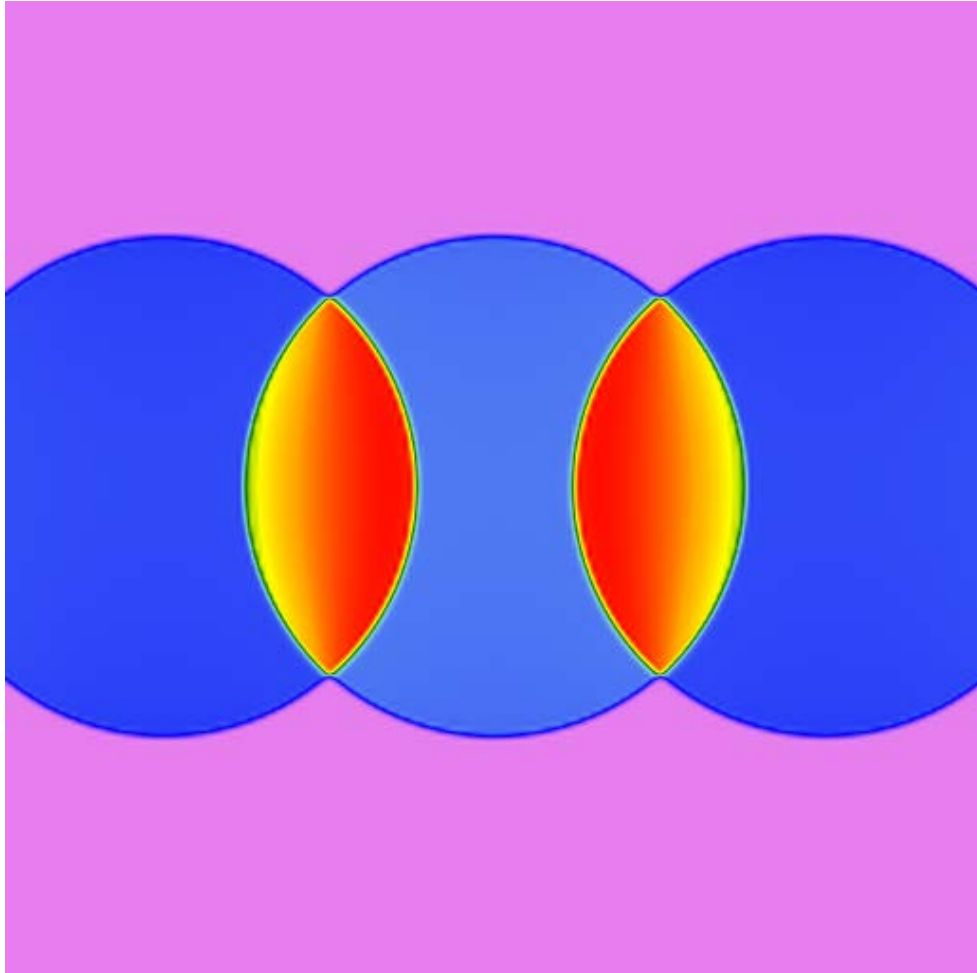# Light Propagation through Waveguide with In- & Outcoupling Surface Gratings

