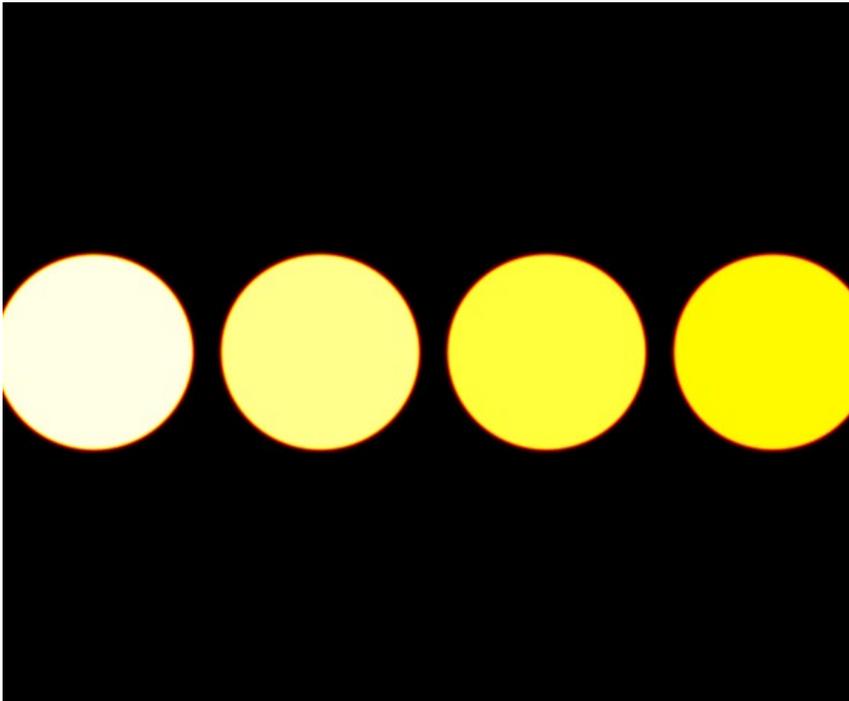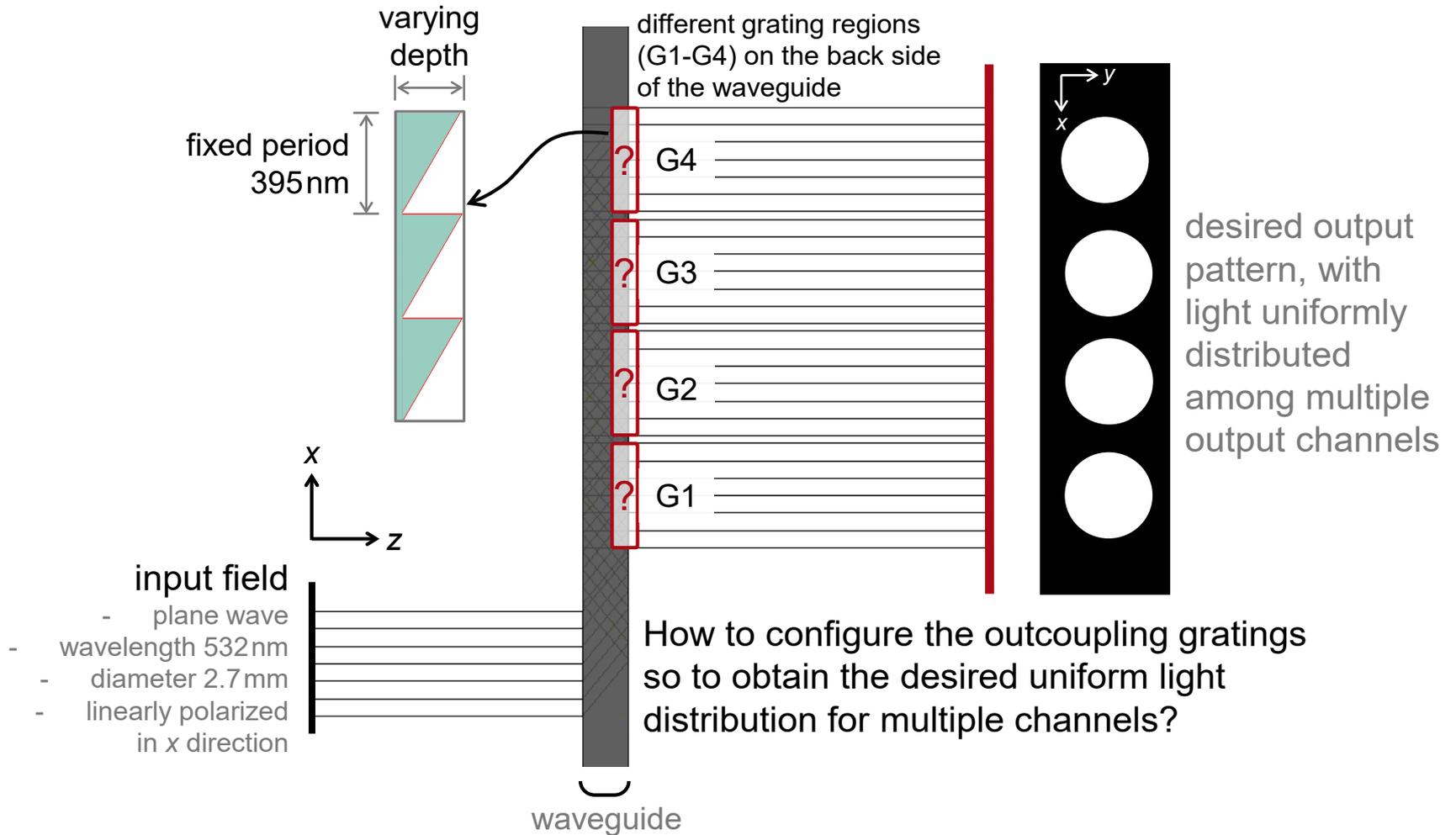# Optimizing Waveguide Outcoupling Gratings for Uniform Multiple Channels

