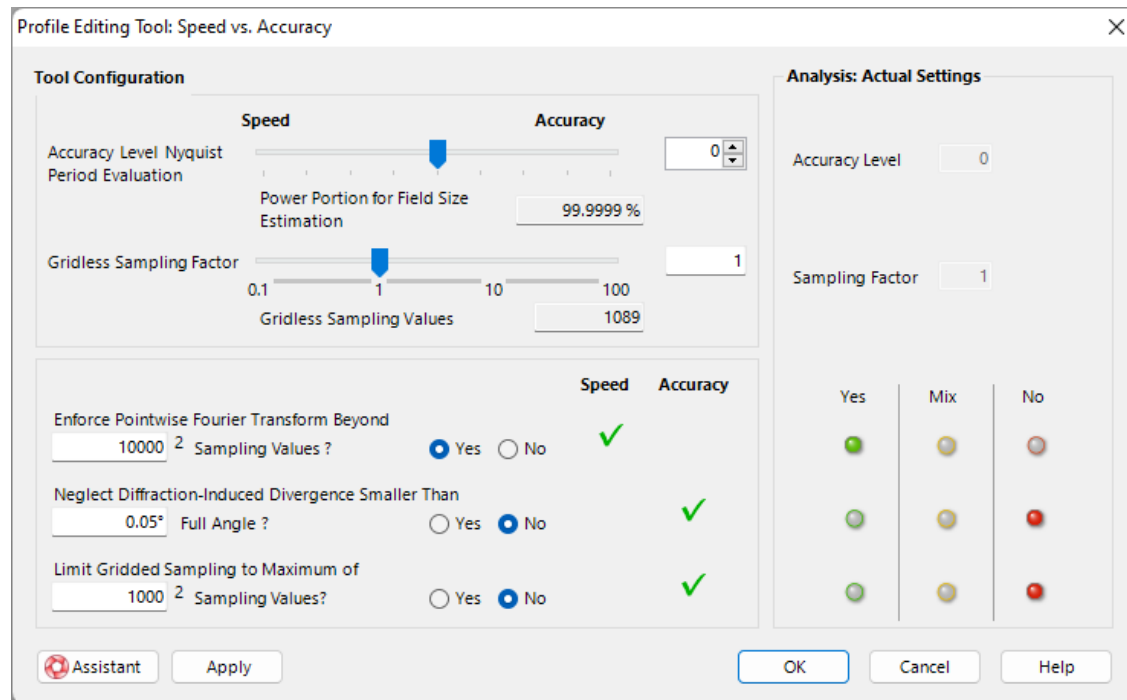# Profile Editing Tool: Speed vs. Accuracy

