

# Design and Optimization Strategy of Lightguide Coupling Gratings for Near-Eye Displays

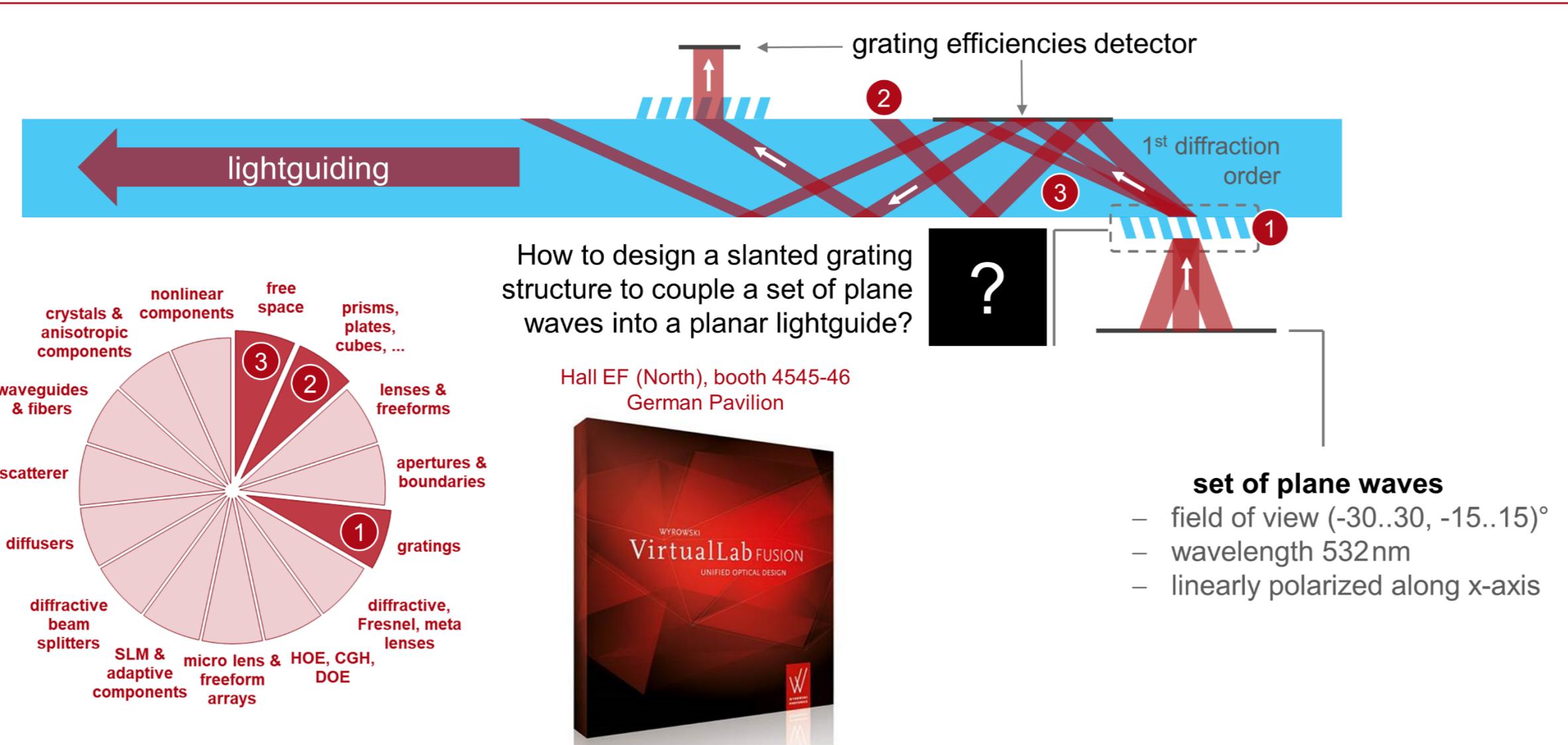


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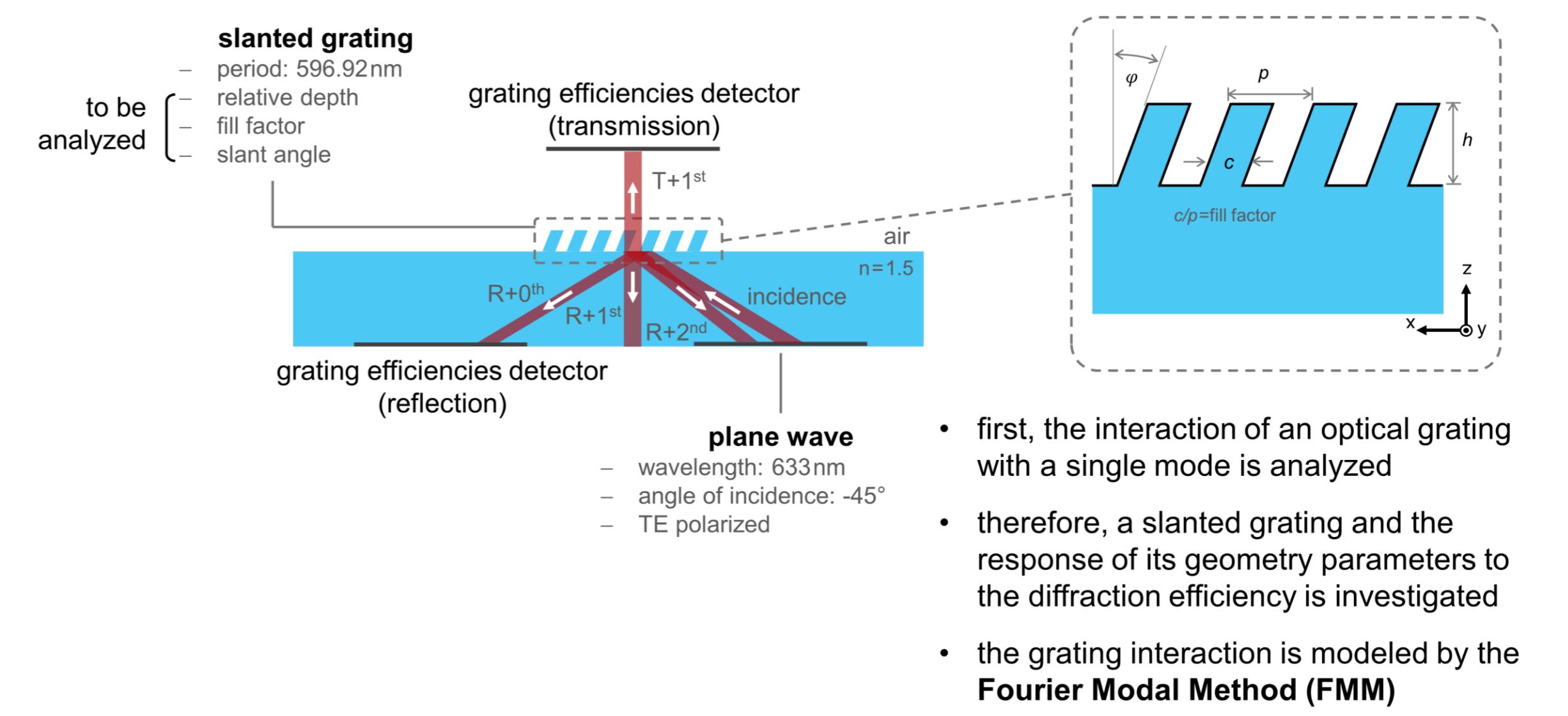
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## Design of a Lightguide Coupling