Abstract

In the design of waveguide-based near-to-eye displays, a key issue is the configuration of the in- and outcoupling gratings. As a multi-channel imaging system, the uniformity among all output channels must be ensured. In this example, a set of outcoupling gratings are optimized in VirtualLab Fusion, so to generate uniform multiple channels. For grating modeling and diffraction efficiency calculation in the optimization, rigorous Fourier Modal method is employed.
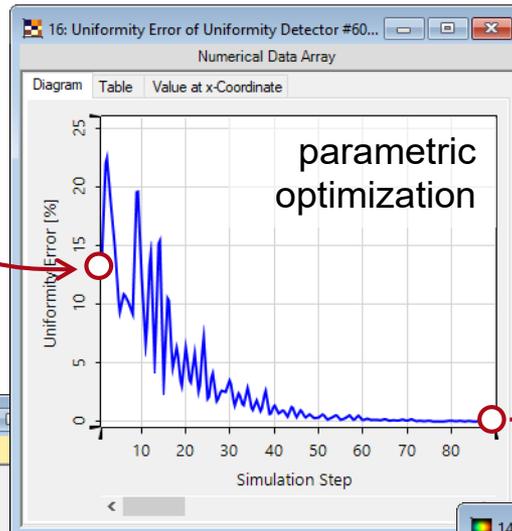
Design Task

varying depth

different grating regions (G1-G4) on the back side of the waveguide

fixed period 395 nm

G4

G3

G2

G1

desired output pattern, with light uniformly distributed among multiple output channels

input field
- plane wave
- wavelength 532 nm
- diameter 2.7 mm
- linearly polarized in x direction

How to configure the outcoupling gratings so to obtain the desired uniform light distribution for multiple channels?

waveguide

Results

initial grating configuration

Grating	Depth
G1	140 nm
G2	140 nm
G3	140 nm
G4	140 nm

16: Uniformity Error of Uniformity Detector #60...

Numerical Data Array

Diagram | Table | Value at x-Coordinate

parametric optimization

Uniformity Error [%]

Simulation Step

optimized grating configuration

Grating	Depth
G1	132 nm
G2	138 nm
G3	145 nm
G4	153 nm

13: Camera Detector #601 after Waveguide #1 (T) (Field Tracing 2n...

Chromatic Fields Set

output channels (initial)

uniformity error 13.8%
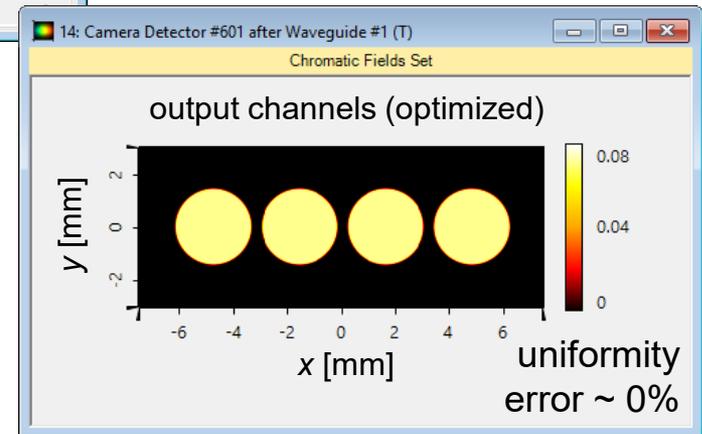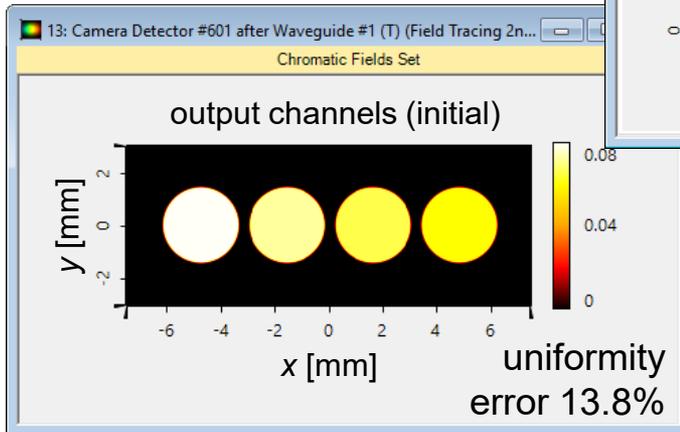
Rigorous Fourier modal method (FMM) is used for calculation of grating efficiencies in the modeling.

14: Camera Detector #601 after Waveguide #1 (T)

Chromatic Fields Set

output channels (optimized)

uniformity error ~ 0%

Document Information

title	Optimizing Waveguide Outcoupling Gratings for Uniform Multiple Channels
version	1.0
VL version used for simulations	7.3.0.41
category	Application Use Case