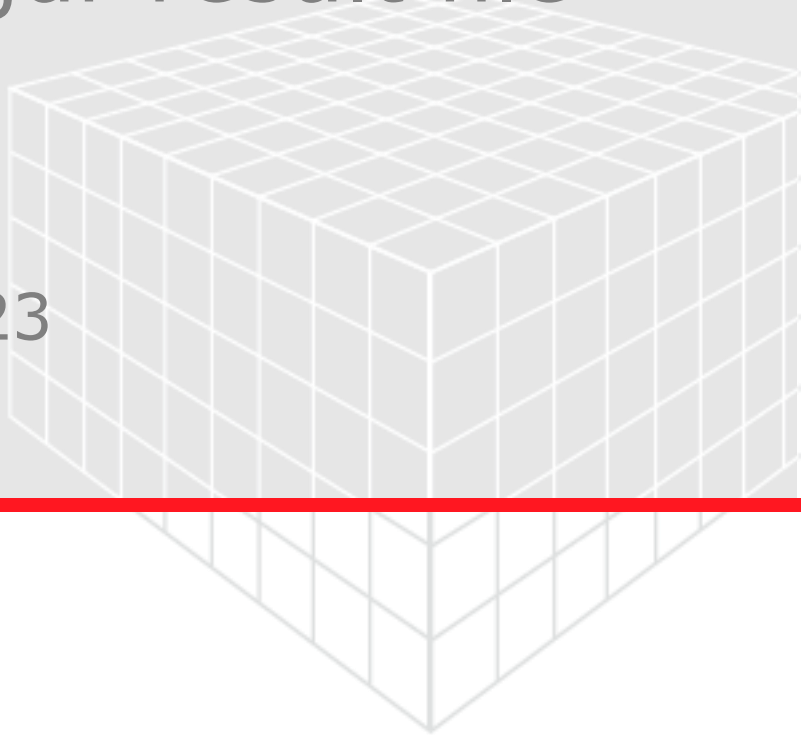
Explaining the Result Viewer of GeoDict *.gdr result file



User Guide

GeoDict release 2023

Published: June 19, 2023

GeoDict

https://doi.org/10.30423/userguide.geodict

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Citation:
Barbara Planas, Janine Hilden. GeoDict 2023 User Guide. Explaining the Result Viewer of Geodict *.gdr result file handbook. Math2Market GmbH, Germany, doi.org/10.30423/userguide.geodict

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The Result Viewer of GeoDict result files

GeoDict result files

Most commands in GeoDict – for example, structure generation, simulation or analysis - produce a so-called **result file,** with the file ending ****.gdr***, that contains information about input, runtime, and output of the specified command.

In most cases, a folder with the same name is also created and may contain additional files associated with the result file. If result files (*.gdr) should be copied to another directory, always keep in mind that the corresponding folder should also be copied there.

Key : Value Maps

GeoDict result files contain many different **Key : Value Maps**, where parameters are hierarchically arranged.

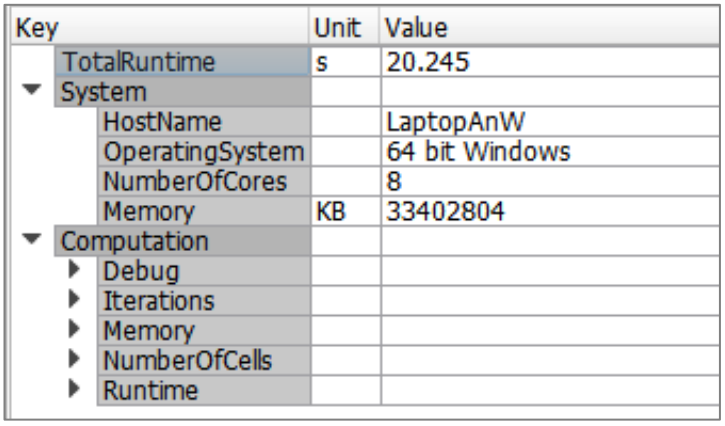
These **Maps** consist of a describing **Key**word and the corresponding **Value**:

Key	**Value**
Pressure	123 Pa

The **Value** in such a combination can be a **Key : Value Map** again**,** which is then called a **Sub-Map**. This is often used in GeoDict's result files to clarify associated parameters, for example:

Key	**Value**
Batch1	
Pressure	123 Pa
Batch2	
Pressure	456 Pa

In GeoDict's Result Viewer, those maps are shown in well-arranged tables, where sub-maps can be unfolded by clicking on the rotating triangle:



Clicking on an entry here will highlight the line for better readability and contents can be copied using **Ctrl + C**.

RESULT FILES AS RAW TEXT

The **.gdr* files contain all results in ascii text. Therefore, it is possible to open them simply with a text editor, if GeoDict is not available. All data inside a result file is arranged in a **Key : Value Map** with several **Sub-Maps**, to keep the file in an organized shape.

