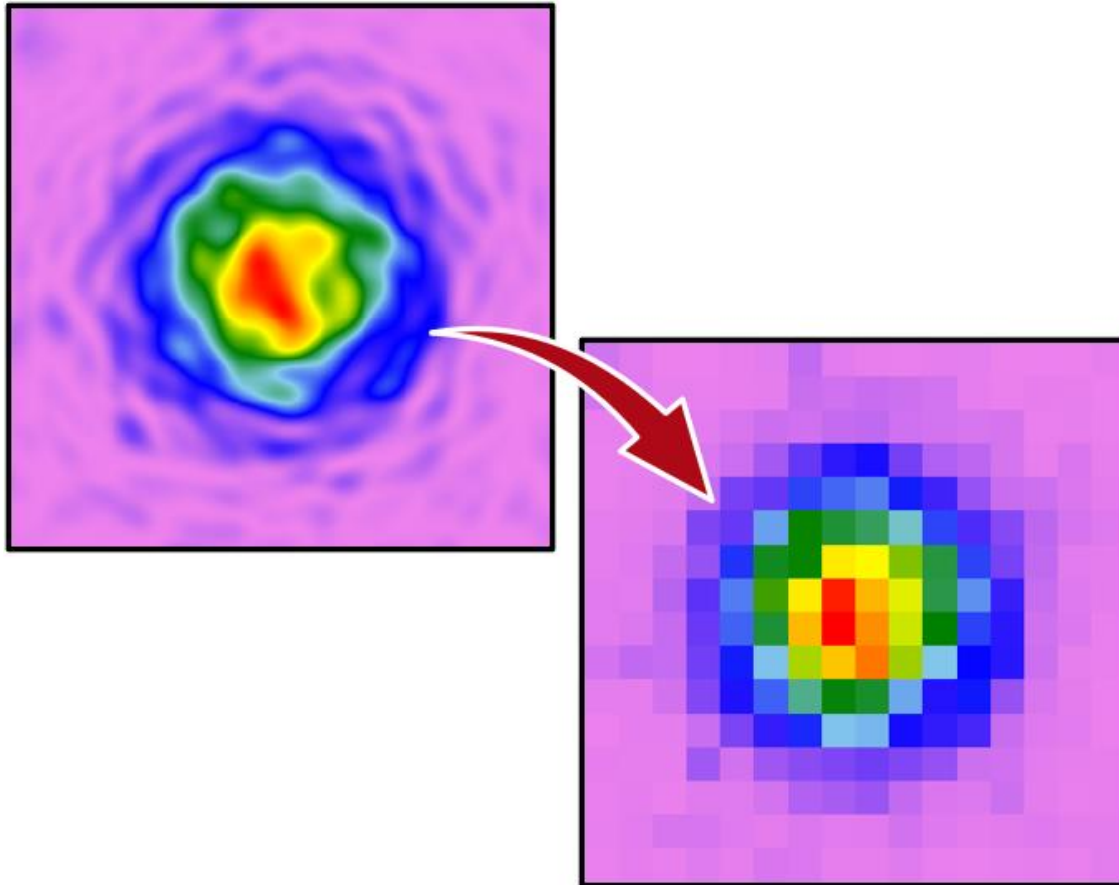


Result Resampling by Average Calculation Yielding Desired Number of Pixels

Abstract



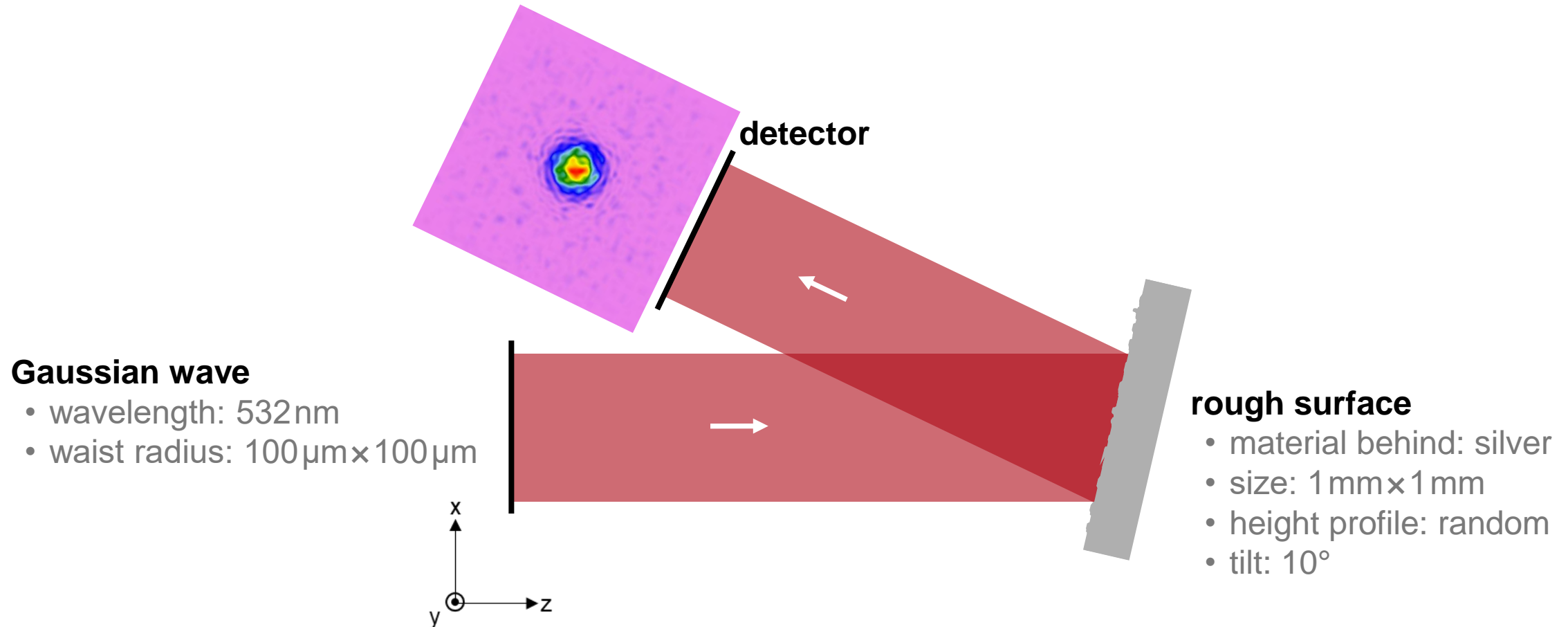
VirtualLab Fusion's flexible detection concept enables precise calculation of radiometric quantities, like irradiance, at any desired detail level. Sometimes it is also necessary to take sensory limitations into account. This example shows a detector add-on that converts results so that an averaged value is output for each adjustable number of data points.

Evaluation of Result Fields from Two Scenarios

A: Reflected Beam with Stray Light from Rough Surface

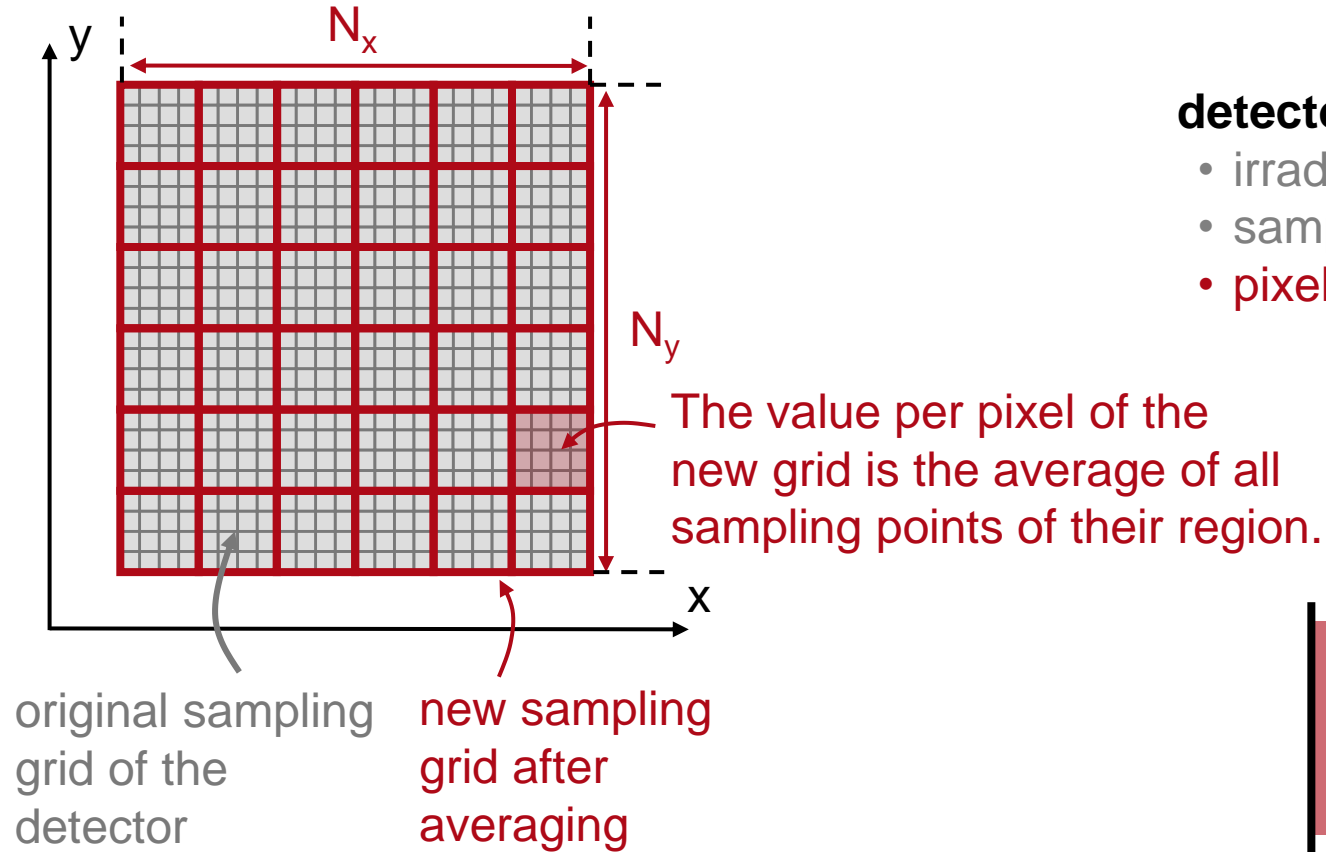
B: Speckle-Pattern of Diffractive Diffusor

