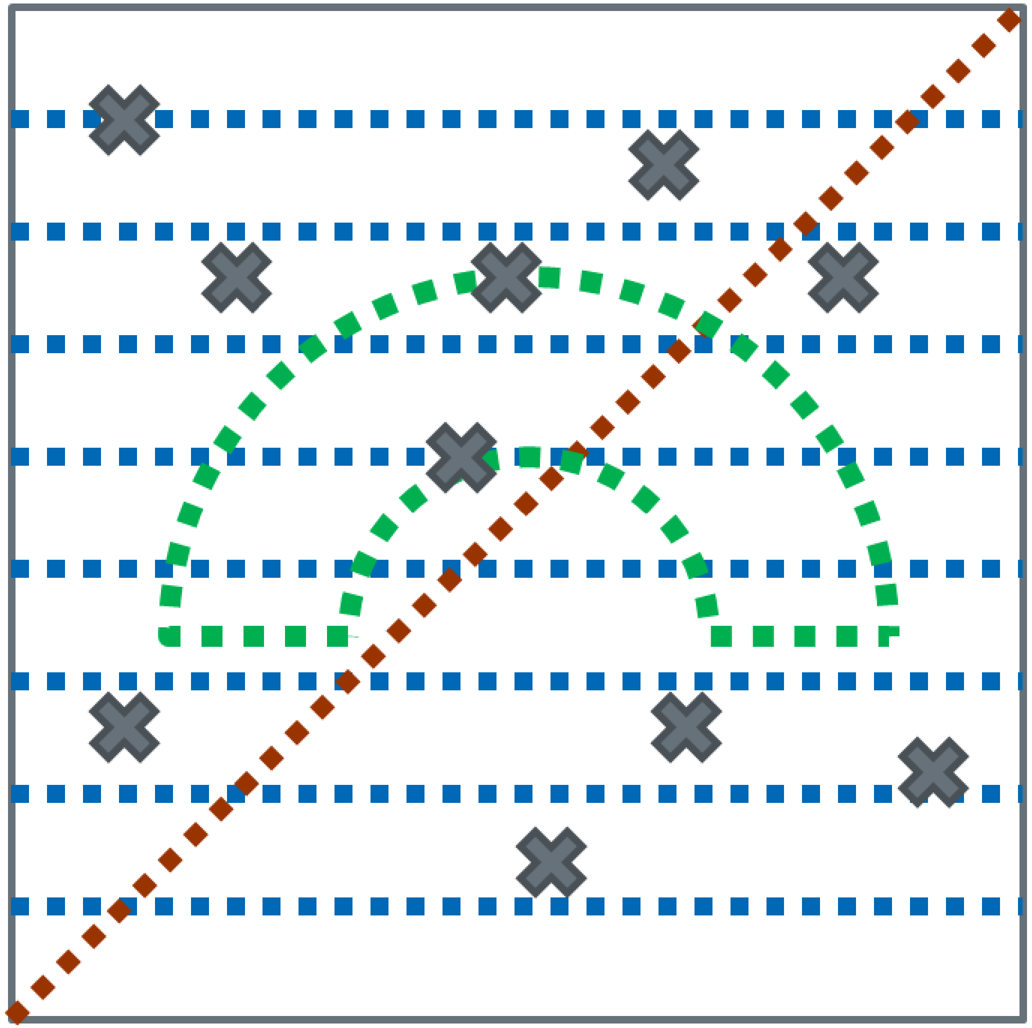
Usage of the Parameter Run Document

Abstract



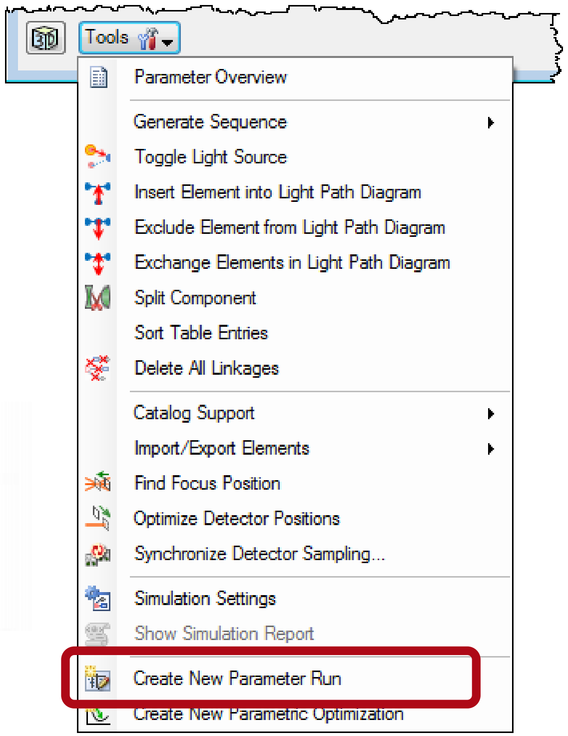
For a given optical system, it is helpful to check its performance by controlling and varying selected parameters. VirtualLab Fusion provides a fully flexible and computationally efficient (via parallelization) Parameter Run, which enables the user specify different manners of parameter variations. As an example, it can be used for the tolerance analysis with respect to any system parameters under investigation. The analysis result can be visualized in different ways, such as single numbers, graphs, or even animations.

