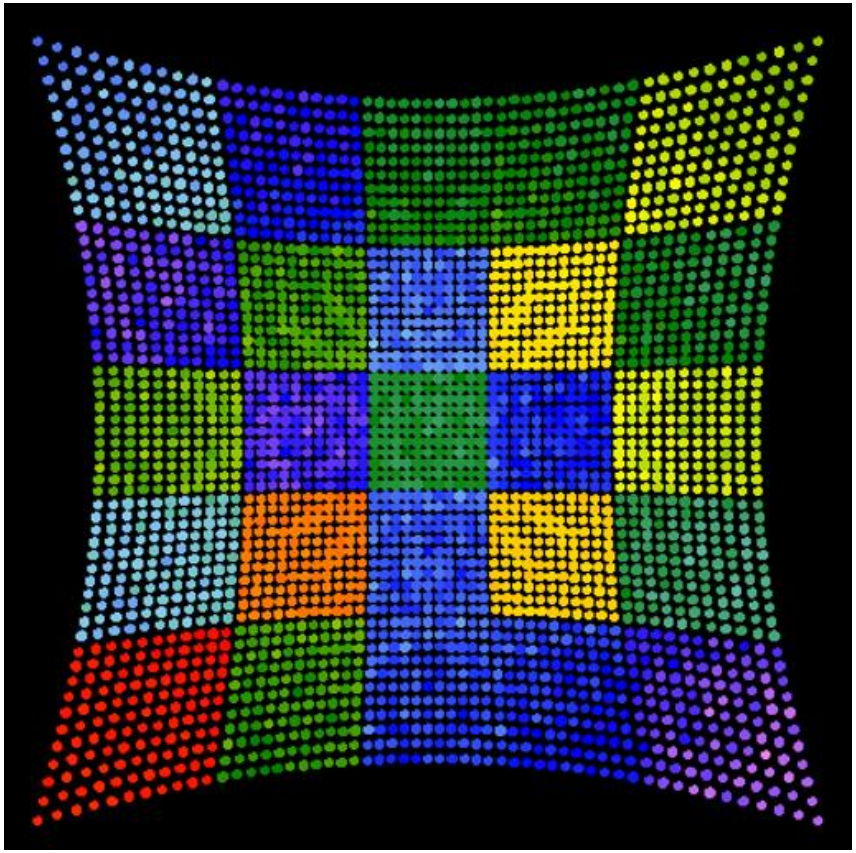
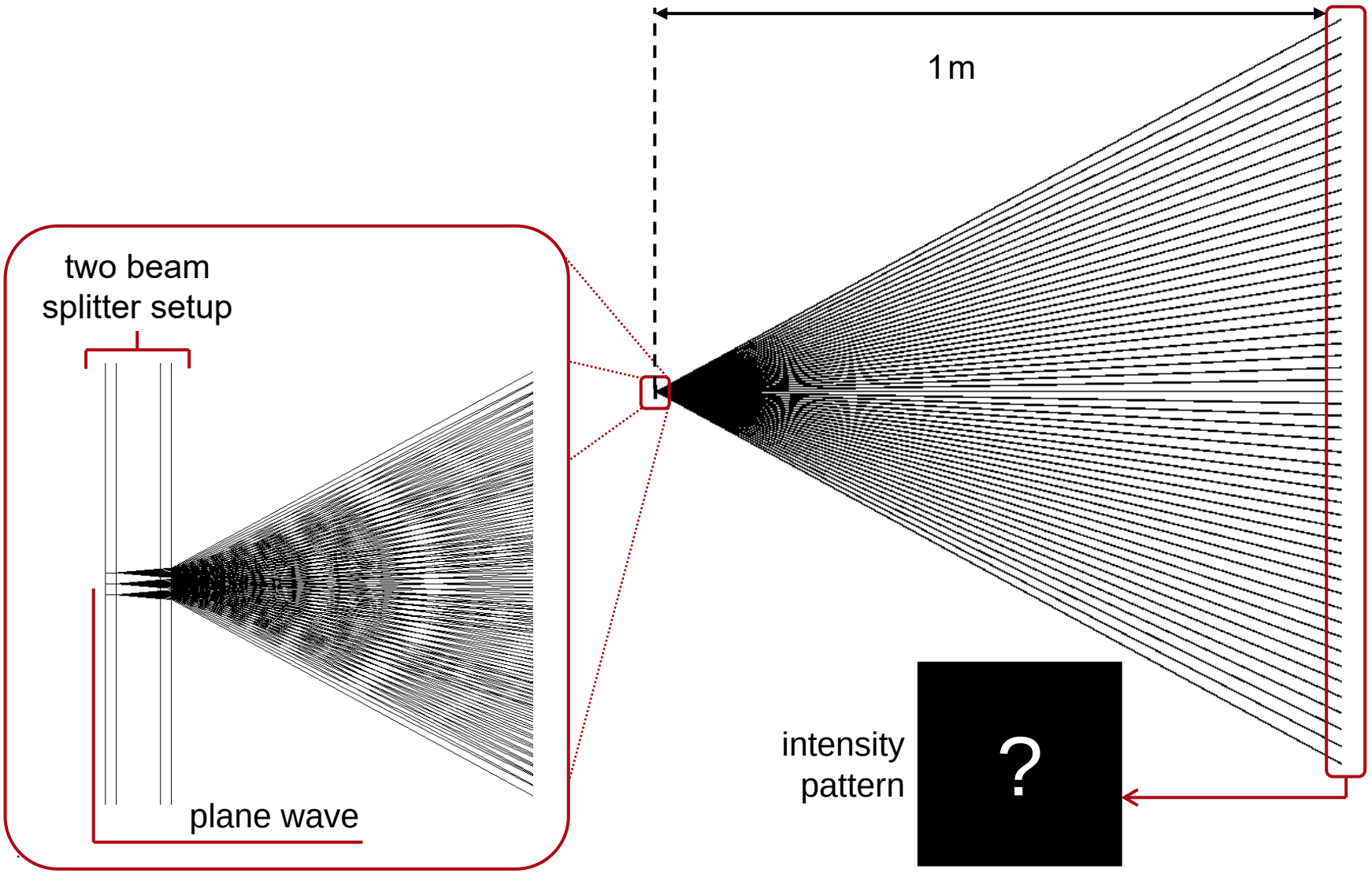
High-NA Pattern Generation by Combining Two Beam Splitter Elements