Abstract

As one of the important issues for near-to-eye display design, propagation of light through waveguide structure with tailored in- and outcoupling gratings is of concern. With the region and channel concepts in VirtualLab Fusion, the in- and outcoupling gratings can be configured flexibly. Very importantly, light propagation through such structures can be modeled fast and accurately, with the electromagnetic property of the light source taken into account.
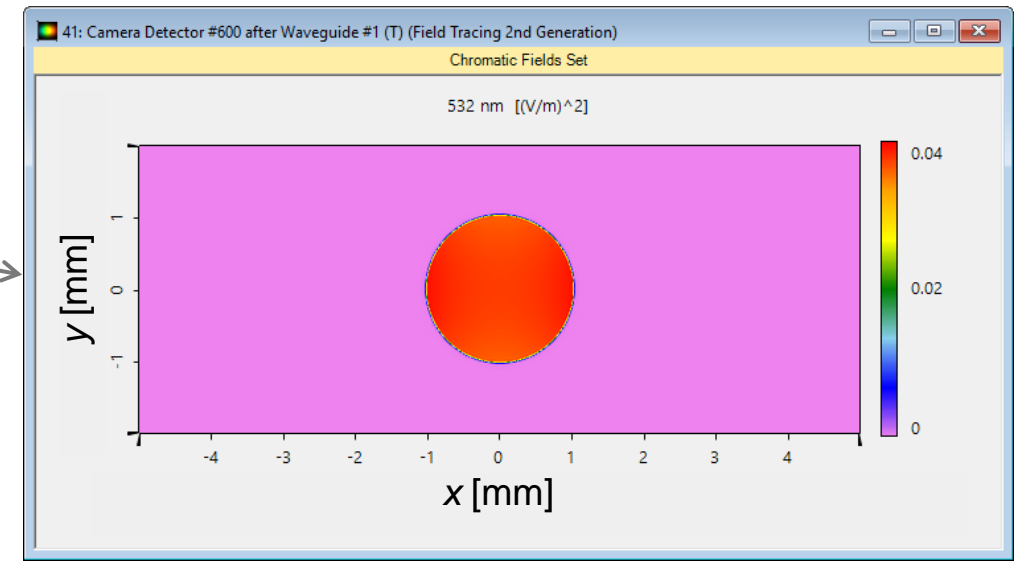
Modeling Task
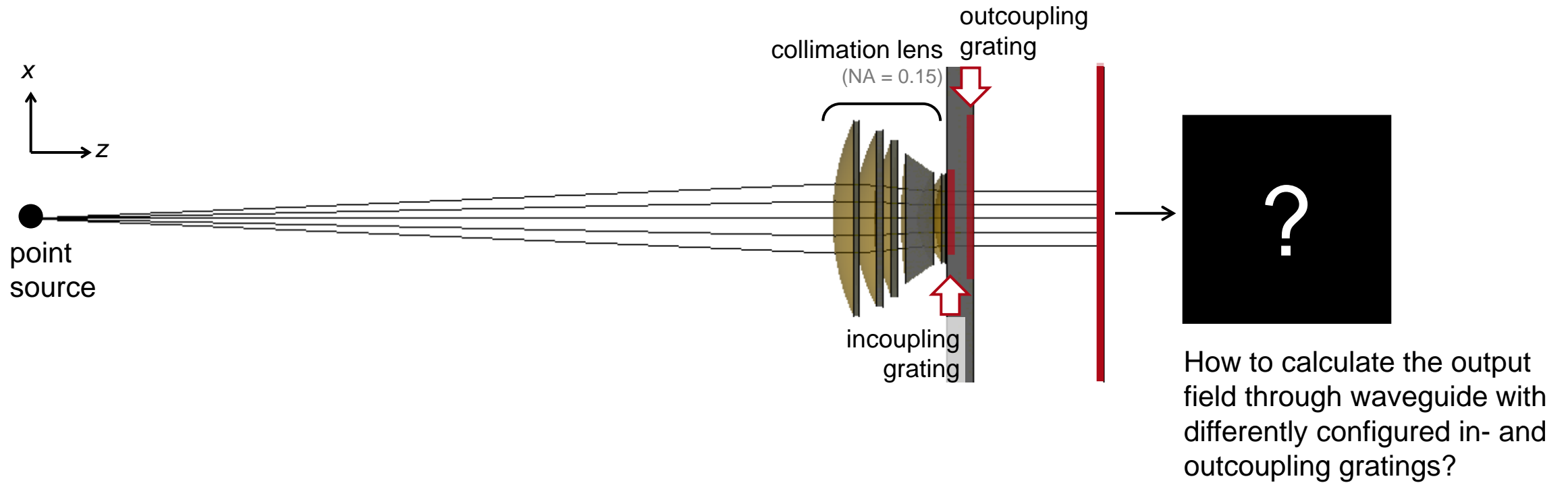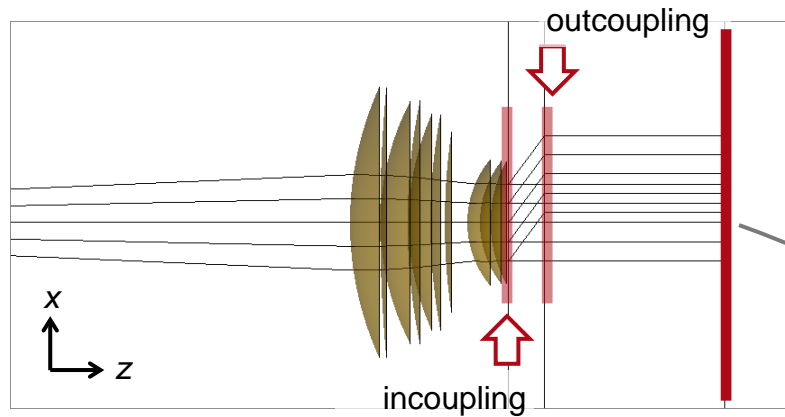
Result with Only Zeroth Grating Diffraction Order