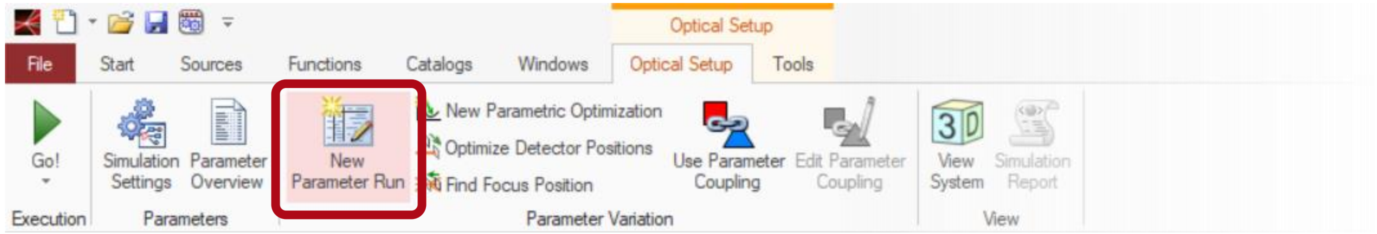
Parameter Run Document

- The Parameter Run document allows the variation of the numerical parameters of an Optical Setup.
- It can be used e. g.
  - to investigate the system's sensitivity for parameter tolerances
  - to optimize parameters
  - to evaluate the changing profile of a beam in the vicinity of a focus
  - ...
- One or multiple parameters can be varied.
- Detector results are recorded within the Parameter Run document.
- A copy of the original Optical Setup is stored in the Parameter Run document.

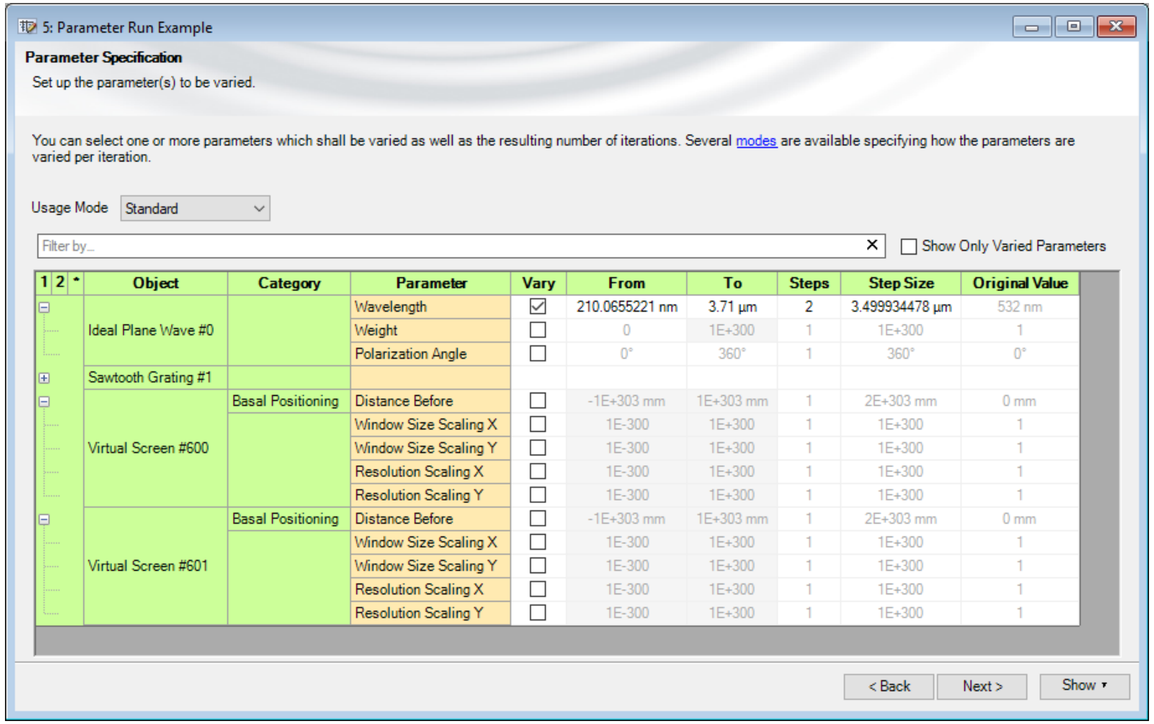
New Parameter Run

- To generate a new Parameter Run an open and activated Optical Setup window is required.
- A new Parameter Run document can be generated via
  - ribbon
  - Optical Setup Tools
  - shortcut Ctrl + P