Abstract

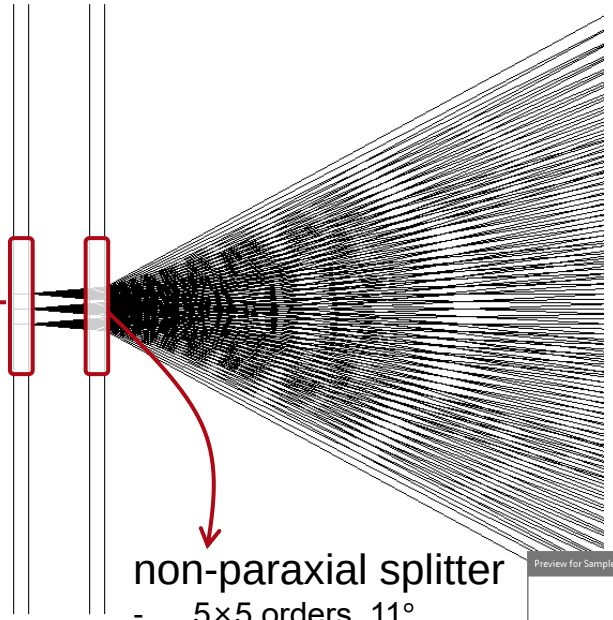


Non-paraxial and large dots number diffractive beam splitters are of great use for e.g. 3D object detection and recognition. It is typically realized by employing a paraxial and a non-paraxial splitter. The design of both beam splitters can be done by using the iterative Fourier transform algorithm (IFTA). But the non-paraxial beam splitter, due to its small period and pixel size, must be evaluated with rigorous method. By applying Fourier modal method for the non-paraxial beam splitter, the performance of the two splitter system is investigated.

