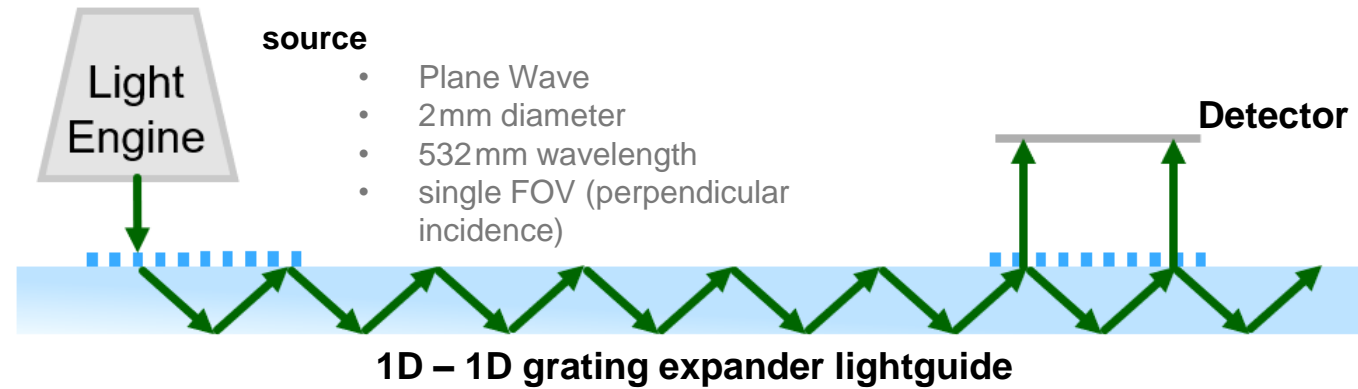


Lightguide Featuring Segmented Gratings Regions with Intermittent Gaps

Application Scenario

Application Scenario: System



Configuration a)

Incoupler (idealized grating)

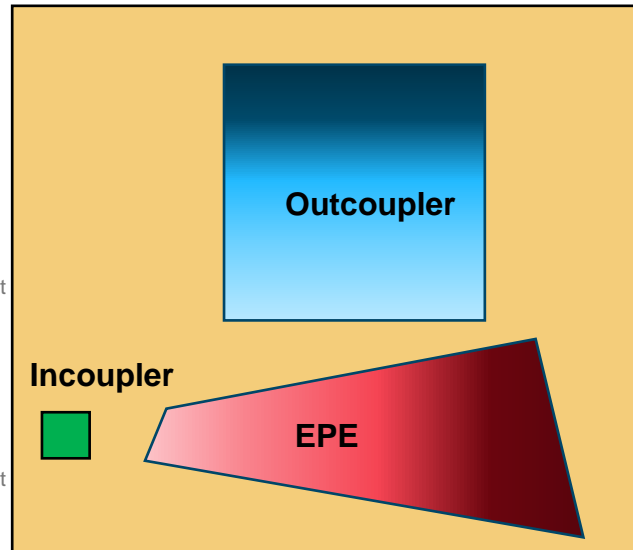
- 380nm period
- 1st transmission order (100%)

Eye Pupil Expander (idealized grating)

- 268.7 nm period
- smooth variation of efficiency of 1st reflection order between 5% and 12%

Outcoupler (idealized grating)

- 380nm period
- smooth variation of efficiency of 1st transmission order between 5% and 23%



Configuration b)

Incoupler (idealized grating)

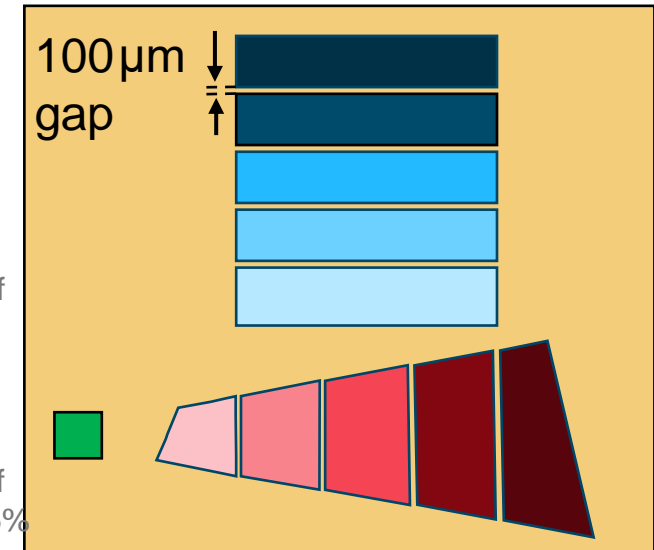
- 380nm period
- 1st transmission order (100%)

Eye Pupil Expander (idealized grating)

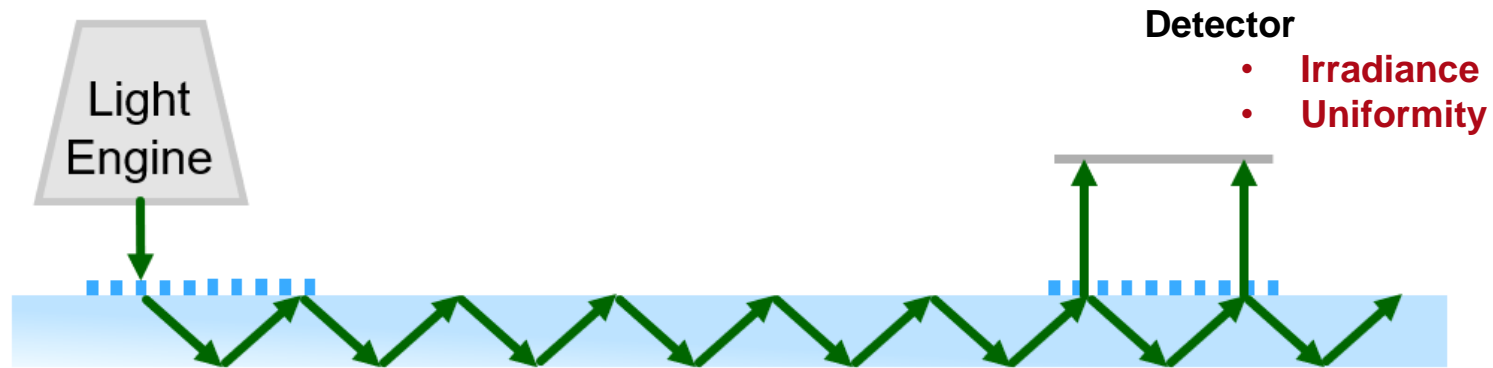
- 268.7 nm period
- stepwise variation of efficiency of 1st reflection order between 5% and 12%