A: Reflected Beam with Stray Light from Rough Surface



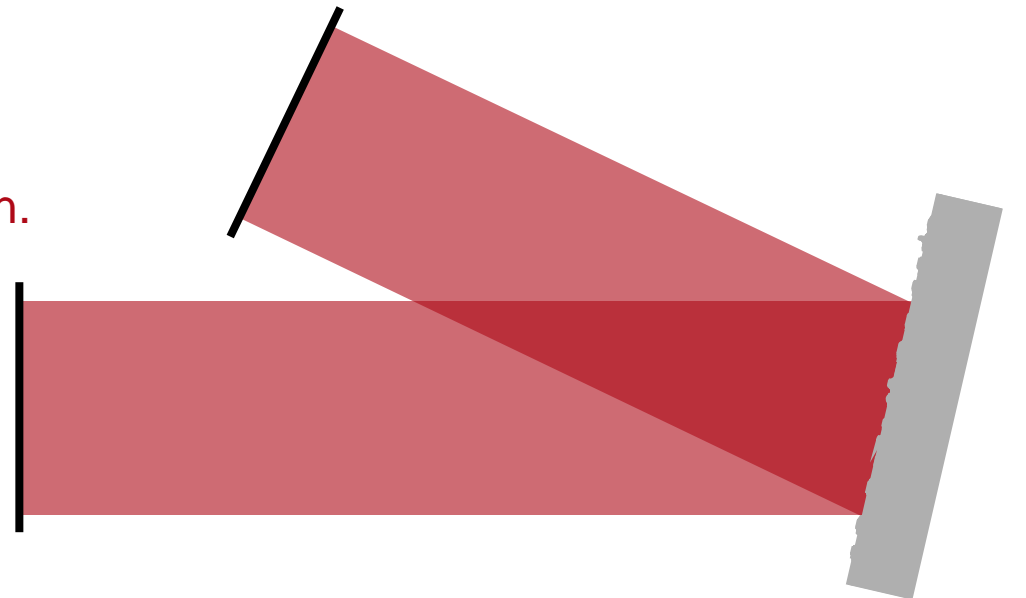
see the full use case: [Reflection at a Rough Surface](#)

Modeling Task of Scenario A



detector

- irradiance
- sampling points of field data: 1000×1000
- pixel number (N_x, N_y) : $[100 \times 100]$, $[40 \times 40]$

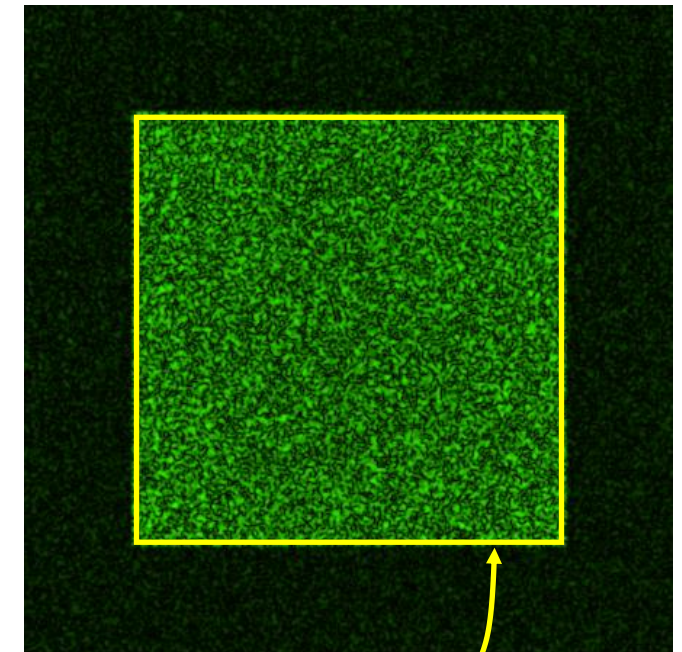
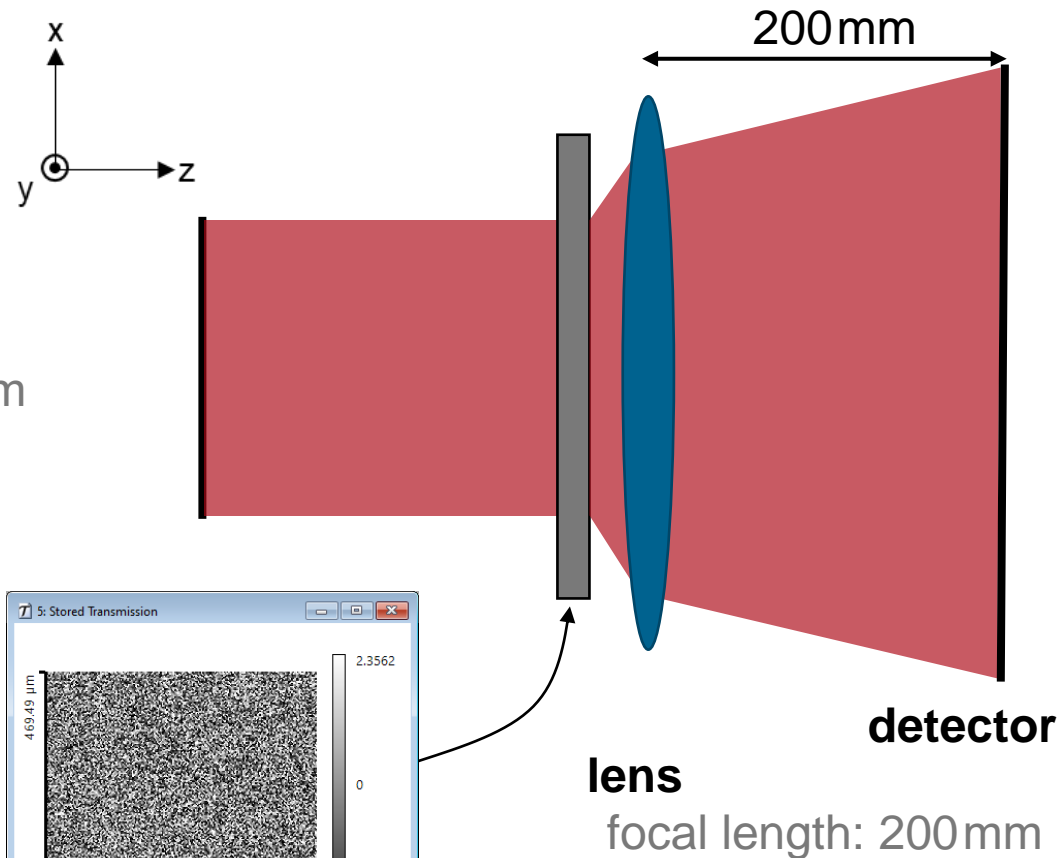
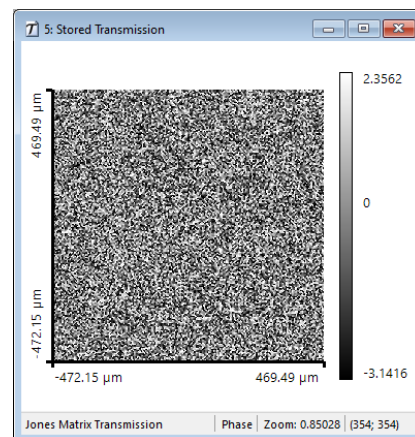


B: Speckle-Pattern of Diffractive Diffusor

Gaussian wave

- wavelength: 532nm
- waist radius: $300\mu\text{m} \times 300\mu\text{m}$

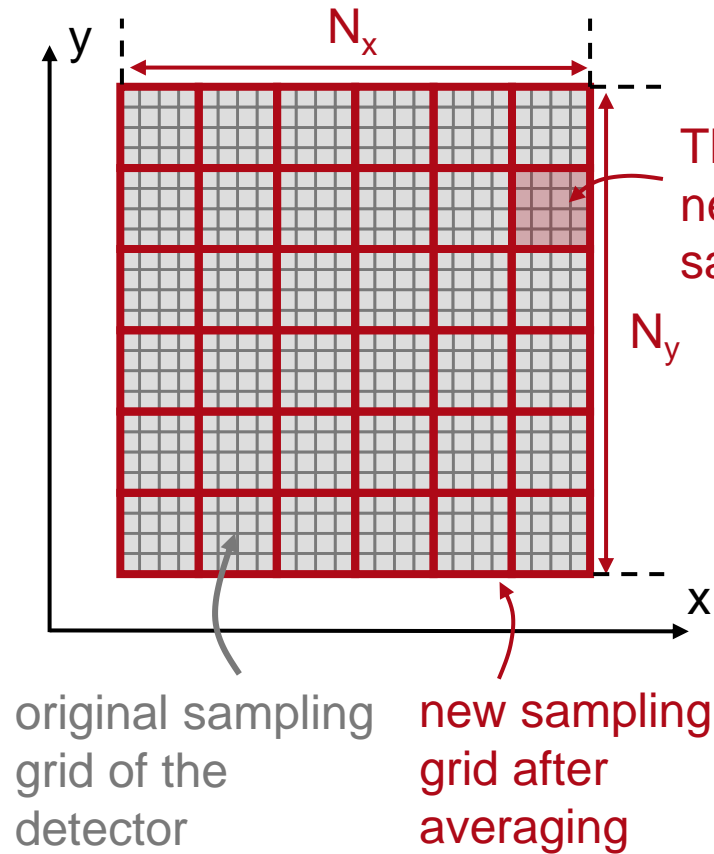
diffusor
phase-only
transmission
function



