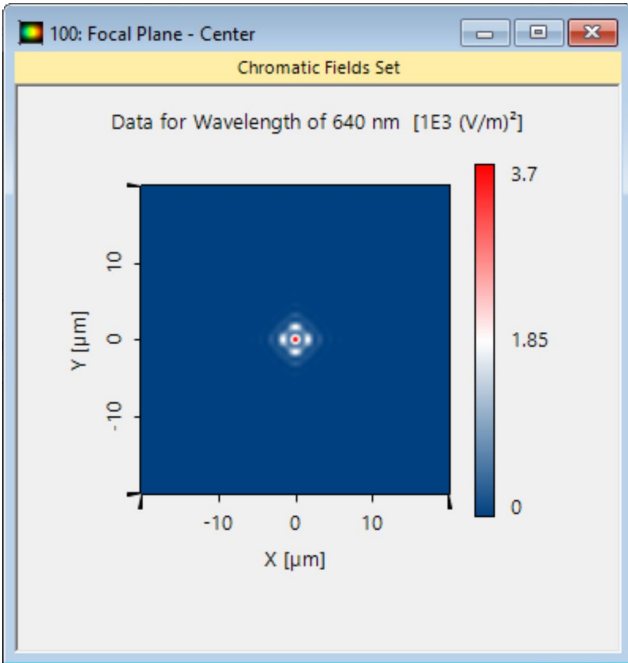
# Field Tracing Results – Focal Plane



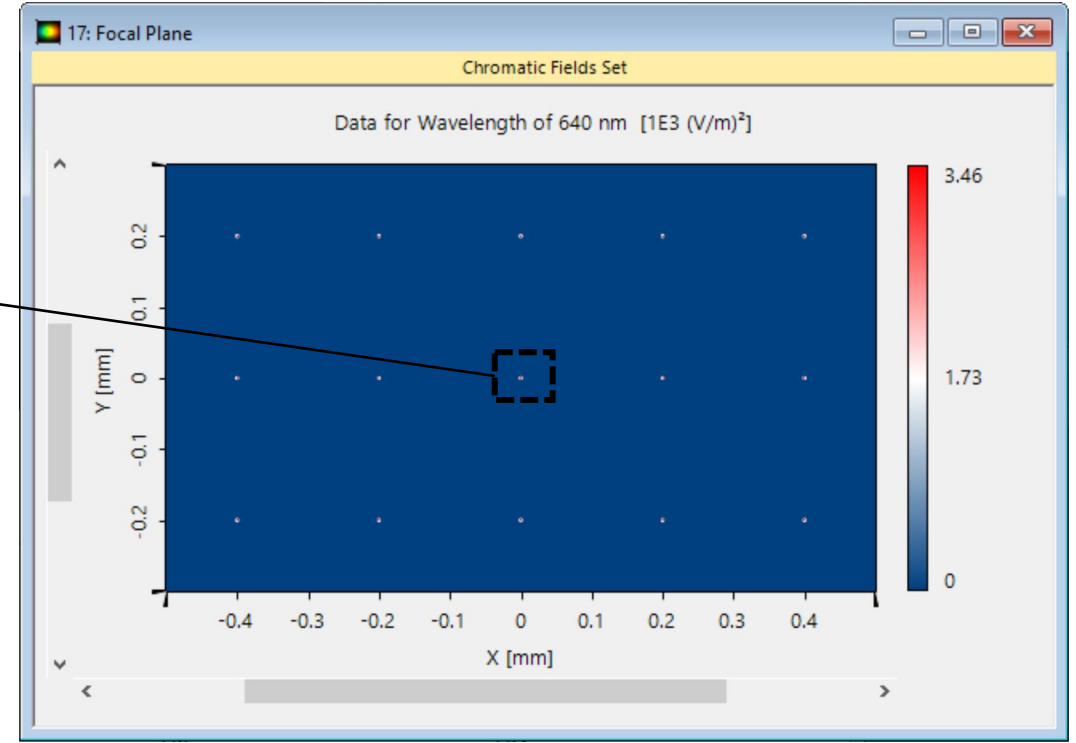
Per microlens, a focal spot is generated in the focal plane. As the individual modes are still disjunct each spot corresponds exclusively to a specific mode of the microlens array.



