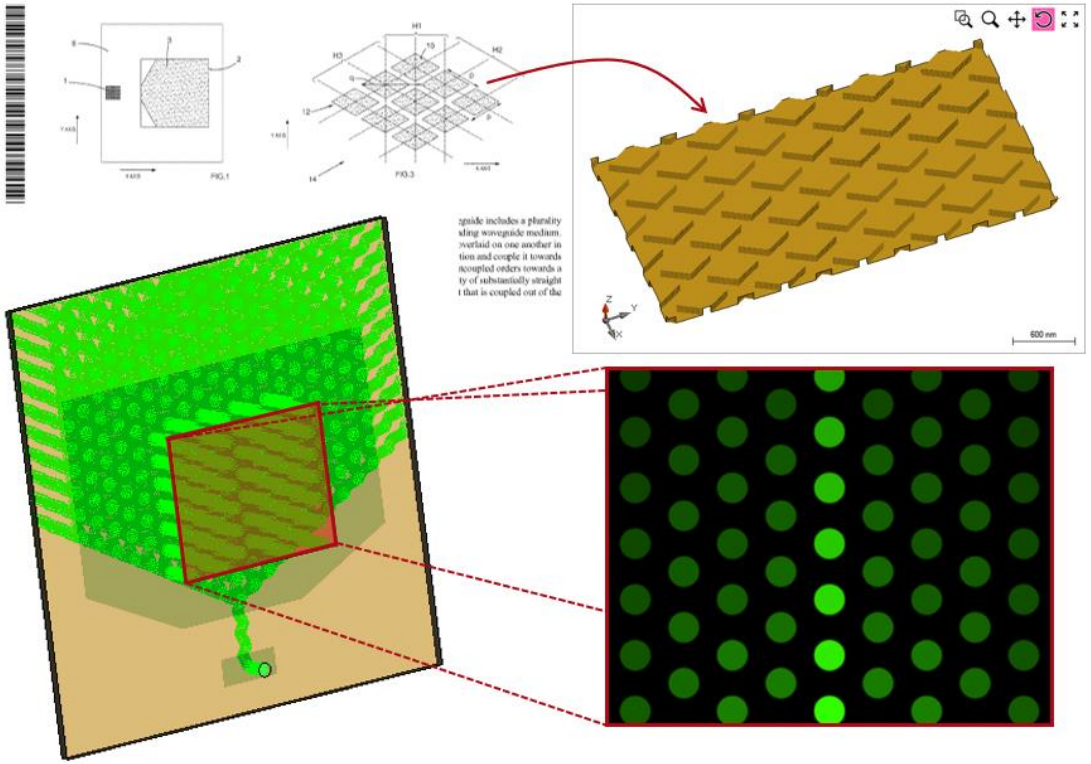
Lightguide with 2D-periodic Grating Structures (diamond-shaped) based on Patent by WaveOptics

Abstract



Most innovative AR & MR devices nowadays are based on lightguide or waveguide systems in combination with microstructures for in- and outcouple of the light. VirtualLab Fusion is capable of detailed modeling of such devices by applying our unique physical optics approach, including all effects (e.g. coherence, polarization and diffraction). We demonstrate this capability by modeling a device mentioned in patent WO2018/178626, consisting of complex 1D and 2D-perodic grating structures.

Modeling Task: Approach from Patent WO2018/178626

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(54) Title: WAVEGUIDE FOR AN AUGMENTED REALITY OR VIRTUAL REALITY DISPLAY

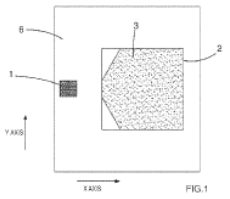

FIG.1

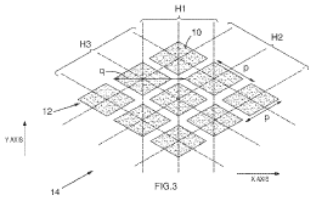

FIG.3

(57) Abstract: A waveguide is disclosed for use in an augmented reality or virtual reality display. The waveguide includes a plurality of optical structures (10, 20, 30, 40, 50, 60, 70, 80) exhibiting differences in refractive index from a surrounding waveguide medium. The optical structures are arranged in an array to provide at least two diffractive optical elements (H1, H2) overlaid on one another in the waveguide. Each of the two diffractive optical elements is configured to receive light from an input direction and couple it towards the other diffractive optical element which can then act as an output diffractive optical element, providing outcoupled orders towards a viewer. The optical structures have a shape, when viewed in the plane of the waveguide, comprising a plurality of substantially straight sides having respective normal vectors at different angles and this can effectively reduce the amount of light that is coupled out of the waveguide on first interaction with the optical structures.

