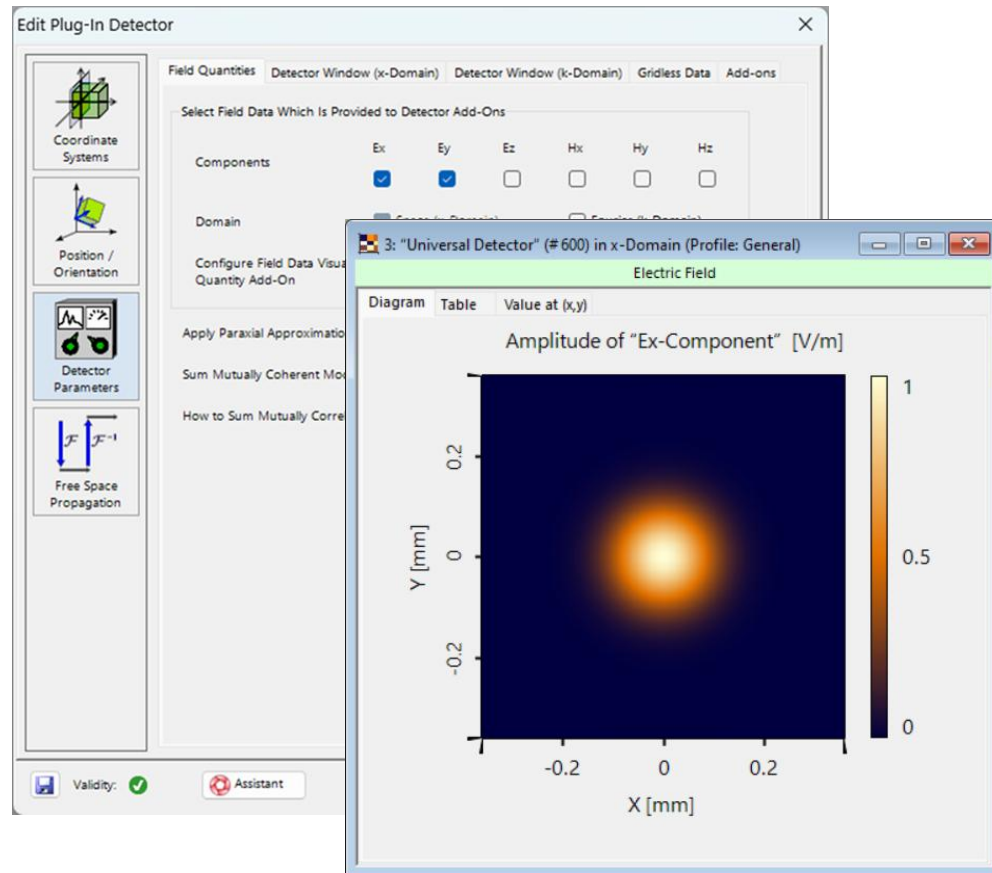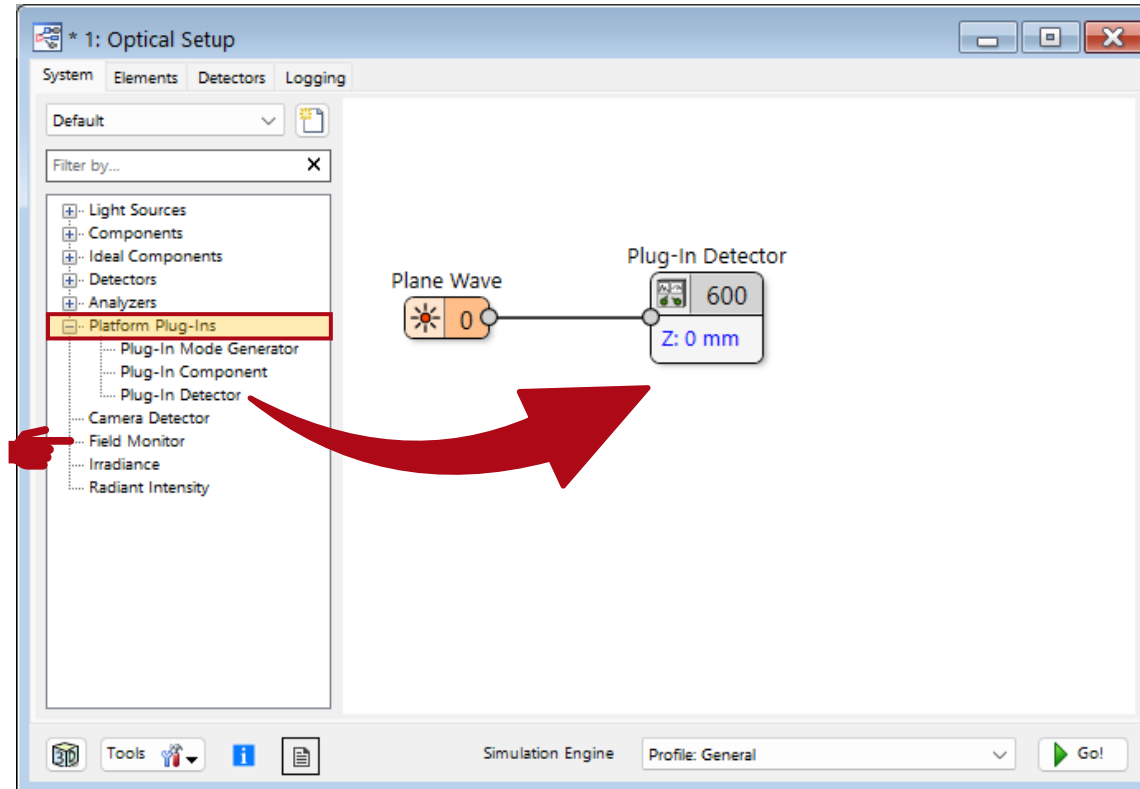# Plug-In Detector

Abstract

The *Plug-In Detector* is the most versatile tool to evaluate and output any information of an electromagnetic field in VirtualLab Fusion. It is capable of providing information in different domains (spatial and spatial-frequency domain) and coordinate systems (coordinate system of the field vs. detector position). Moreover, it enables to further evaluate and export the information of the impinging light to calculate any physical, radiometric or photometric quantity by using very flexible in-built or customized *Add-ons*.