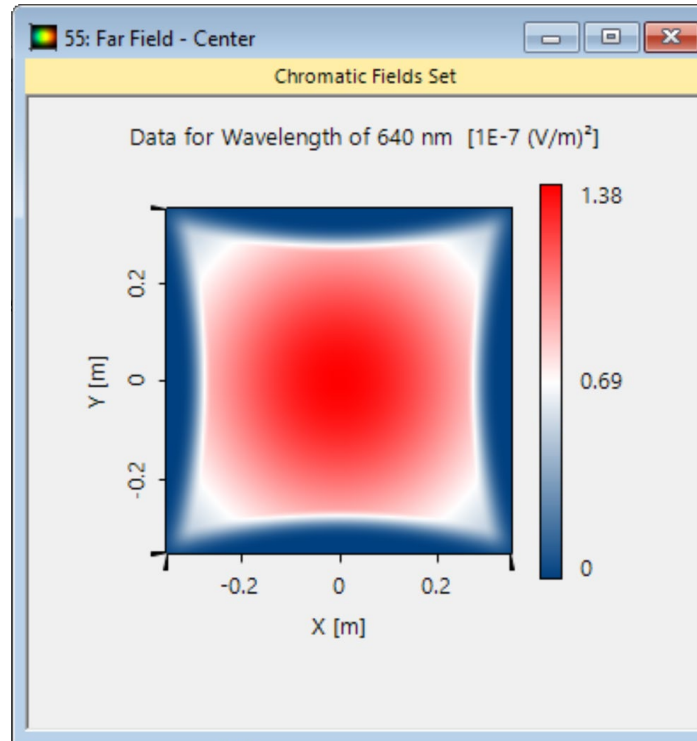
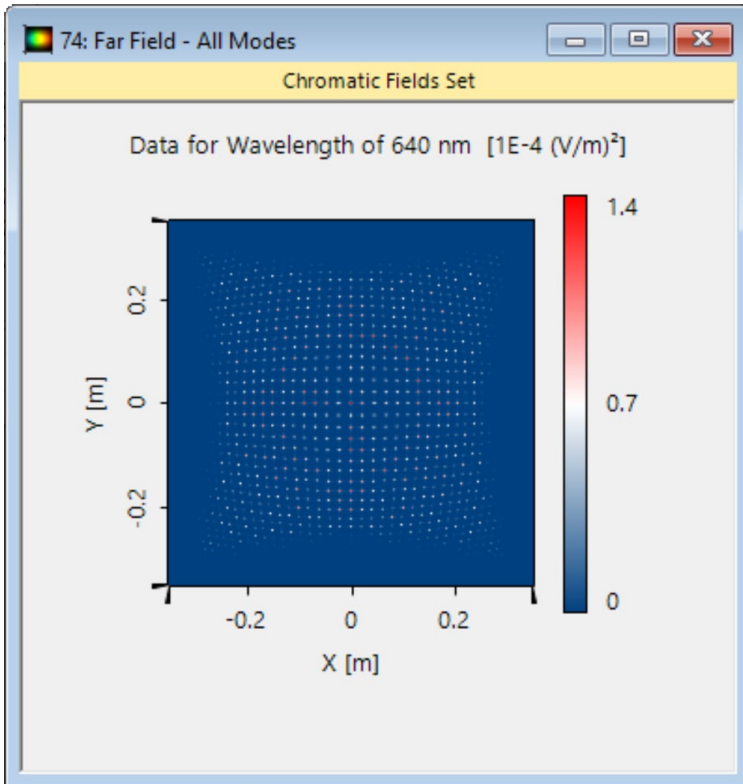
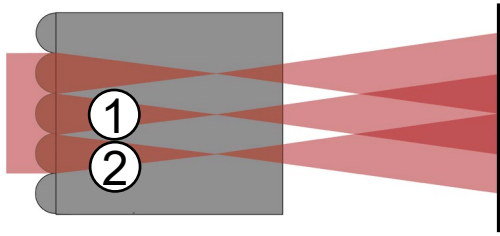
① Only central mode



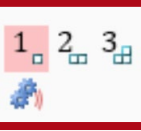
E.g. the center spot is equal to the result from the simulation with only the central mode active.