Abstract

VirtualLab Fusion provides handy tools to configure basic simulation options of even complex optical systems comprising lots of surfaces and components with just a few clicks. One of these tools is the *Speed vs. Accuracy* profile editing tool, which comes at hand for the customization of the settings of the sampling of the field data, that is used during the propagation of the light through the optical system.
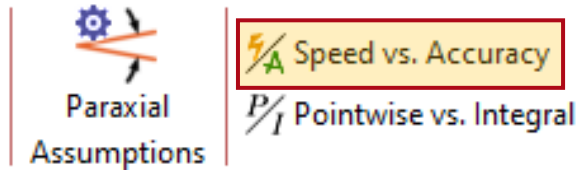
The Profile Editing & Run Ribbon
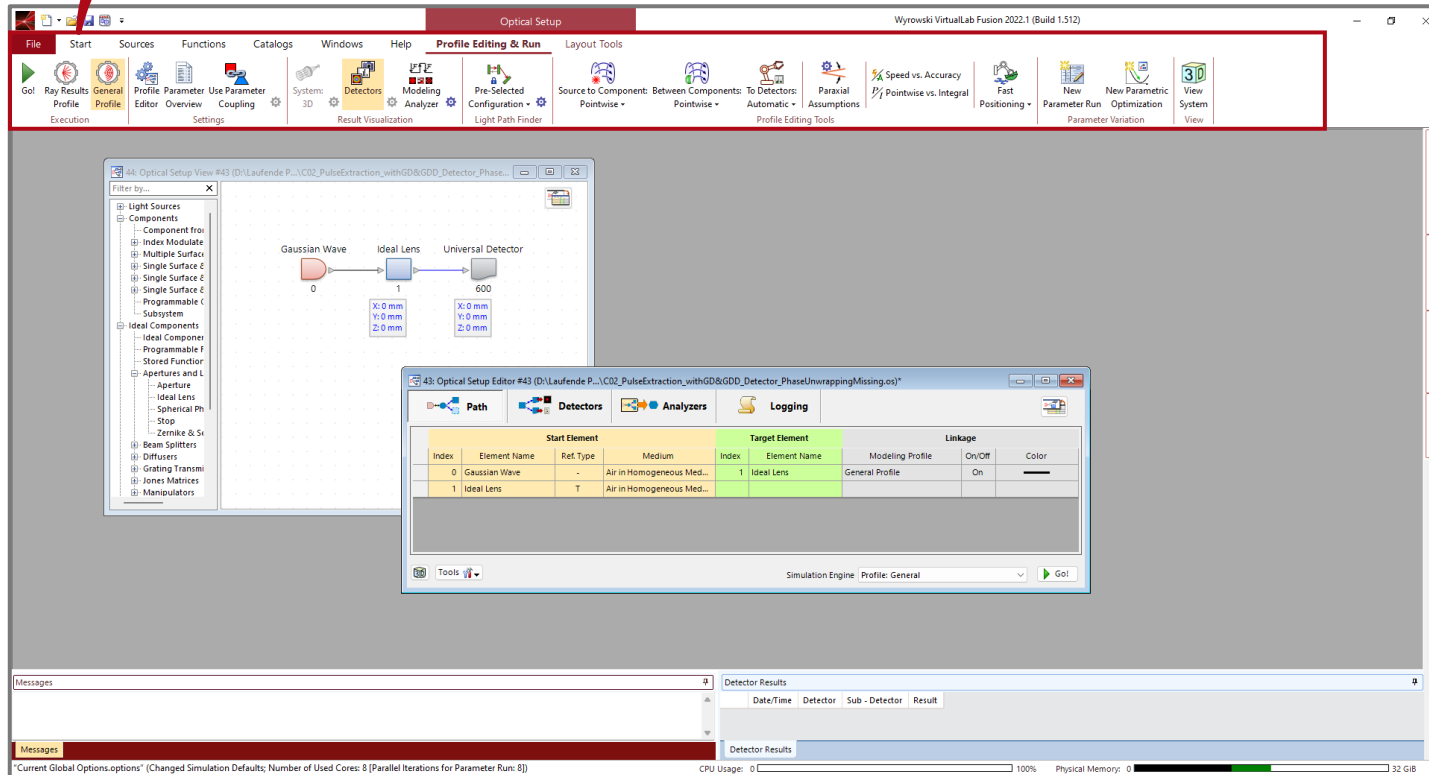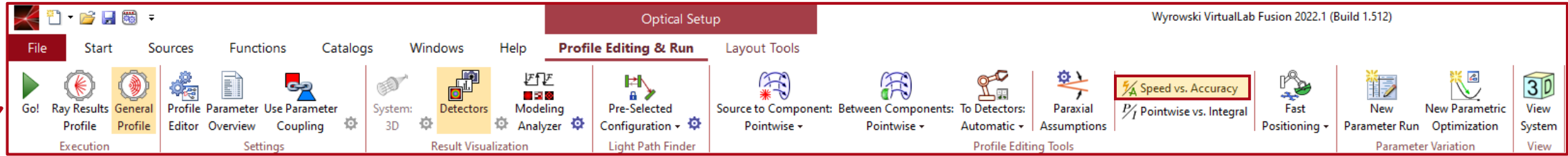
When an *Optical Setup* document is active, a new ribbon *Profile Editing & Run* will be available in the start menu automatically.

In this Use Case, we want to focus on the options to control the accuracy of the field representation, provided by the *Speed vs. Accuracy* tool.