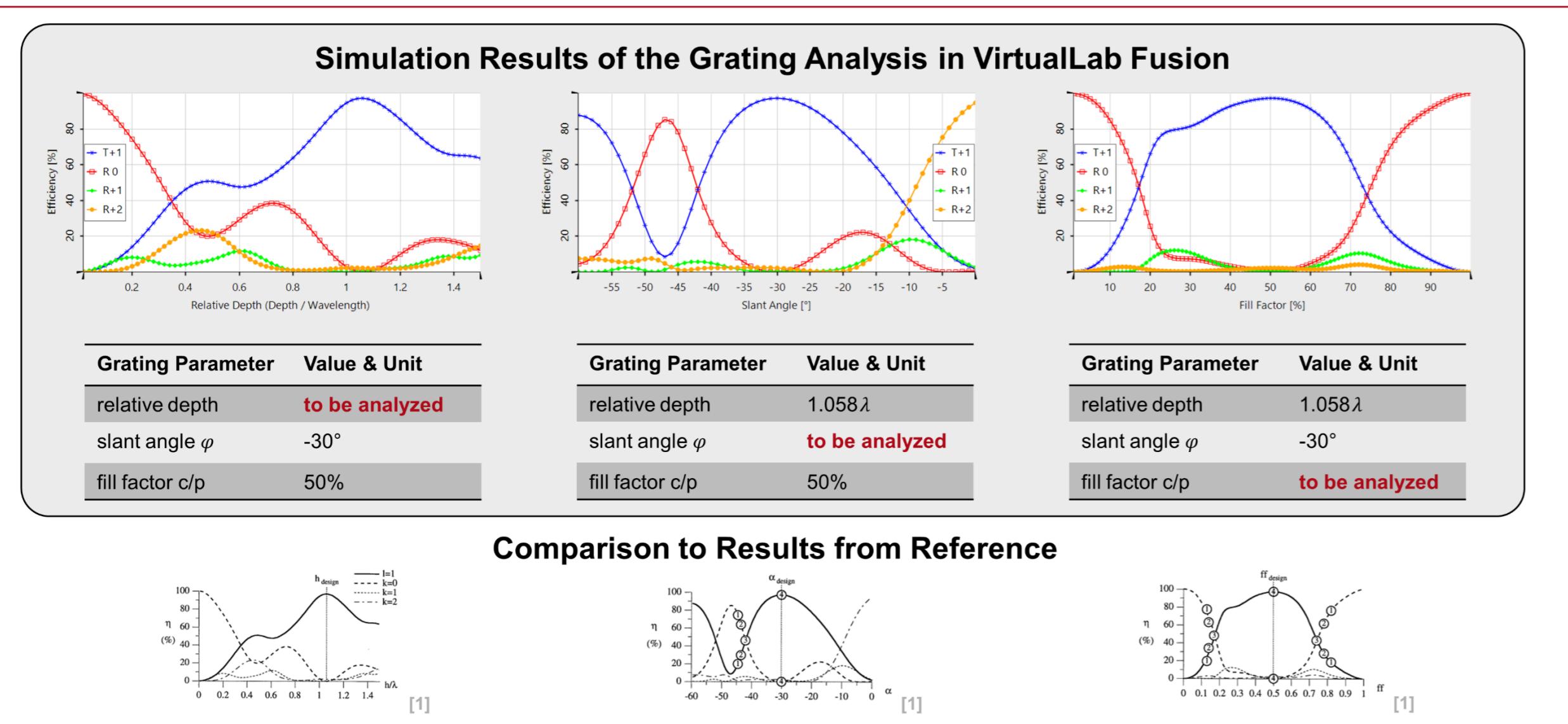
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## Analysis of Grating Coupling by Single Mode Illumination



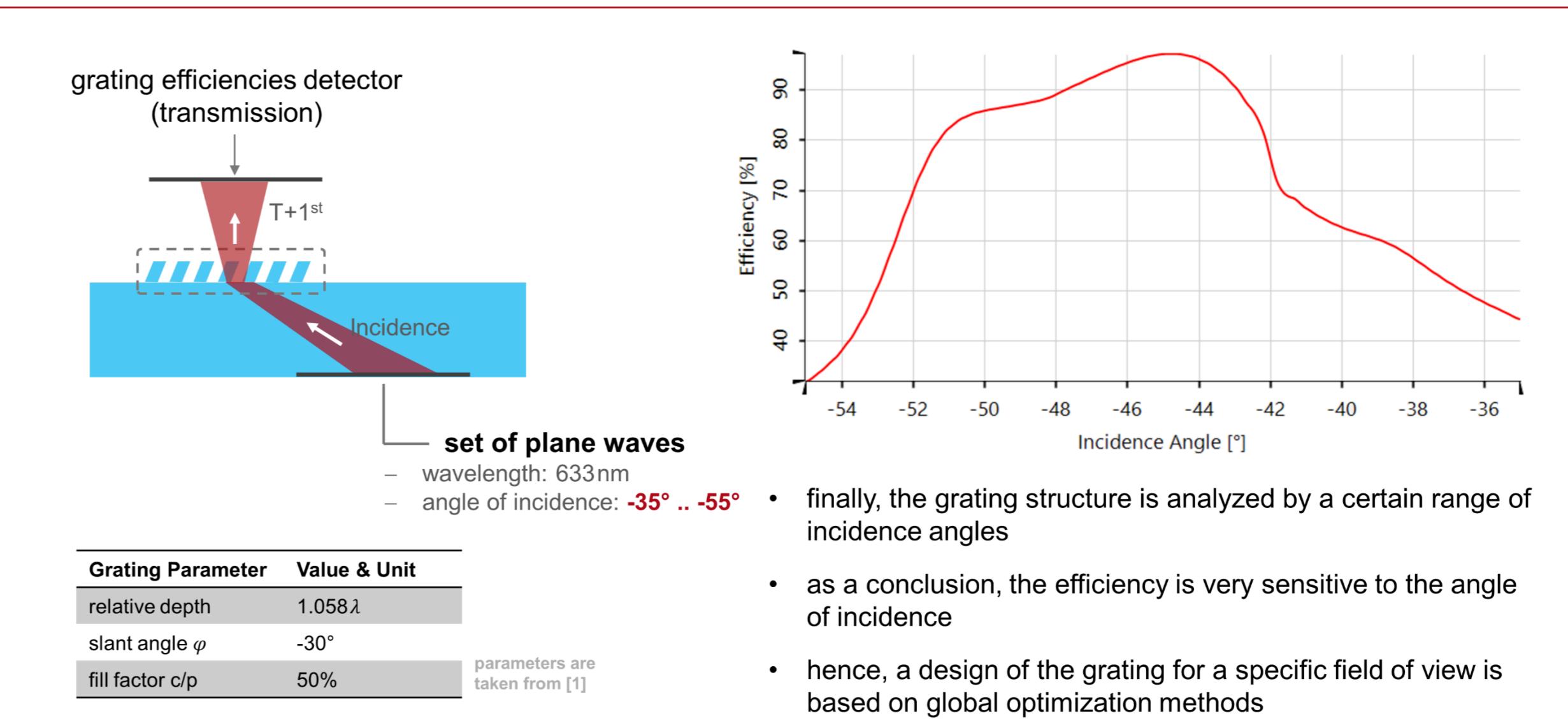
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## Diffraction Efficiency vs. Grating Parameters