How to Find the Plug-In Detector ?

The *Plug-In Detector* can be found in the component tree of the *Light Path Editor*. It may appear directly under the name *Field Monitor*, indicating its ability to evaluate and output any information of an electromagnetic field, or it can be found within the *Platform Plug-Ins* category.
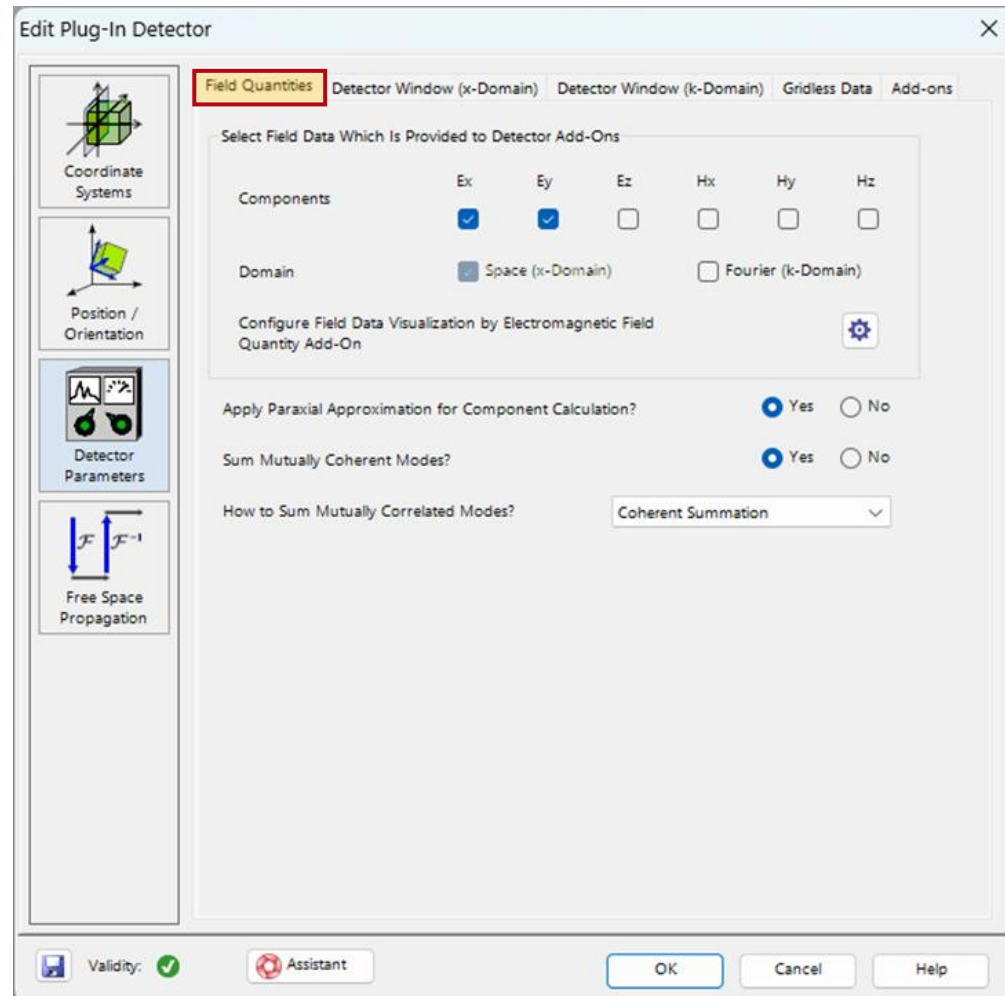
To add it to your system, simply drag & drop it to the desired position.

Plug-In Detector with Different Modeling Profiles

The available options in the *Plug-In Detector* depend on whether *Ray Results Profile* or *General Profile* is chosen.
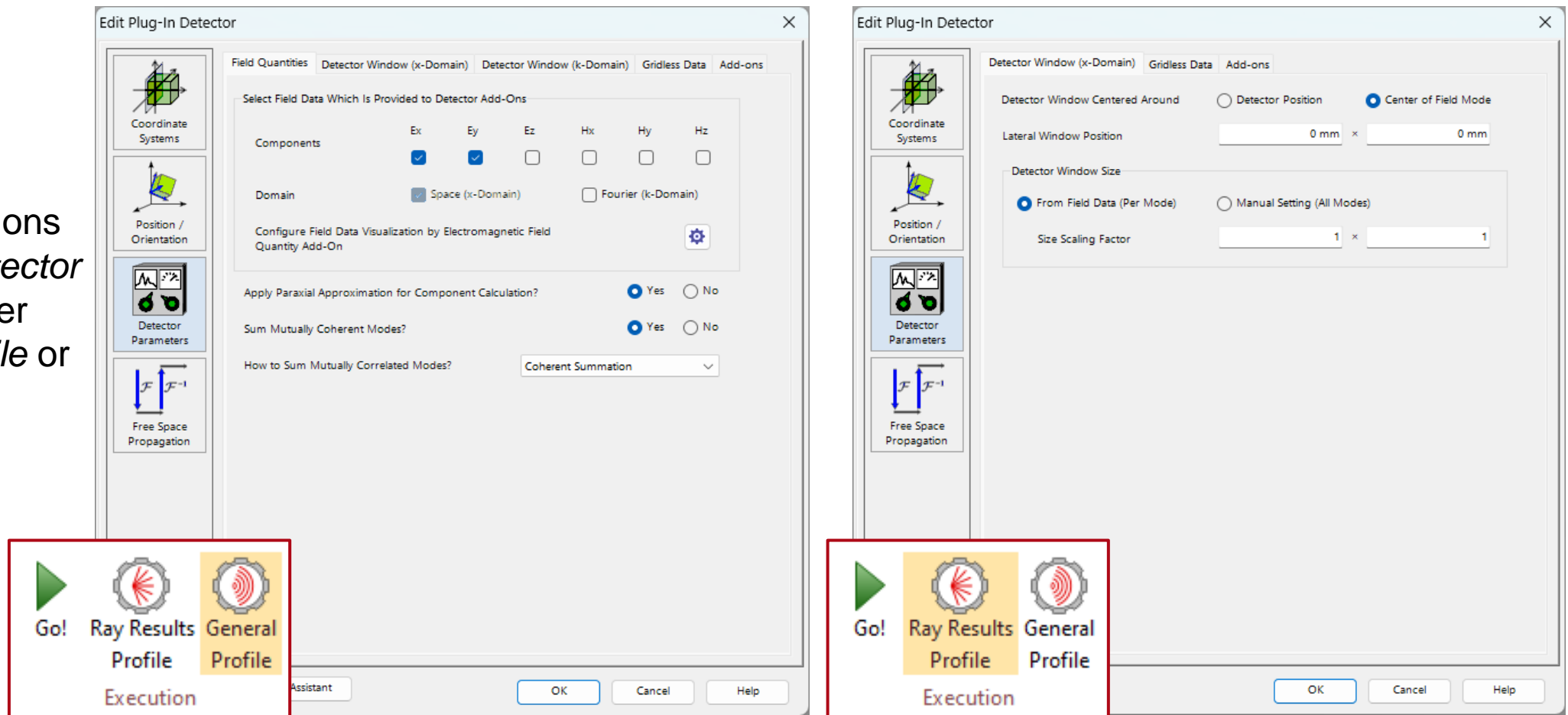
Field Quantities (General Profile)