Incoupler (idealized grating)

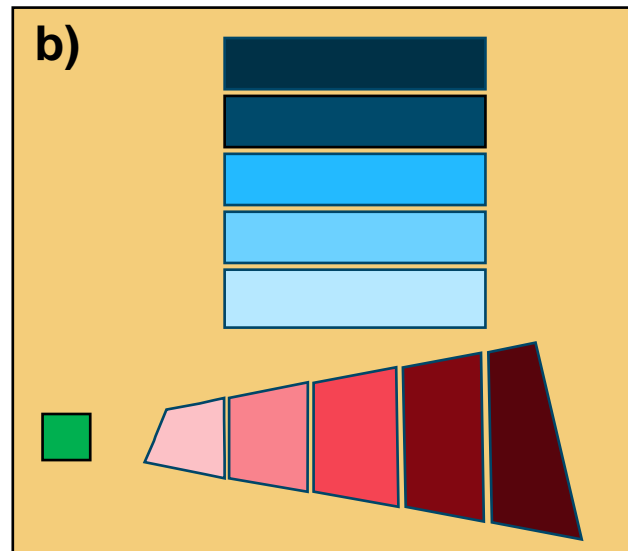
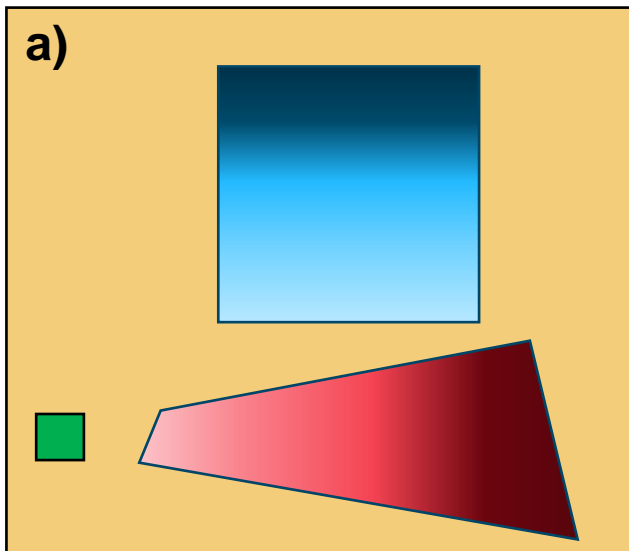
- 380nm period
- stepwise variation of efficiency of 1st transmission order between 5% and 23%



Application Scenario: Task

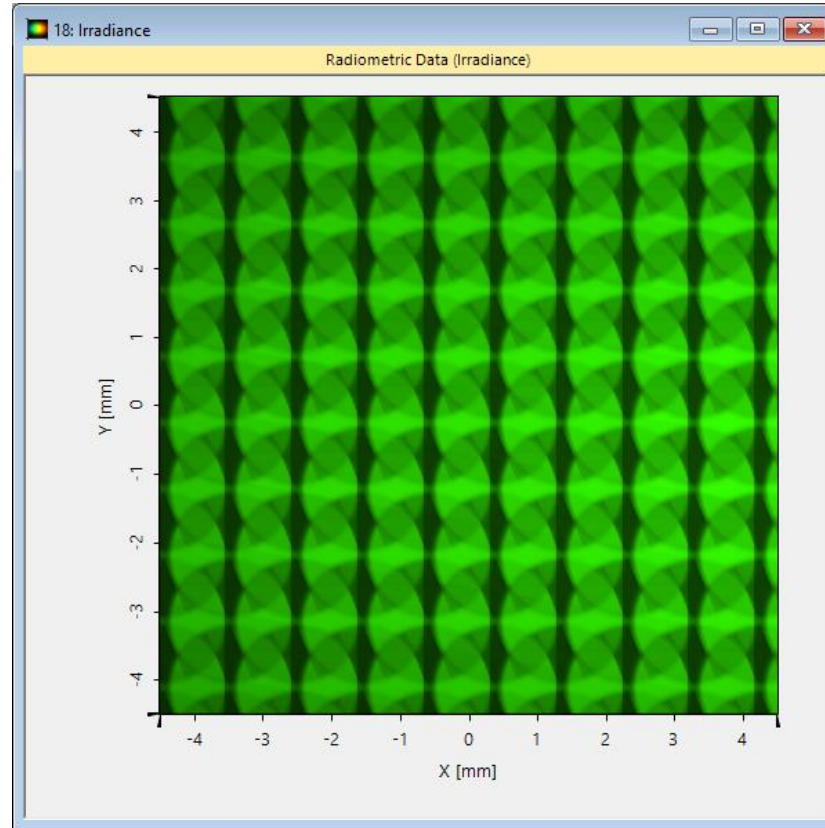
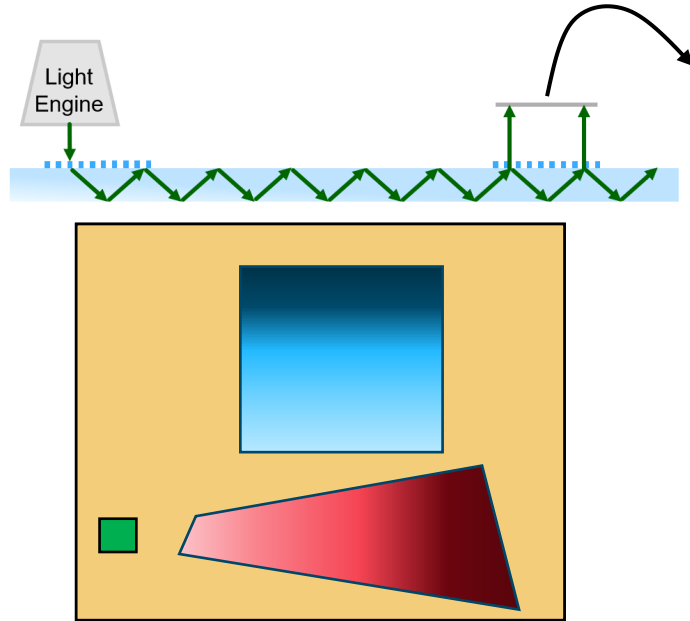


Task: Calculate irradiance and uniformity for the two configurations.