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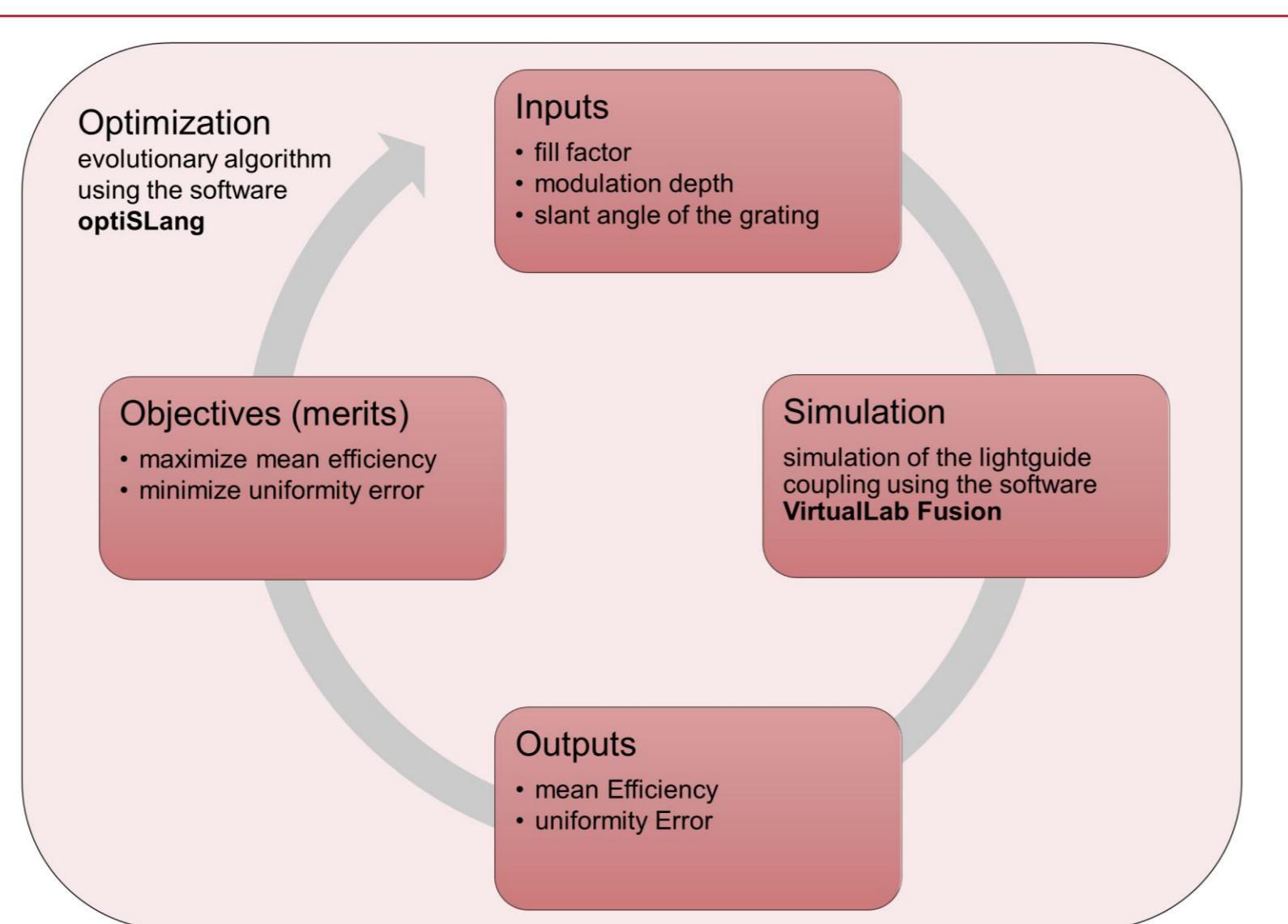
## Diffraction Efficiency vs. Angle of Incidence



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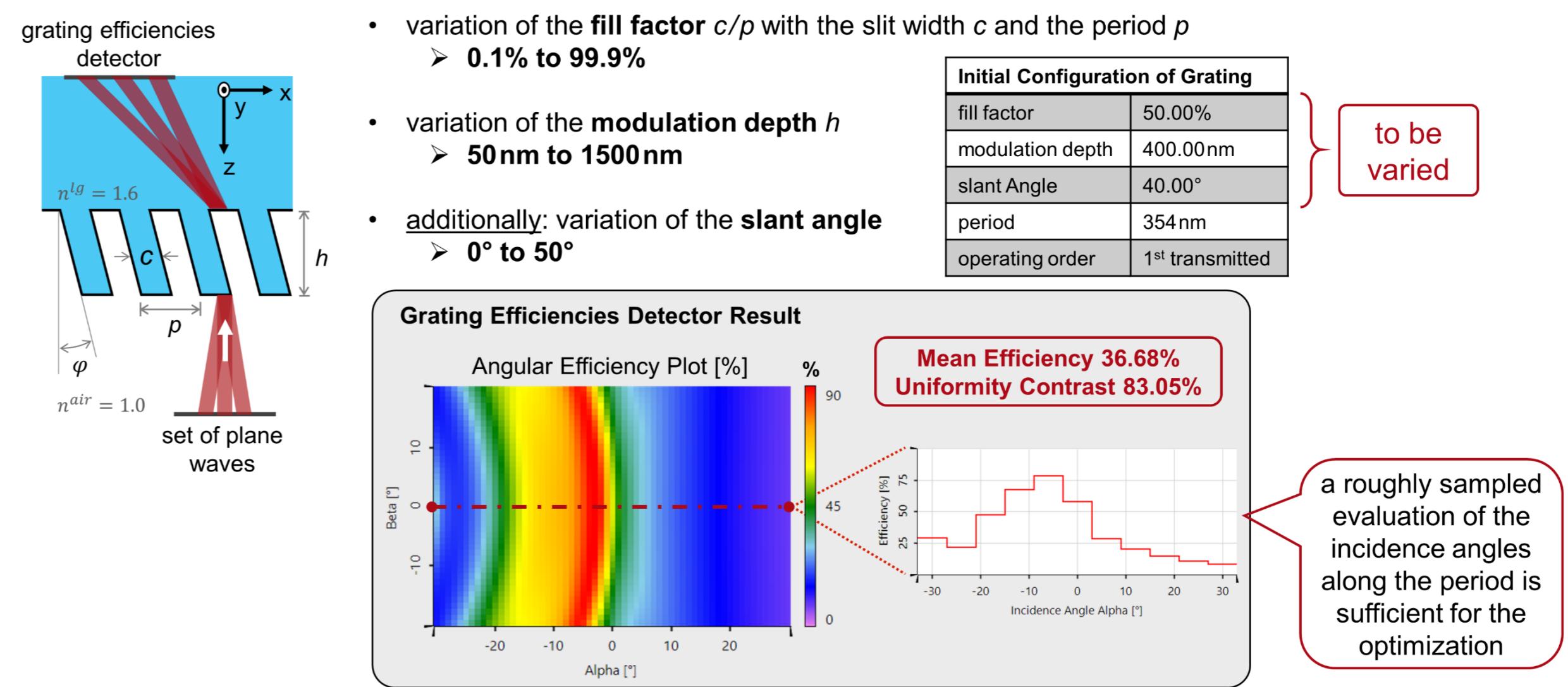
## General Optimization Workflow

- the following optimization workflow is applied to design