Speed vs. Accuracy - Tool

The *Speed vs. Accuracy* tool analyses and allows to set the sampling parameters of the field data for gridded and gridless representation. It consist of of two parts:
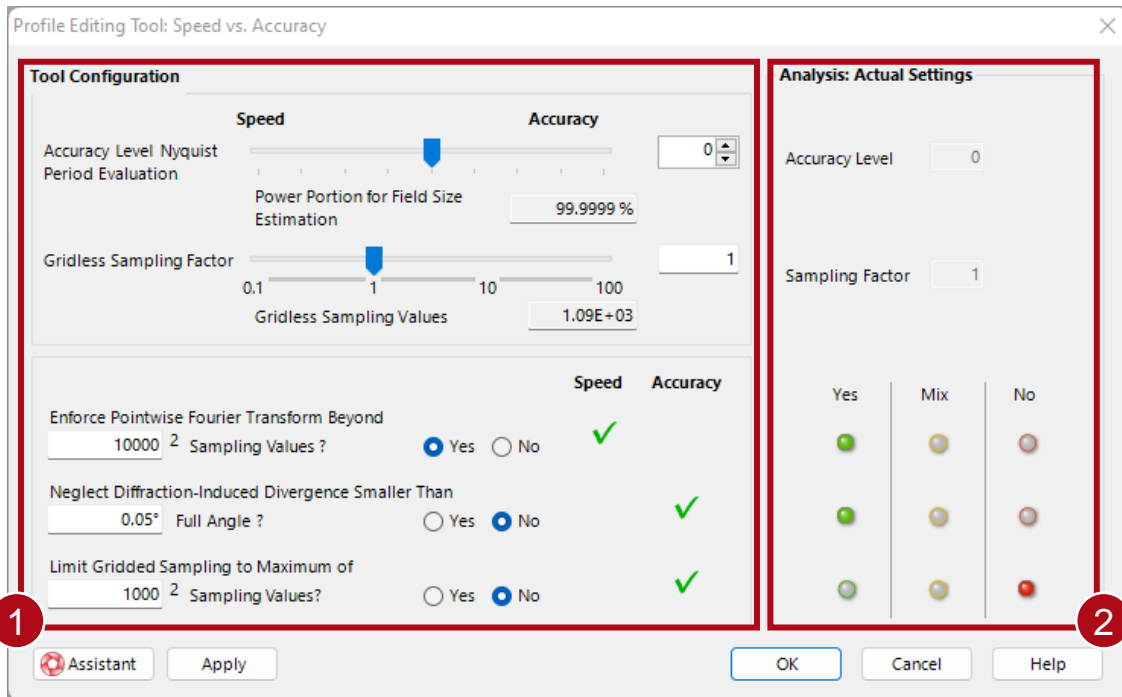
1 The fast configuration part can adapt the parameters in the entire optical system at once (all components and detectors). The two buttons (*Yes* / *No*) are only used for configuration and **do not** necessarily indicate the current settings of the system.

2 The analysis part provides information about the current settings of the optical system by using a traffic light system. Here, the red and green light indicate, that the regarding parameter is active or inactive for the entire system. Yellow light means that the parameter is activated in parts of the system, currently. This especially can happen in complex systems that comprise multiple components or detectors.