Modeling Task

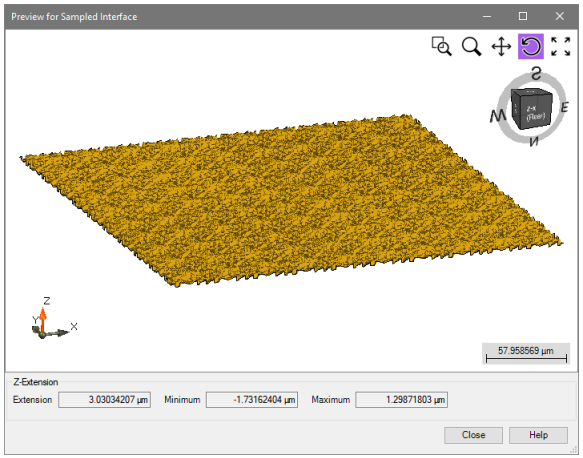


Modeling Task



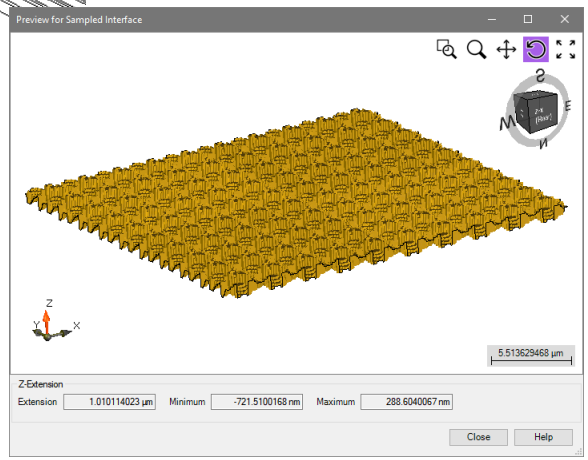
paraxial beam splitter

- 11×11 orders, 1° separation
- period 30.5×30.5 µm
- pixel size 690×690 nm
- 8 height levels

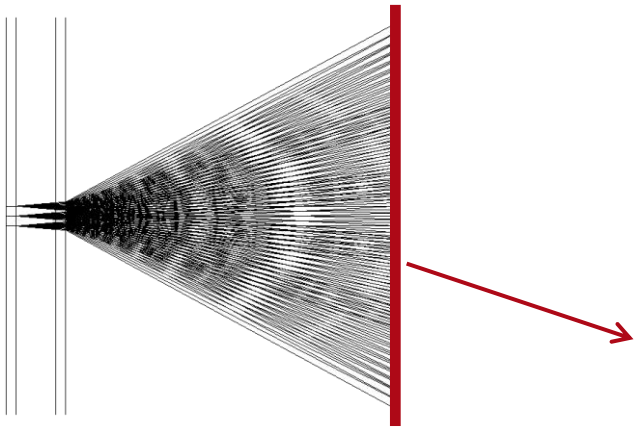


non-paraxial splitter

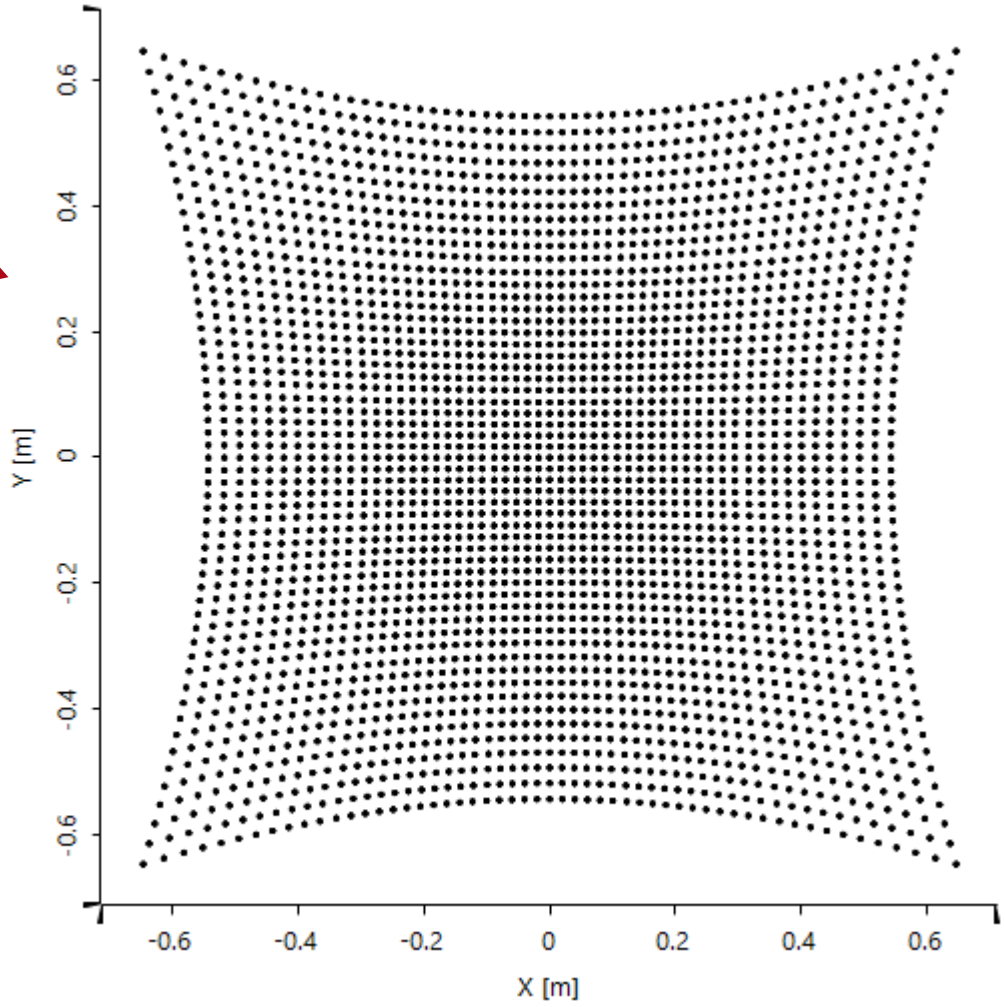
- 5×5 orders, 11° separation
- period 2.73×2.73 µm
- pixel size 130×130 nm
- 8 height levels