a binary grating for efficient lightguide coupling:
  - Define the inputs and their ranges, start with a reference input combination
  - Perform the optimization with several simulations
  - Calculate the corresponding outputs
  - Evaluation of the defined objectives
  - Next iteration with new inputs
- the optimization algorithm stops after certain iterations and/or when no more improvement of the objectives can be achieved



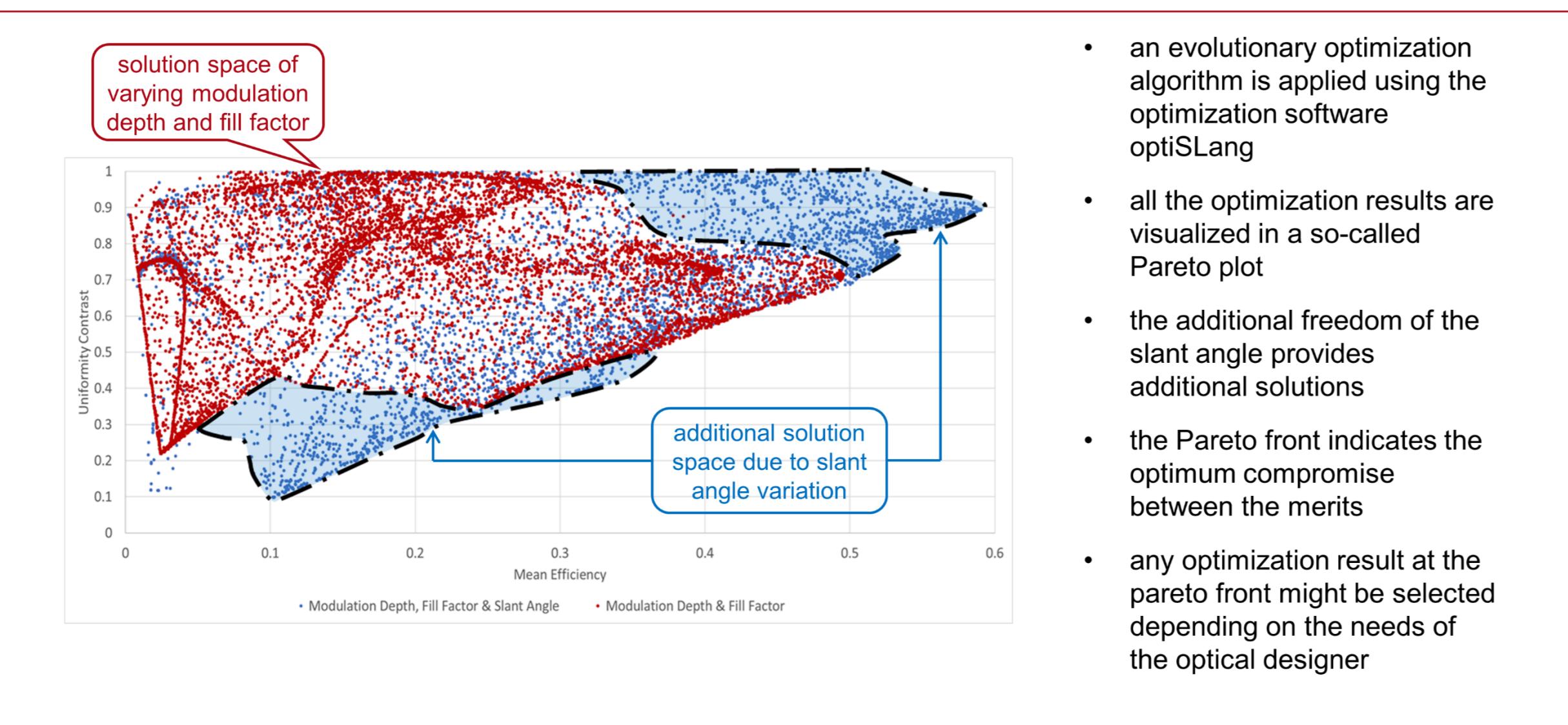
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## Simulation and the Configuration of the Merit Function



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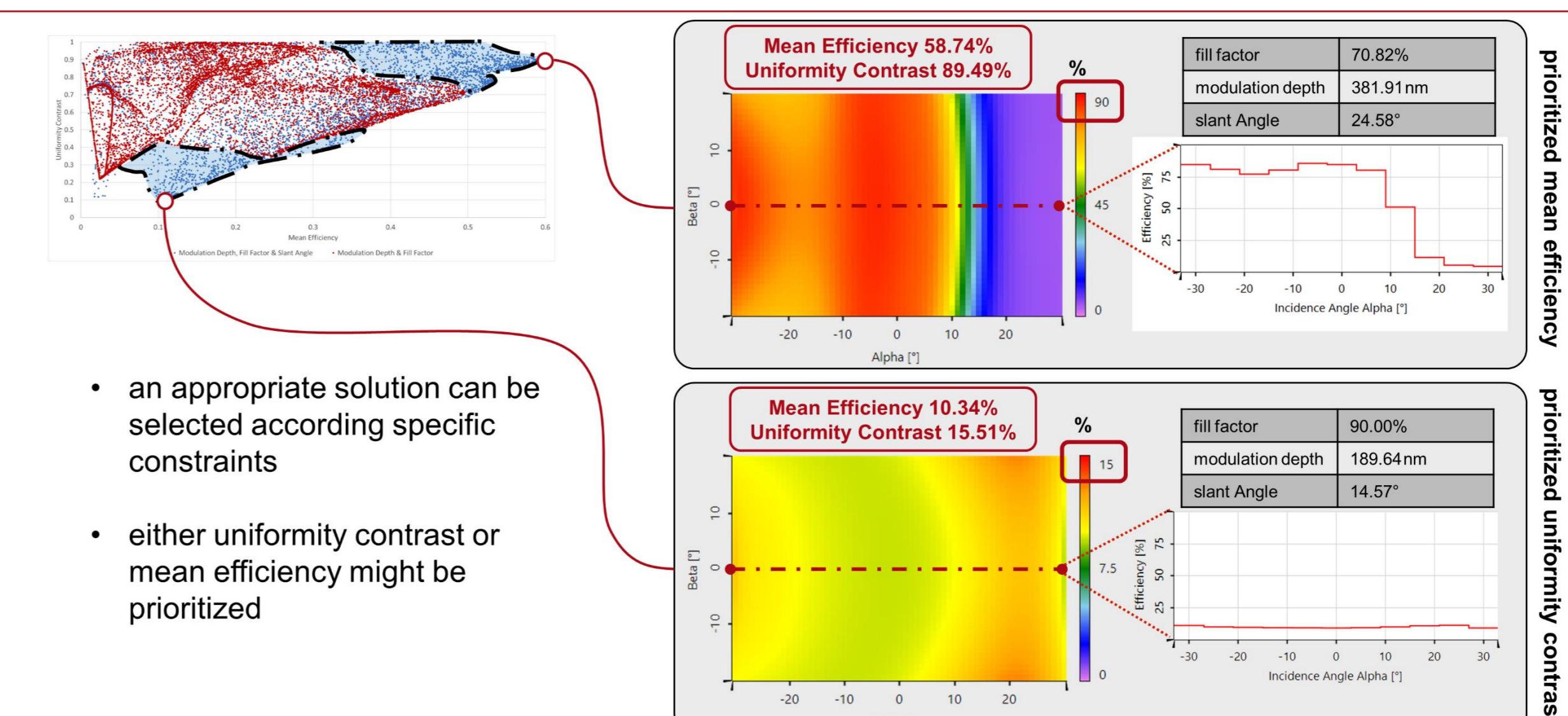
## Optimization Result of the Evolutionary Optimization Algorithm



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- an evolutionary optimization algorithm is applied using the optimization software optiSLang
- all the optimization results are visualized in a so-called Pareto plot
- the additional freedom of the slant angle provides additional solutions
- the Pareto front indicates the optimum compromise between the merits
- any optimization result at the Pareto front might be selected depending on the needs of the optical designer

## Analysis of Coupling Efficiency for Optimization Results



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## Bibliography

- J. Michael Miller, Nicole de Beaucoudrey, Pierre Chavel, Jari Turunen, and Edmond Cambril, "Design and fabrication of binary slanted surface-relief gratings for a planar optical interconnection," Appl. Opt. 36, 5717-5727 (1997)