outcoupling

incoupling

x

z
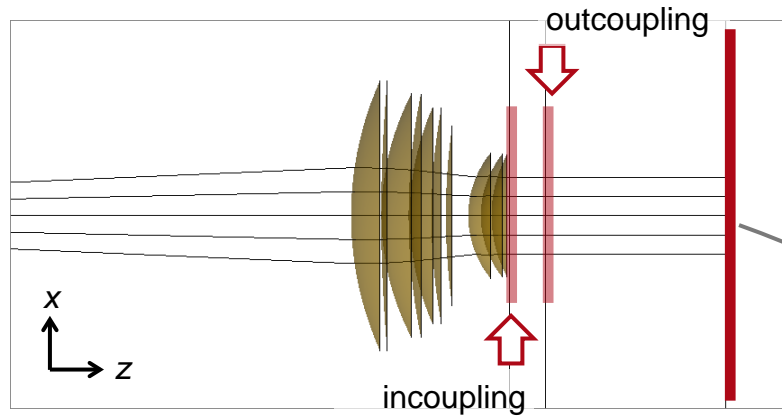
Region	Channel	Order	Efficiency
incoupling	+/+	T0	20 %
outcoupling	+/+	T0	20 %

Slight modulation in the intensity
distribution is caused by lens effects.

41: Camera Detector #600 after Waveguide #1 (T) (Field Tracing 2nd Generation)

Chromatic Fields Set

532 nm [(V/m)^2]

y [mm]

x [mm]

Result with ±1ˢᵗ Diffraction Orders

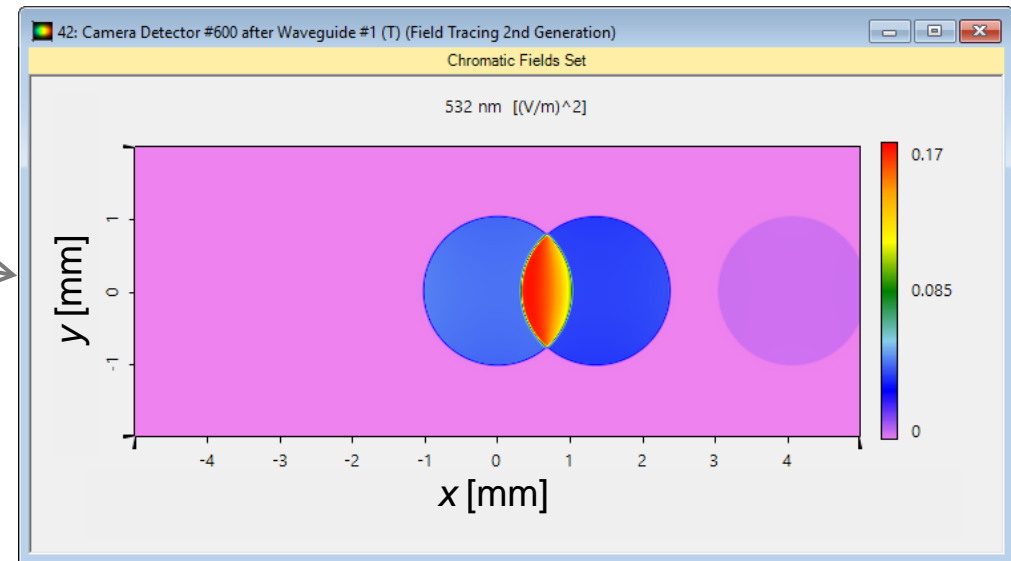| Region	Channel	Order	Efficiency
incoupling	+/+	T0	20 %
	+/+	T+1	20%
outcoupling	+/+	T0	20 %
	+/+	T-1	20%