Components:
Determines which components of the electromagnetic field are detected. At least one component must be selected. Note: VirtualLab Fusion uses E_x and E_y for the propagation and calculates other components on demand.

Domain:
The detector can evaluate and output the data in the x-domain (spatial domain) and/or k-domain (spatial-frequency domain).

**Apply Paraxial Approximation for Component Calculation:**
Determines whether the detector uses a paraxial approximation to calculate additional components of the electromagnetic field. (See: Paraxial Assumptions)

Sum Mutually Correlated Modes?
If this option is activated, correlated modes will be summed before any further evolution or output is performed. It offers three options for the summation:

Coherent Summation
Incoherent Summation
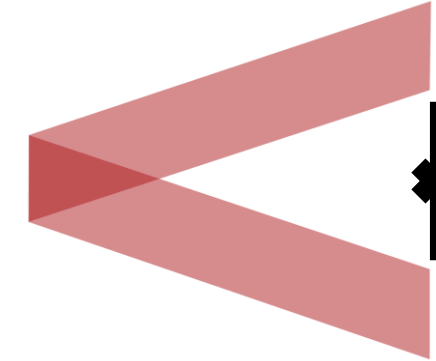Partially Coherent Summation

Detector Window
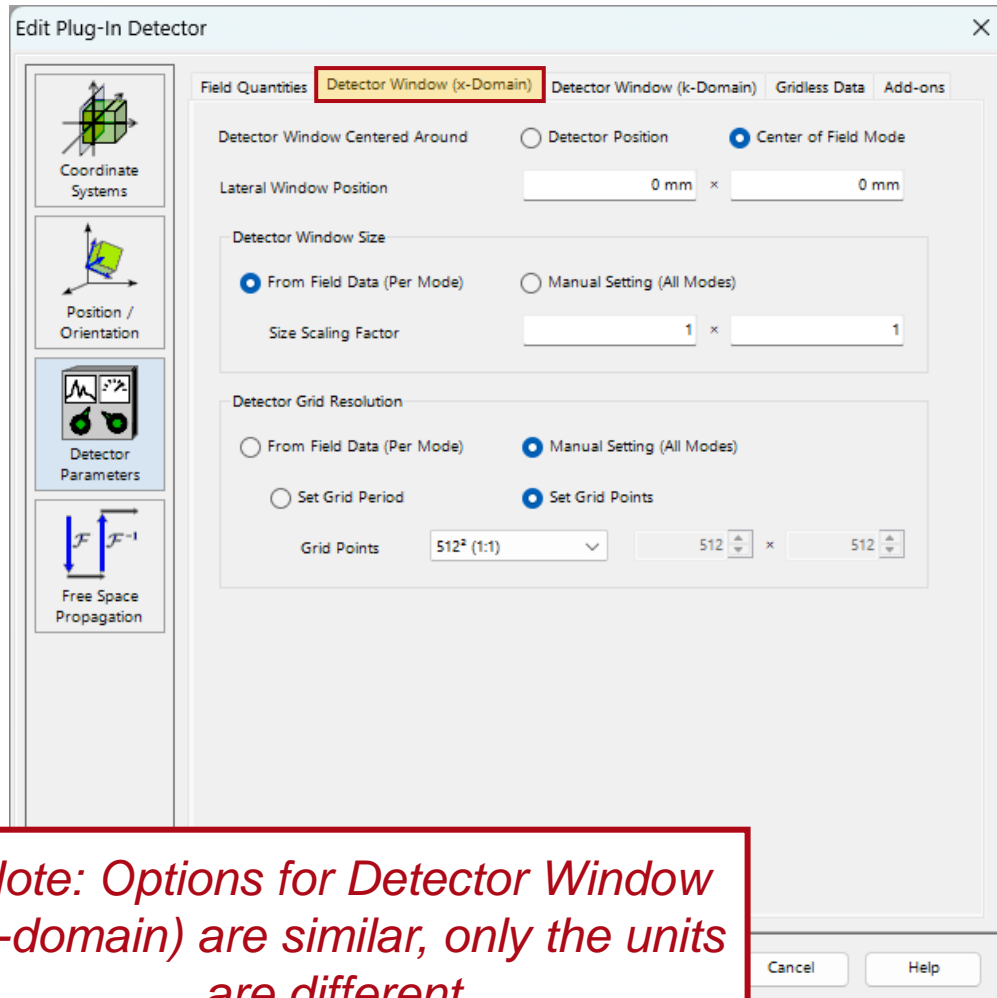
The central position and size of the detector window can be defined according to coordinate system and extend of each individual mode or the position of the detector.
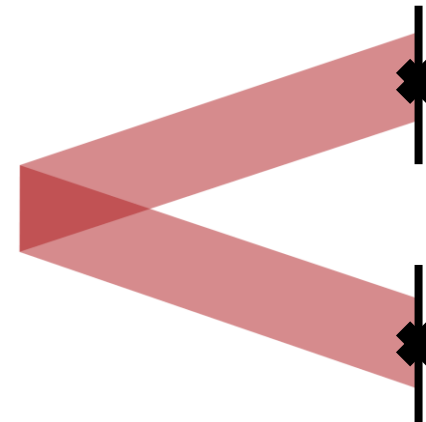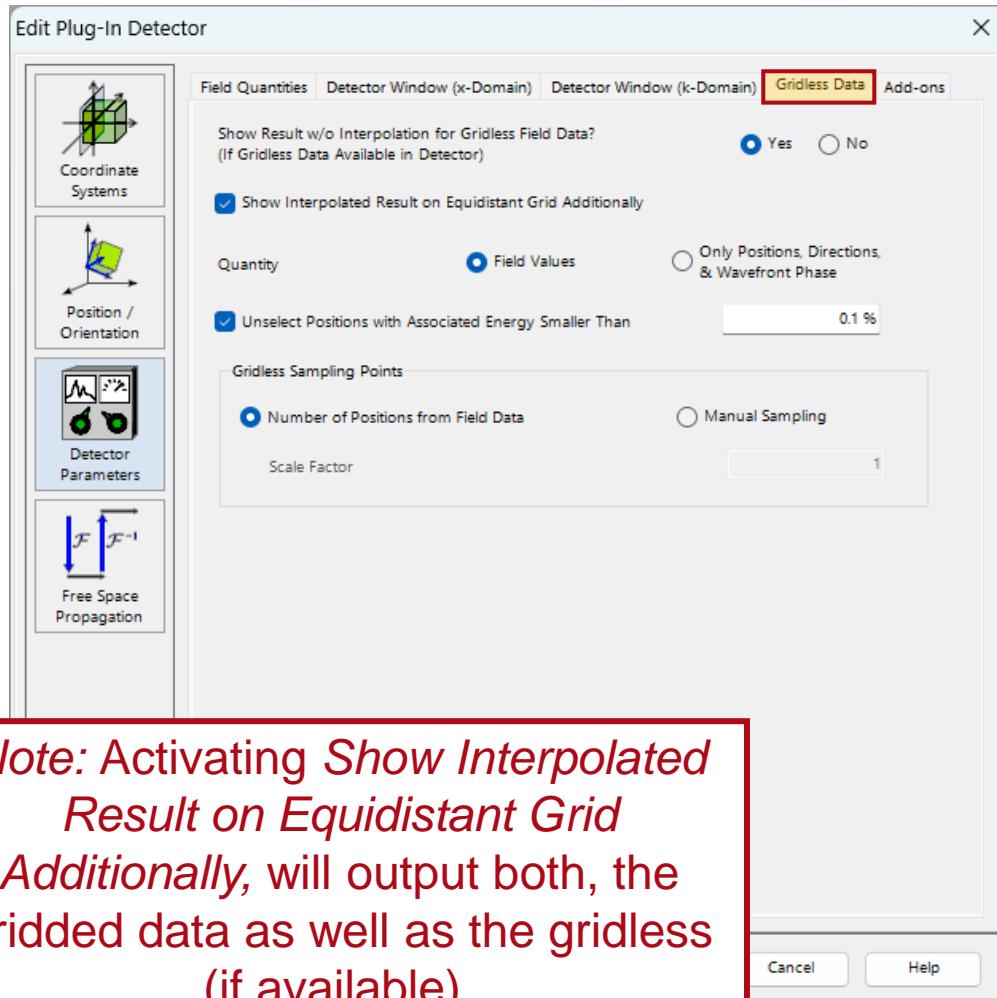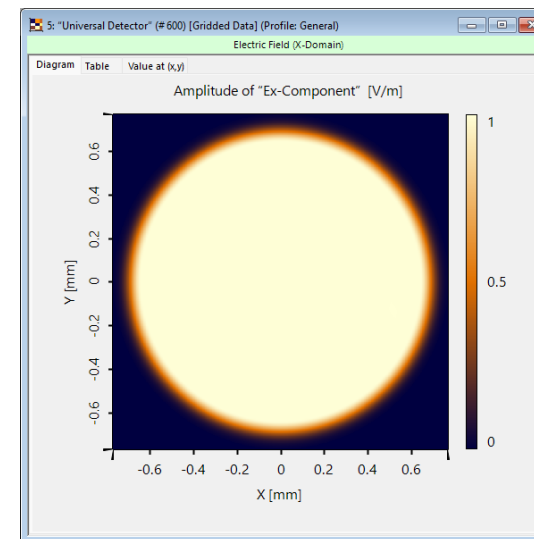

Center of Field Mode   *Detector Position*

The user can also configure, whether the sampling shall be handled individually (per mode) or on a mutual grid. This grid can be either specified by a period (sampling distance) or grid points (number of sampling points).
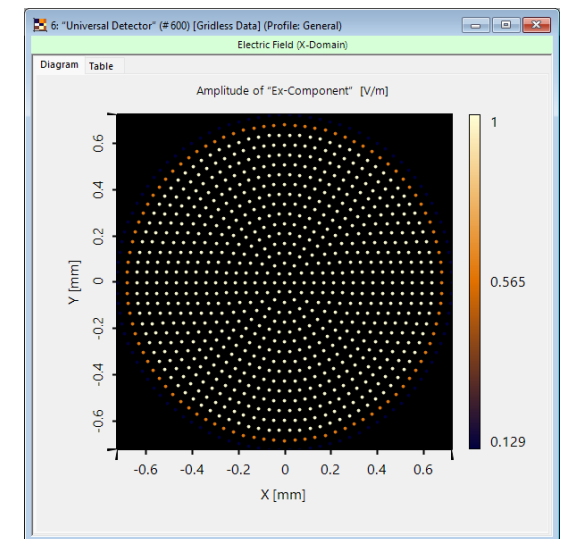
Gridless Data