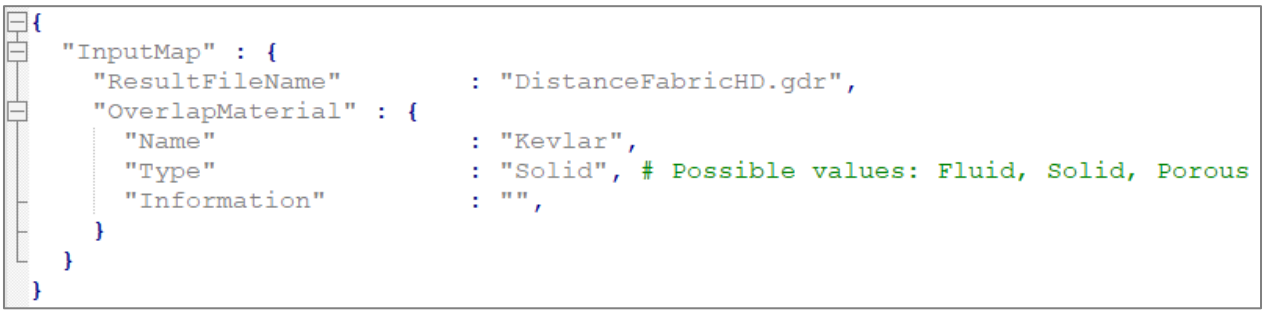
The raw text of **Key : Value Maps** is written in **Python** code as **Python dictionaries**, or short **dict**, and looks as follows:

```
{
  "InputMap" : {
    "ResultFileName"         : "DistanceFabricHD.gdr",
    "OverlapMaterial" : {
      "Name"                 : "Kevlar",
      "Type"                 : "Solid", # Possible values: Fluid, Solid, Porous
      "Information"          : "",
    }
  }
}
```

Maps are always surrounded by curly braces { }. If a key describes a Sub-Map the sub-map again is embraced by { } symbols, denoting start and end of a sub map or sub dictionary. A key-value pair is always separated by a colon. The entries in a dictionary are separated by comma.

Some text editors can understand this syntax and will highlight the text accordingly.

To activate Python syntax highlighting for a **.gdr* in Notepad++, simply click on **Language** → **Python** after the file is loaded:



In Notepad++, it is then also possible to collapse Sub-Maps for clarity by clicking on the [-] minus control at the left border of the page.

Such **Key : Value Maps** are also to be found in Python macros and look the same.

VIEWING RESULT DATA IN GEODICT RESULT FILES

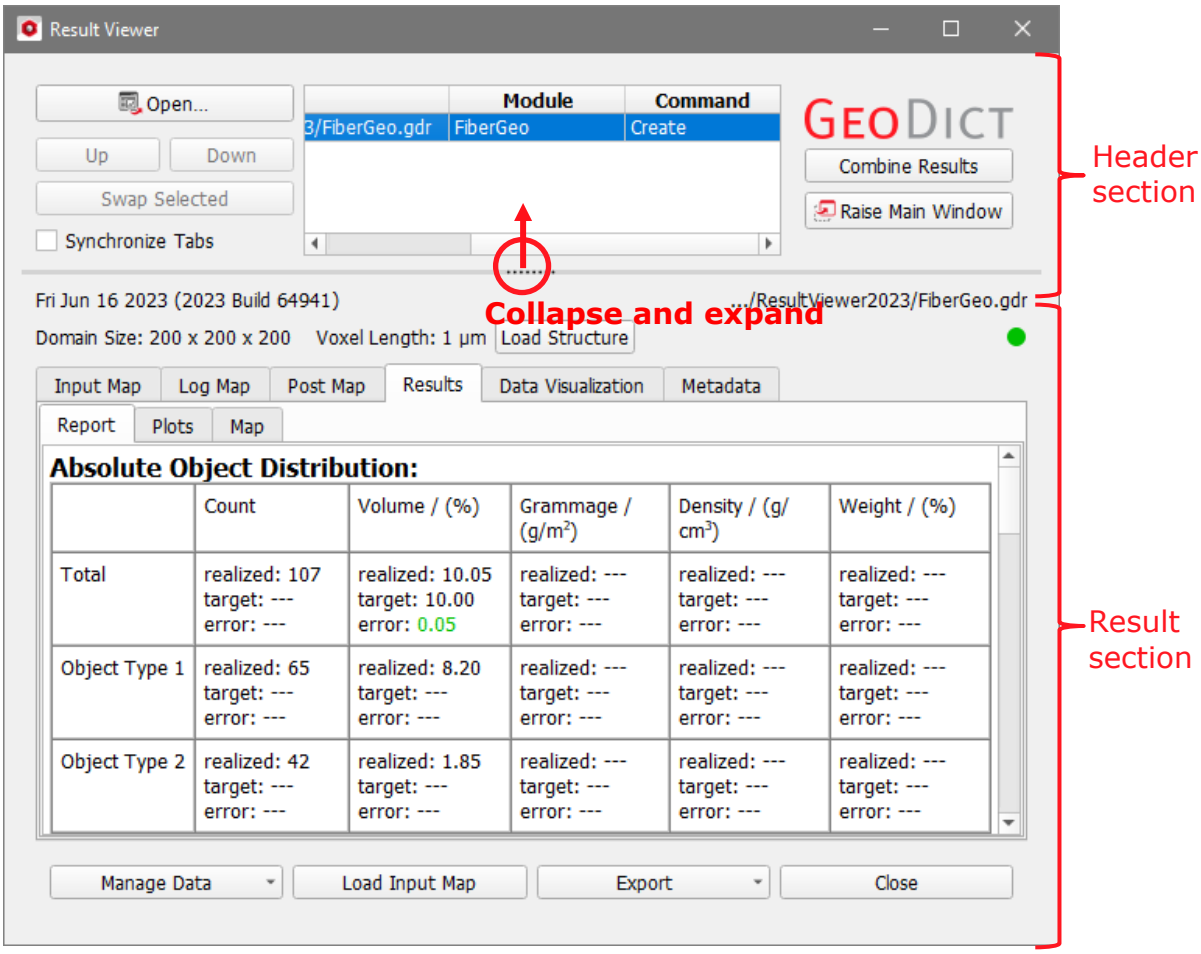
After execution of a GeoDict command from the User Interface (GUI), the contents of the corresponding result file (**.gdr*) are automatically displayed in the GeoDict **Result Viewer**.