Coherence among diffraction orders is taken into account and it leads to interference.
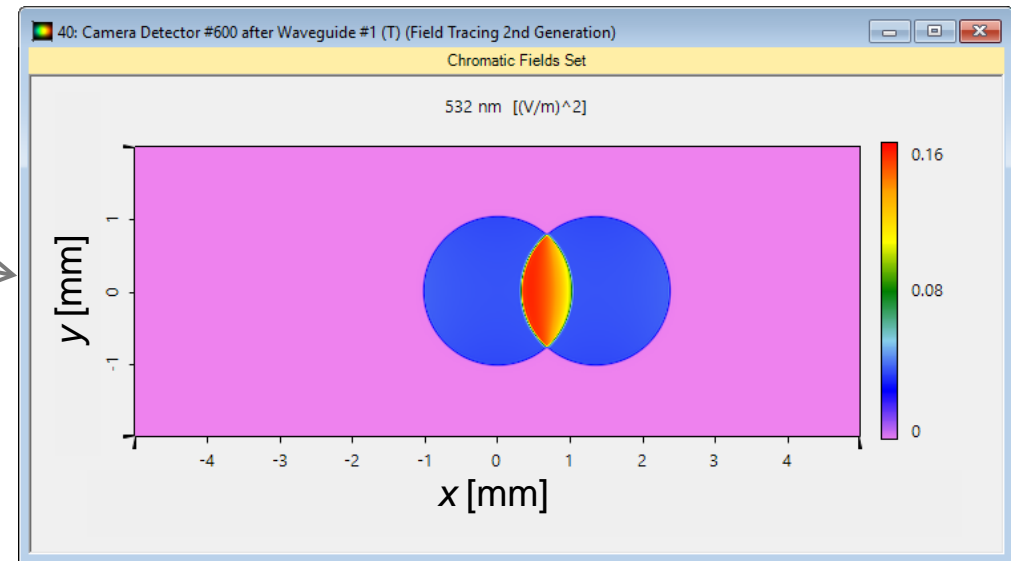
Result with Higher Diffraction Orders
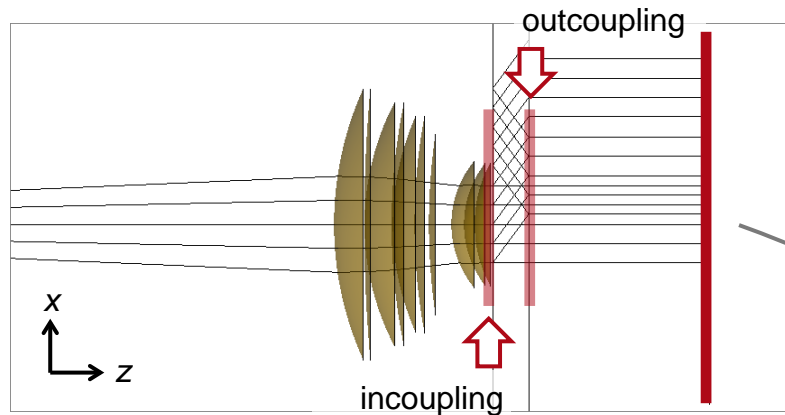
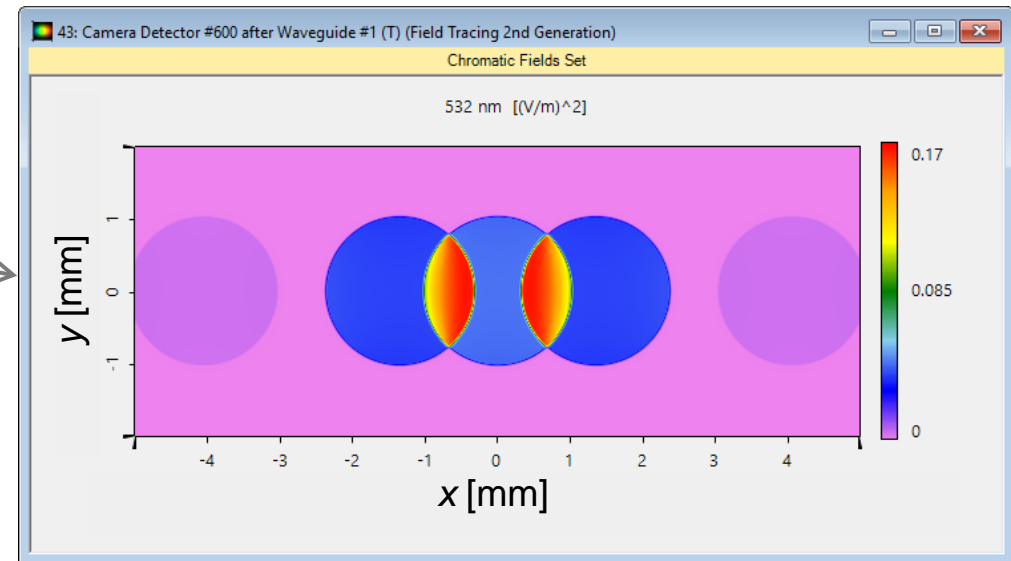| Region	Channel	Order	Efficiency
incoupling	+/+	T0	20%
	+/+	T+1	20%
	-/+	R0	10%
outcoupling	+/+	T0	20%
	+/+	T-1	20%
	+/+	R0	10%