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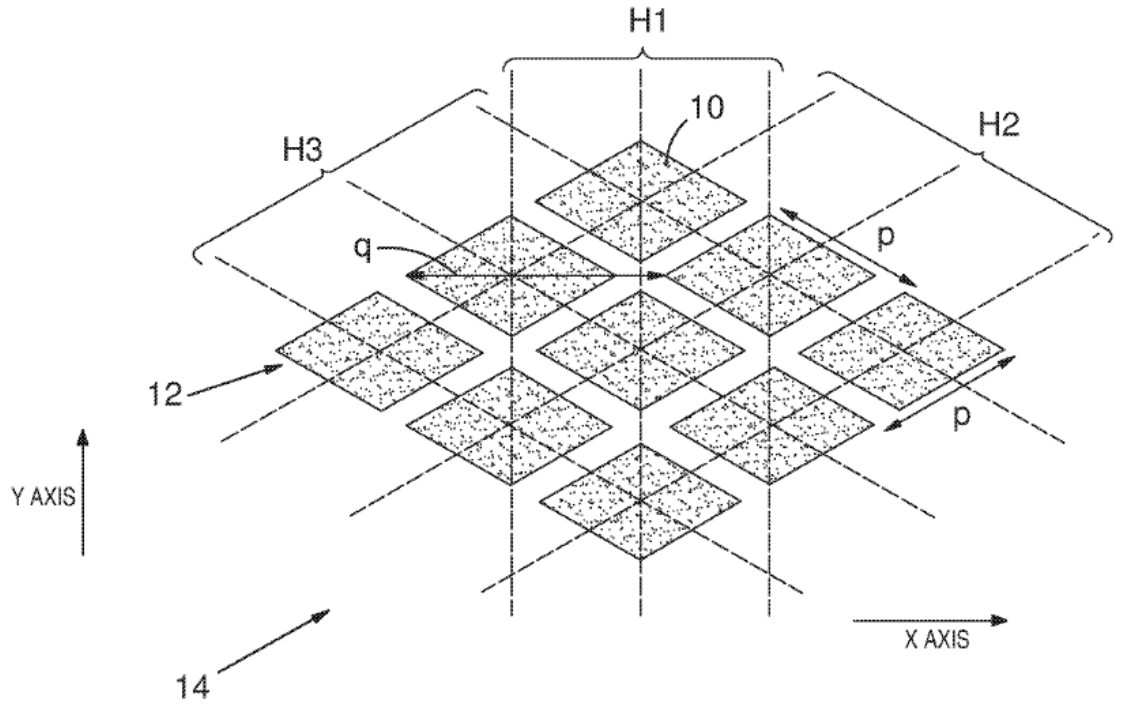
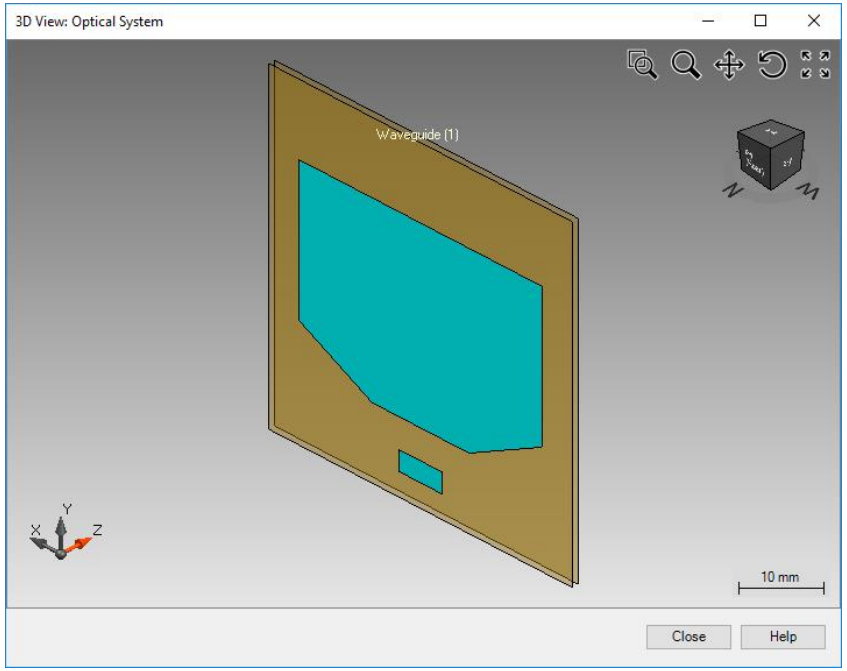