Accuracy Level Nyquist Period Evaluation
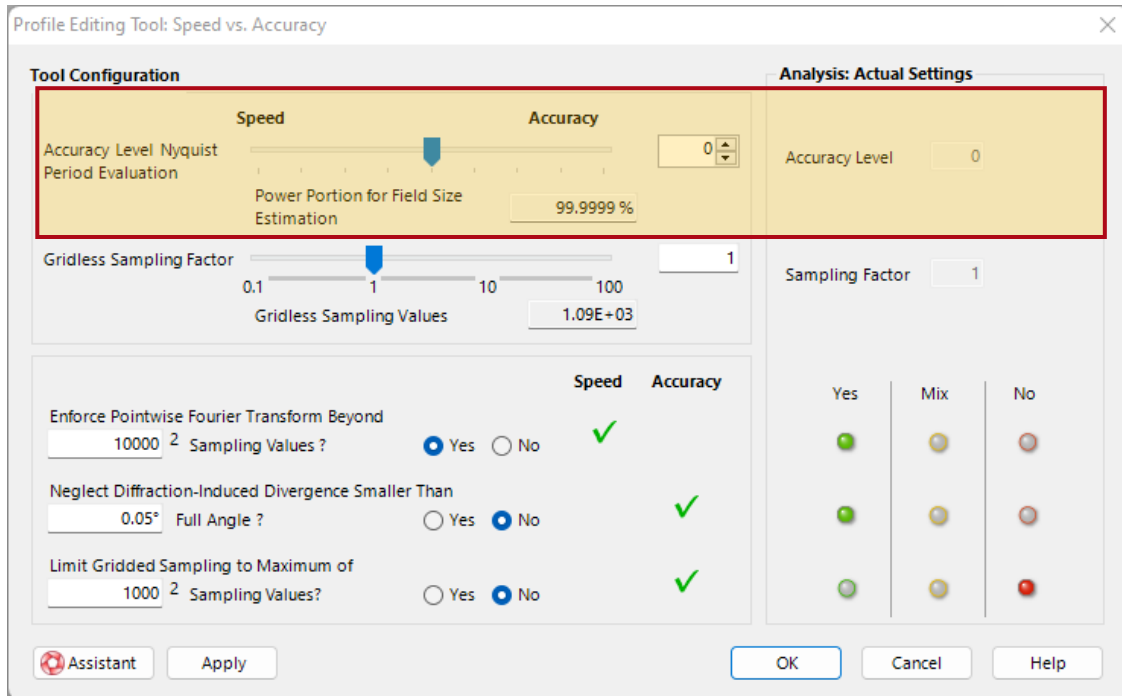
For the propagation of light through a particular optical system, VirtualLab Fusion uses a hybrid sampling of the field data, means the data can be either equidistantly (gridded) or non-equidistantly (gridless) sampled, depending on the optical component and the applied solver. The proper type of representation is chosen automatically as well as if a conversion between both types is required. For the sampling of gridded data, the extension of the field plays a major role in the automatic estimation of the required number of sampling points. The *Accuracy Level Nyquist Period Evaluation* parameter allows to adapt the field size estimation according to the regarded portion of power (see next page).
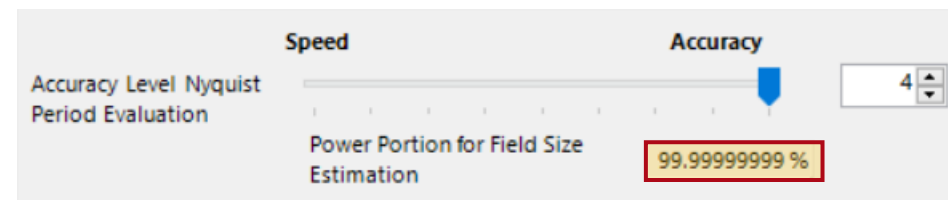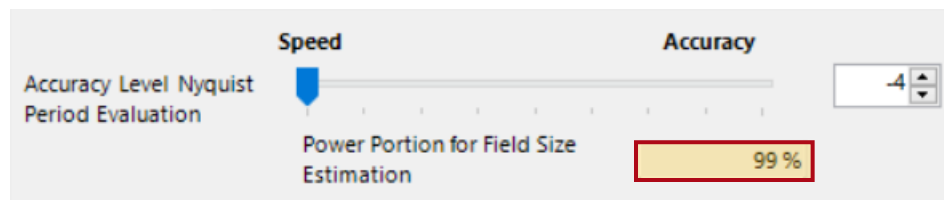
Power Portion of Field Size Estimation