Results

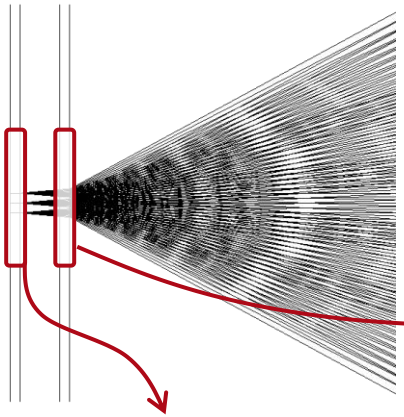


spot diagram



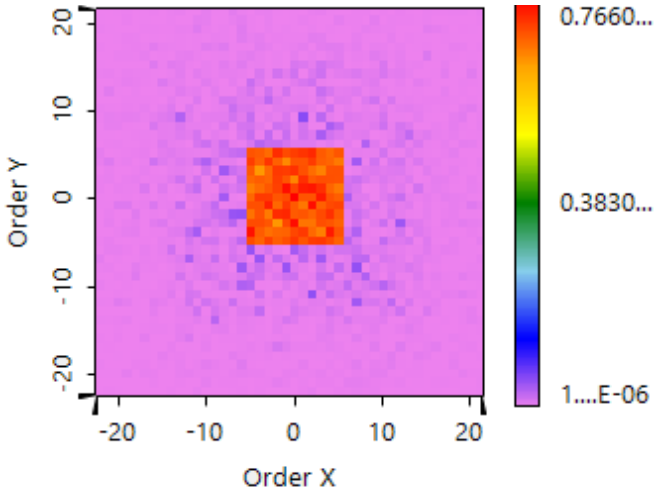
combination of both beam splitter − generation of 55×55 orders with 55°×55° angular distribution

Results

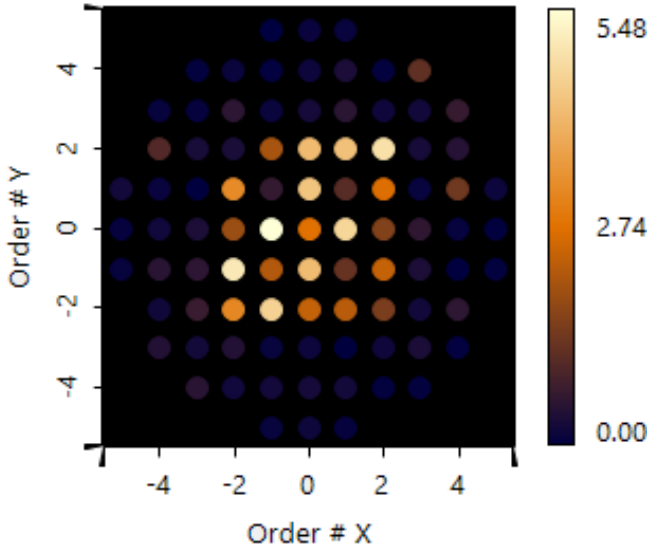


Both beam splitters are initially designed by using IFTA. But the diffraction efficiency of the non-paraxial one is then evaluated by the rigorous Fourier modal method.