Any **.gdr* file can be open through:

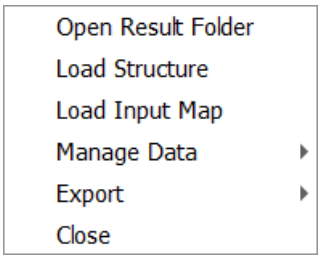
- the menu bar (File → Open Results (*.gdr)…)
- the toolbar:
- dragging-and-dropping the *.gdr file on the GeoDict GUI or on the Result Viewer window
- the GeoDict:LoadGdrFile command in a Python macro

When loading a new result file, its Result Viewer opens. The Result Viewer consists of the **Header section** on top and the **Result section** underneath. The name of the loaded result file and the path to it are highlighted in blue in the header section.

The box in the **Header section** of the Result Viewer can be collapsed (and expanded) by pulling up (or down) the dotted line between the Header section and the Result section.

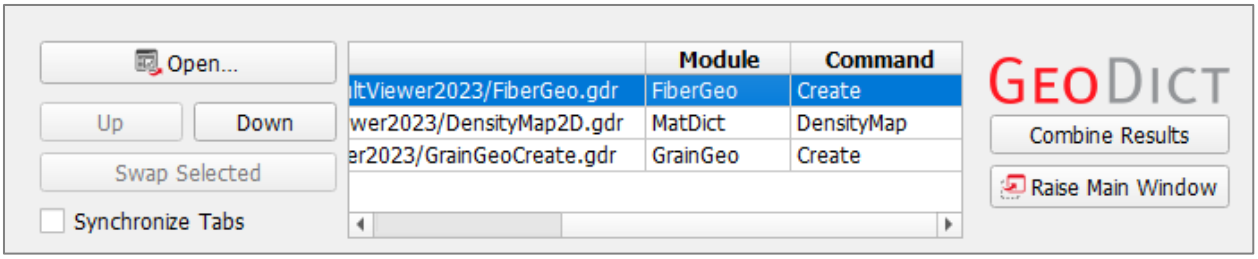


HEADER SECTION



In the header section of the Result Viewer, the box contains the **File** name and path to it, the name of the **Module** that created the file, and the **Command** name of currently opened results. Right-click on a file opens a context menu. It contains the options from the bottom section described on page 10. Additionally, the result folder corresponding to the result file can be opened in the file explorer by selecting **Open Result Folder**.

Only the content of the files highlighted in blue is visible below in the **Result section**. Multiple result files can be loaded, and then selected and highlighted by using **Shift+click** or **Ctrl+click** on the list of entries. The buttons on the left side can be used to **Open** a new *.gdr result file directly from the dialog, to move opened *.gdr files **Up** and **Down** in the list shown in the box, or to **Swap Selected** result files.