If gridless data is used for the propagation, the detector can visualize this type of data as well. The gridless pattern of the field samples is output either in addition to the gridded information or exclusively. Further, the amount of output information (quantities) can be reduced to just positions and directions (like a ray tracing result). Please note that this will only work for a single mode or when the coherent summation is disabled.
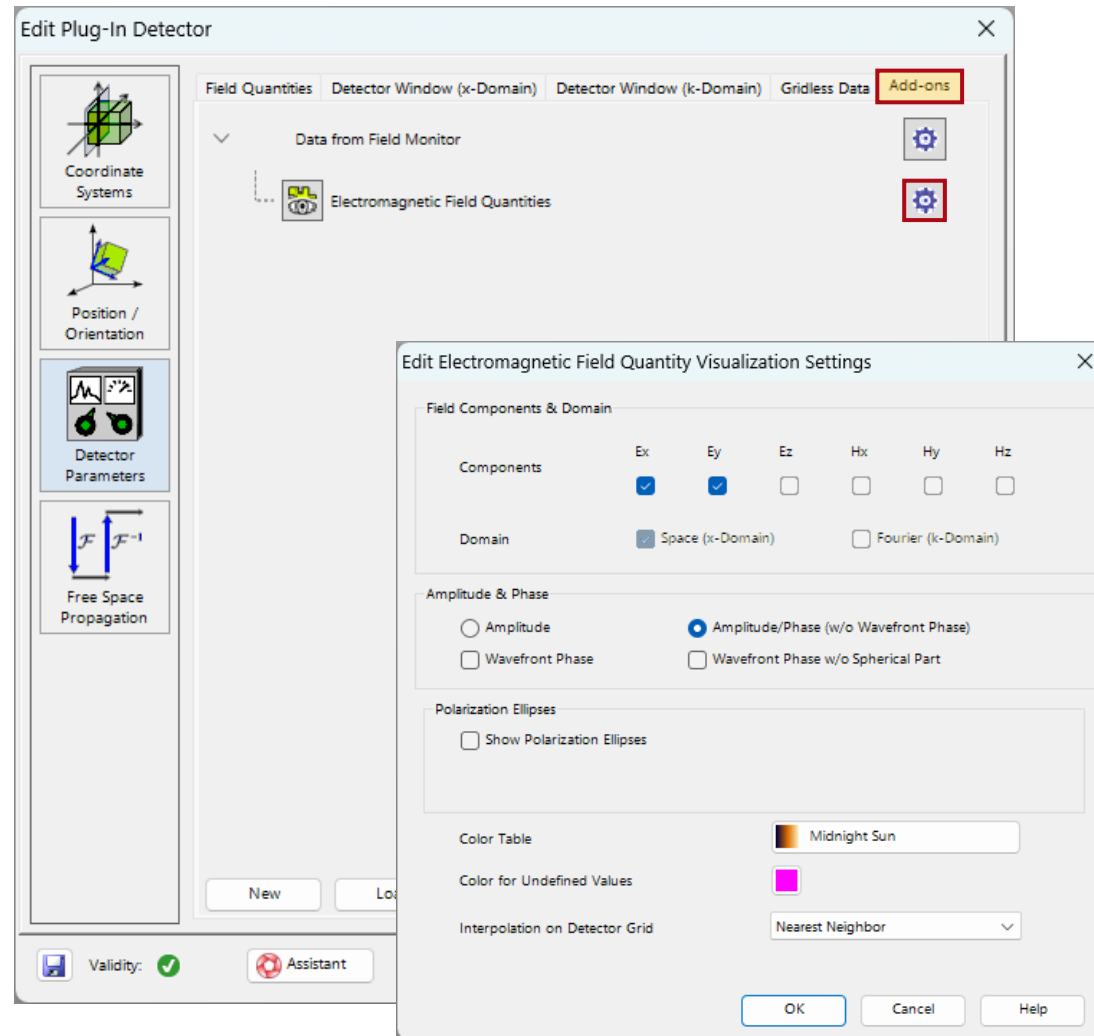
Note: Activating *Show Interpolated Result on Equidistant Grid Additionally,* will output both, the gridded data as well as the gridless (if available).

gridded data

gridless data

Detector Add-Ons – Electromagnetic Field Quantities

Add-ons are versatile tools that allow for an additional calculation of any values based on the impinging field data (either single physical values or 2D arrays). They are organized in tree, for the case the one add-on requires the result of another.

By default, the *Electromagnetic Field Quantities* add-on is preconfigured (cannot be deleted). It outputs any field component in the x- and/or k-domain. Please note, that only field components can be output, which are selected in the *Field Quantities* tab (vice versa, it is not necessary to enable the output of all components). Furthermore, the user can choose to output just the amplitude or the wavefront phase, and various display options are also available to customize the output.
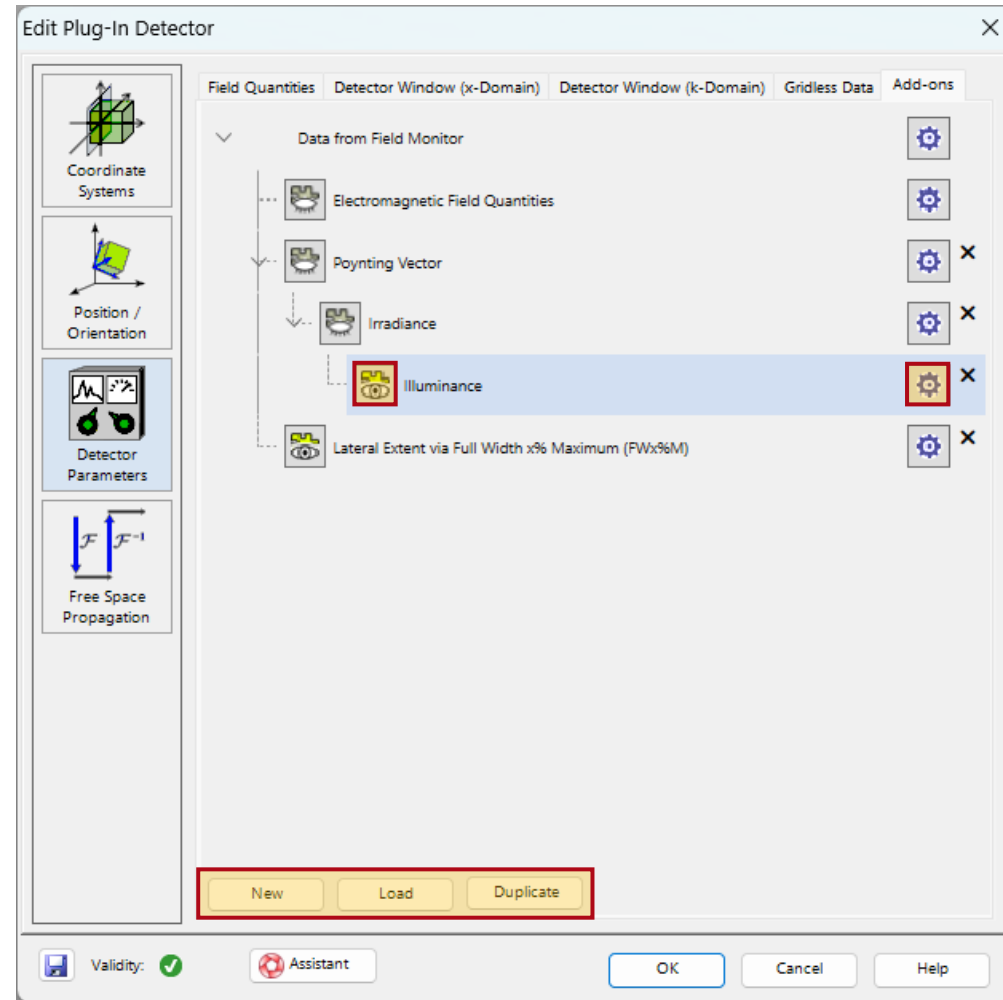
Detector Add-Ons – Custom Add-ons