to be evaluated

- 20mm \times 20mm area
within speckle pattern

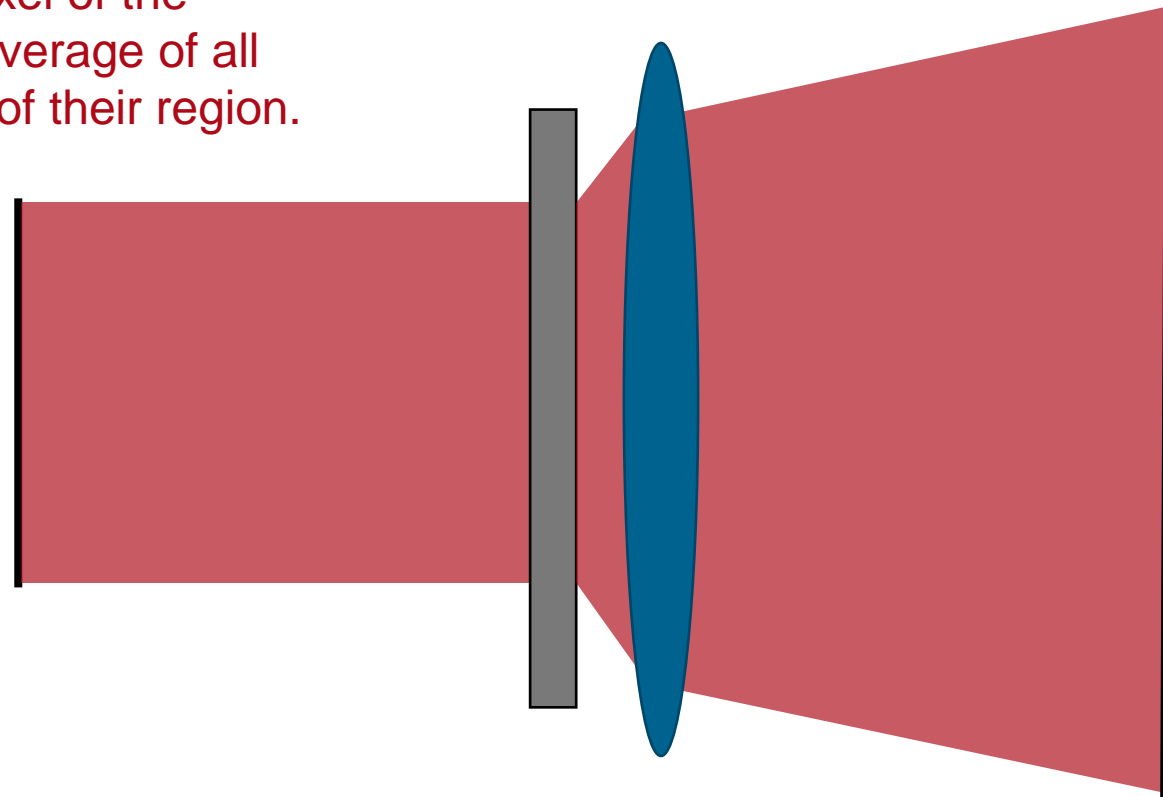
Modeling Task for Scenario B



The value per pixel of the new grid is the average of all sampling points of their region.

detector

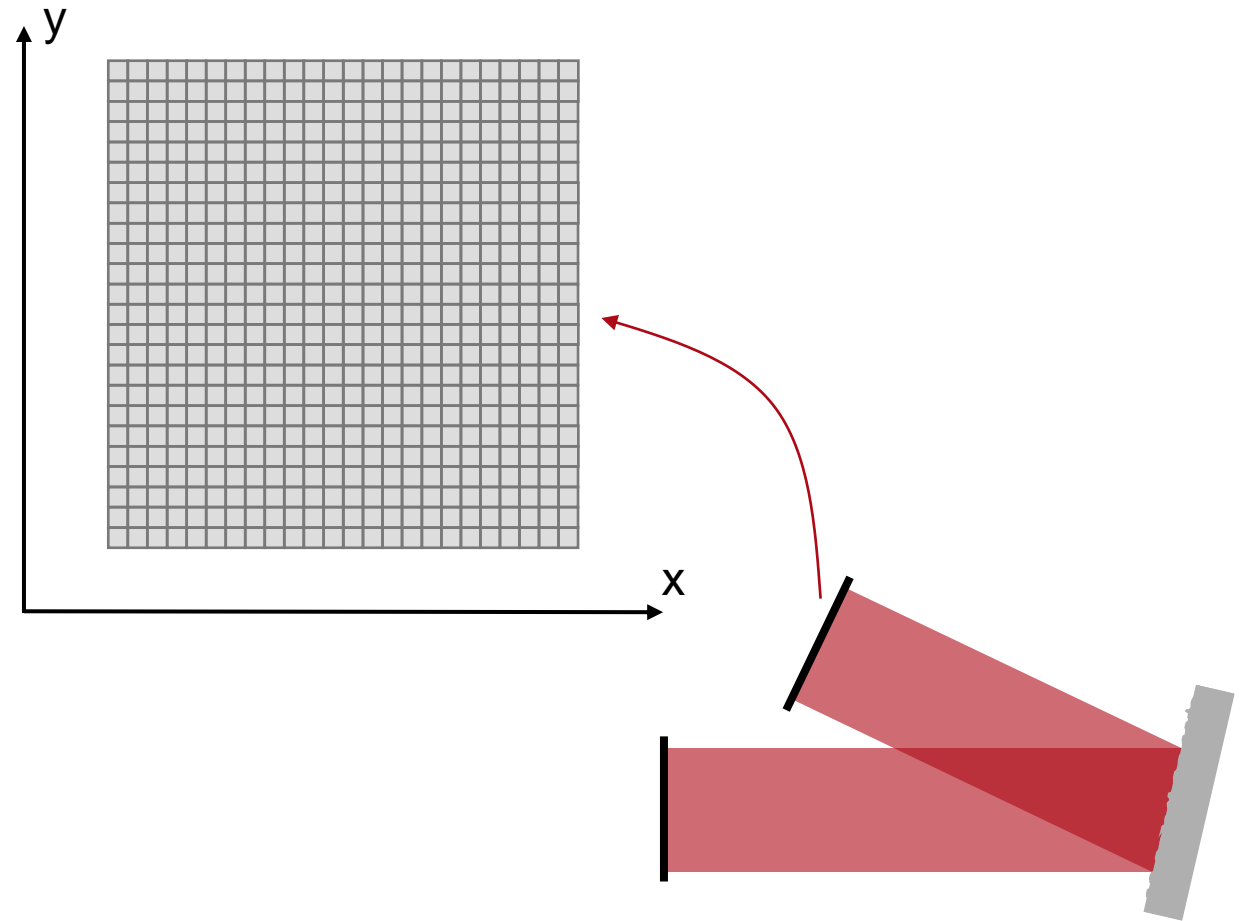
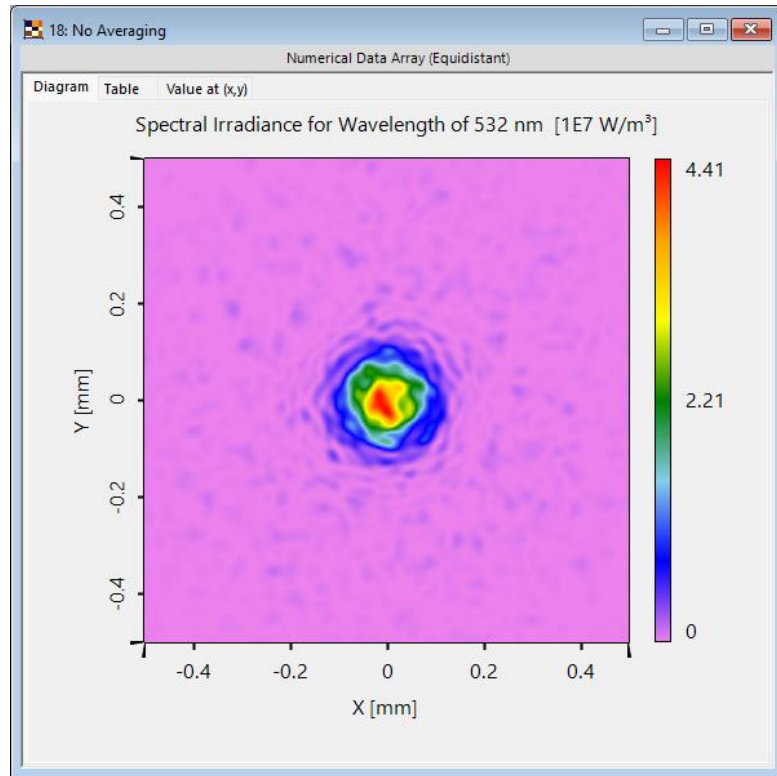
- irradiance
- sampling points of field data: 2000×2000
- pixel number (N_x, N_y): [100×100], [40×40]