Parameter Specification Page

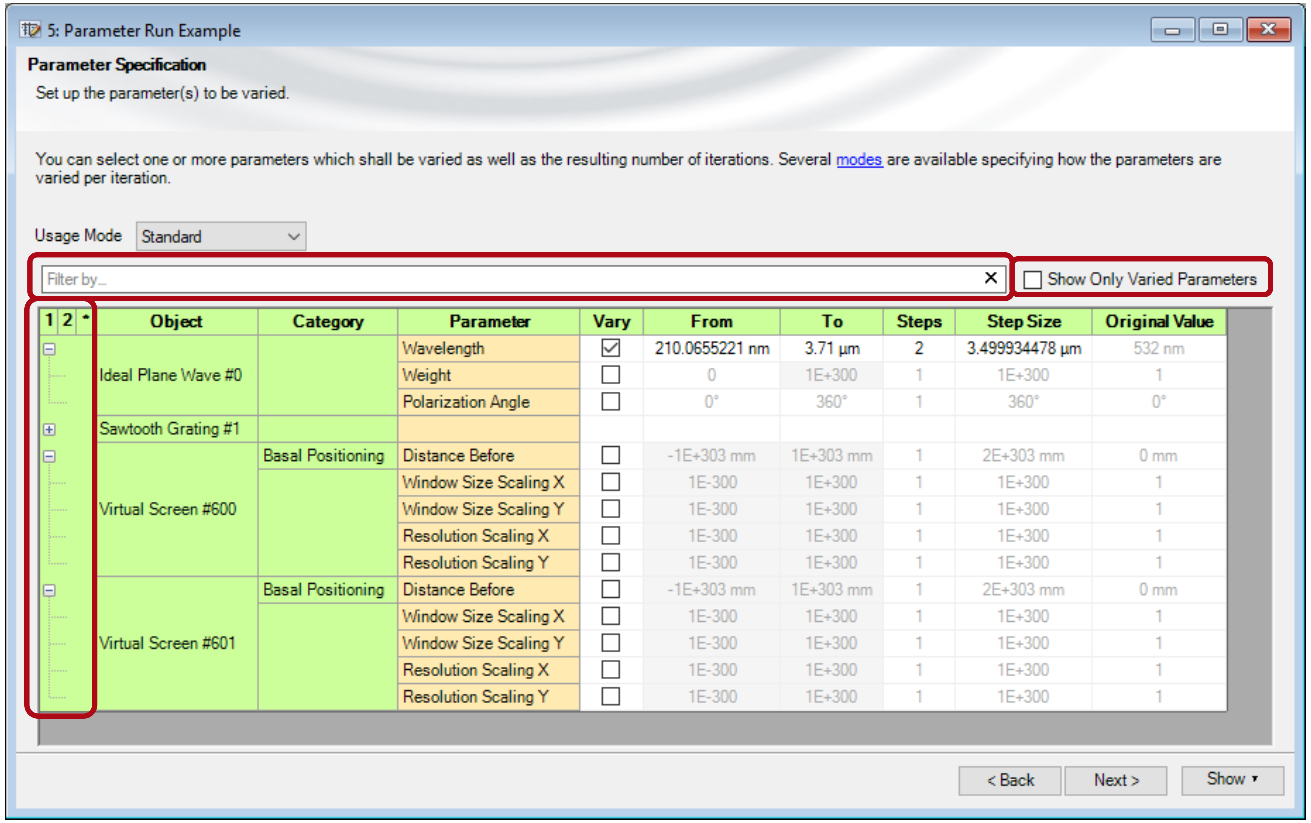


- This page allows you to select the parameters that should be varied.
- The parameter range and the number of steps can be specified.
- Four different Usage Modes (Standard, Programmable, Scanning, Random) will be Explained later.

Parameter Specification Page

You can

- filter for specific parameters
- show only the ones that are already set for variation
- fold/unfold the parameter list for a clearer representation by using the first three columns



Usage Modes

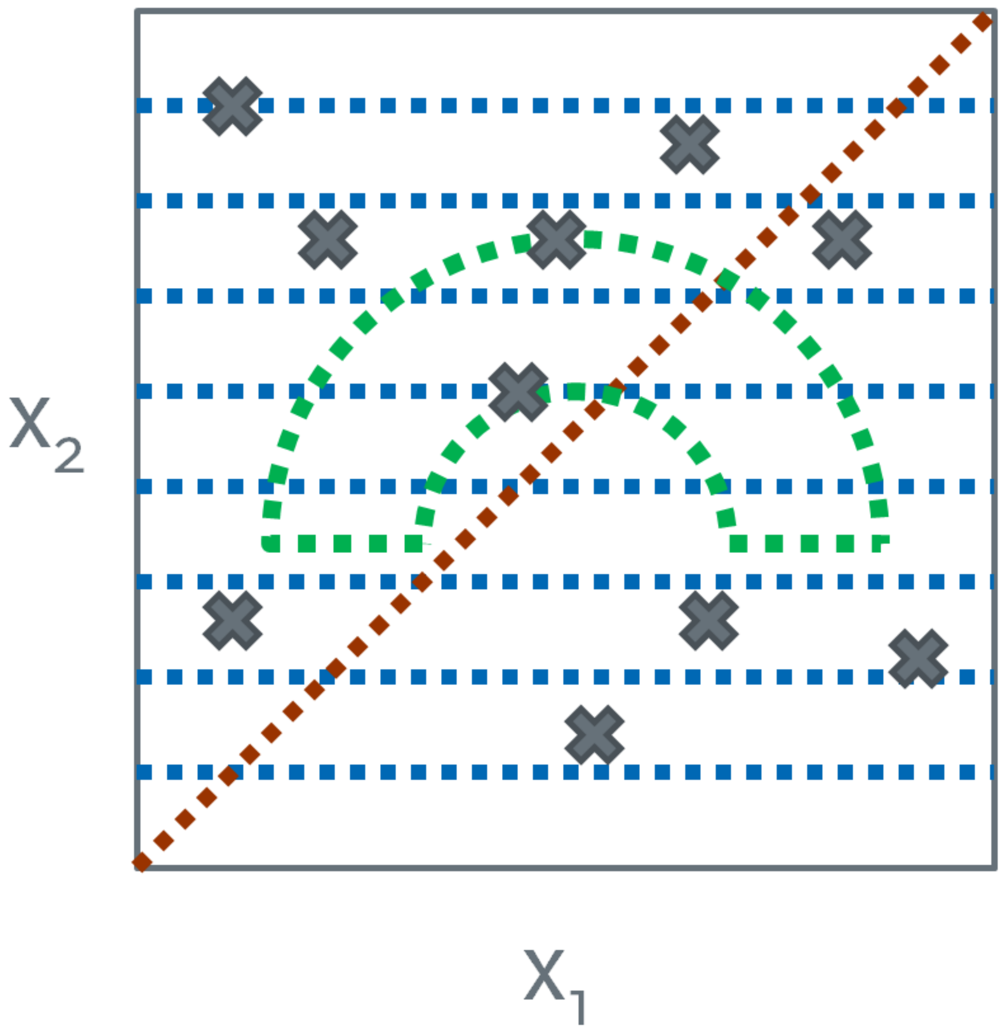
- Standard Mode:
  Linear variation of all selected parameters between minimum and maximum value.

- Programmable Mode:
  Customized parameter values per variation step. A table with the parameter values per variation step is filled by a snippet.

- Scanning Mode:
  Scan of parameter space – all possible parameter combinations are simulated.