Result with Higher Diffraction Orders
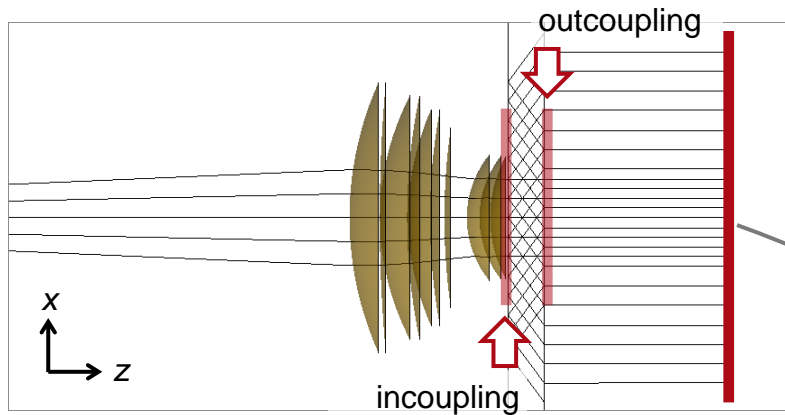
Simulation of light propagation through waveguide with tailored in- and outcoupling gratings, with coherence property taken into account, takes 3 seconds only.

Region	Channel	Order	Efficiency
incoupling	+/+	T0	20%
	+/+	T+1	20%
	-/+	R0	10%
	+/+	T-1	20%
outcoupling	+/+	T0	20%
	+/+	T-1	20%
	+/+	R0	10%
	+/+	T+1	20%

Document Information

title	Light Propagation through Waveguide with In- & Outcoupling Surface Gratings
document code	ARMR.0001
version	1.1
toolbox(es)	Waveguide Toolbox
VL version used for simulations	7.4.0.49
category	Application Use Case
further reading	- Channel Setting for Non-Sequential Tracing - Non-Sequential Ray Tracing Analysis of Glass Plate - Optimizing Waveguide Outcoupling Gratings for Uniform Multiple Channels