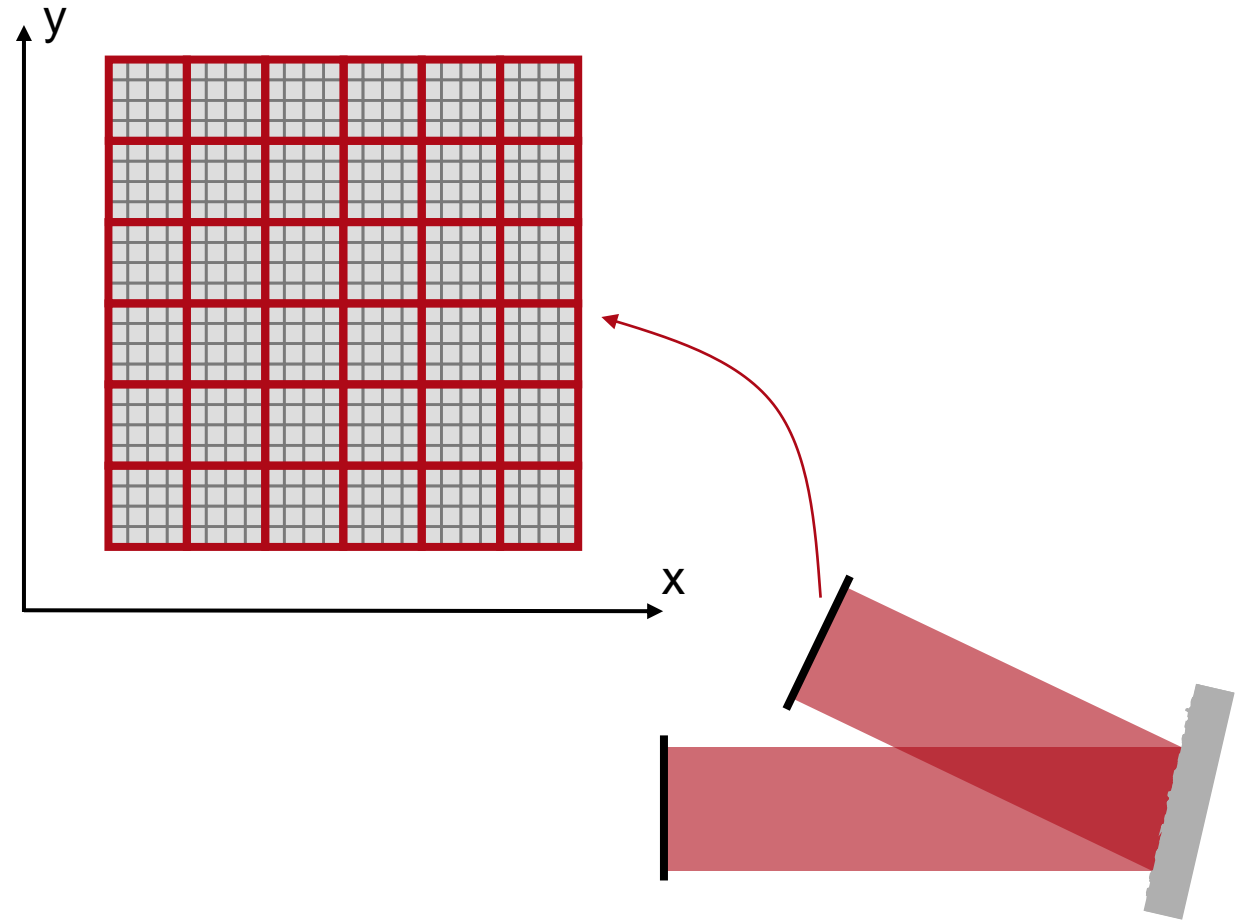
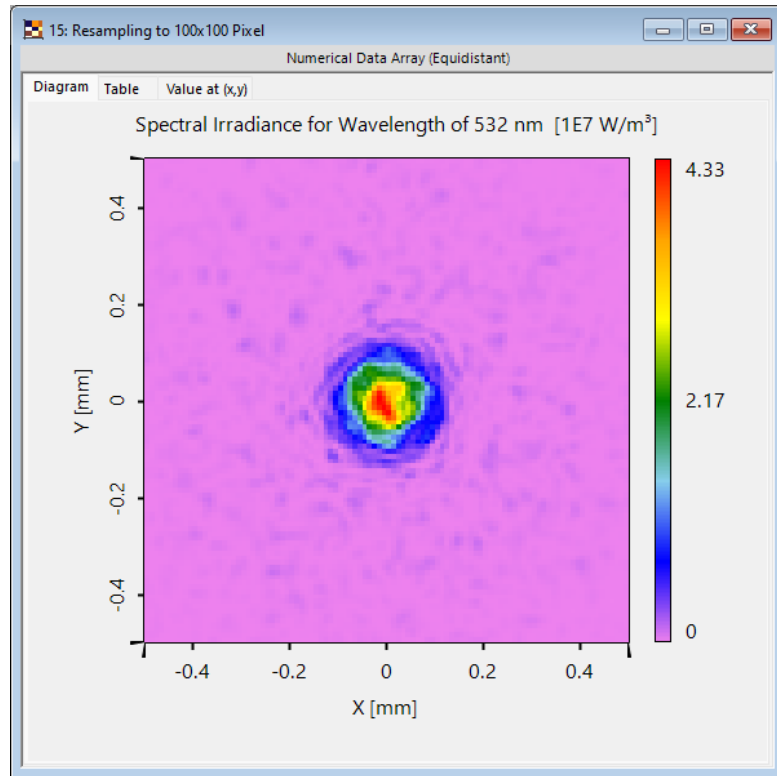
Results for Scenario A

Detected Gaussian beam with stray light reflected from a rough surface

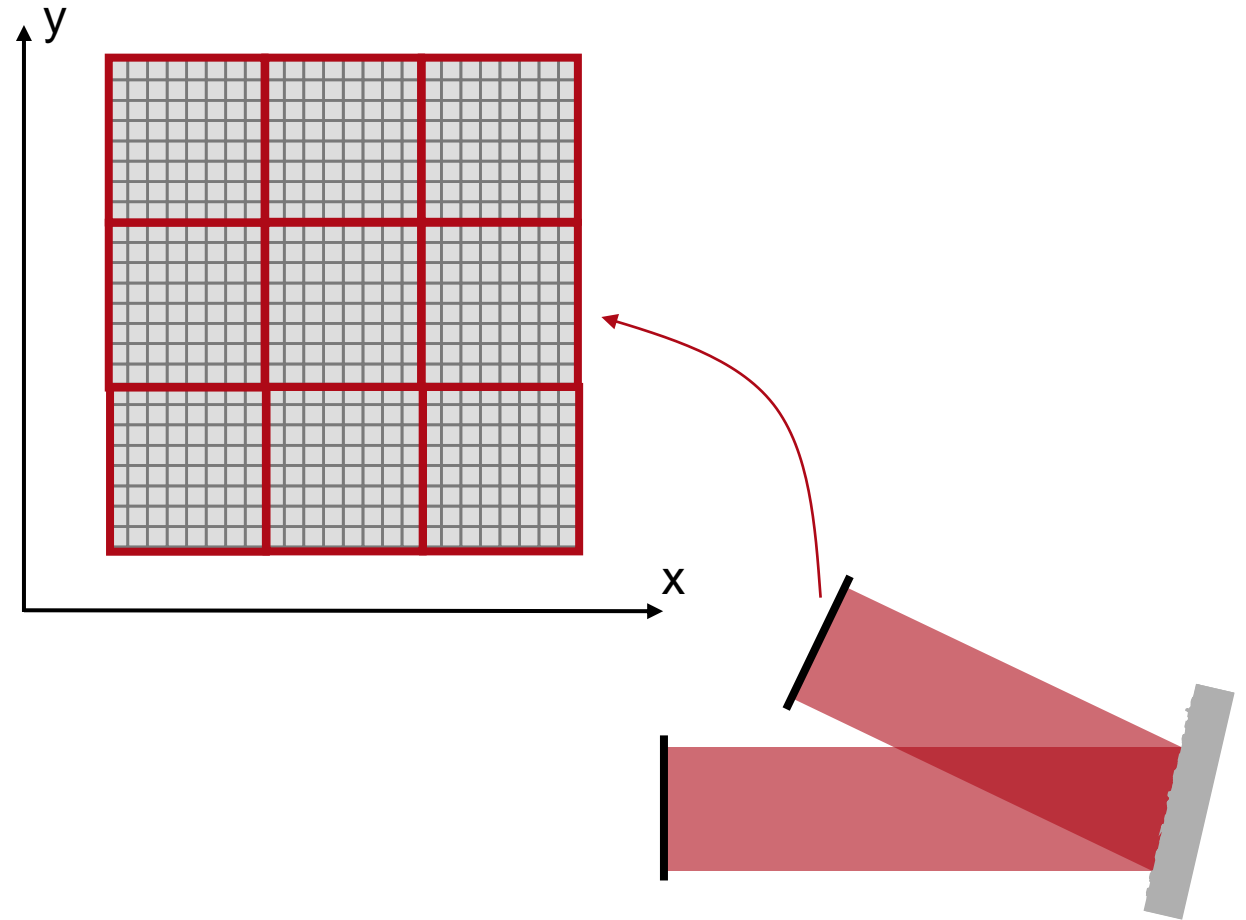
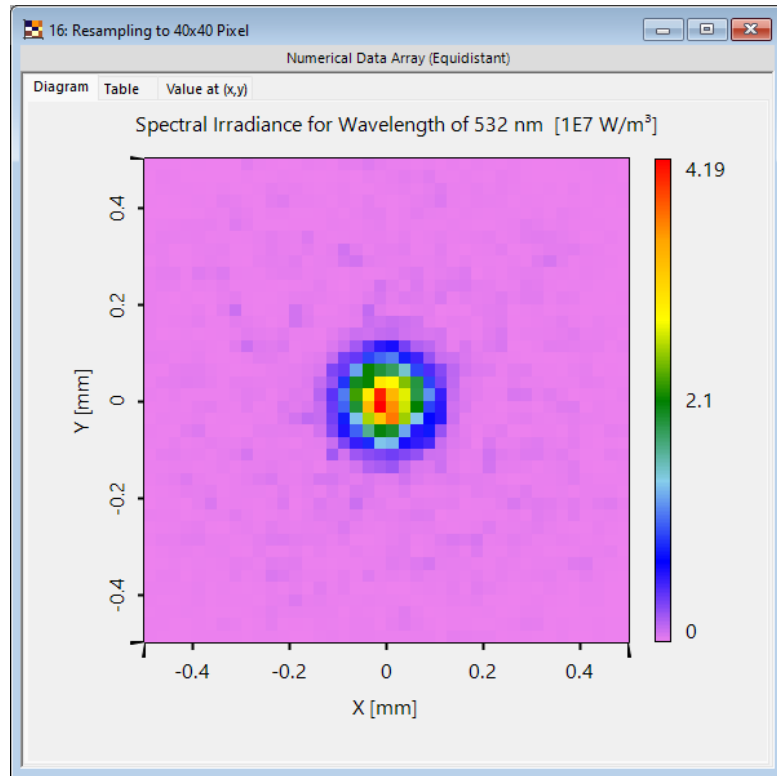
Irradiance of the Reflected Field (No Averaging)