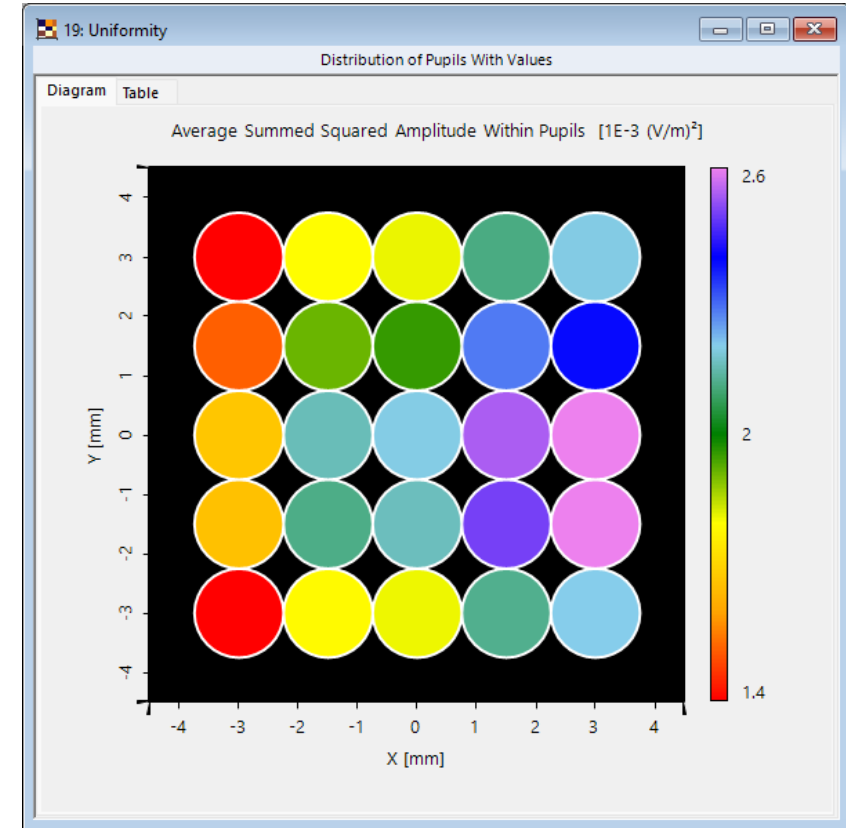


Simulation Results

Config. A: Irradiance & Uniformity Error behind Outcoupler



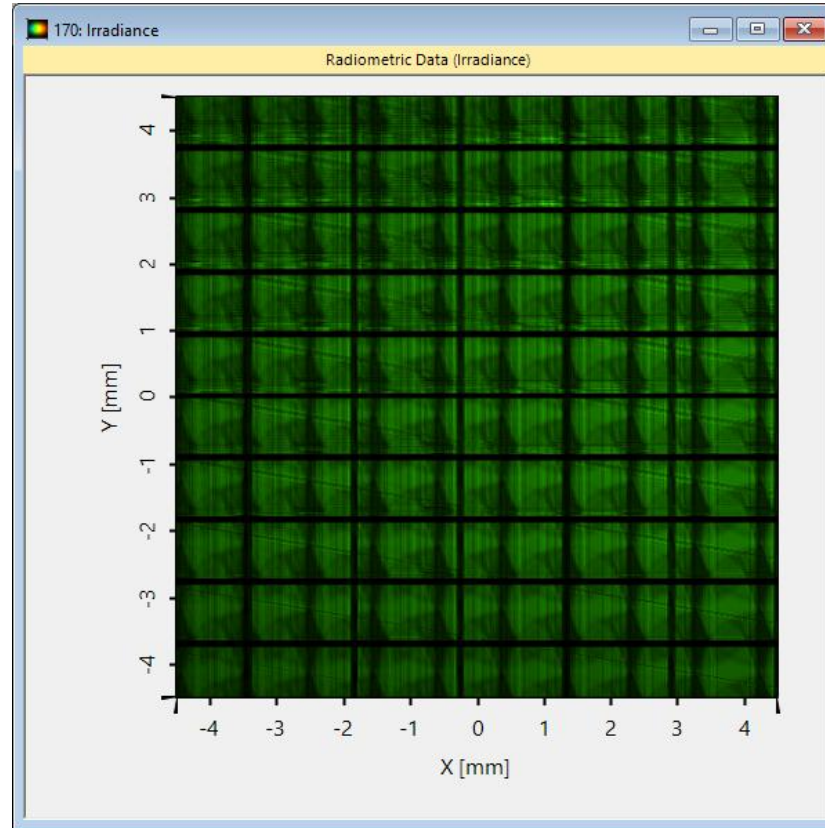
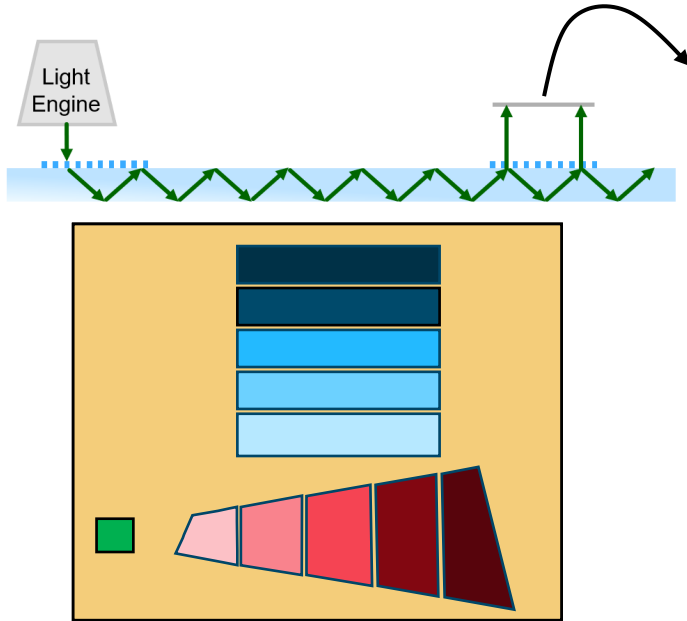
Irradiance (real color)