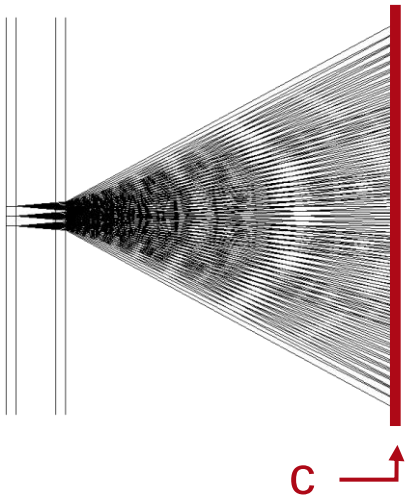
efficiencies of paraxial beam splitter (TEA calculation)



efficiencies of non-paraxial splitter (FMM calculation)

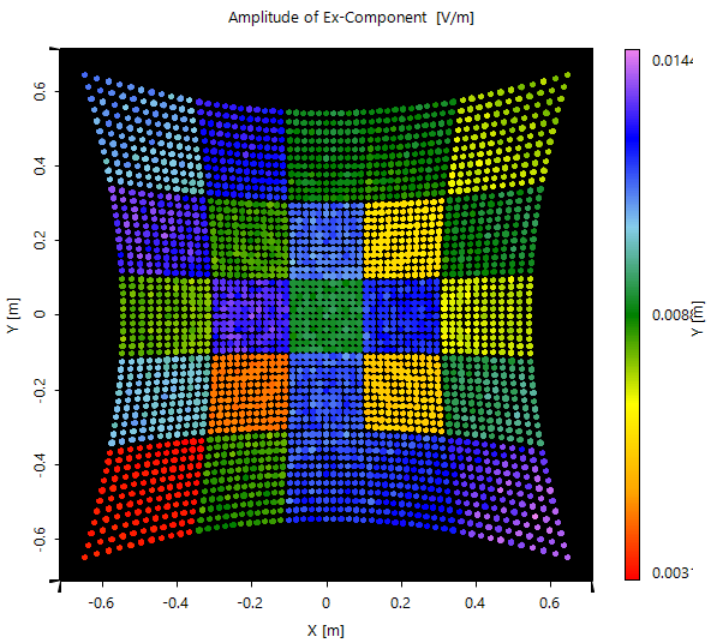


Results

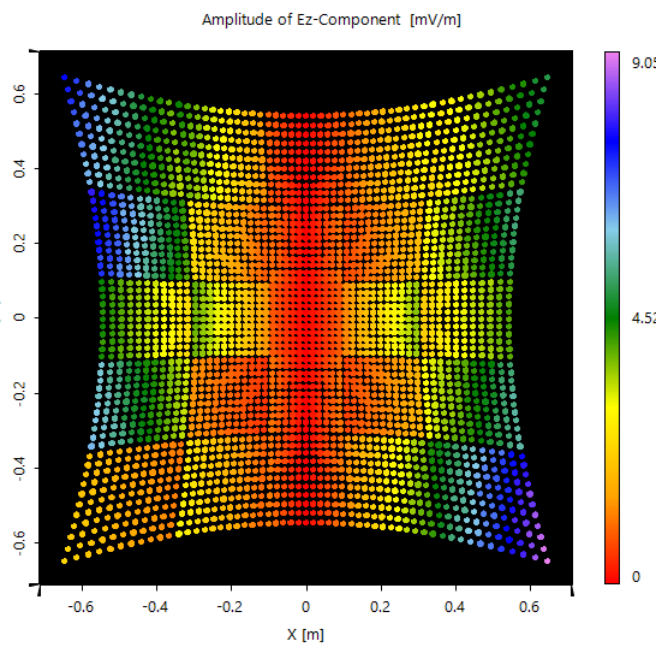


Rigorously calculated diffraction efficiencies are included in the system analysis, and vectorial effects are included as well.

amplitude of E_x



amplitude of E_z



Document Information

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