Resampling to 100 × 100 Pixels by Average Calculation

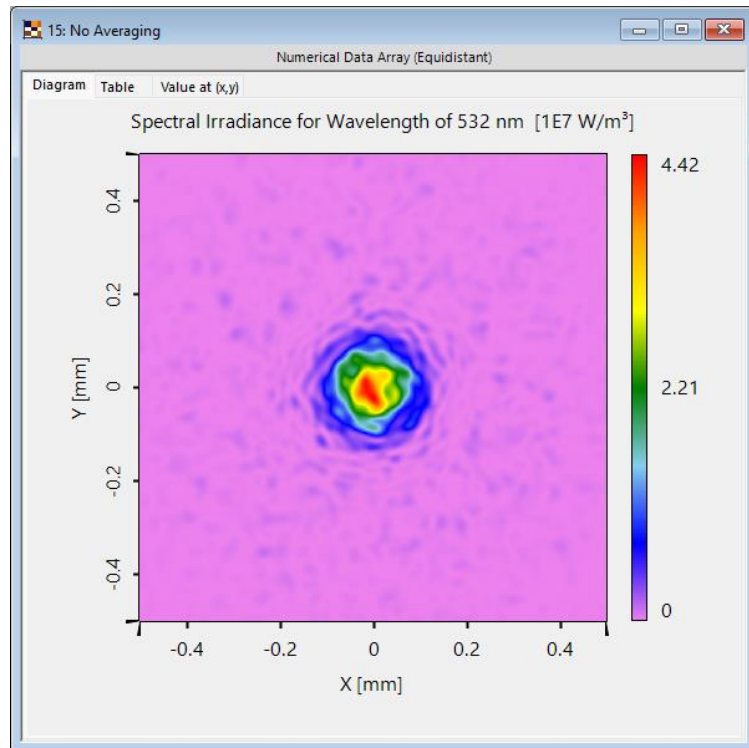


Resampling to 40 × 40 Pixels by Average Calculation

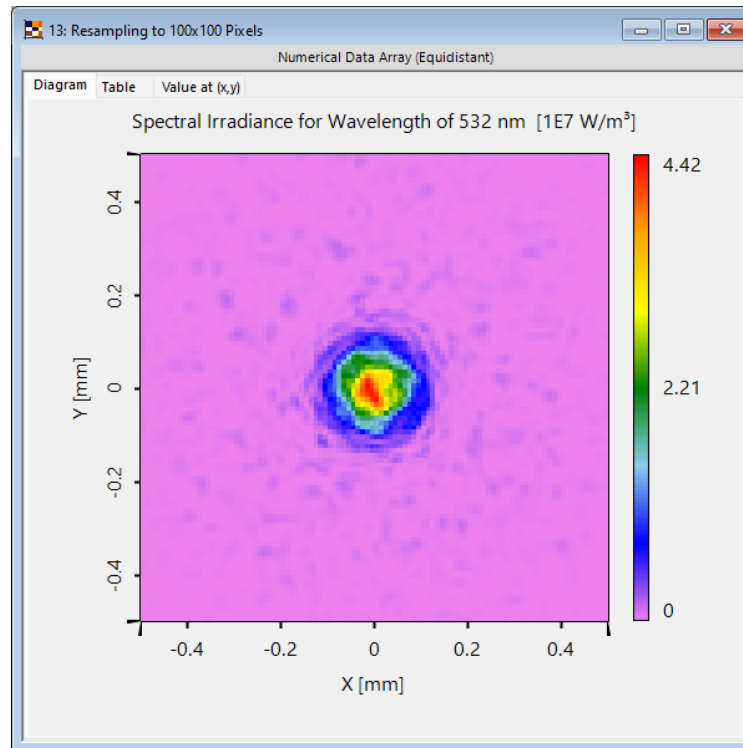


Result Comparison for Different Resolutions

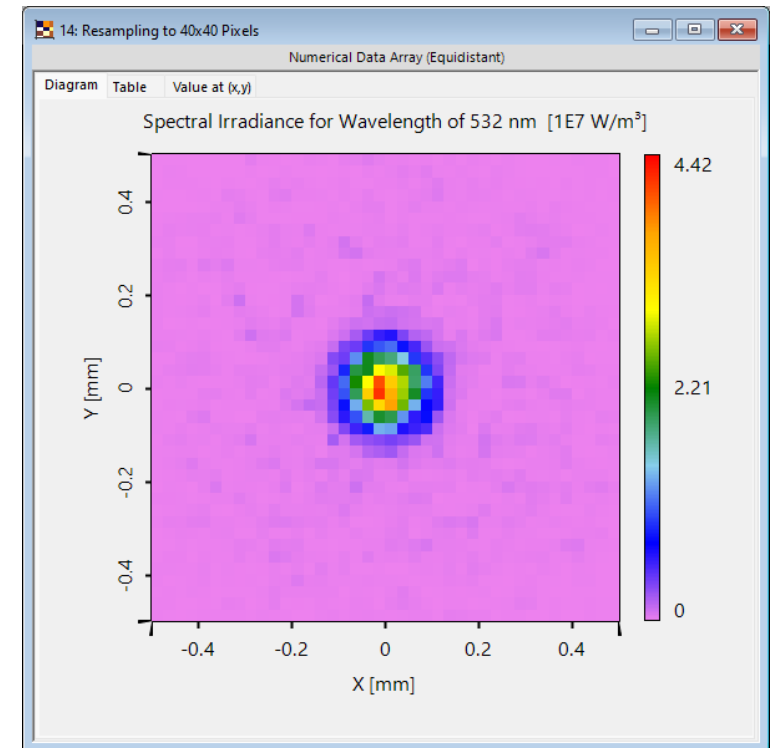
This add-on enables emulation of the output of real sensors with limited resolution that average the incoming light over each pixel area.



1000 × 1000 pixels (original sampling)



100 × 100 pixels

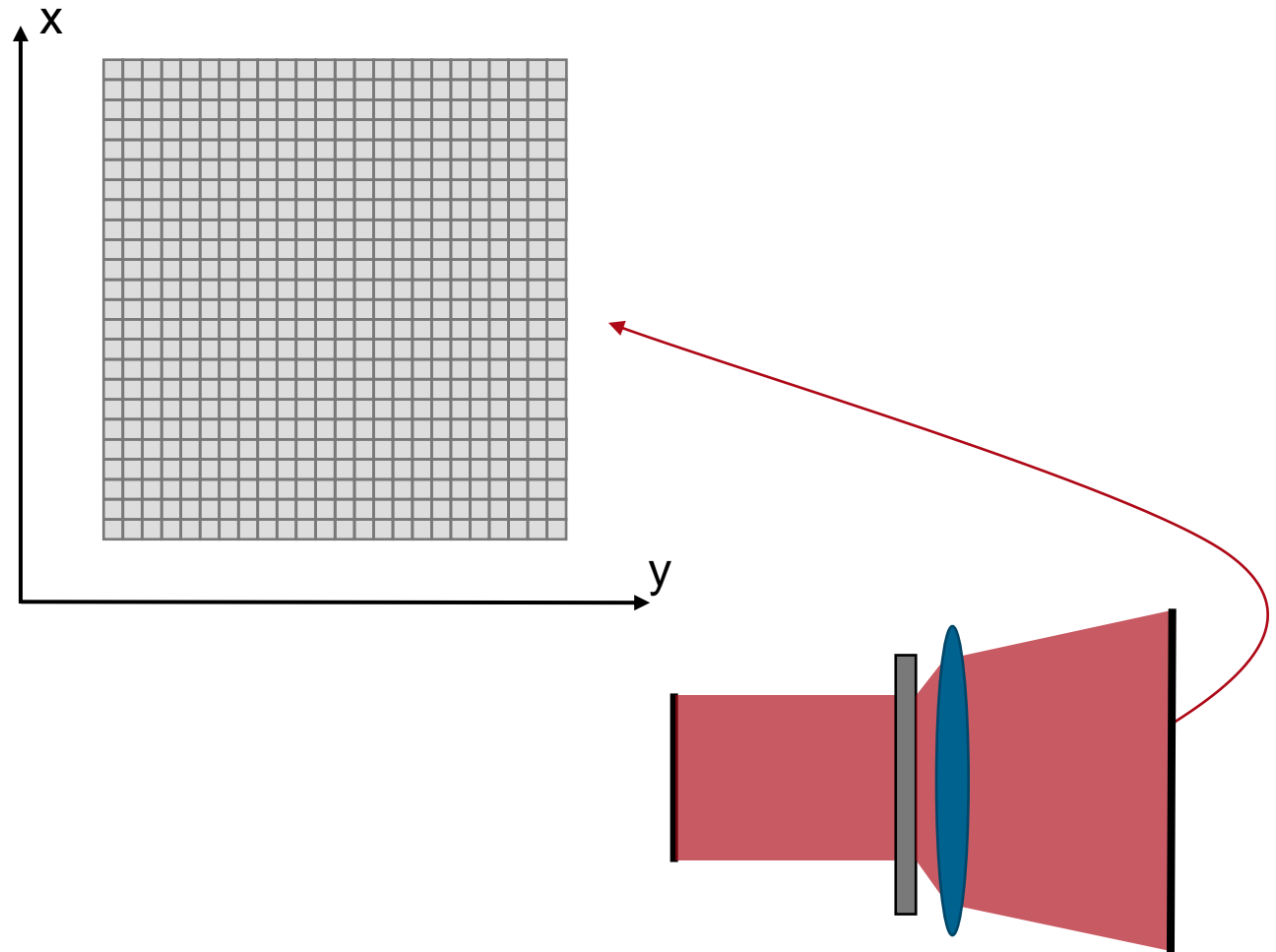
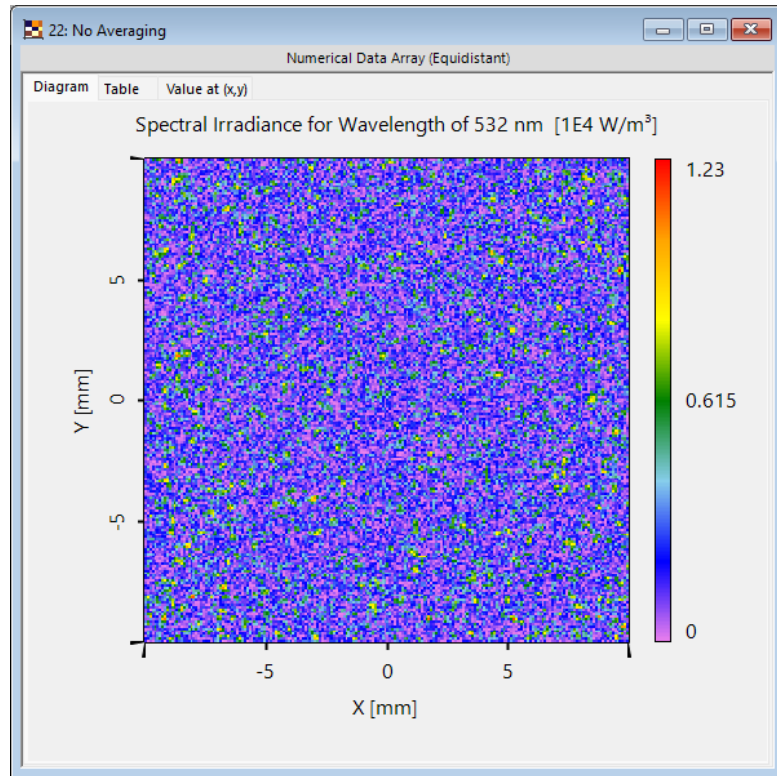