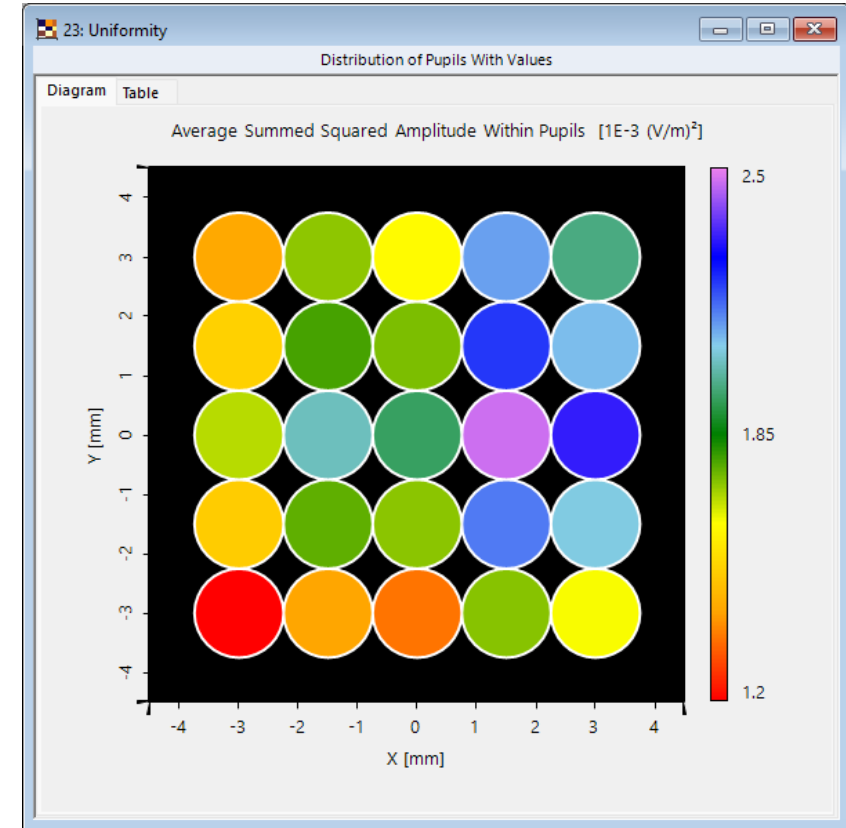
Average energy density per pupil

Uniformity error: 31.126%
Arithmetic mean: 2039.8 mV/mm²

Config. B: Irradiance & Uniformity Error behind Outcoupler



Irradiance (real color)

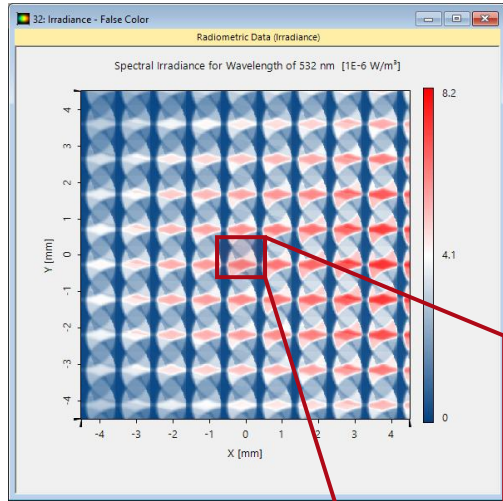


Average energy density per pupil

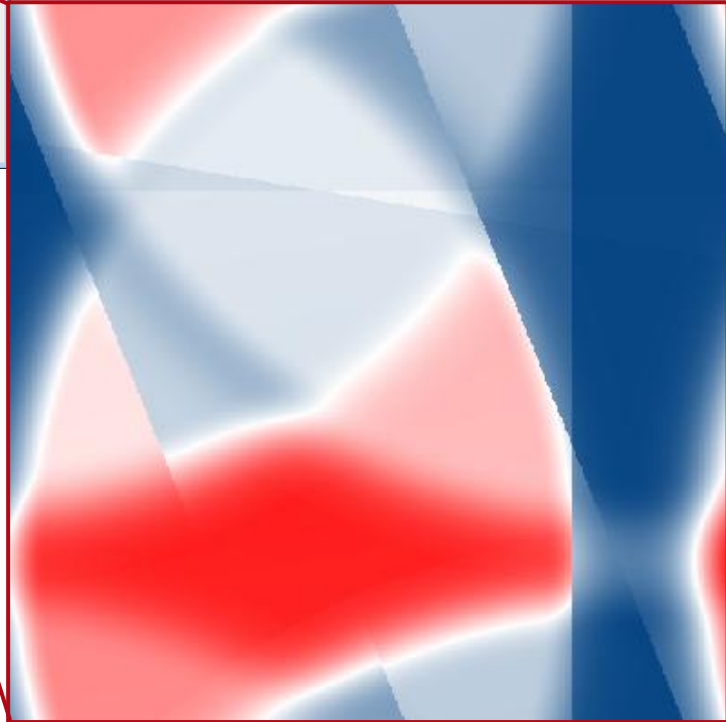
Uniformity error: 35.148%

Arithmetic mean: 1809.8 mV/mm²

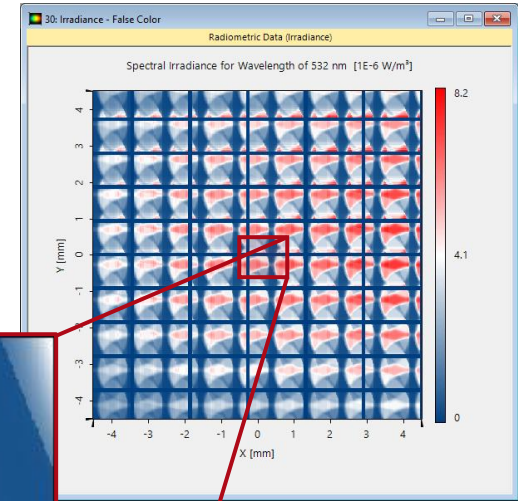
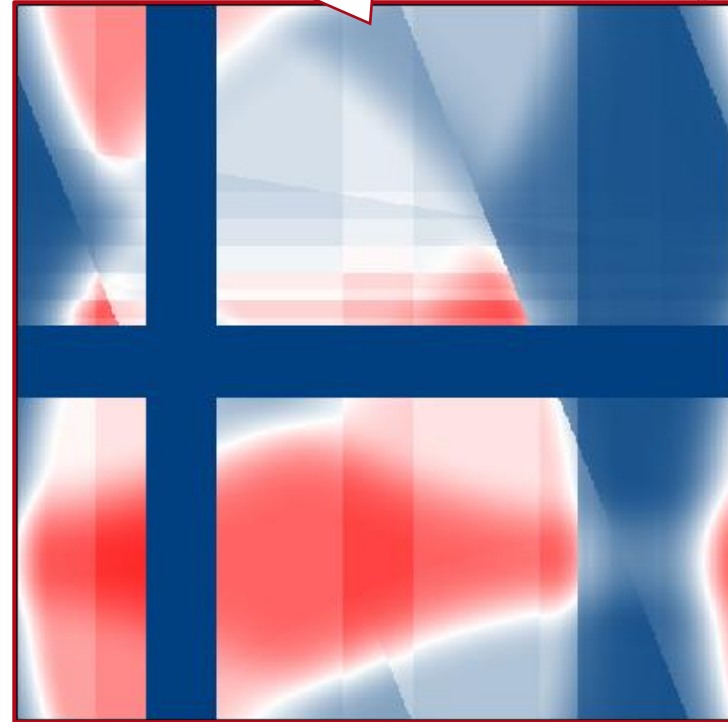
Comparison