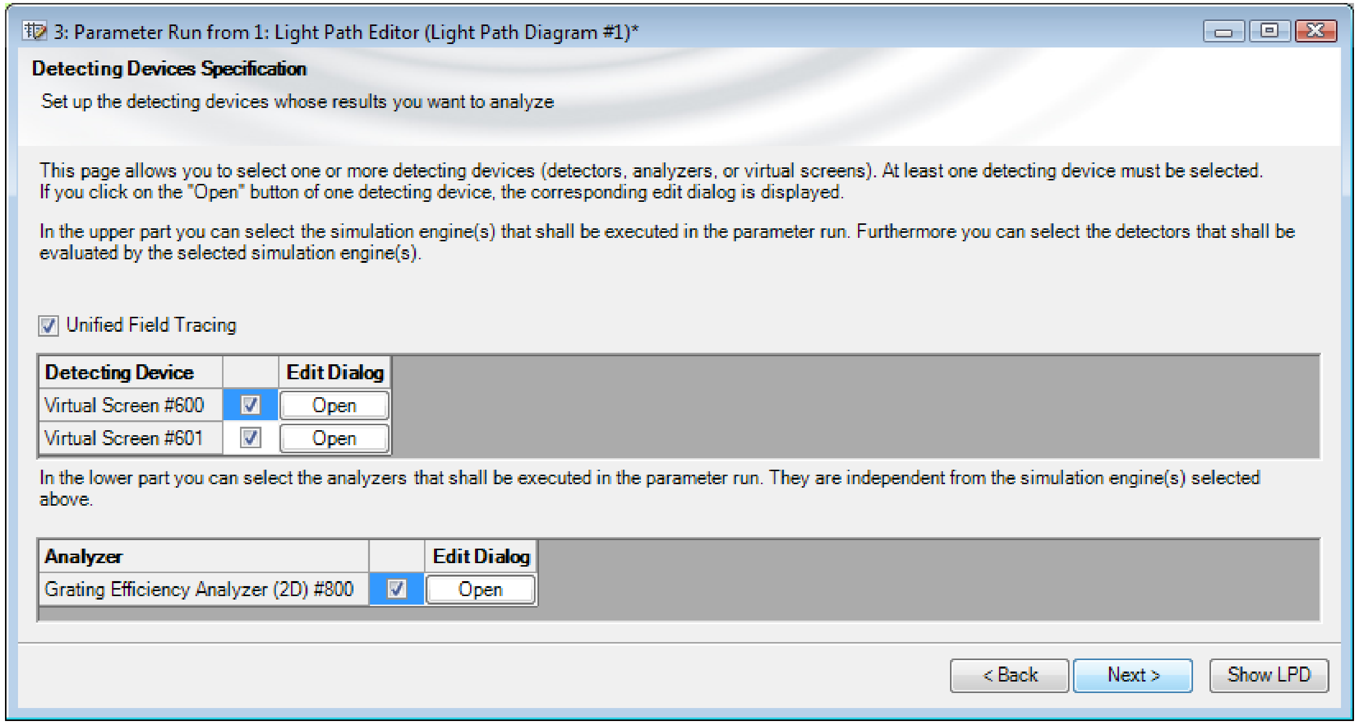
- Random Mode:
  Random variation of parameters between minimum and maximum value. Sometimes also called Monte-Carlo-Simulation. A seed can be used for reproducible results.

Usage Modes



- Illustration of the different usage modes for the parameter run. A two-dimensional parameter space defined by two parameters X_1 and X_2 is shown.
- Red: Resulting parameter sets for the standard mode.
- Green: Example how the parameter sets can be generated by a snippet in the programmable mode.
- Blue: Resulting parameter sets for the scanning mode.
- Grey: Some randomly generated parameter sets.