40 × 40 pixels

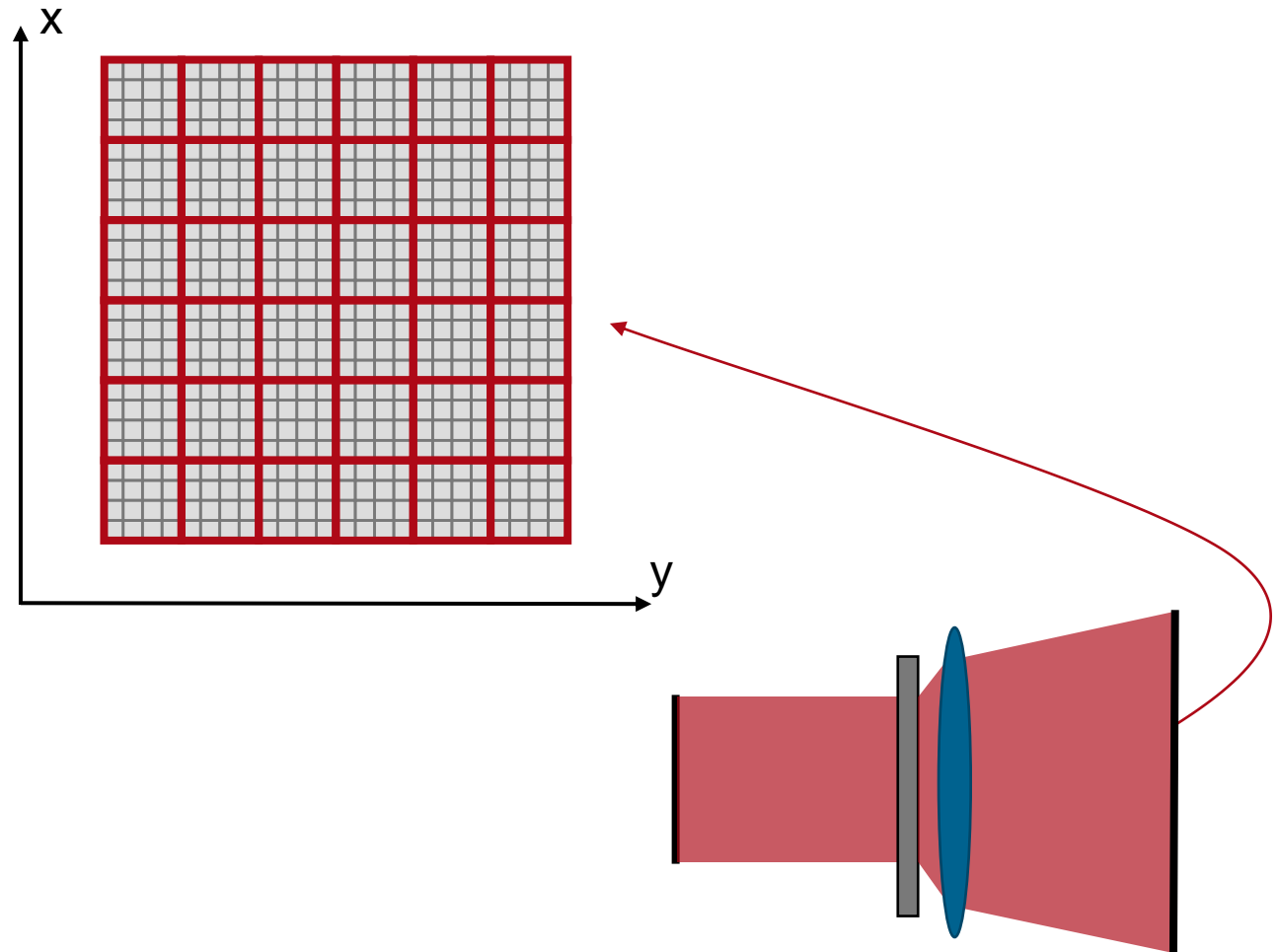
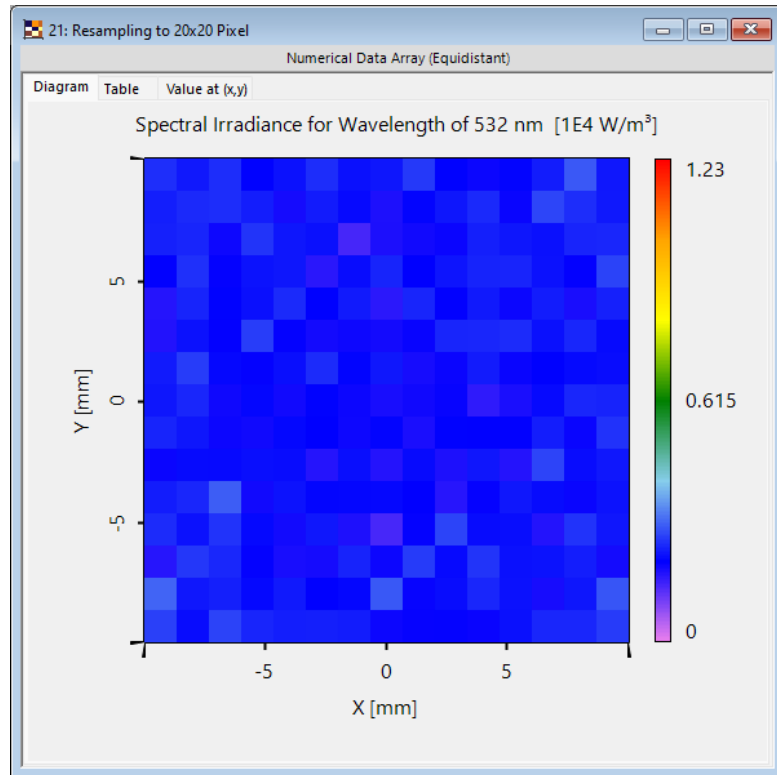
Results for Scenario B