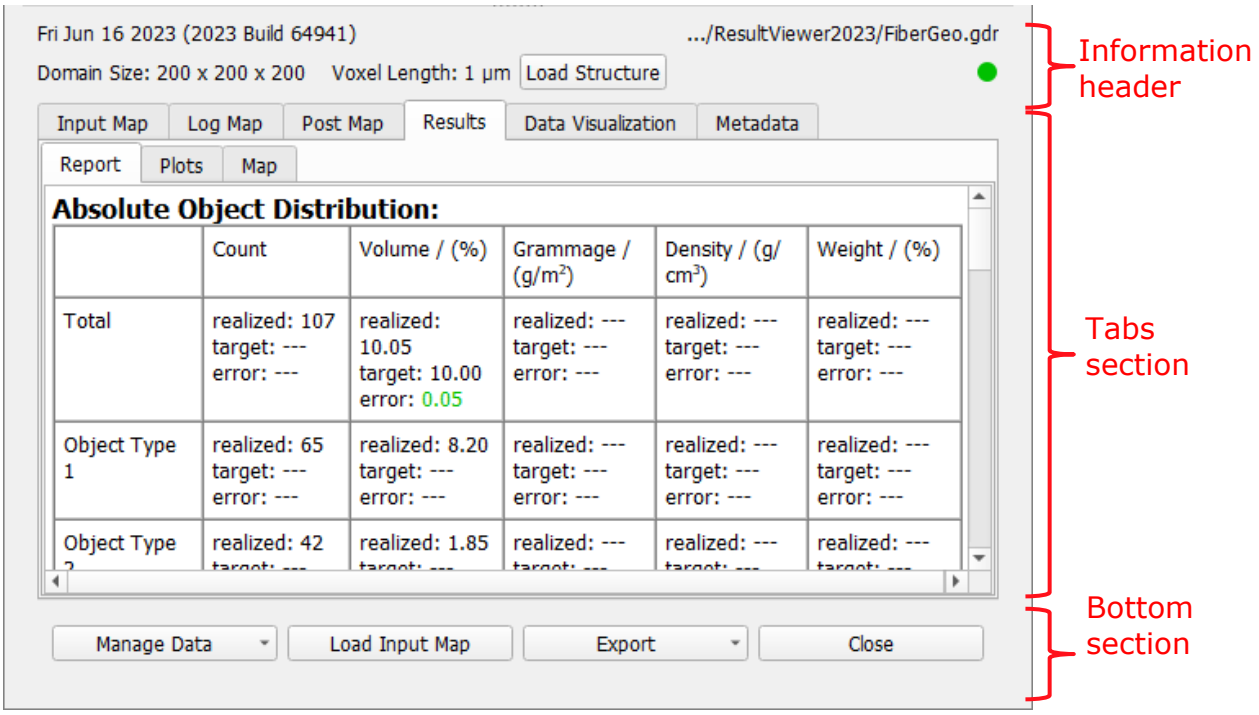


Synchronize Tabs can be checked if multiple results are highlighted. If checked, clicking a tab in one of the result files will display this tab in all opened result files simultaneously. This facilitates the navigation through multiple opened result files. For example, in all opened **Map** tabs, the differences between the results are highlighted, as described below on page 23, and are easier to spot after synchronization.

On the right side of the header section box, click to **Combine Results** into one *.gdr file (detailed description on page 16) and to **Raise Main Window**, which brings up the main screen of the GeoDict GUI in front of the Result Viewer.

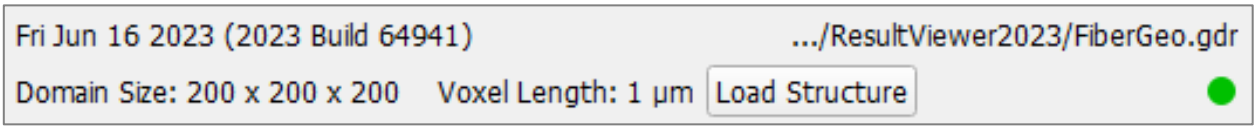
Result section

One **Result section** window appears below for each result file name highlighted in the header section box. If multiple results are highlighted, the result sections of each result file appear side by side. The result section consists of three parts:



Information header

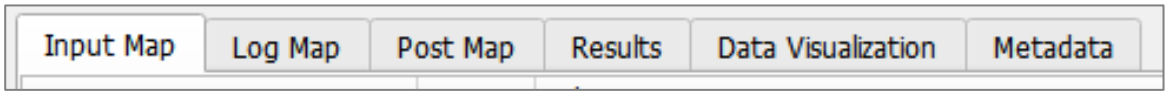
The **Information header** shows the date of creation and the version of GeoDict that was used to create this result file.



If the structure for which the result file was created is available, the **Domain** size and **Voxel** length are also shown here, and the **Load Structure** button allows loading it. On the right, the path to the location of the result file is shown. The dot turns green when the corresponding structure is currently loaded in the Visualization area of the GeoDict GUI. Otherwise, the dot is red.

Tabs section

Each step of the commands to obtain a result file is mirrored by tabs in the Result Viewer. The tabs are arranged in an organized way from left to right, starting with the inputs and ending with the quantitative results and visualization.



Some tabs show simple **Key : Value Map** tables (see page 1) while other tabs are filled with plots, report texts, or even more interactive forms of result management.

Input Map

The **Input Map** tab shows an overview of all input data entered in the command options. Often, settings like **desired voxel dimensions** or solver **tolerances** are found here. If the command uses **Constituent Materials**, all material parameters are listed in the input map as well.