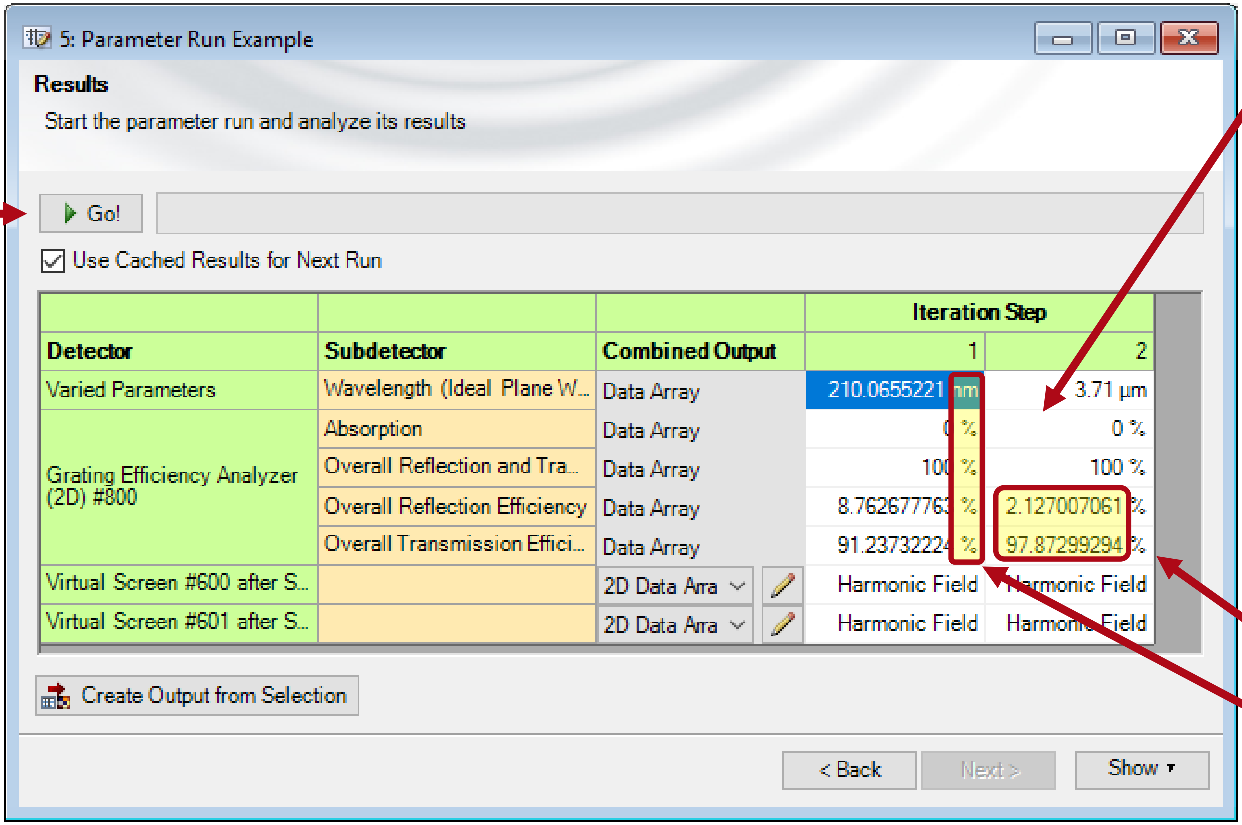
Detecting Devices Specification Page



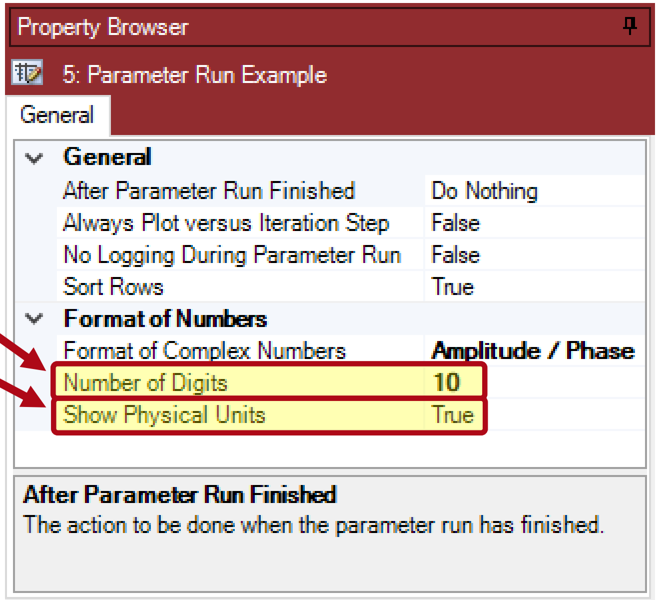
- This page allows to select which simulation engines, detectors, screens and analyzers are evaluated.
- The detecting devices can be configured after clicking Open to get to the edit dialog.

Results Page

Starts and stops the parameter variation.

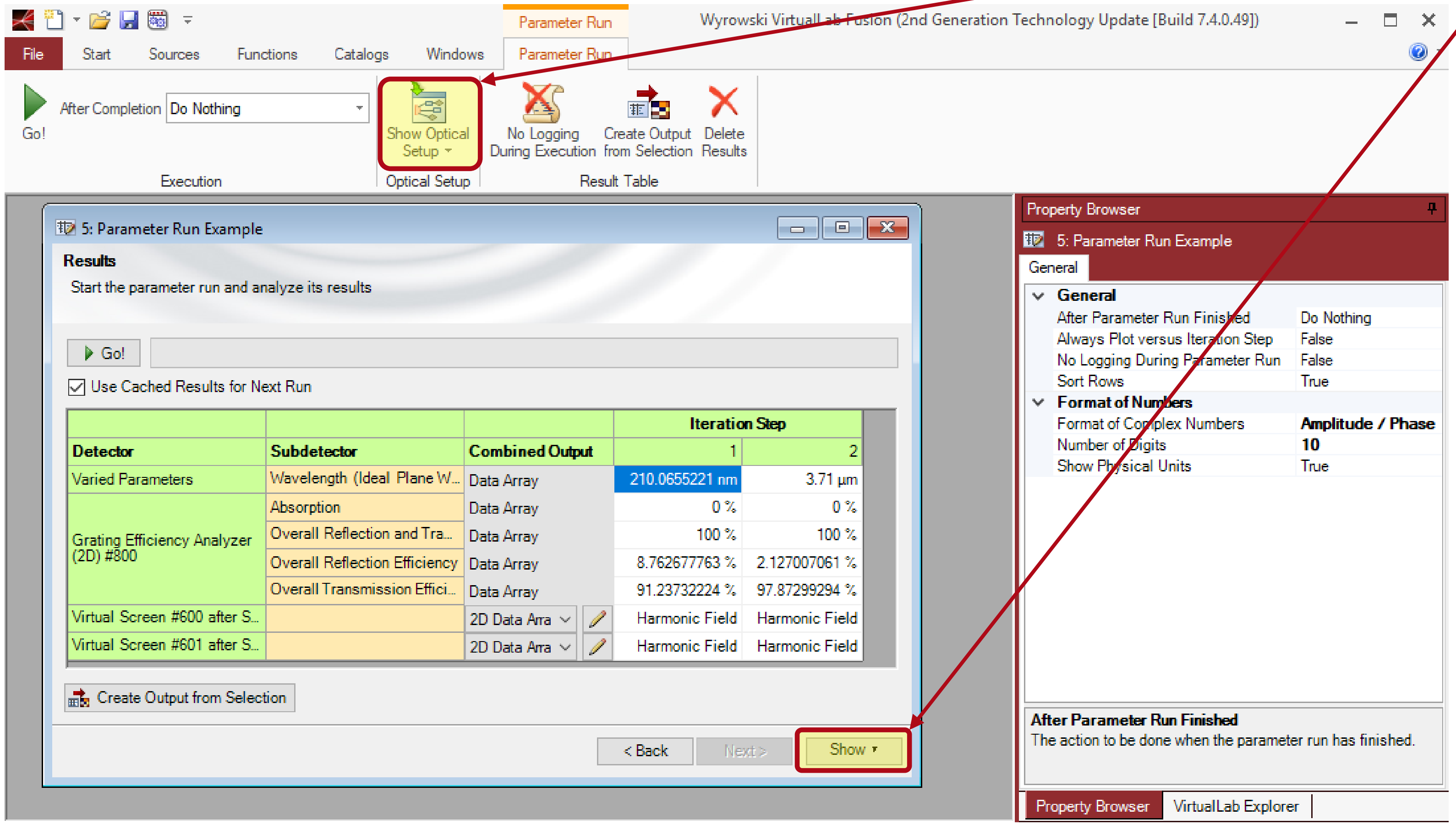


Simulation results: Double click on a document to view it in a separate window.



In the Property Browser you can change the formatting of the shown physical values (number of digits and whether physical units are shown) so that you can better export them to e.g. spread sheet programs via copy & paste.