In order to estimate the required sampling of a field (given e.g. in space domain), a series of 1D-cuts will be extracted and Fourier transformed into the k-domain. Based on these information, VirtualLab calculates the required size of the field in the k-domain, considering the configured value of *Power Portion for Field Size Estimation.* Due to the characteristics of Fourier transformations the necessary sampling distance in the space domain can be obtained (and is applied for data given in the k-domain vice versa).
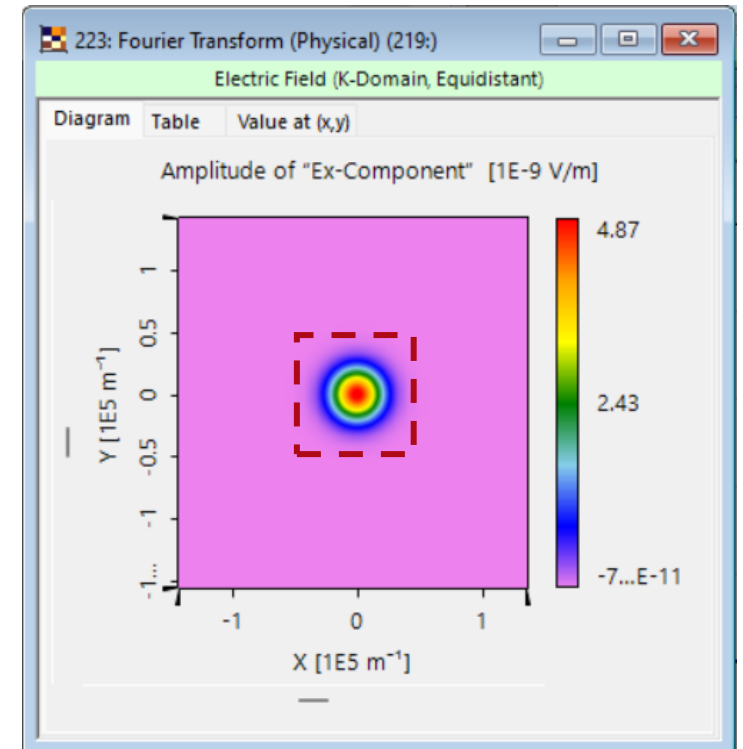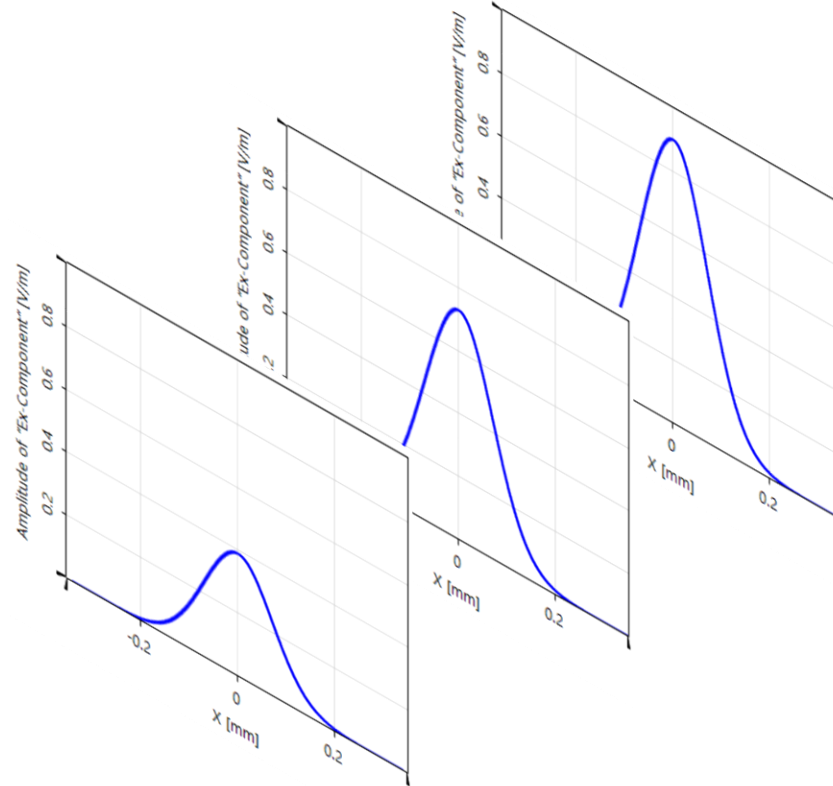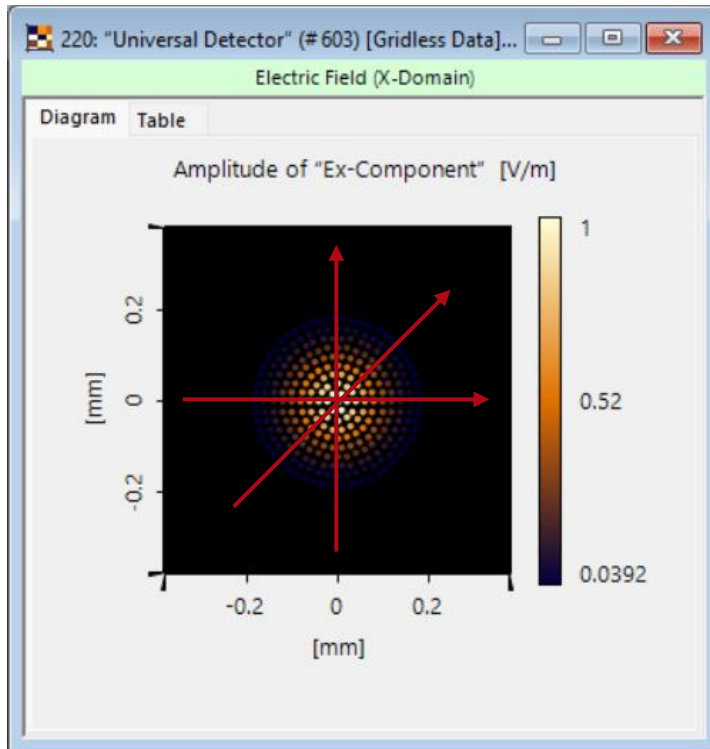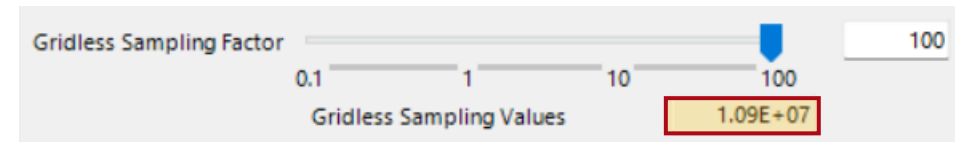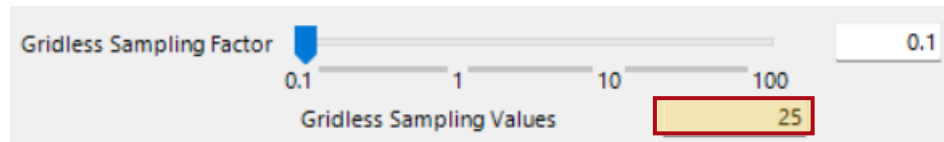
Gridless Sampling Factor
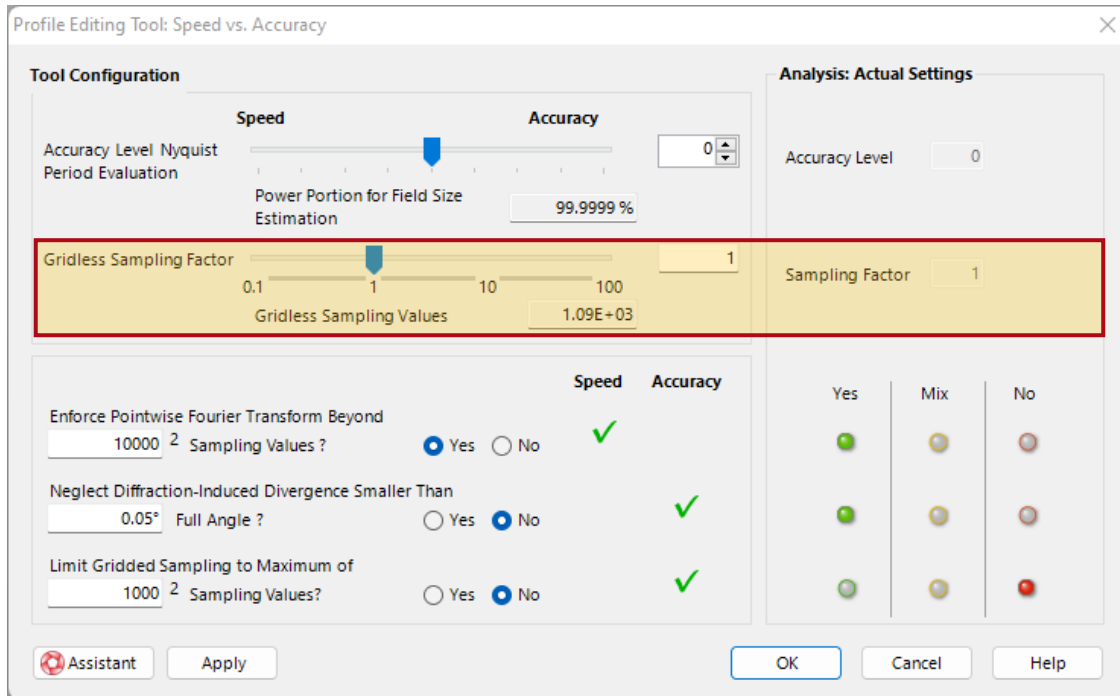
For the sampling of gridless data, the number of gridless samples, which are used for the representation of the field data, is the most crucial parameter.