Clicking the **Load Input Map** button in the bottom section (see below in page 10) loads all the settings displayed under the **Input Map** tab into the corresponding command of the corresponding GeoDict module. This can be verified as follows:

1. Check the **Module** and **Command** that appear in the box of the **Header section** (see page 4) of the Result Viewer.
2. Navigate to the GeoDict GUI, and select this GeoDict **Module**.
3. Open the options dialog for the **Command** and observe that the default (or other) settings have been replaced by those from the input map.

Taking the settings directly from the input map to run the corresponding command again on the same structure produces exactly the same results. This can be very useful to run the same digital simulation experiment on a variety of structure models.

Log Map

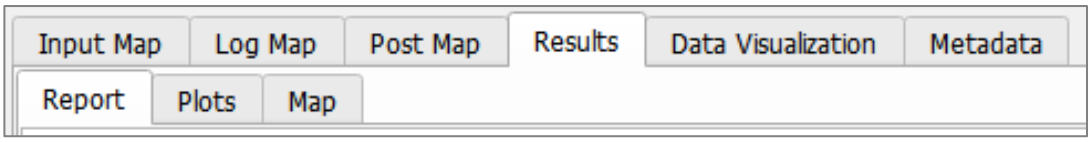
The **Log Map** tab shows the information of **runtime**, **system** and **memory consumption** during the command execution.

Post Map

The information for all the plots contained under the **Results** tab is saved under the **Post Map** (postprocessing map) tab.

Results

The **Results** tab contains the **Report**, **Plots**, and **Map** subtabs.



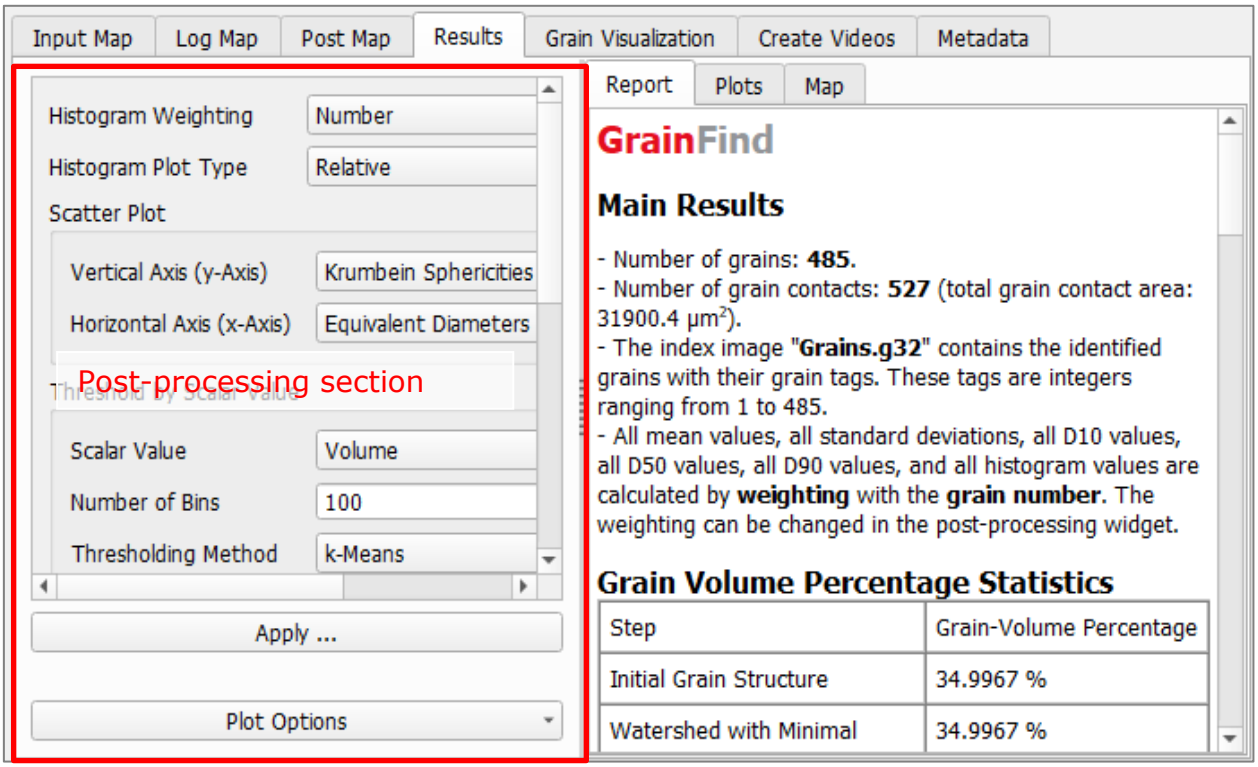
The **Report** subtab displays the report page, which is individually generated for each command. The report is a summary of all the important values to be found in a result file. Result tables or tensor data are shown here in a clear way.