While all *Add-ons* are calculated, the user can specify which results to display.
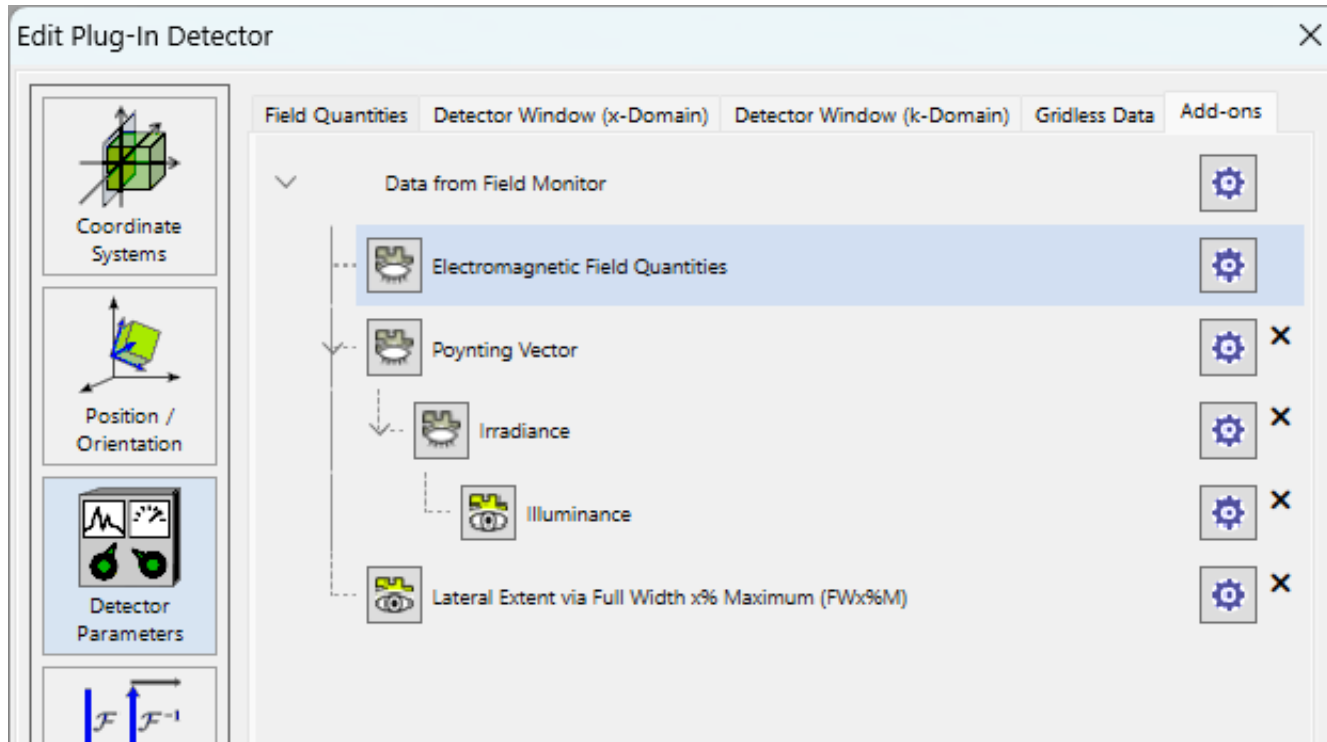
Result will be visualized.

Result will not be visualized.

Each *Add-on* comes with its own set of options. They can be accessed via the ⚙ - button.

In this area detector *Add-ons* can be created, duplicated or loaded from the VirtualLab Fusion database.

# Detector Add-Ons – Hierarchy Tree

Note: Detector Add-ons can be moved in the tree by drag & drop to the desired position and branch.

By default, the *Plug-In Detector* provides all *Add-ons* with the electromagnetic field information based on the field components that are specified in the *Field Quantities* tab. Some *Add-ons* will require just single components, while other necessitate a full set of all 6 components (**E** and **H**). Furthermore, some *Add-ons* require a different physical quantity as input (e.g. the Poynting-Vector). For this purpose, *Add-ons* can be arranged in a tree.

In the example, the *Poynting Vector* add-on is applied on the field data to calculate the Poynting-vector in x-domain. The resulting information can be used to calculate the (spectral) *Irradiance* and moreover processed to calculate the *Illuminance*. In contrast, *Lateral Extent via Full Width x% Maximum* just requires the full set of field data. Hence, it is positioned at a new branch.