Irradiance of
configuration
a) (false
color)

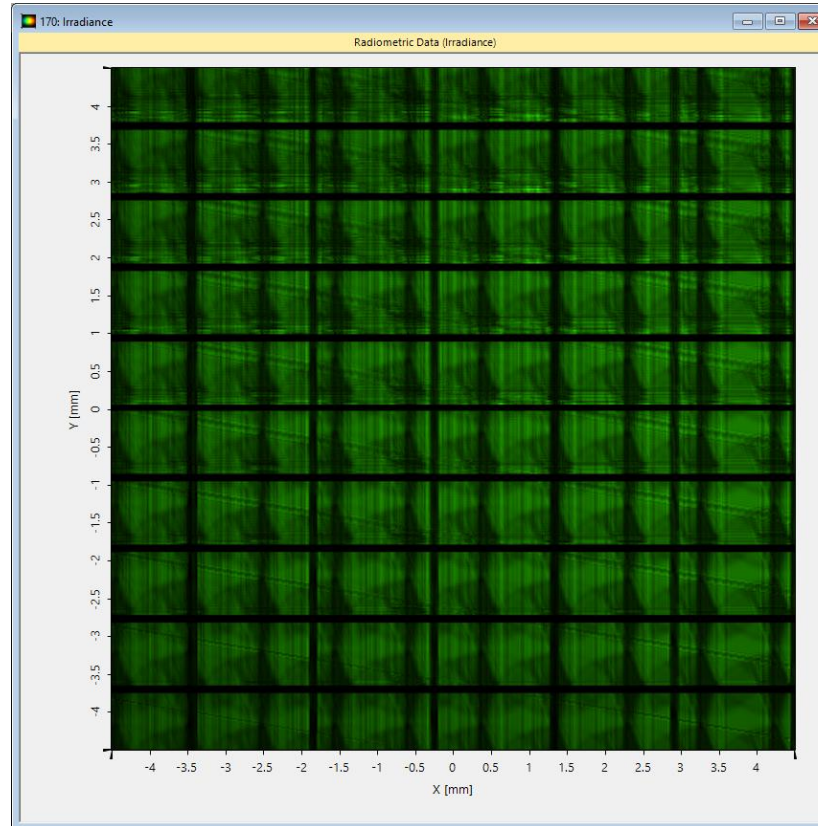
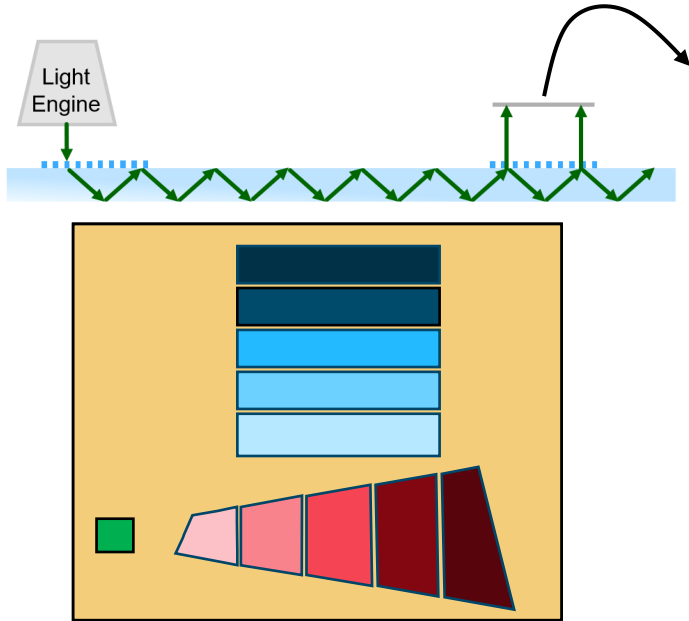


The introduction of gaps
between grating regions will lead
to additional boundary
interactions visible in the
outcoupled field.

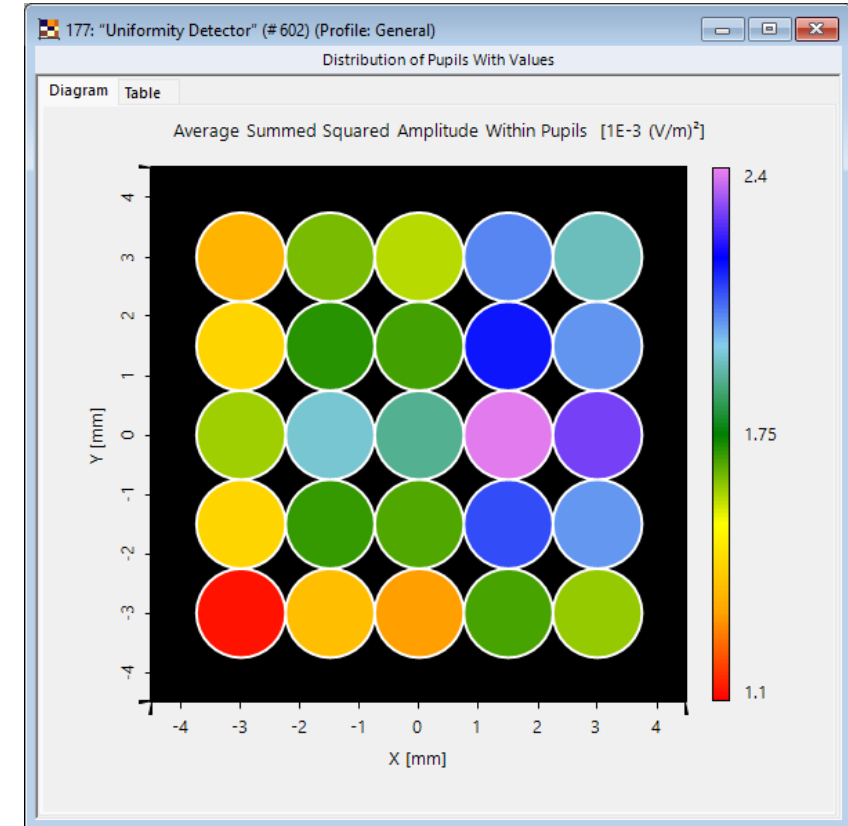


Irradiance of
configuration
b) (false
color)