Comment: Sources with round or elliptical aperture will use a hexapolar-like pattern for the gridless data, whereas for a rectangularly truncated sources an x-y-pattern is used.

The number of used sampling points will automatically be calculated and is depicted below:
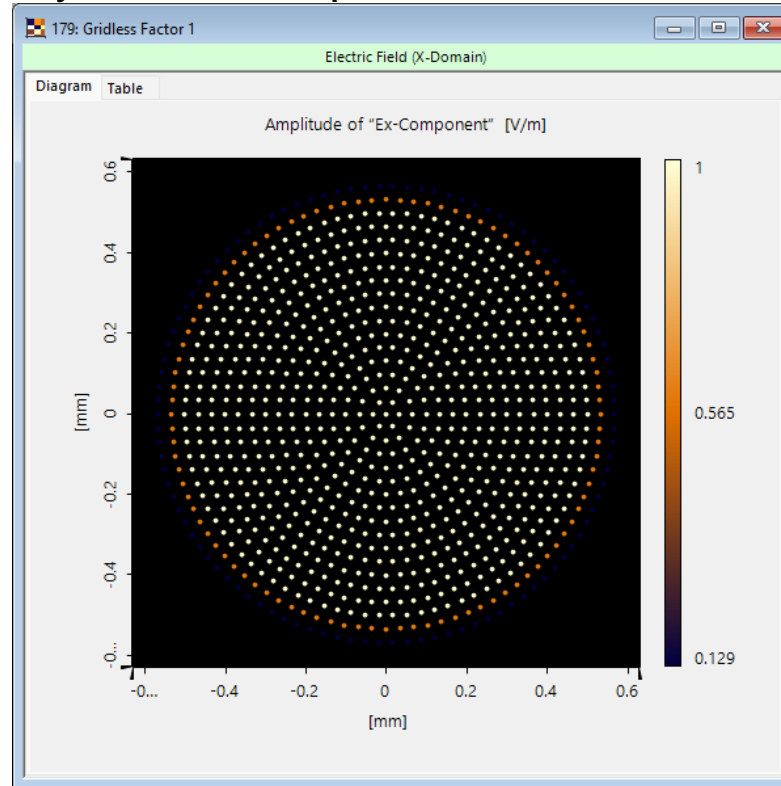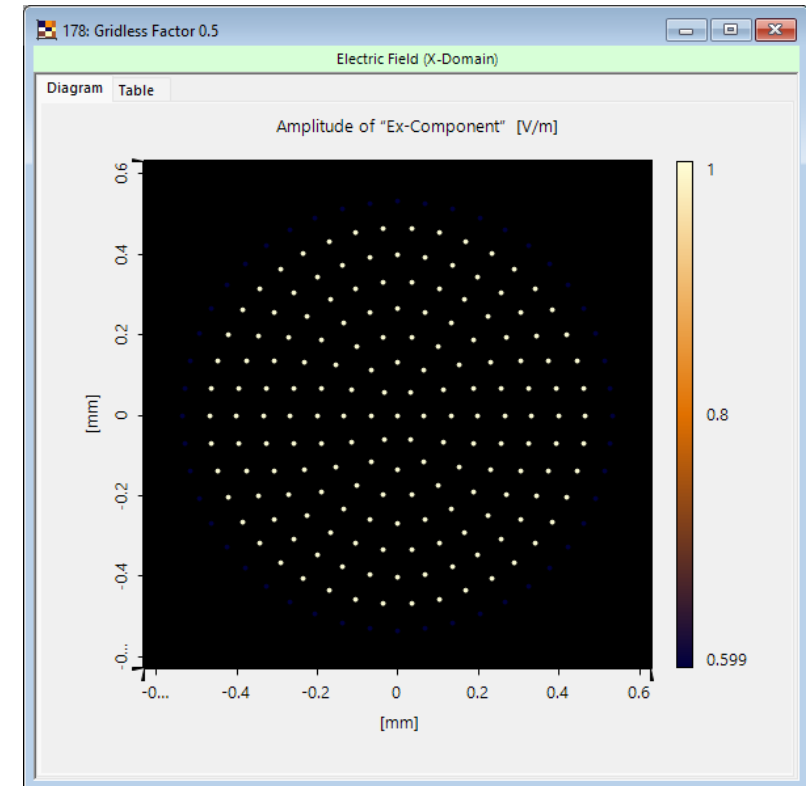
Gridless Sampling Factor