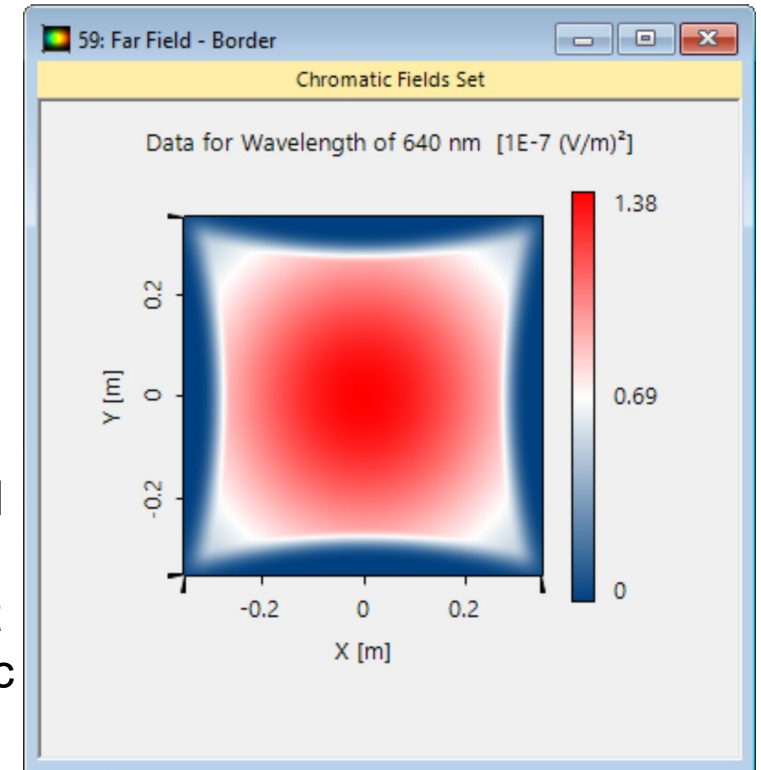
# Field Tracing Results – Far Field



① Only central mode

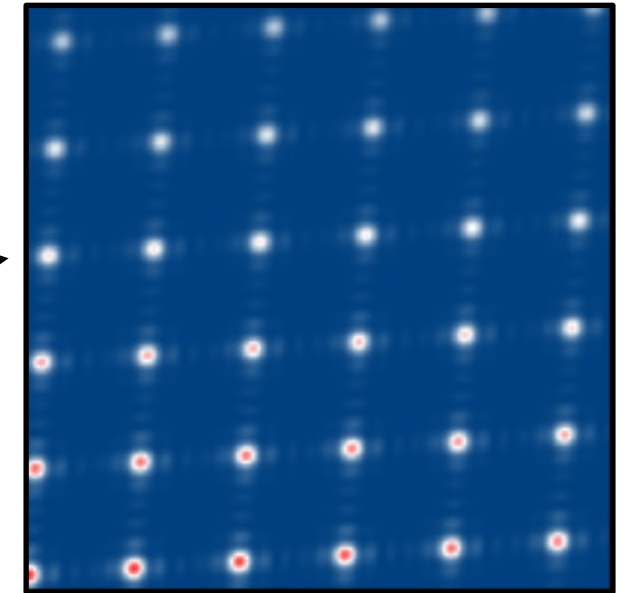
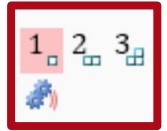
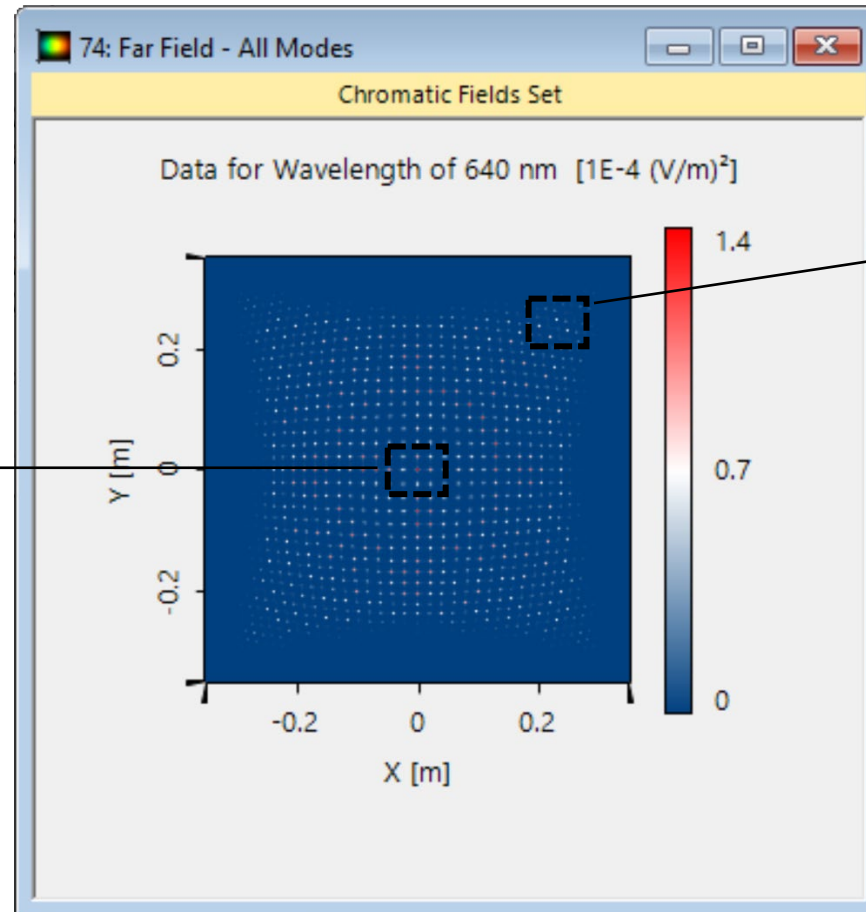
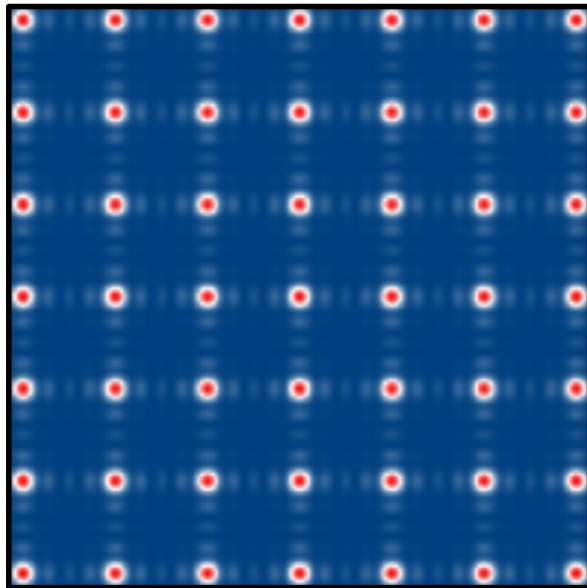
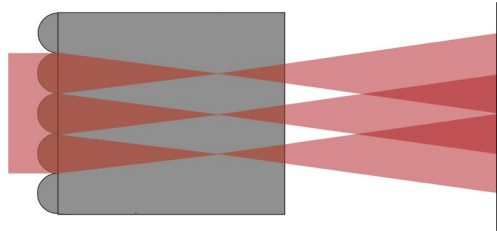


② Only corner mode



In the far field all the modes are shifted and are overlapping. By interference this generates a dot pattern. Each spot does no longer correspond to a specific mode alone.

# Field Tracing Results – Far Field



In the far field spots that are close to the borders and corners become distorted.

# Document Information

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