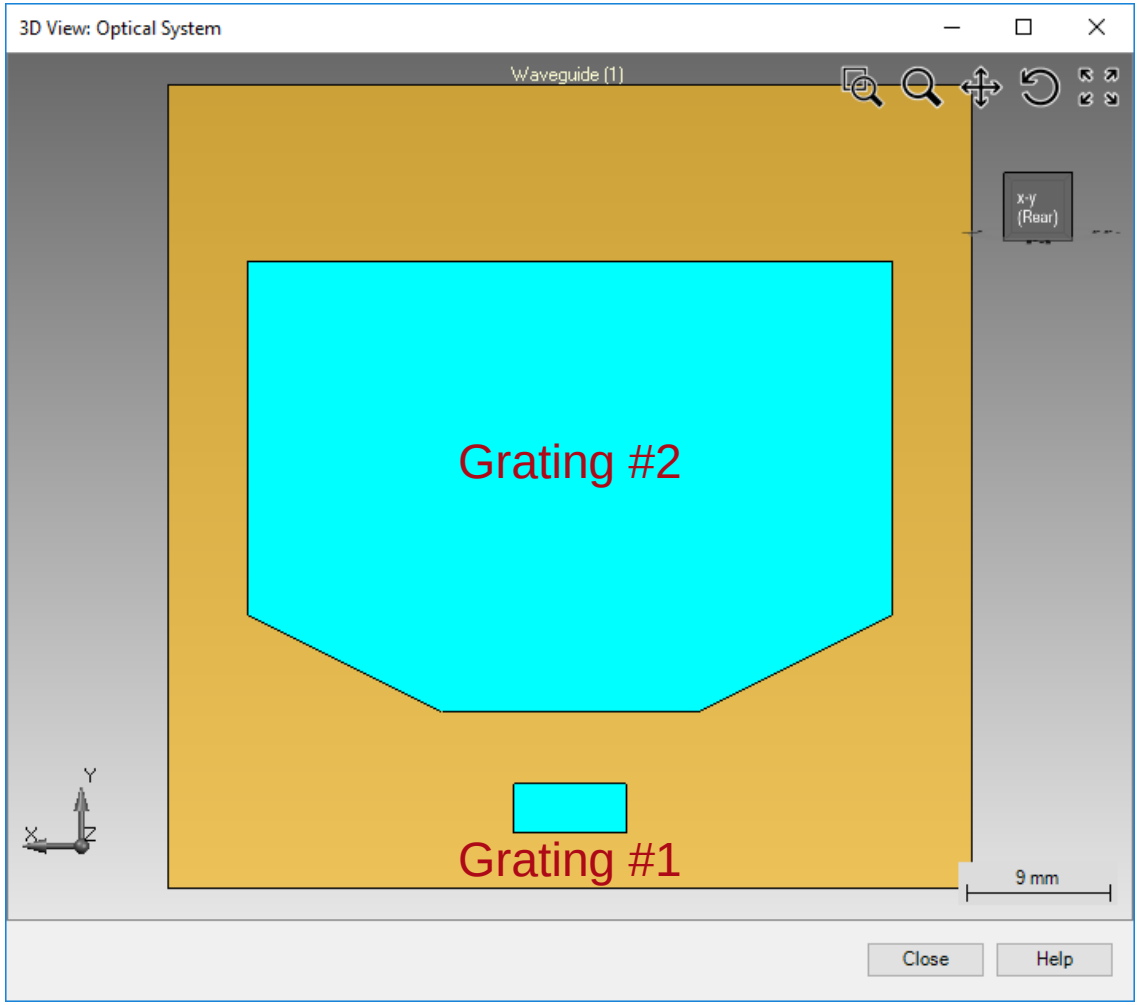
FIG.3

Lightguide Layout

Geometric layout exhibits 2 gratings:

- Grating 1: lamellar (1D-periodic), e.g. slanted grating
- Grating 2: crossed grating (2D-periodic, non-orthogonal)



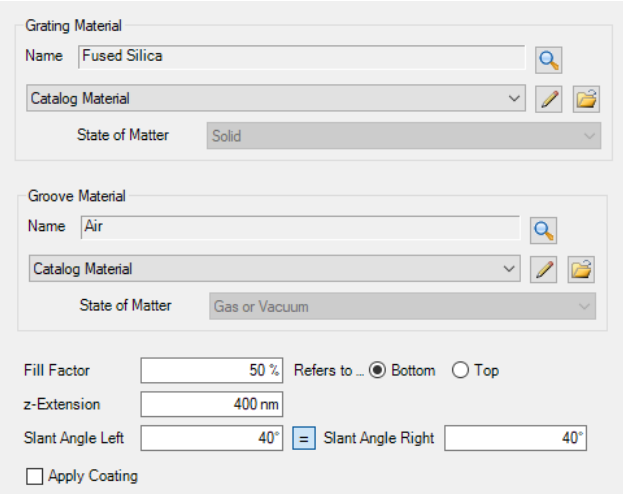


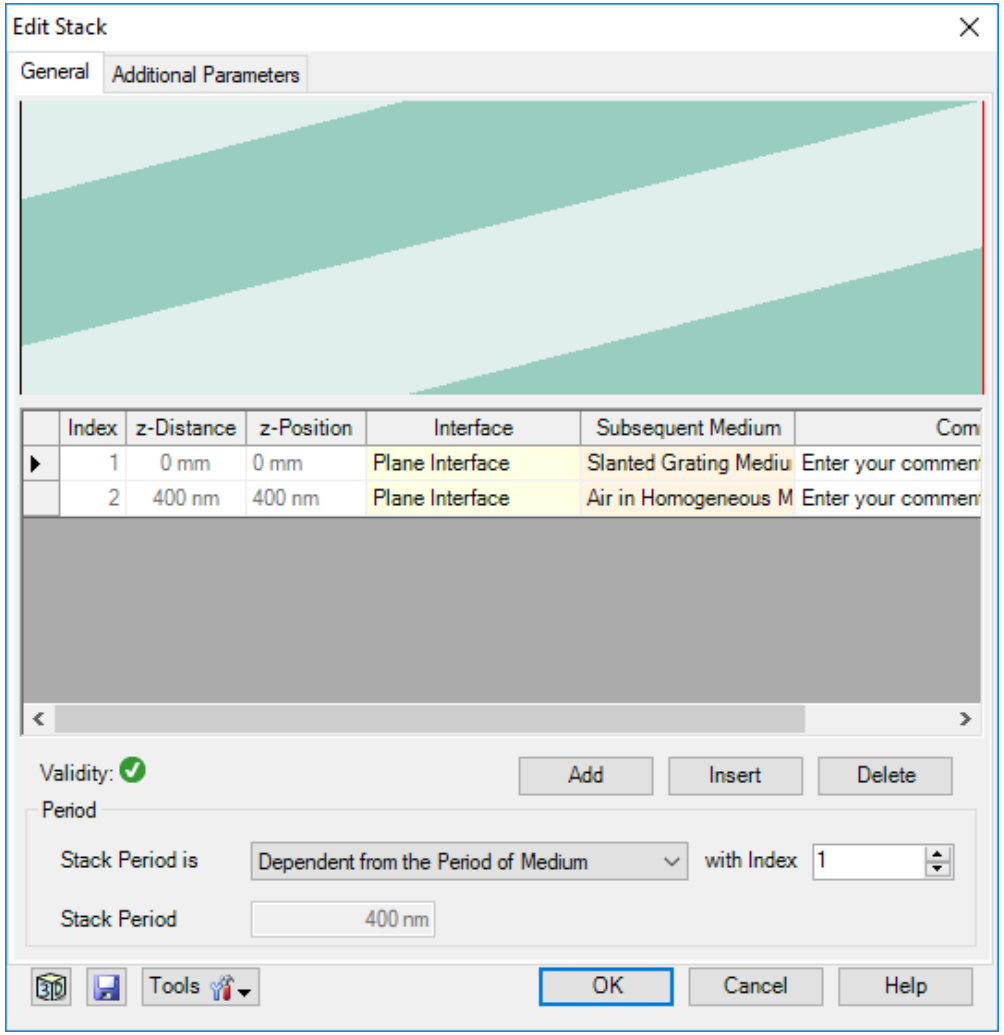
Grating #1: 1D-periodic Grating with Slanted Grating Ridges