Conf B: Irradiance & Uniformity Error after Lightguide



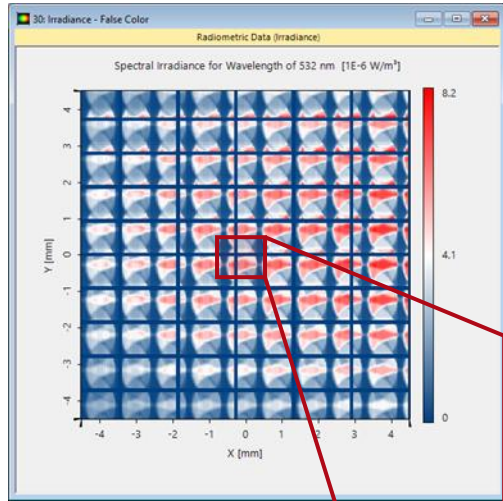
Irradiance (real color)



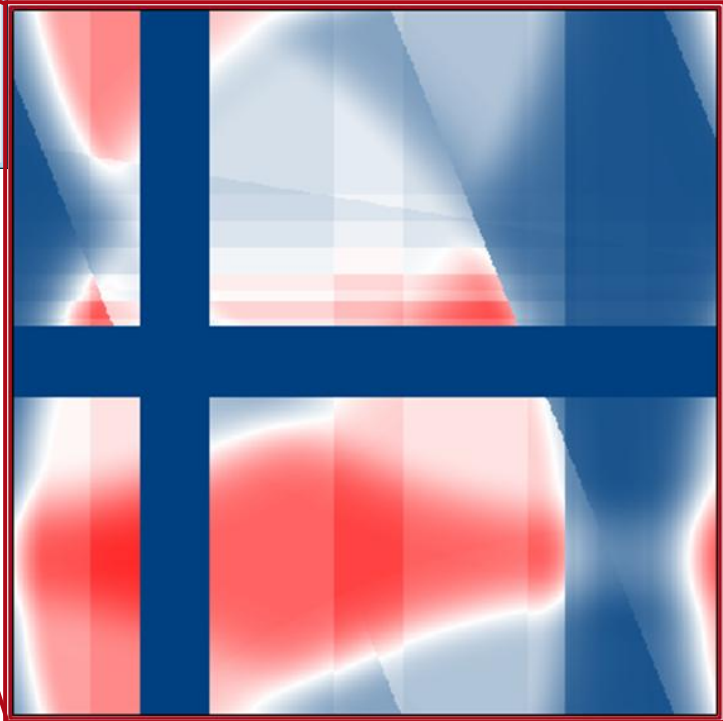
Average energy density per pupil

Uniformity error: 35.985%
Arithmetic mean: 1752 mV/mm²

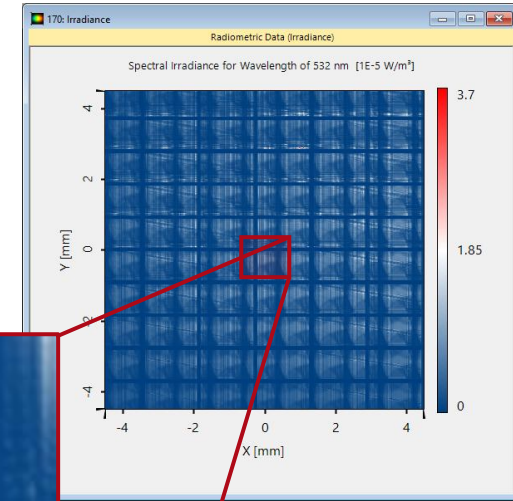
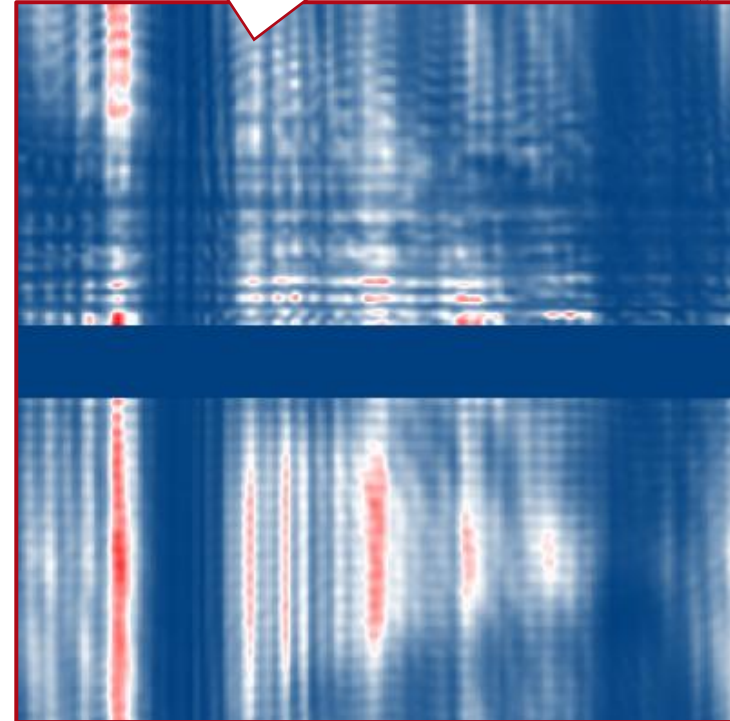
Comparison



Irradiance
without
inclusion of
diffraction
effects

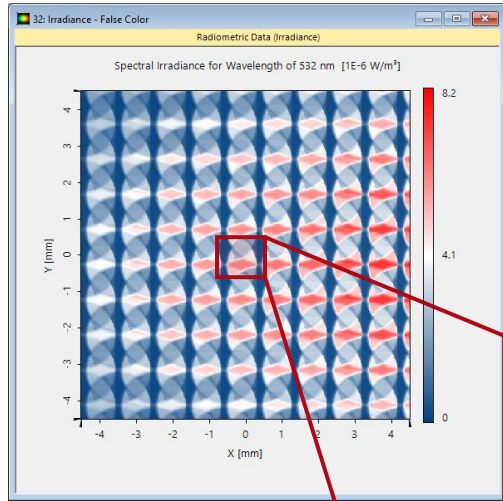


While the uniformity merit function will not show too much effects due to the averaging, locally diffraction effects matter a lot.