Detector Add-Ons Read Me – Documents
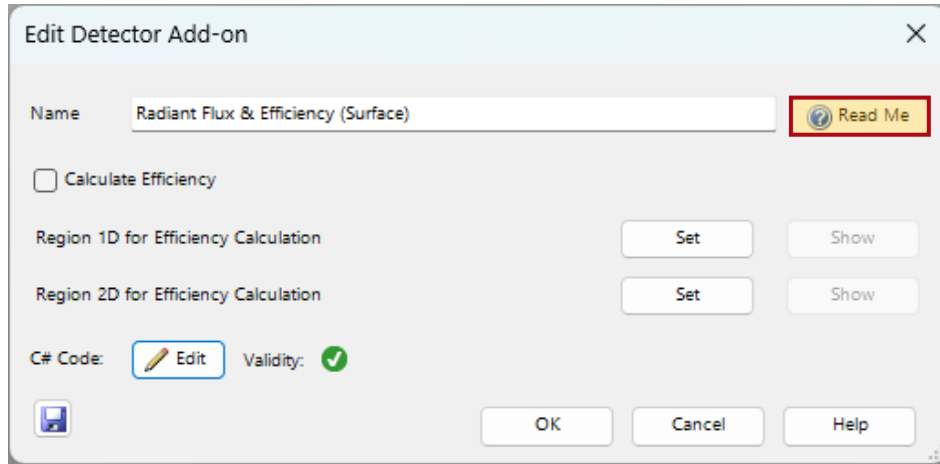
Every *Add-on* from the official database comes with a read-me document, explaining its functionality and stating the input and output parameters.

Release 2025.1 – Overview of Add-Ons

The official database categorizes the available detector add-ons into subcategories. With the release of version 2025.1 the following add-ons are available:

Export:
- Export to CSV
- Export to Image
- Export to Raw Data

Field Evaluation:
- Angles and Eccentricities of Polarization Ellipses
- Point Evaluation (x-Domain)
- Summed Squared Amplitude

Lateral Extent Measurements:
- Lateral Extent via Full Width x% Maximum (FWx%M)
- Lateral Extent via Standard Deviation
- Lateral Extent via Sum of Squares Percentage

Photometry:
- Illuminance
- Luminous Energy Density
- Luminous Energy
- Luminous Flux & Efficiency (Solid Angle)
- Luminous Flux & Efficiency (Surface)
- Luminous Intensity

Pulse Evaluation:
- Pulse Evaluation (Line)
- Pulse Evaluation (Point)
- Pulse Evaluation (Rectangle)
- Spectrum Evaluation (Line)
- Spectrum Evaluation (Point)
- Spectrum Evaluation (Rectangle)

Radiometry:
- Intensity
- Irradiance
- Poynting-Vector
- Radiant Energy Density
- Radiant Energy
- Radiant Flux & Efficiency (Solid Angle)
- Radiant Flux & Efficiency (Surface)
- Radiant Intensity
- System Efficiency (x-Domain)
- System Efficiency (k-Domain)

Region Indication:
- Add Region Information from Light Guide

Detector Add-Ons – Programmable Snippets
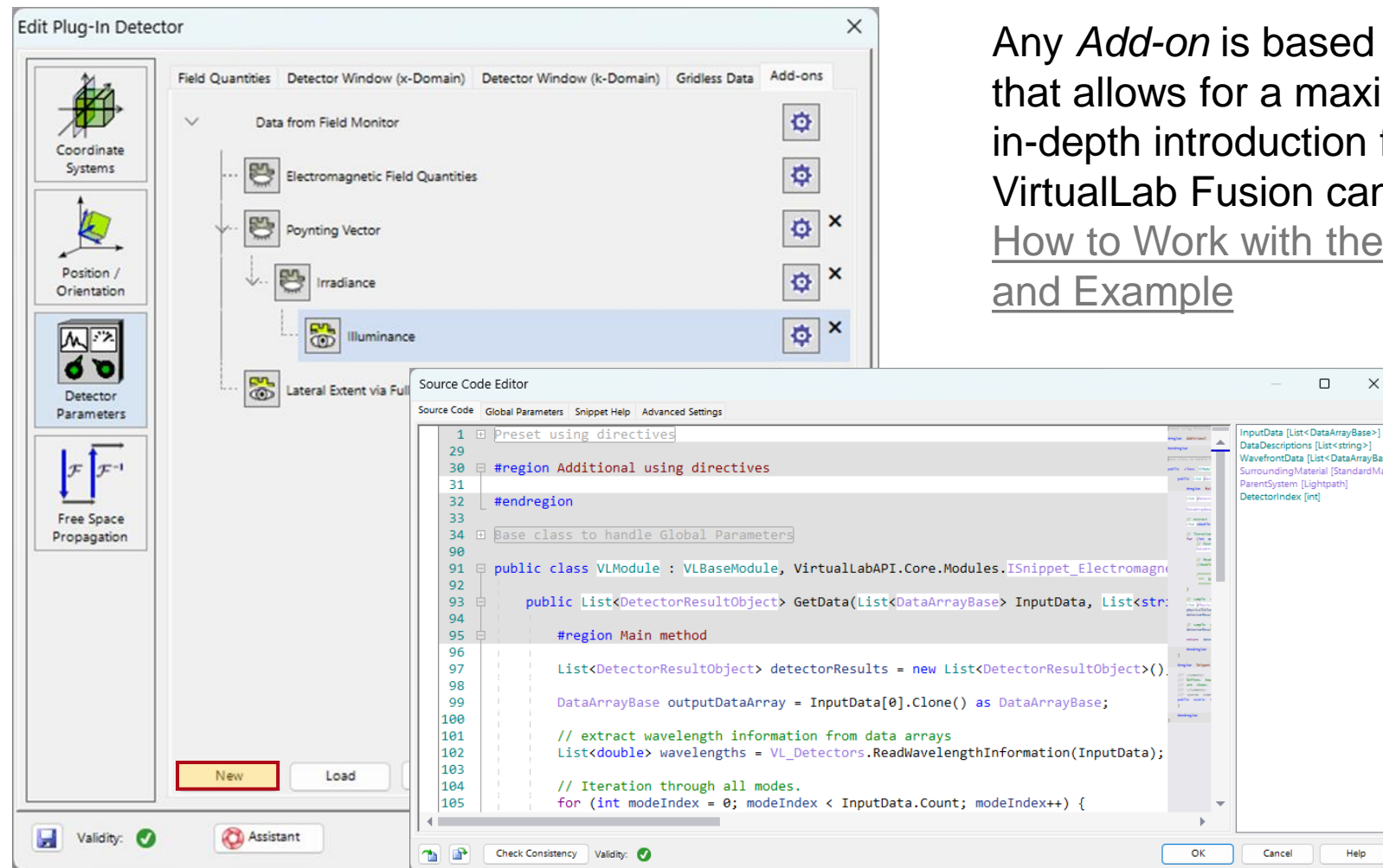
Any *Add-on* is based on a programmable snippet that allows for a maximum of flexibility. A more in-depth introduction for programmable tools in VirtualLab Fusion can be found under:
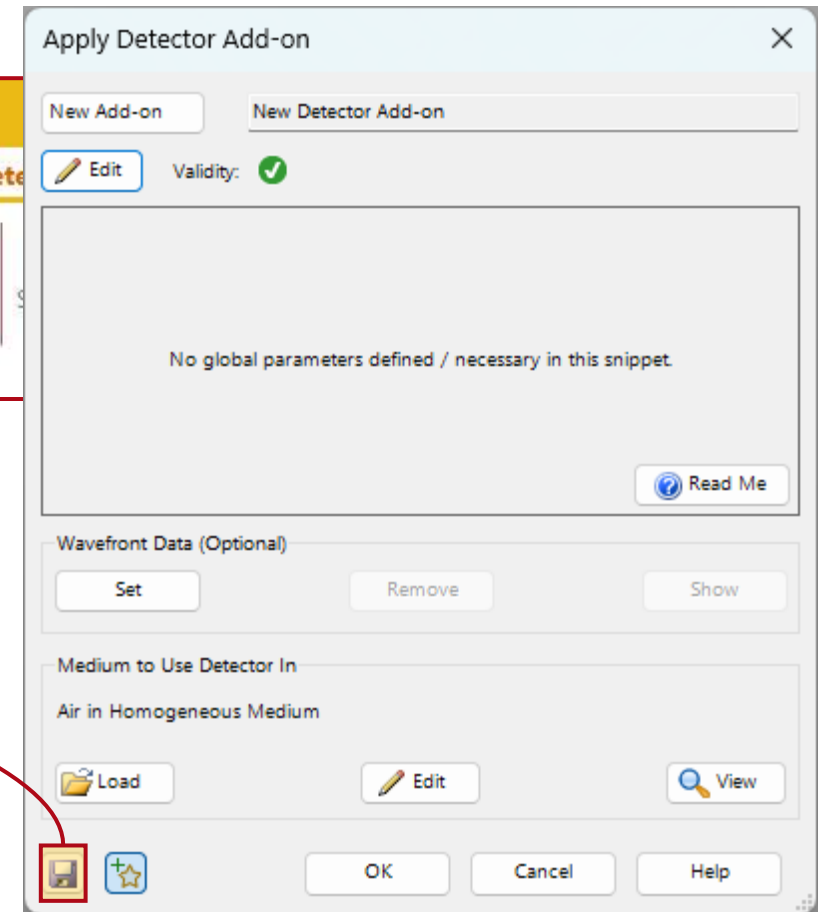How to Work with the Programmable Detector and Example