1D-periodic grating structure with slanted grating ridges, by using an inbuilt modulated medium.

Available parameters:

- Period
- Z-extension (Modulation depth along z-axis)
- Fill factor (at bottom or top in non-parallel case)
- Slant angles of sidewalls



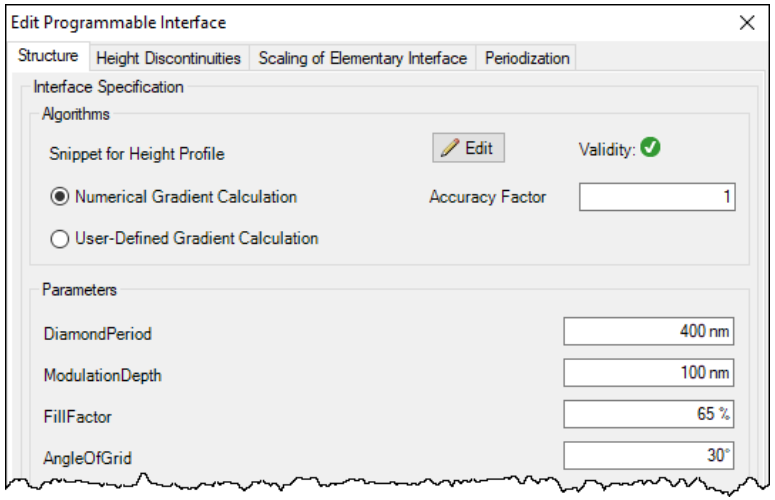


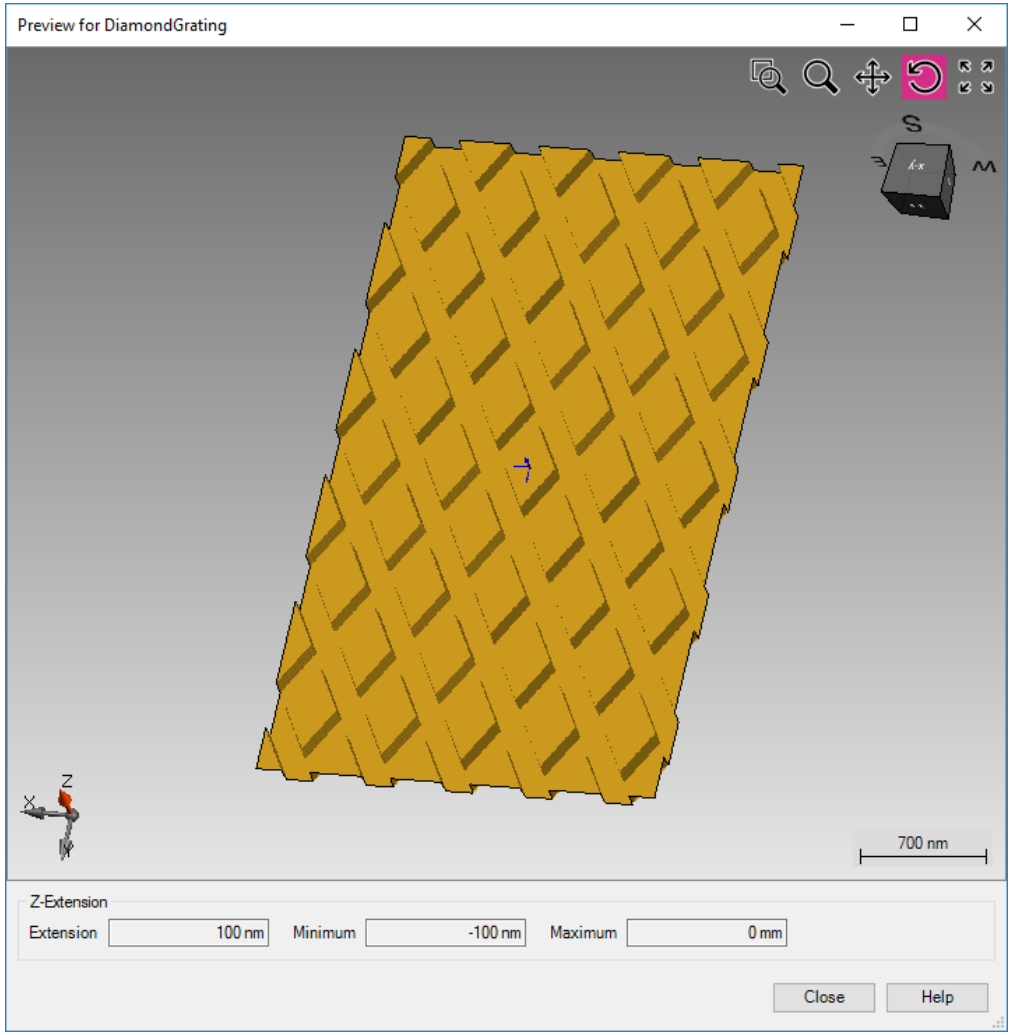
Grating #2: 2D-periodic Grating with Diamond-like Shape