For the example of a source with a round aperture, the gridless samples which contain the field information use a hexapolar pattern, where its density can be adapted:
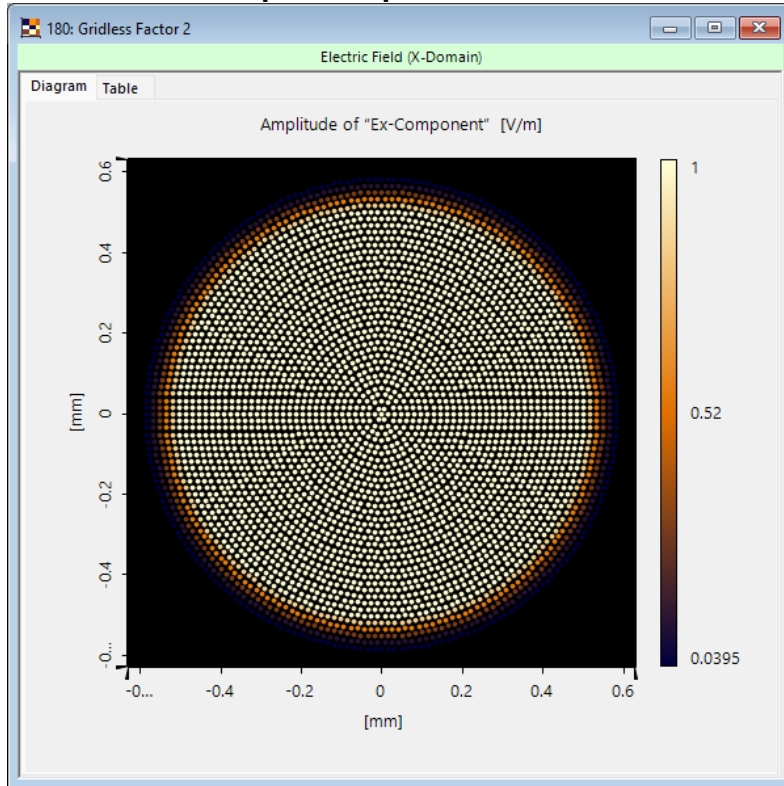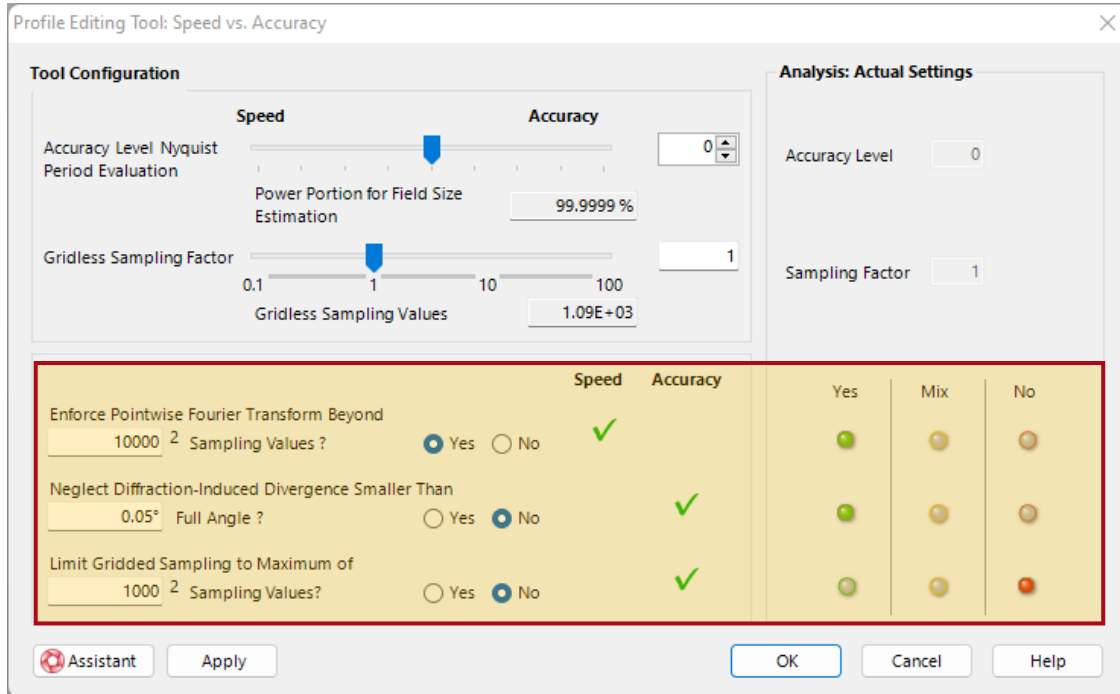

Gridless Sampling Factor 2   *Gridless Sampling Factor* 1   *Gridless Sampling Factor* 0.5

Additional Global Sampling Options (for Gridded Data)

Enforce Pointwise Fourier Transform Beyond: Integral Fourier transformations require properly sampled field data (gridded), what can result in a large number of sampling points for a complex field. To prevent an overflow of the available memory during the simulation, this option allows to enforce a pointwise Fourier transform if the entered number of sampling points is exceeded. Note: This may result in a more inaccurate result.

Neglect Diffraction-Induced Divergence Smaller Than: This is the same option provided in the *Paraxial Assumption* tool. A pointwise Fourier transform is enforced, if the diffraction-induced divergence is below a preset limit, what is valid for paraxial fields.
(See also: Paraxial Assumption Tool)

Limit Gridded Sampling to Maximum of: This option enables to limit the number of gridded sampling points of the field data to prevent an overflow of the memory during the simulation, but still allows to perform an integral Fourier transform if required. While the maximum number of sampling points is entered symmetrically, the aspect ratio of the estimated sampling according to the set power portion will be taken in account for the final sampling of the field. Note: This may result in a more inaccurate result.

Document Information

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software version	2023.1 (Build 1.554)
category	Feature Use Case
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