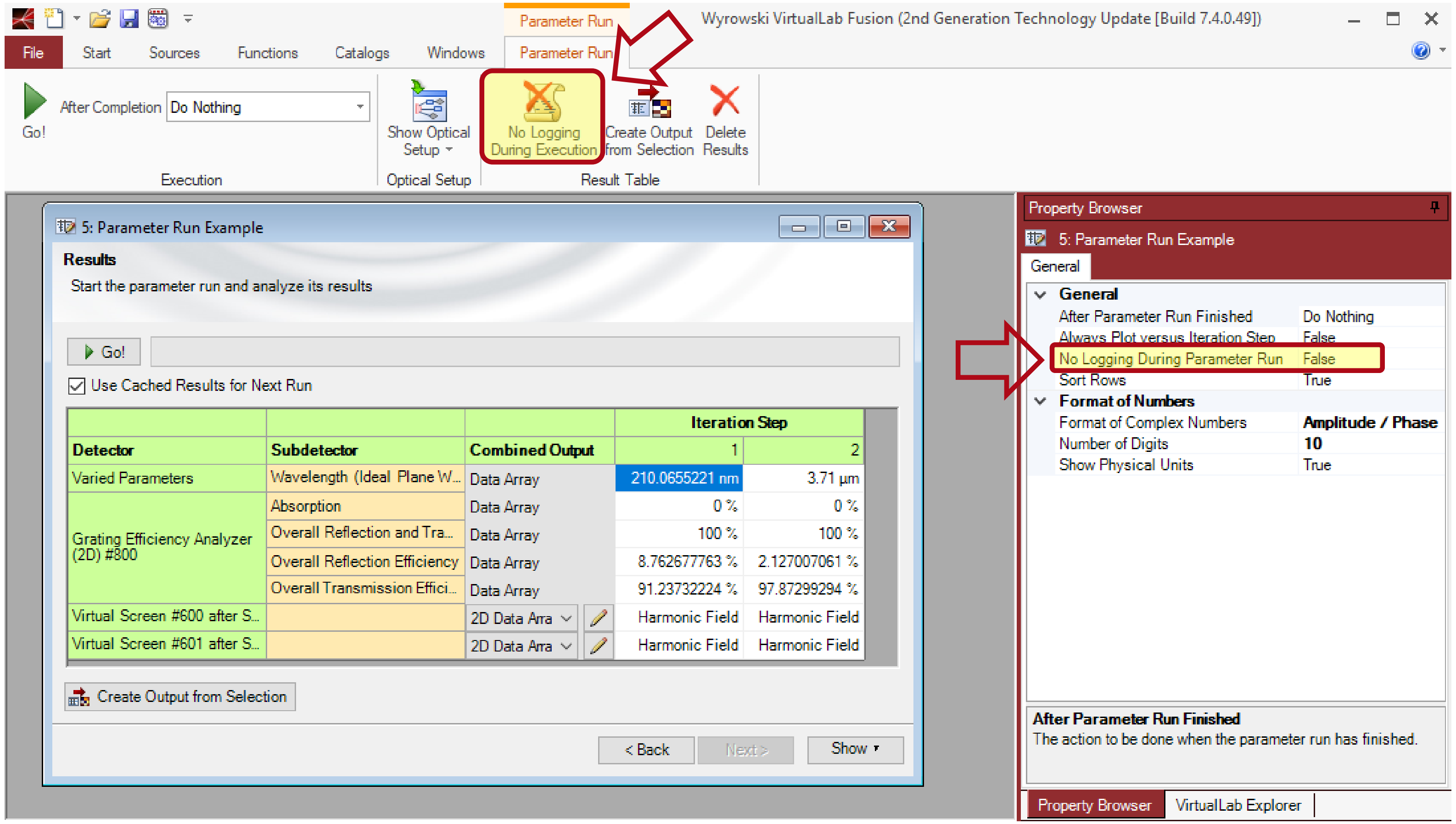
Optical Setups within Parameter Run



Displays the optical setup:

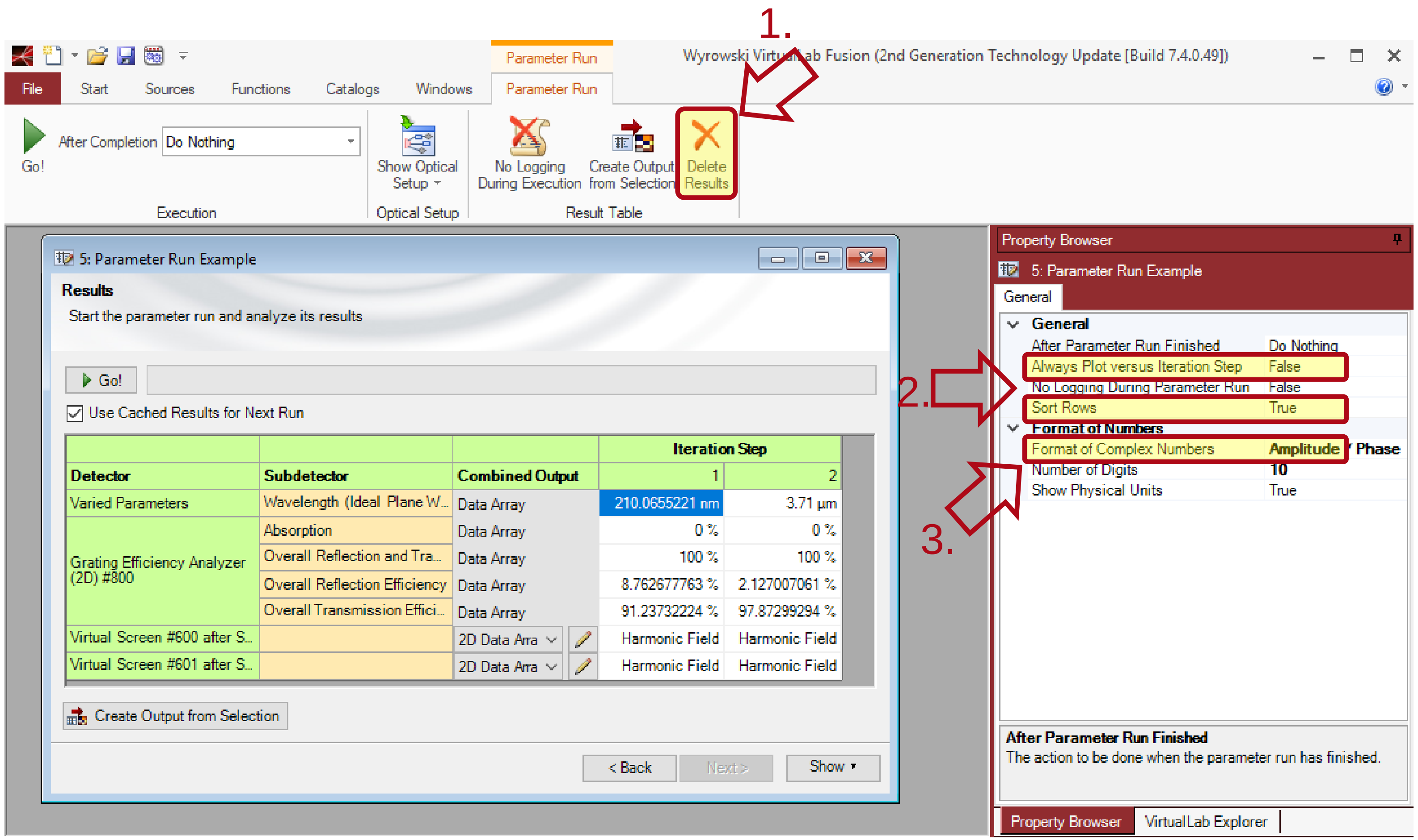
- initial
- from any iteration

Logging of Parameter Run Results



- For time critical simulations especially for Parameter Runs with many iterations, the simulation time can be reduced by **deactivating the logging**.
- Thus the results are only shown after all iterations are finished.
- In order to see the results of a running Parameter Run document that have been produced so far, you can duplicate the document via the Windows ribbon; then VirtualLab creates a Paramter Run document of the current status with all already calculated results.

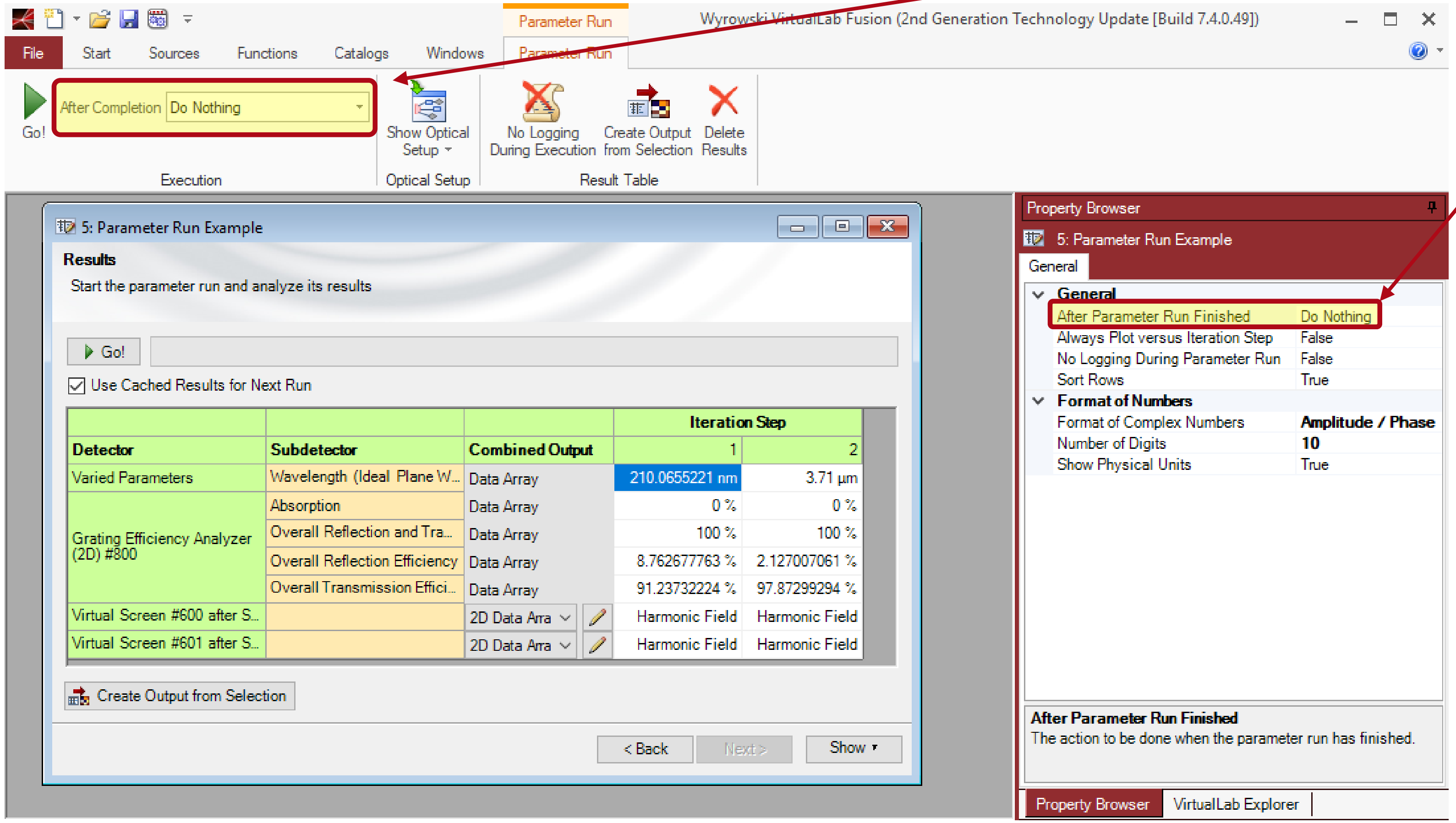
Display of Parameter Run Results



1. It is possible to delete the results in order to save a smaller Parameter Run document (e.g. for email sending). (Sometimes the saving or opening of a Parameter Run document with many and/or huge results takes longer than the simulation of all iterations.)
2. The user can select different orders for the display of the results.
3. There are different options to display compex numbers.