Diamond-shaped (rhombus) grating structure with non-orthogonal 2D period, realized by a programmable interface.

Available parameters:

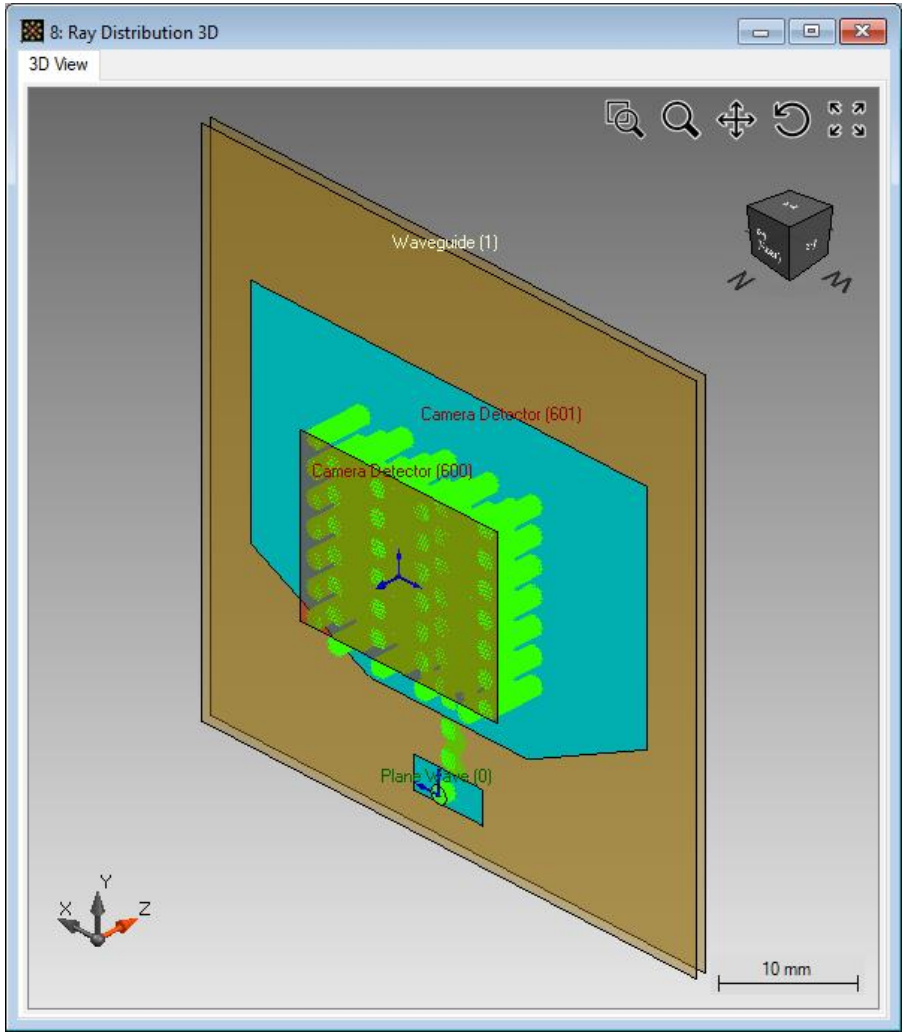
- Period (in direction of diamond)
- Modulation depth
- Fill factor
- Angle of diamond grid