The **Plots** subtab allows choosing different plots to graphically display the output data shown under the Report subtab. This subtab is not available for all commands, because not all result files contain plottable data. More information on plots is given below on page 12.

The **Map** subtab gives access to the computed values for the corresponding command. The numbers contained in the **Report** subtab also are available in the Results - **Map** subtab. Additional details are found here, e.g. solution file names and information about the iteration process (number of iterations, stopping criteria, etc.)

Some GeoDict modules and commands have the possibility to run post-processing on how to display result data. If this is the case, a **Post-processing section** with the available settings is displayed on the left, under the **Results** tab. The post-processing

section can be collapsed and expanded as explained above for the header section (see page 3).

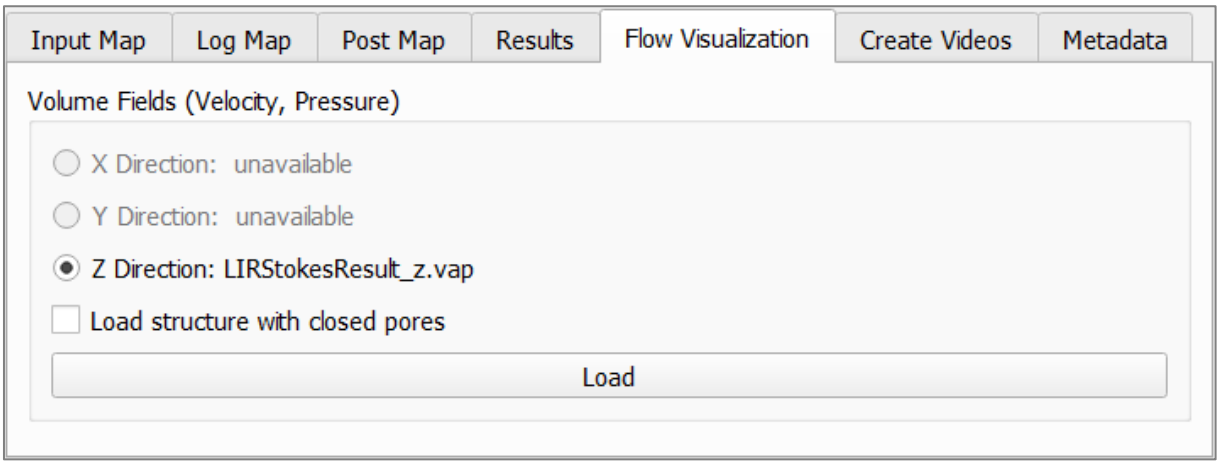


The User Guide handbooks of the corresponding modules explain in more detail the post-processing settings available for commands that are specific to those modules.

Visualization

The **Visualization** tab takes different names depending on the GeoDict module that produced the result file. The **Visualization** tab appears only for commands that produce additional files for visualization. The **Visualization** tab can take the names **Grain Visualization**, **Fiber Orientation Visualization**, **Fiber Identification Visualization**, **Flow Visualization**, **Data Visualization**, **Particle Visualization**, **Strain/Stress Visualization**, **Pore Size Visualization**, or **Pore Visualization**.

Under the **Visualization** tab, it is possible to load volumetric result fields, particle trajectories, or triangulation meshes.



The **Load** button is greyed out if a file is **unavailable** - e.g. because calculating this result and saving it was turned off in the command's Output Options when setting the simulation. This is also the case if the file was deleted from the project folder.

As default, suitable view settings are automatically applied when a volume file is loaded via the **Visualization** tab. For example, if a **.g32* index file from **GrainFind** → **IdentifyGrains** is loaded, the visualization automatically switches on the **As Index** option in the Visualization panel, above the Visualization area of the GUI.

The User Guide handbooks of the corresponding modules explain in more detail whether additional files might be outputted for a command and are available for visualization.