Post-Processing: Application of Detector Add-ons
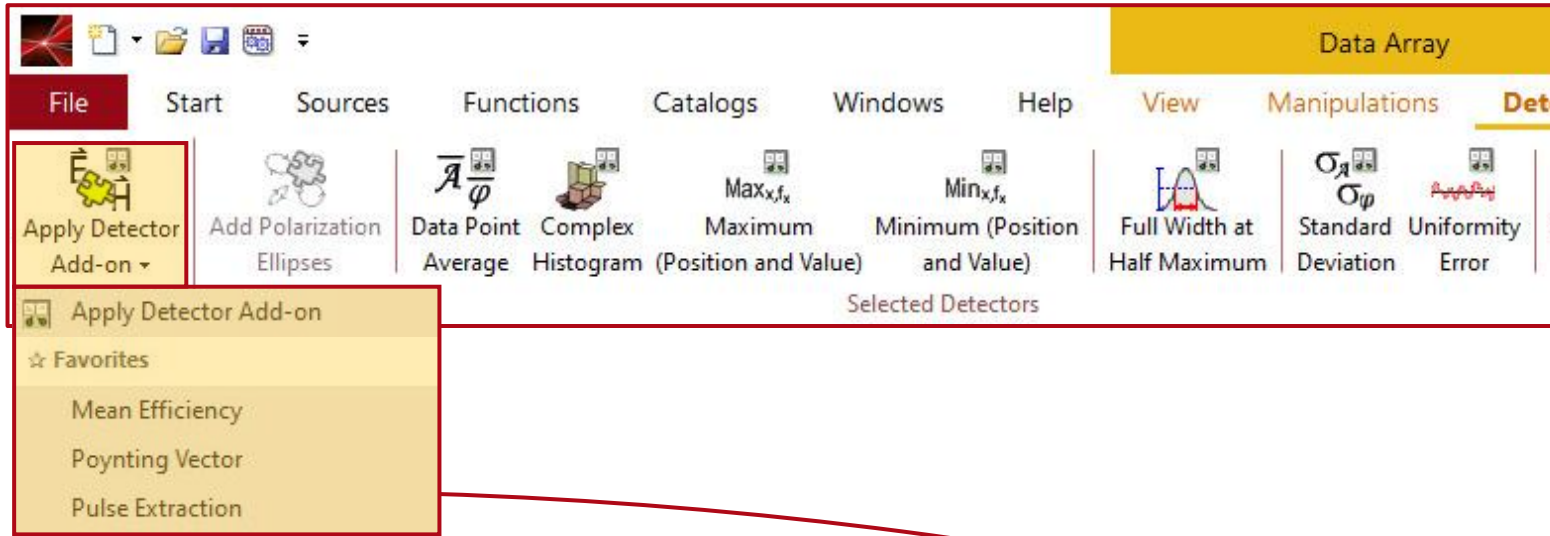
Under *Detectors/Apply Detector Add-on* the user can apply any predefined or customized *Detector Add-ons* to a *Data Array* to further post-process the results.

Clicting on the - button will add a *Detector Add-on* to the favorites list, allowing easier access.

Document Information

Title	Plug-in Detector
Document code	TUT.0332
Publication date	08.07.2025
Required packages	-
Software version	-
Category	Tutorial
Further reading	• Plug-in Source • Plug-in Component