Saving (& Shutdownd) after Parameter Run Completion?

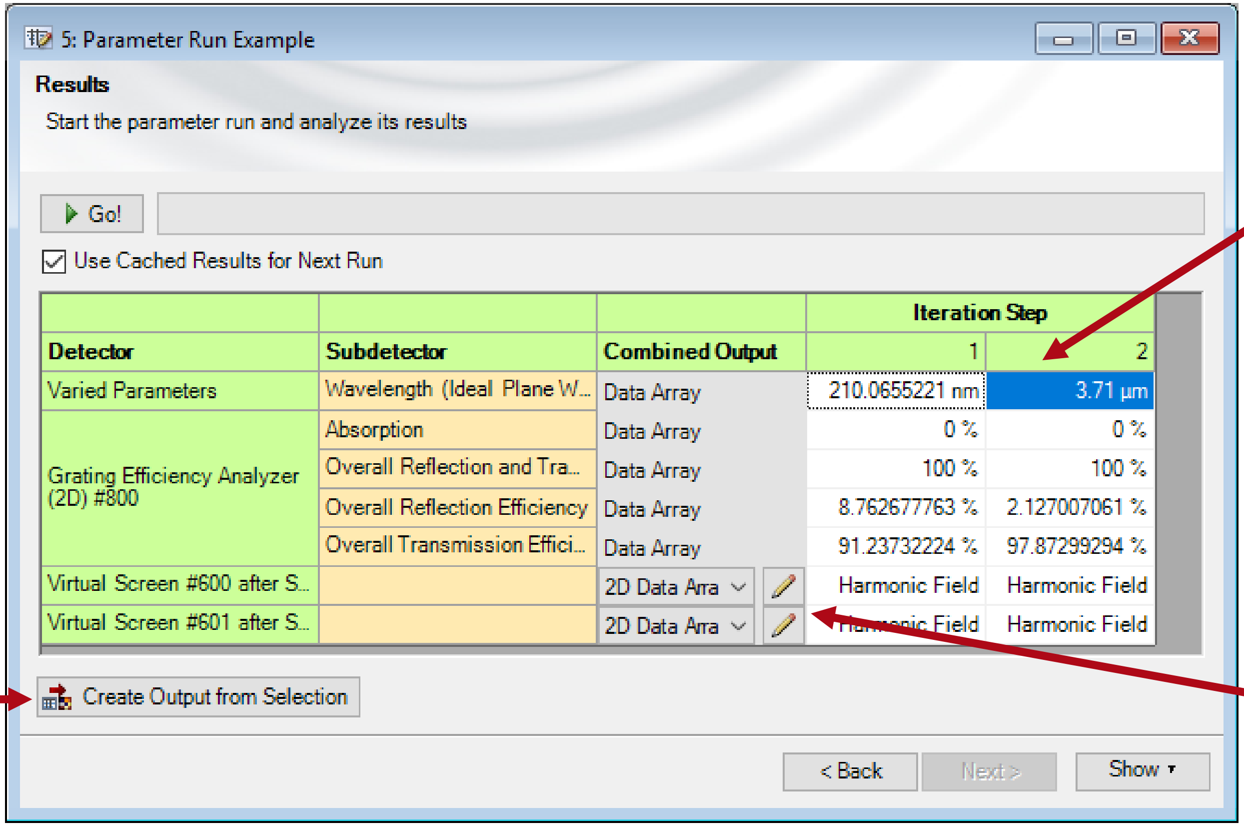
Allows you to save the results after the simulation has finished and then shut down your computer.



Results Page – Combined Outputs

The results for each (sub-)detector can be combined into a Data Array, Animation, Harmonic Fields Set or Ray Distribution. Which combined outputs are available depends on the type and dimensionality of the original documents.

Create the combined output – or stop the creation if it takes too long. Clicking/Double clicking on a cell in the Detector or Subdetector column is a shortcut to selecting the whole row and start the output creation with the current combined output.



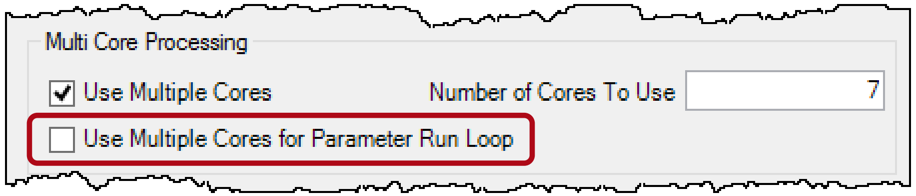
- Select the results to combine.
- Clicking on a cell in the Detector or Subdetector column selects the whole row.

- Choose the desired combined output.
- Several combined outputs can be configured by clicking on the pencil icon.

Parallelization & Amount of Data

- The execution of the different iterations of a Parameter Run simulation is very well parallelized. Thus it represents a very efficient method to simulate many different settings very fast.

- But in case already one simulation is extremely memory consuming, parallel executions are out of the question. They would not be possible or slow down the whole process if VirtualLab may swap such large data on hard disc instead of keeping it in the RAM.
- Then the parallelization should be switched off for Parameter Run Loop.
- VirtualLab will still do parallel computations, as parallelization is also used within single system simulations.



Document Information

title	Usage of the Parameter Run Document
document code	MISC.0071
version	2.0
toolbox(es)	Starter Toolbox
VL version used for simulations	7.4.0.49
category	Feature Use Case
further reading	- Programming a Scanning Parameter Run - Application of the Programmable Mode of a Parameter Run - Tolerance Analysis of a Fiber-Coupling Setup