Create Videos

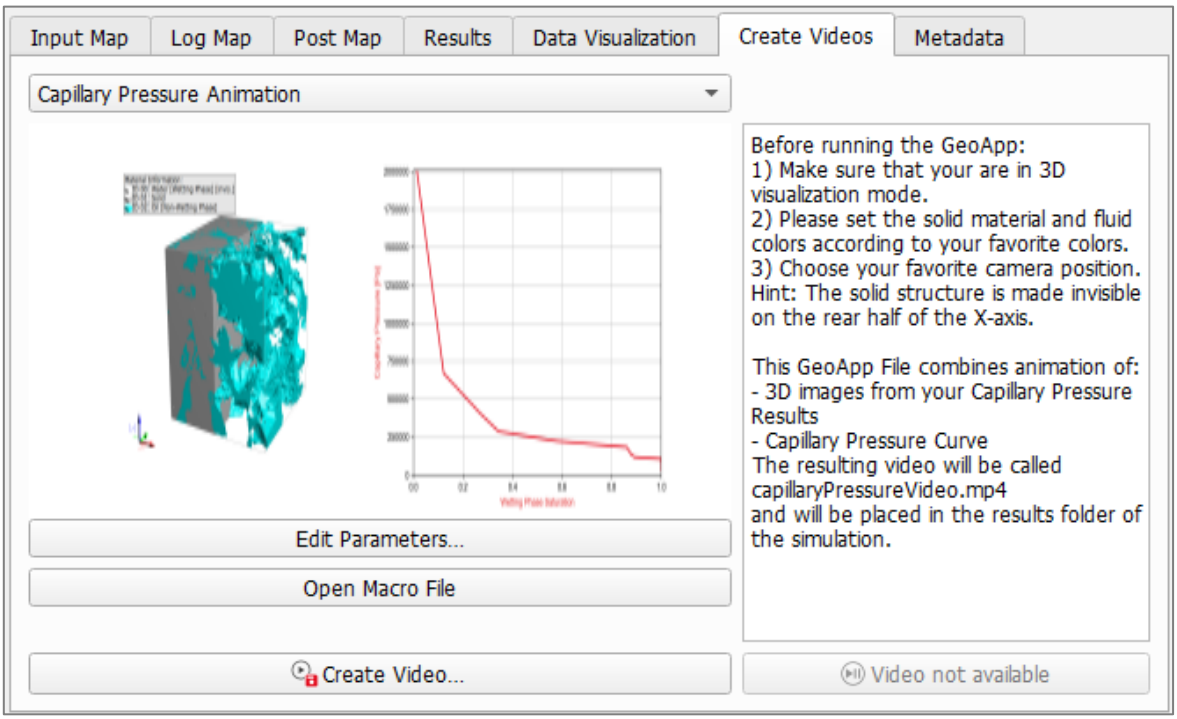
Some modules and their commands come with the capability to generate videos automatically from the results. In this case, the process of generating the video is automated through a Python macro that loads the result data into GeoDict, sets up the needed view options for optimal visualization, and then outputs a video.

Creating a video is especially handy if there are time sequences in the result data. For example, some of the modules and the commands to create result videos are:

- GrainFind:IdentifyGrains
- PoroDict:IdentifyPores
- FlowDict:SolveStokes
- FlowDict:SolveNavierStokes
- SatuDict:CapillaryPressure
- FilterDict:LifeTimeSinglePass
- FilterDict:LifeTimeMultiPass
- FilterDictElement:LifeTimeSinglePass
- ElastoDict:SolveFeelMathLD
- BatteryDict:ChargeBattery
- BatteryDict:ChargeHalfCell

The **Create Videos** tab appears amongst the tabs in the Result Viewer, for result data obtained with these modules and commands.

For some commands, there are multiple types of videos available that can be chosen from the drop-down menu directly under the tab.



Below the drop-down menu, a panel includes a **preview** of the video and **instructions**, on the right. By clicking the buttons under the preview, it is possible to **Edit Parameters** for the creation of the video, to open the macro file controlling it (**Open Macro File**) in a text editor for modifications, and finally, to create the video (**Create Video...**).

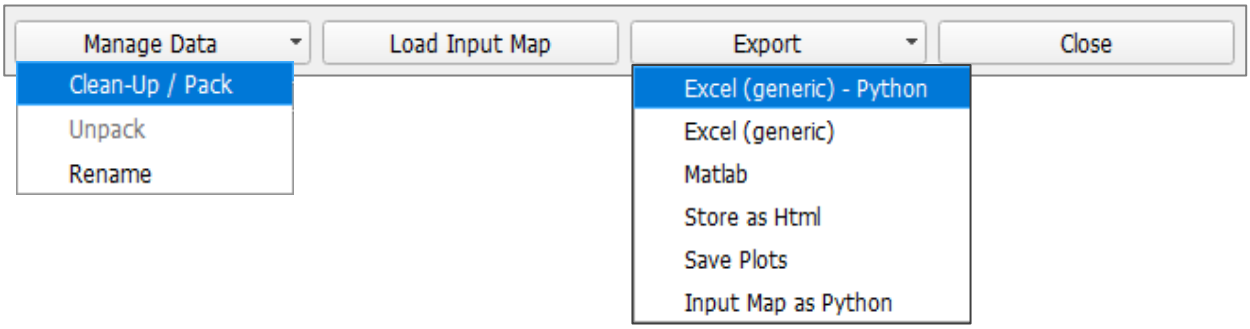
Metadata

Under the **Metadata** tab, the user can create descriptions, notes, or remarks about the results and save them by clicking **Save Description**.

Under **Parameter Map**, GeoDict also shows the values of parameters that might not be saved in other maps, such as the values for **Expert Settings** or input values from a **Python Macro**. These can be modified by clicking **Edit Parameters**.