Speckle Pattern Generated by Diffusor

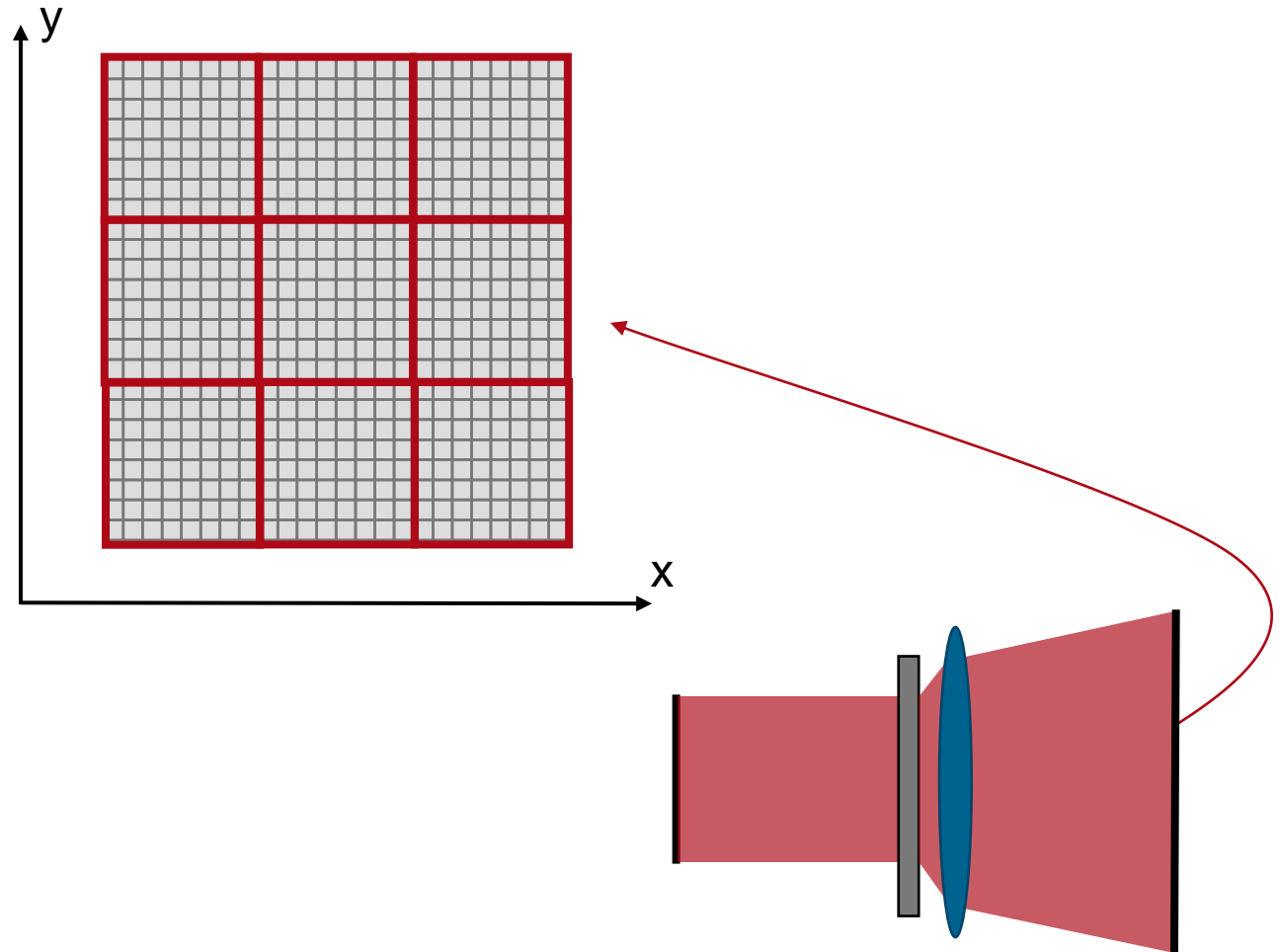
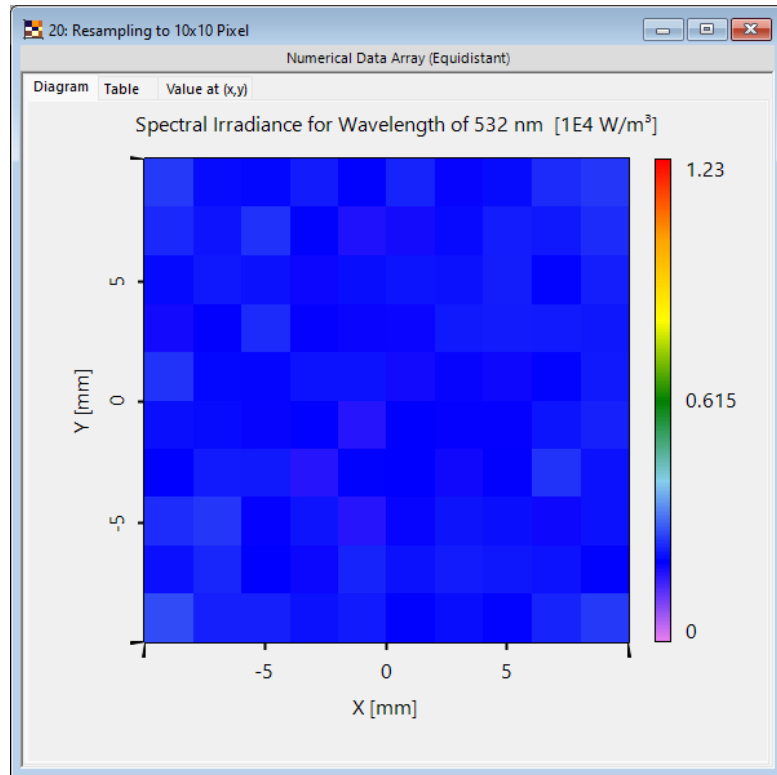
Irradiance of the Reflected Field (No Averaging)



Resampling to 20×20 Pixels by Average Calculation



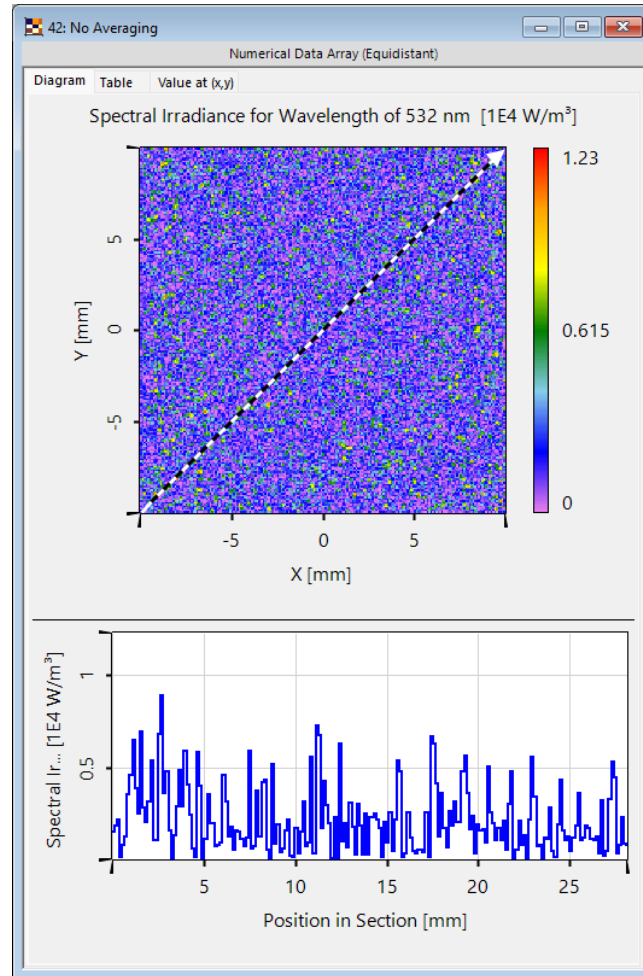
Resampling to 10 × 10 Pixels by Average Calculation



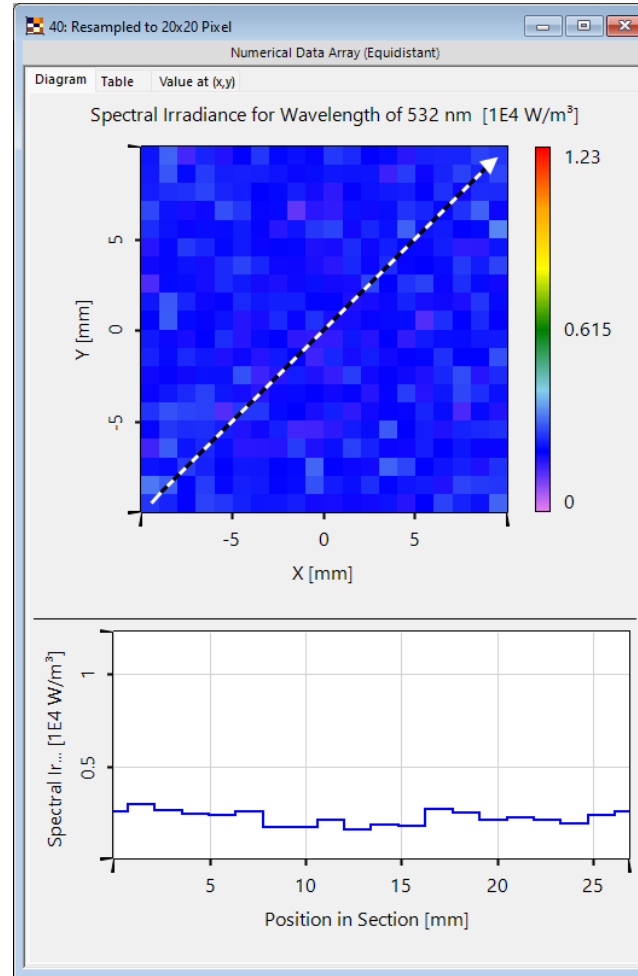
Comparison

The larger the sensor pixels over which the average is calculated, the more homogeneous the signal appears.

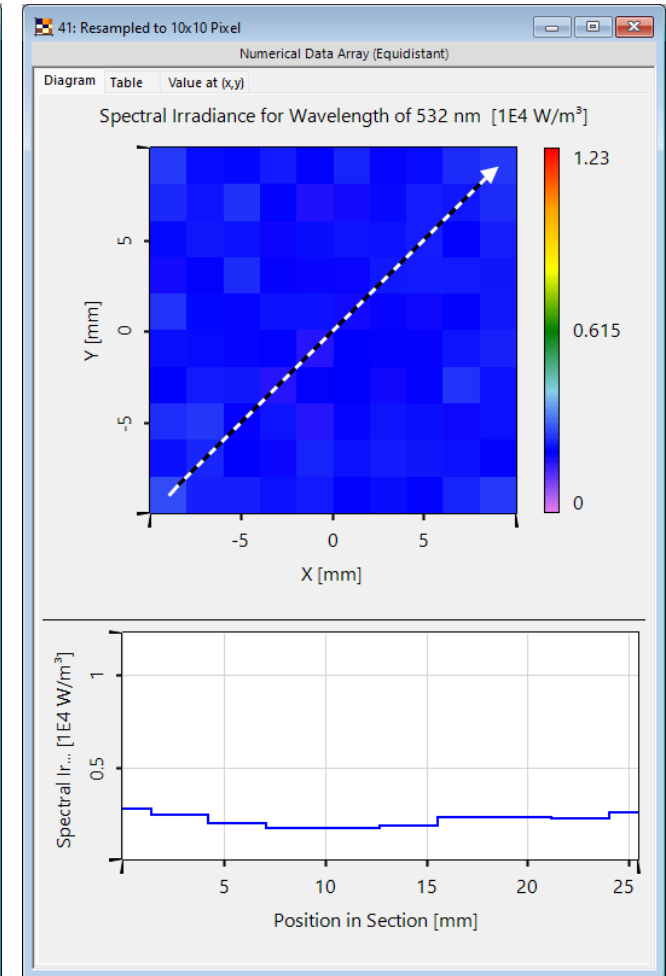
This is one reason why a speckle result from a diffractive diffuser is often suitable for generating homogeneous fields.