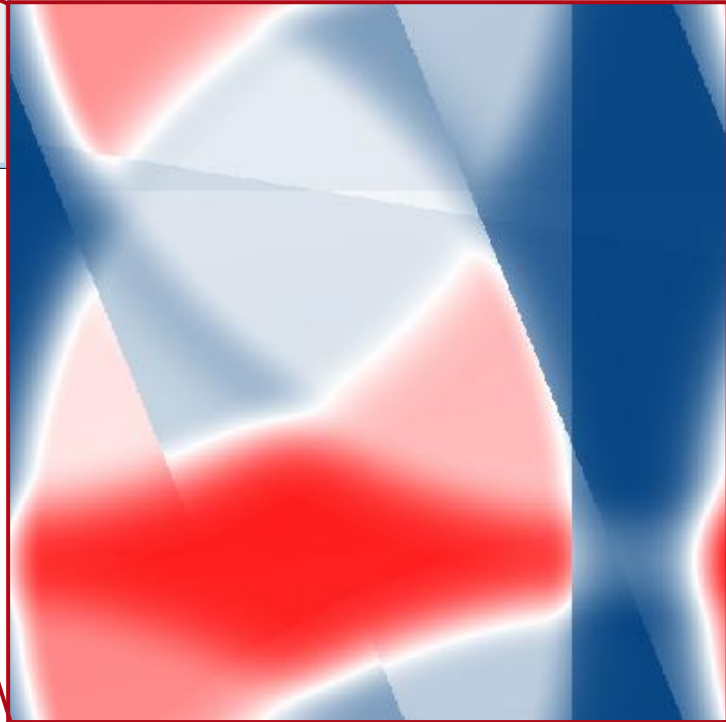


Irradiance
with
inclusion of
diffraction
effects

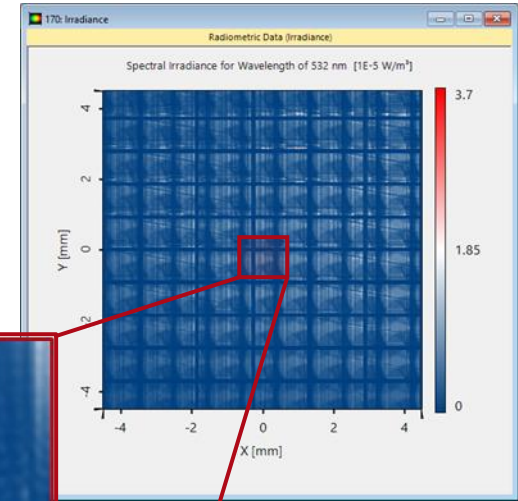
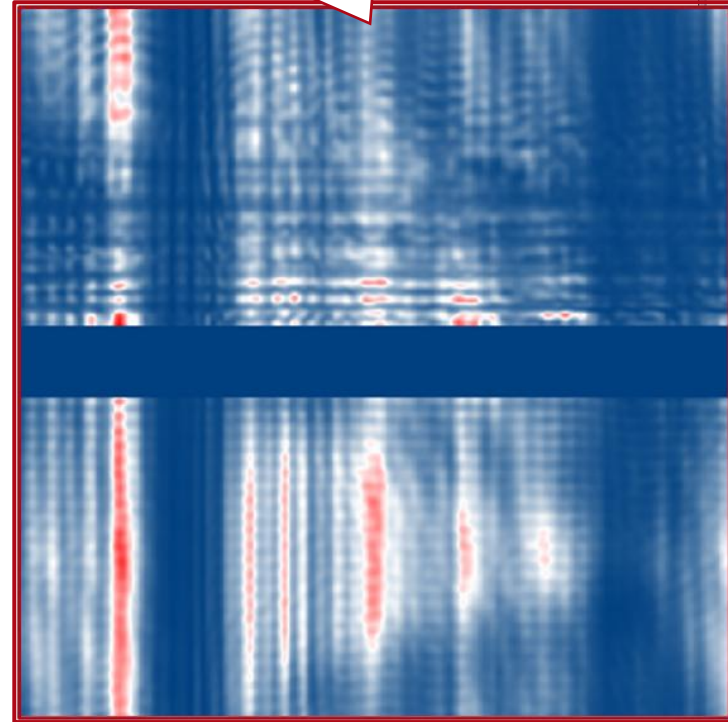
Comparison



Irradiance of
configuration
a) (false
color)



The introduction of gaps
between grating regions will lead
to additional boundary
interactions visible in the
outcoupled field.



Irradiance of
configuration
b) (false
color)

Workflow Steps

Basic Workflow Steps

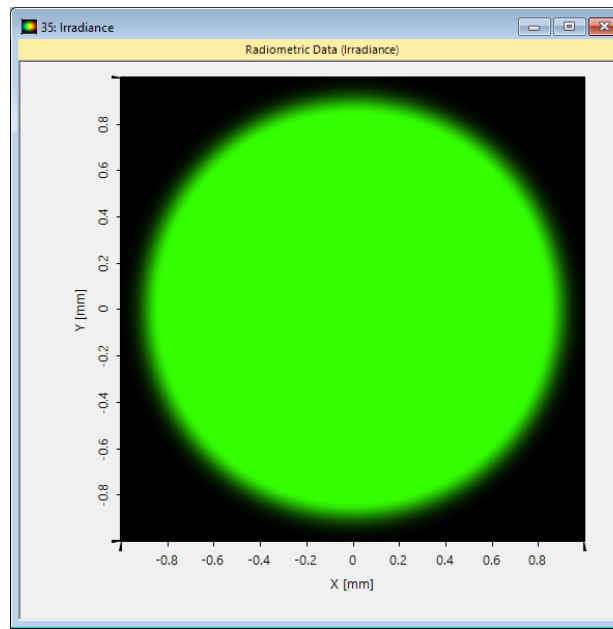
Source selection

System setup

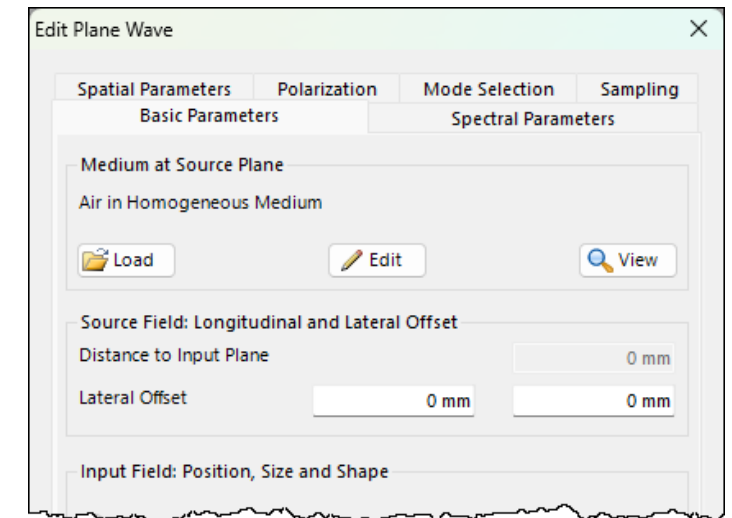
Detector selection

Getting it done in VirtualLab Fusion:

➤ Plane Wave



Irradiance of source



Source settings

Basic Workflow Steps

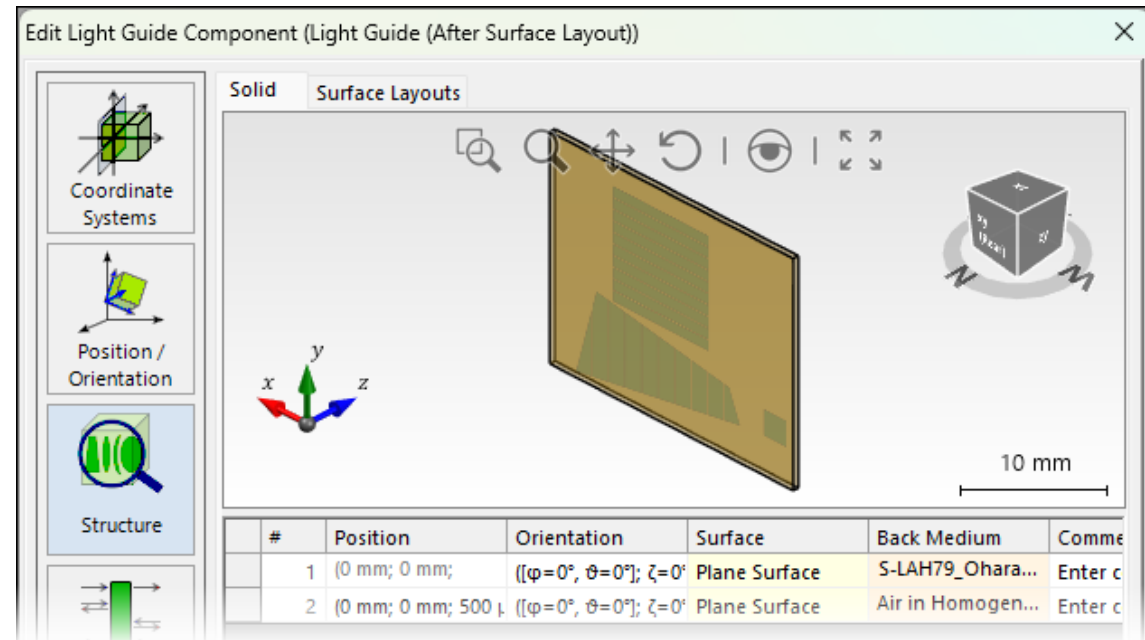
Source selection

System setup

Detector selection

Getting it done in VirtualLab Fusion:

- Lightguide construction by Light Guide Component
- Channel configuration for surfaces and grating regions
- Segmentation of the Grating Regions



Basic Workflow Steps

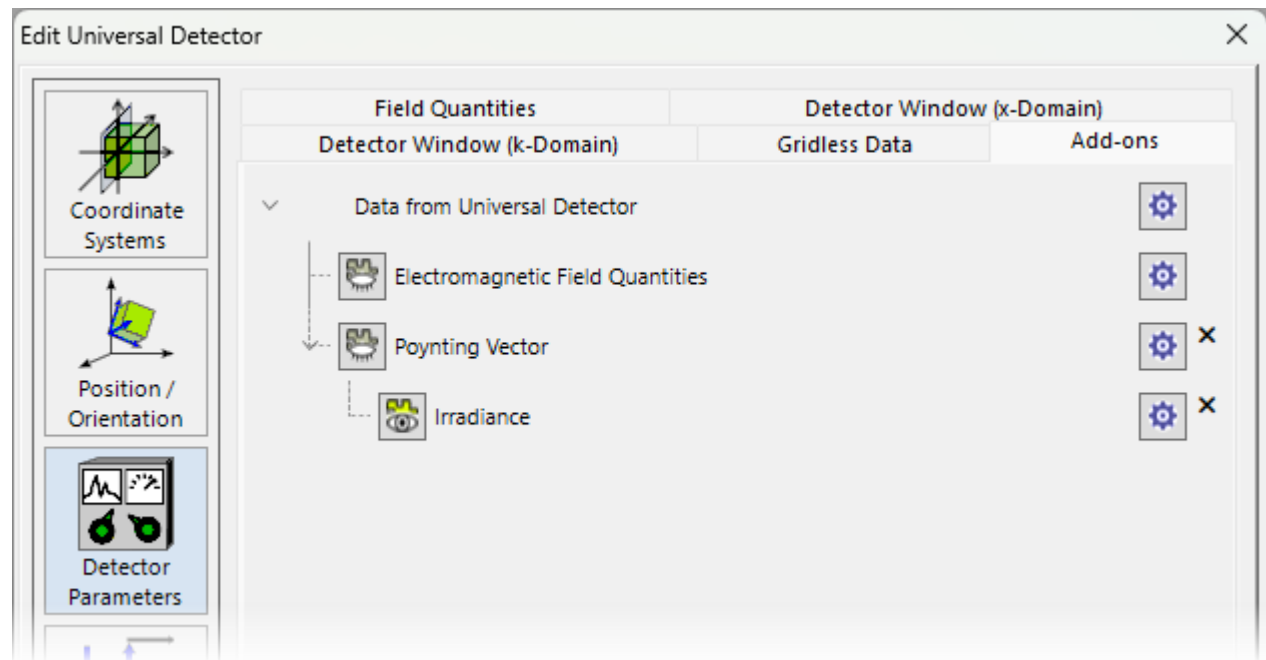
Source selection

System setup

Detector selection

Getting it done in VirtualLab Fusion:

- Universal Detector
- Uniformity Detector



Detector
add-on
selection

Document Information

Title	Simulation of a Lightguide with Segmented Grating Regions including Gaps
Document code	USC.0461
Publication date	08.07.2025
Required packages	-
Software version	2025.1 (Build 1.172)*
Category	Use Case
Further reading	<ul style="list-style-type: none">- Gridded Segmentation of Grating Regions- Grating Analysis and Smoothly Modulated Grating Parameters on Lightguides

* The files attached to this document require the specific version or later.

Conf B: Irradiance & Uniformity Error after Lightguide