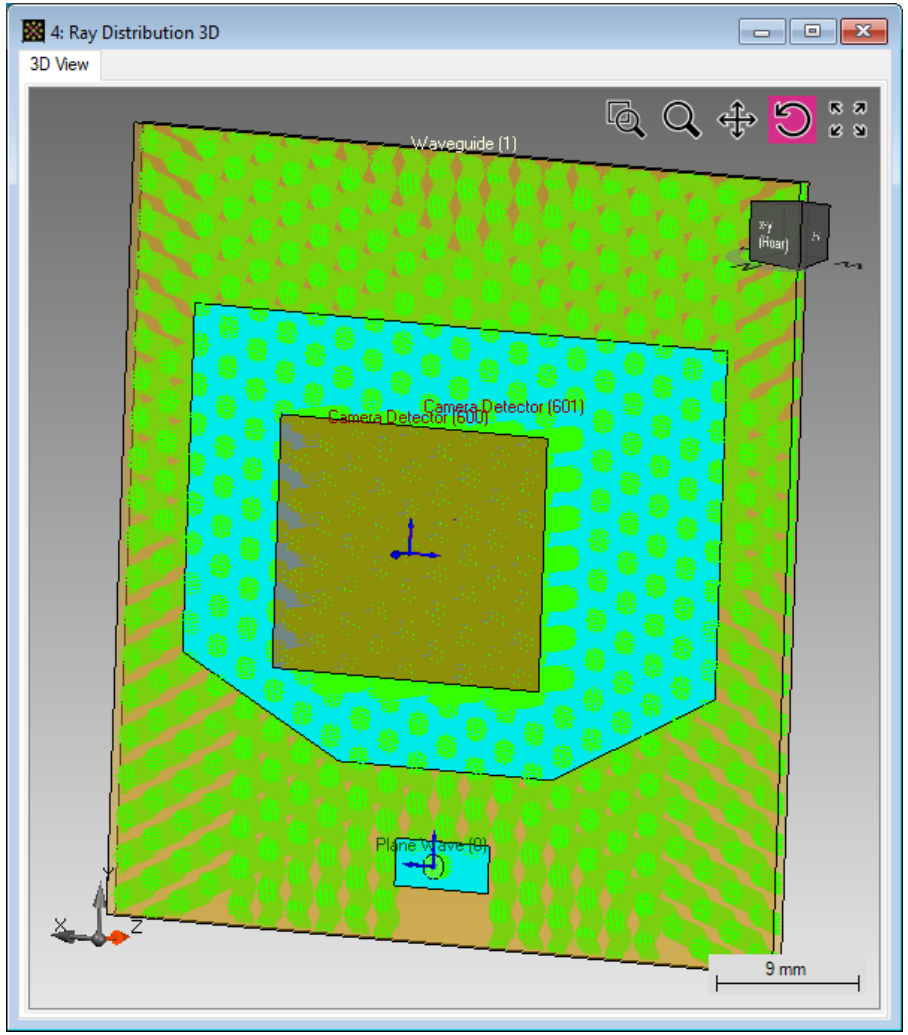


Result: Ray Tracing

just light hitting the “eye-box”:

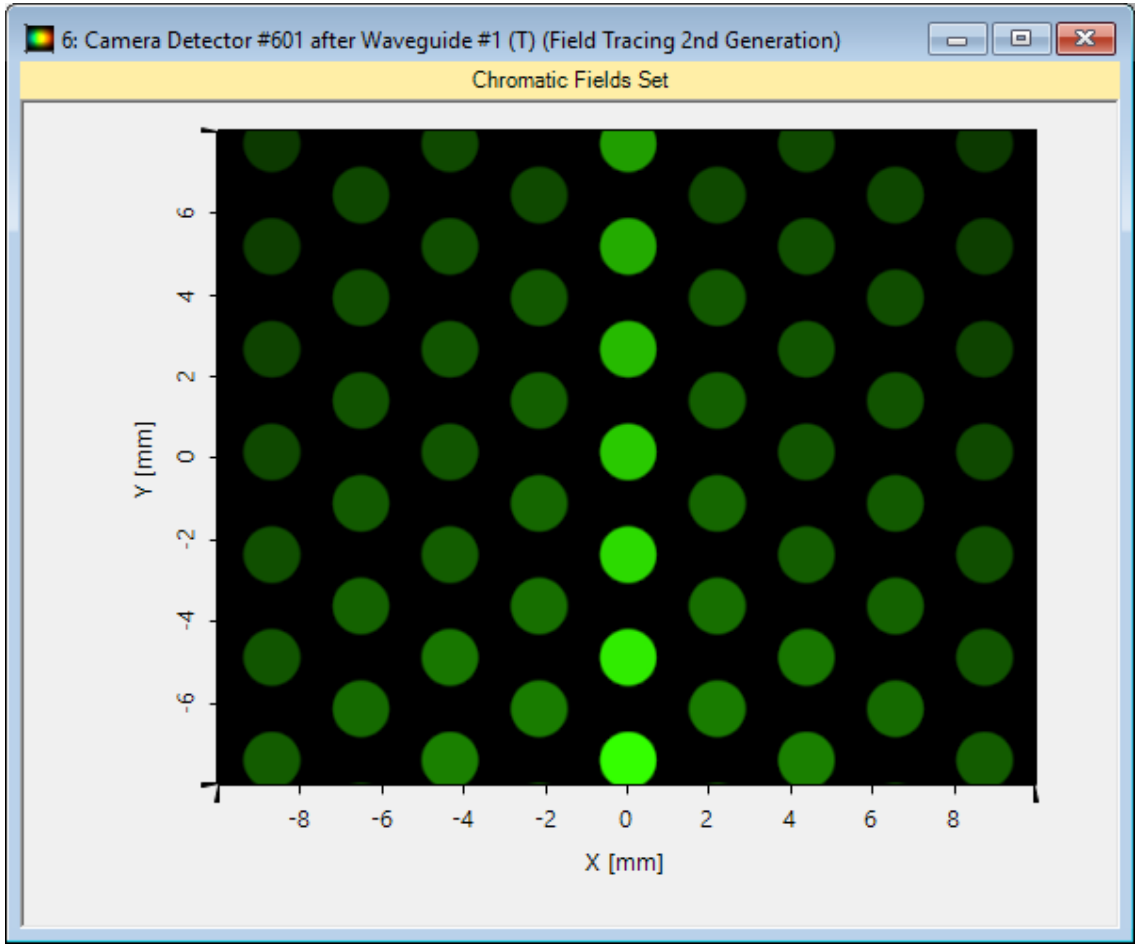


all light:

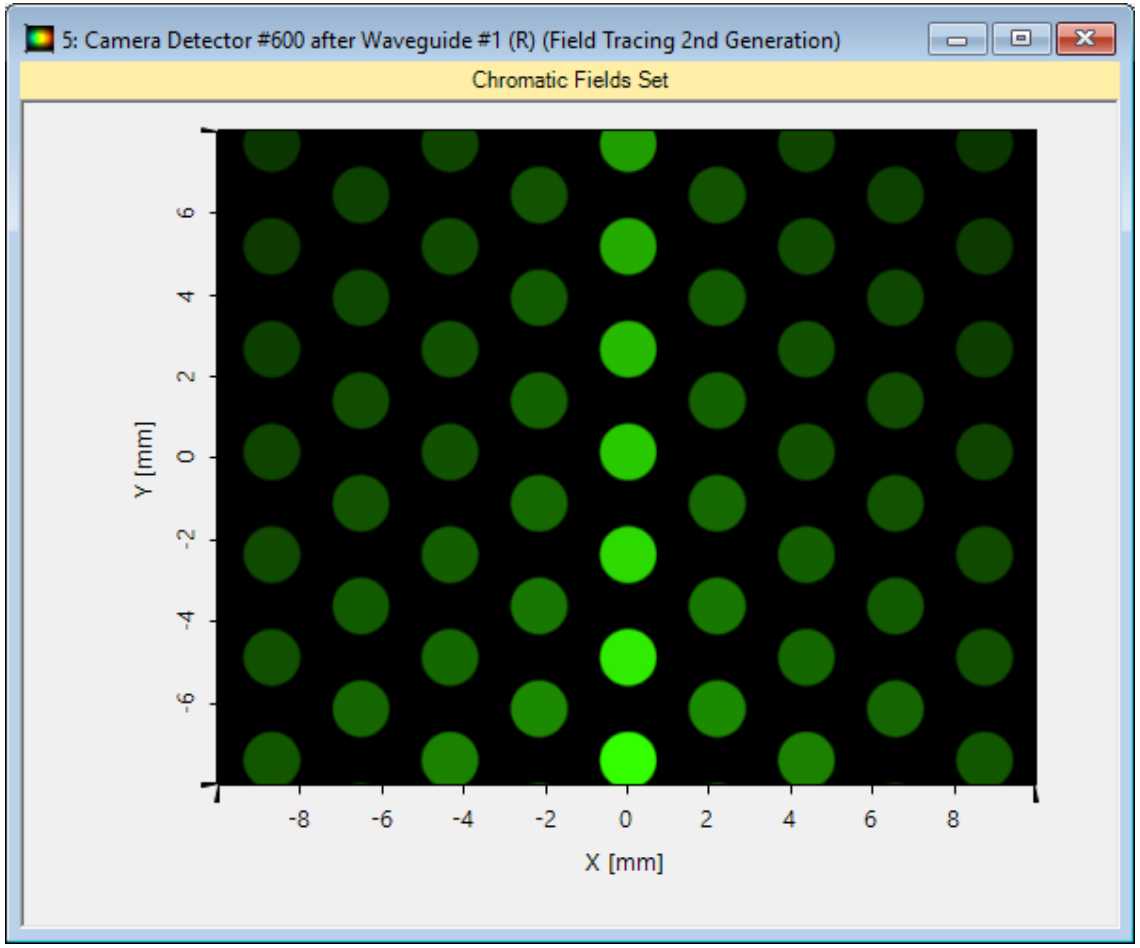


Result: Field Tracing

transmitted light:

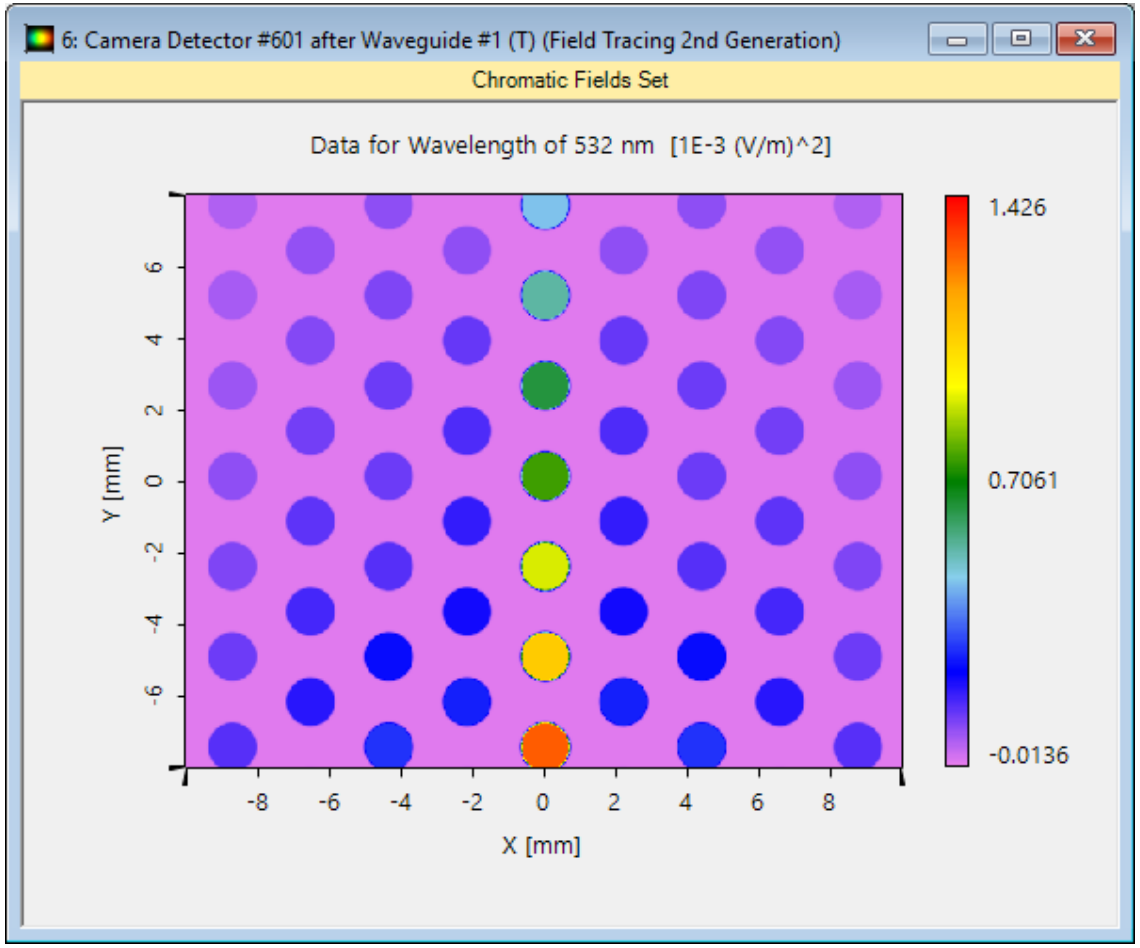


reflected light:

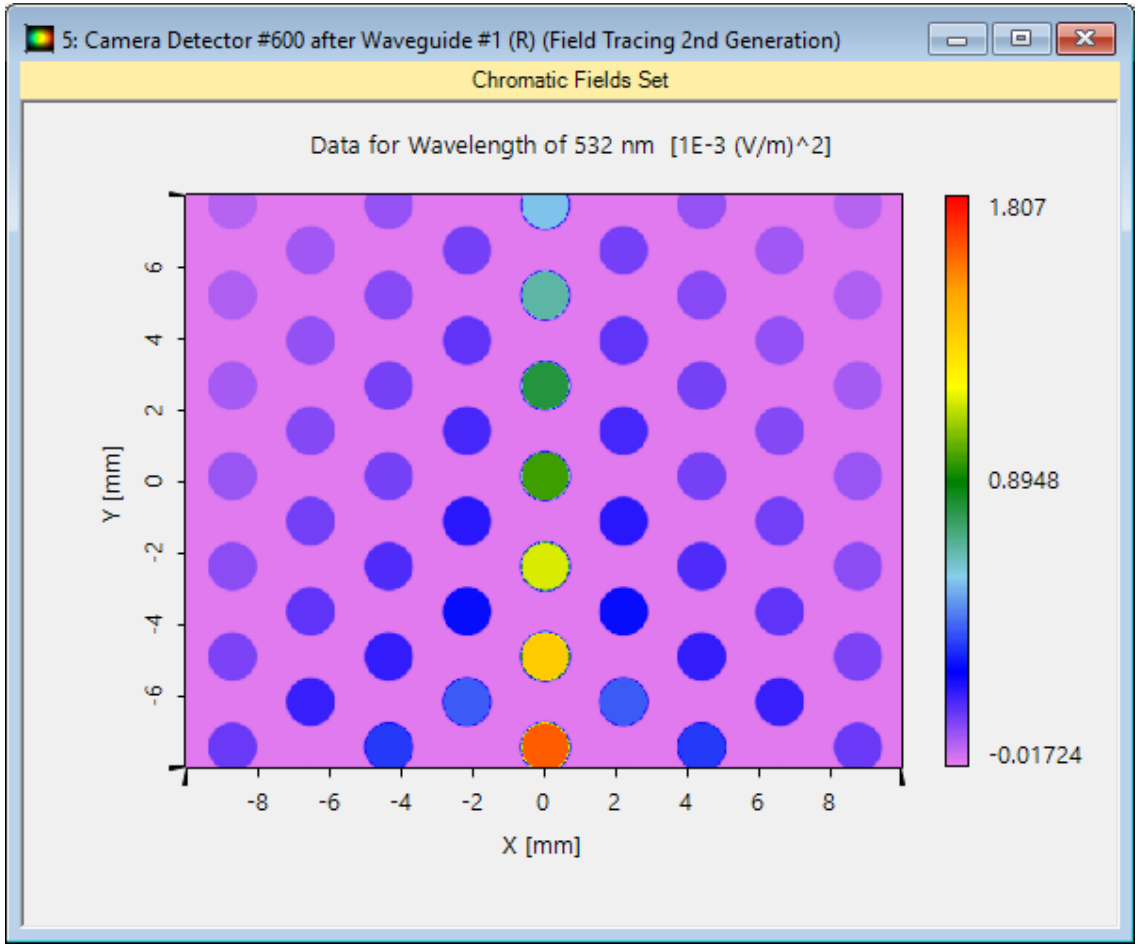


Result: Field Tracing

transmitted light:



reflected light:



Document Information

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