2000 × 2000 pixels
(original sampling)



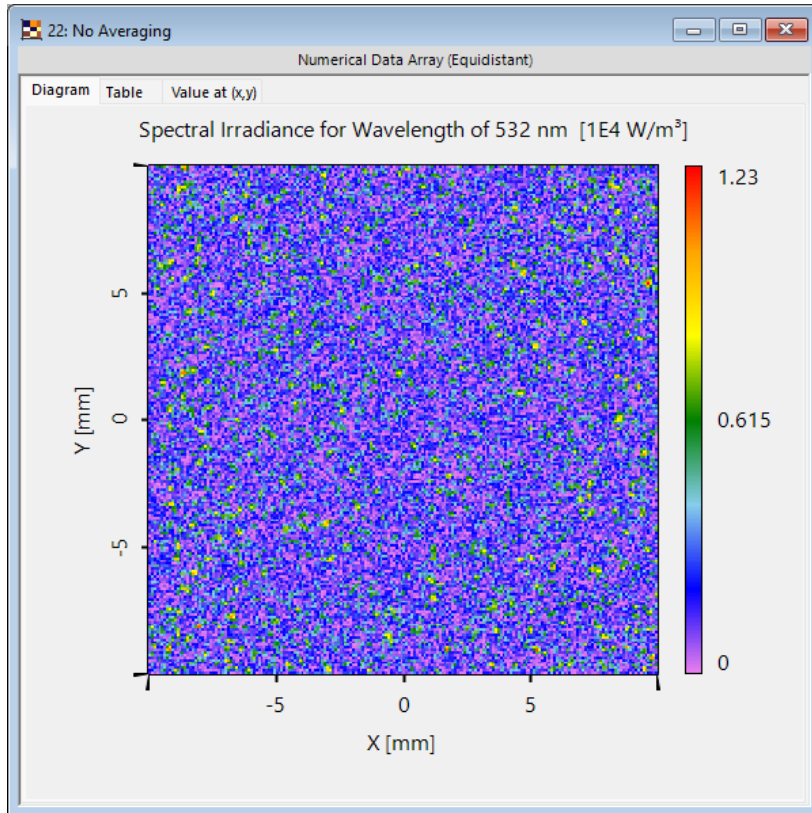
20 × 20 pixels



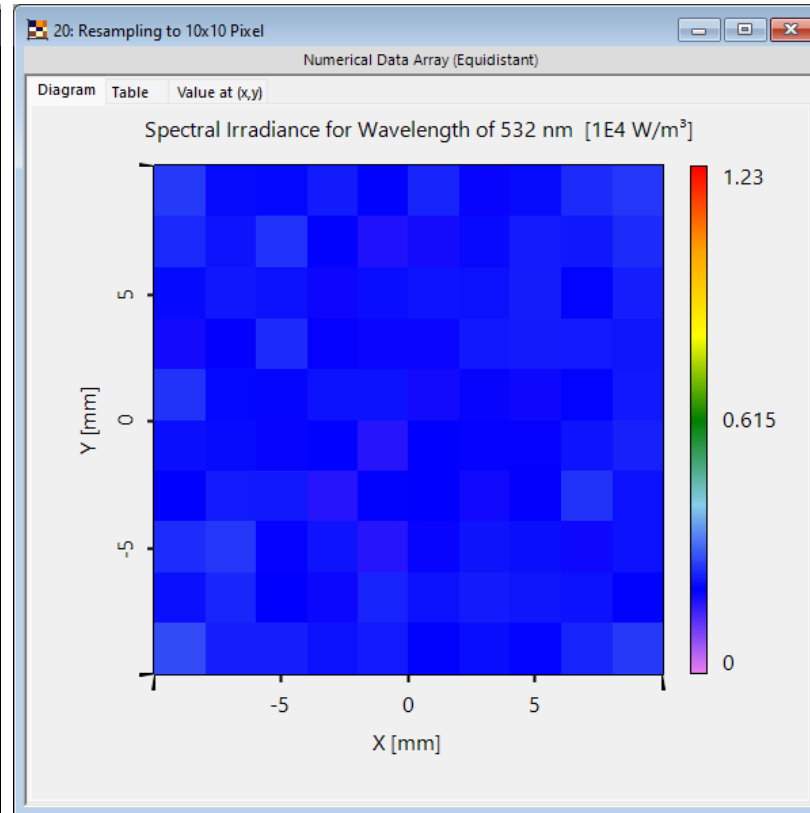
10 × 10 pixels

Adjustment of Detector Sampling

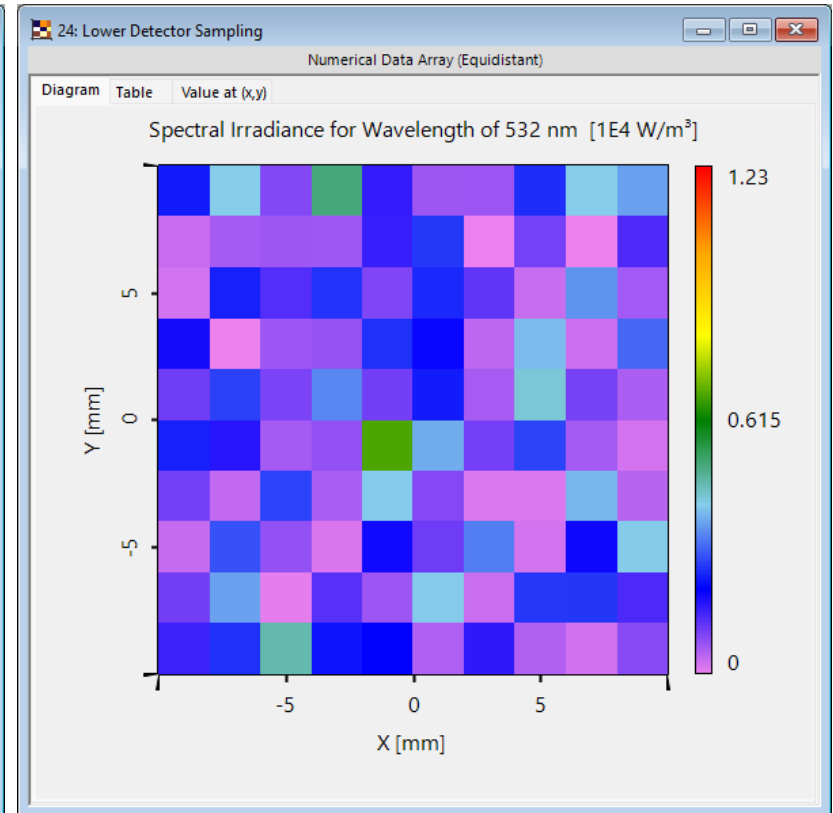
If you simply reduce the detector sampling instead of the add-on presented here, then only the field data at the center position of each of these pixels is sampled, which leads to an undersampled result without any (averaging) consideration of the surrounding field data..



2000 × 2000 pixels (original sampling)



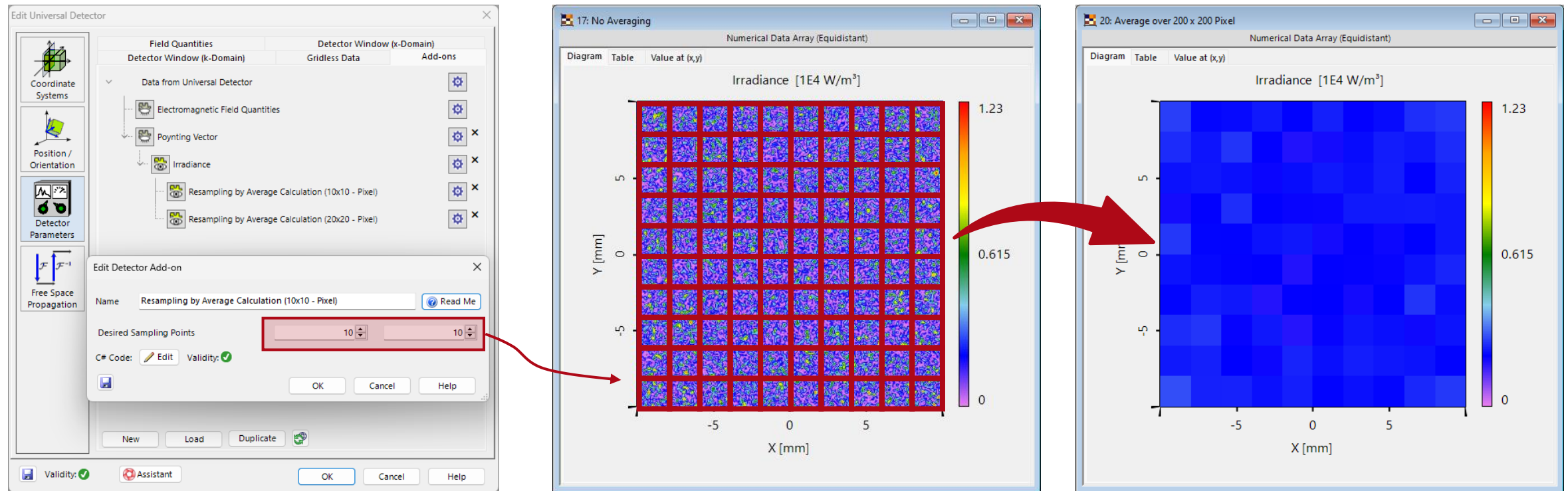
10 × 10 pixels



10 × 10 pixels in detector (no add-on)

Workflow

Universal Detector & Average Per Region Add-on



After a small sampling adjustment, the add-on *Resampling by Average Calculation* divides the initial data into equidistant areas consisting of the same number of data points, over which the arithmetic average is calculated. Further information on the Universal Detector, which allows the use of any such add-ons, can be found at:

- [Universal Detector](#)
- [Programming Detector Add-ons in VLF](#)

Document Information

| | |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| title | Result Resampling by Average Calculation Yielding Desired Number of Pixels |
| document code | USC.0415 |
| document version | 1.0 |
| required packages | - |
| software version | 2024.1 (Build 1.132) |
| category | Use Case |
| further reading | <ul style="list-style-type: none">• <u>Reflection at a Rough Surface</u>• <u>Reflection at a Retro Reflector with Rough Surfaces</u>• <u>Universal Detector</u>• <u>Programming Detector Add-ons in VLF</u> |