BOTTOM SECTION

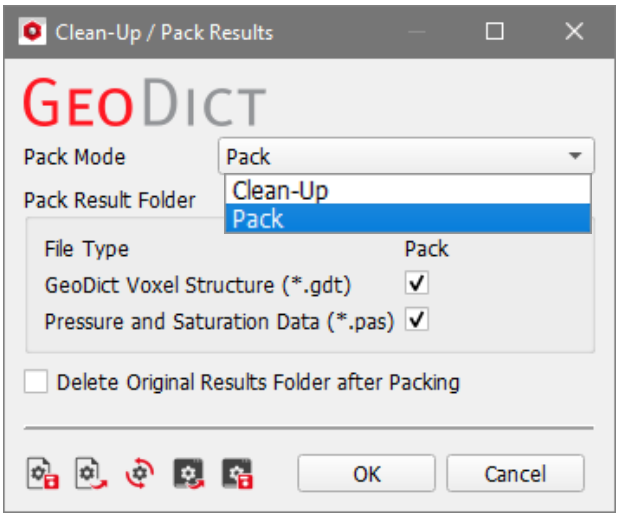
The four buttons found in the **Bottom section** start actions concerning only the data for the single result file currently shown in the **Tabs** section:

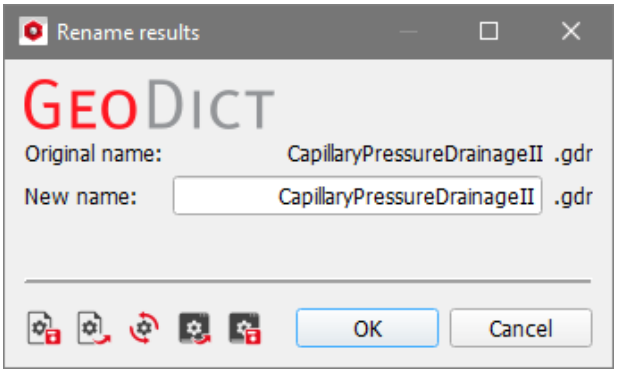


Manage Data

Click **Manage Data** and select **Clean-Up / Pack Results** to delete/compress additional files that are saved in the result folder of the current result file. Also allows decompressing those files again later (**Unpack**).

Select **Rename** to change the name of the result file to a new one.





Load Input Map

Click this button to load the input map from the result file into the corresponding command as explained above in page 6.

Afterwards, the command can be re-run with the same settings, or some settings can be changed to adjust the command accordingly.

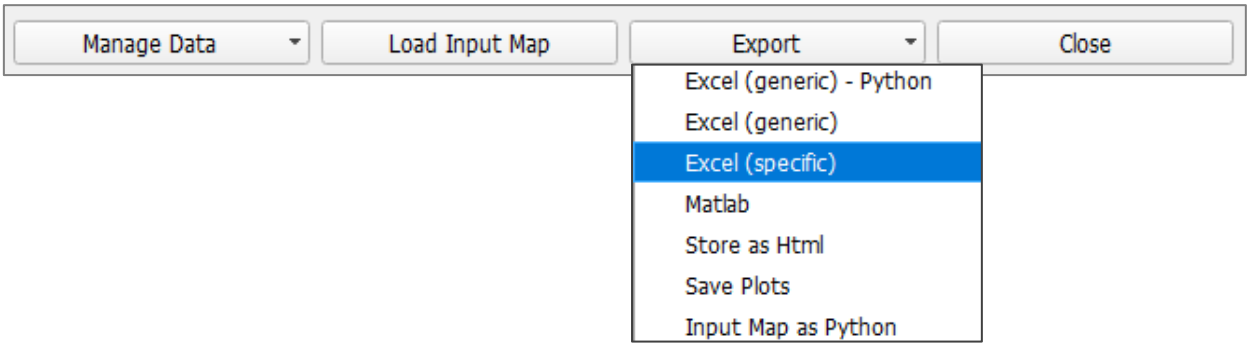
Export

Click the **Export** button to export values from the result file.

The **Excel (generic) – Python**: export the result file as an MS Excel® *.xlsx file using Python. An installation of MS Excel® on the computer is not needed, but if it is installed, the exported file opens automatically. This makes possible the export of results to Excel on computers with Linux Operating Systems.

The **Excel (generic)** export can be done for all result files. It copies the values to an excel table and contains all values from the corresponding Key-Value maps. The values from the plot section are not included there.

The **Excel (specific)** export is available for some specific commands, e.g. FilterDict or PoroDict results. Here, additional values and layout are used in the Excel table. For example, a filter efficiency is added in a well-arranged style.



The **Matlab** export command starts MATLAB® and automatically loads the *.gdr result file there. Of course, this only works if MATLAB® is installed on the computer.

Selecting **Store as Html** exports only the result report page to a *.html file.

Save Plots can be used to save all plots contained in the result file as images (*.png or *.csv).

Select **Input Map as Python** to save the input parameters as a GeoPy (.py) script.

Close

Clicking the **Close** button closes the **Result Viewer** of the result file.

Closing the **Result Viewer** by clicking the close button (×) at the top right of the dialog, closes (of course) **all** result files at once.

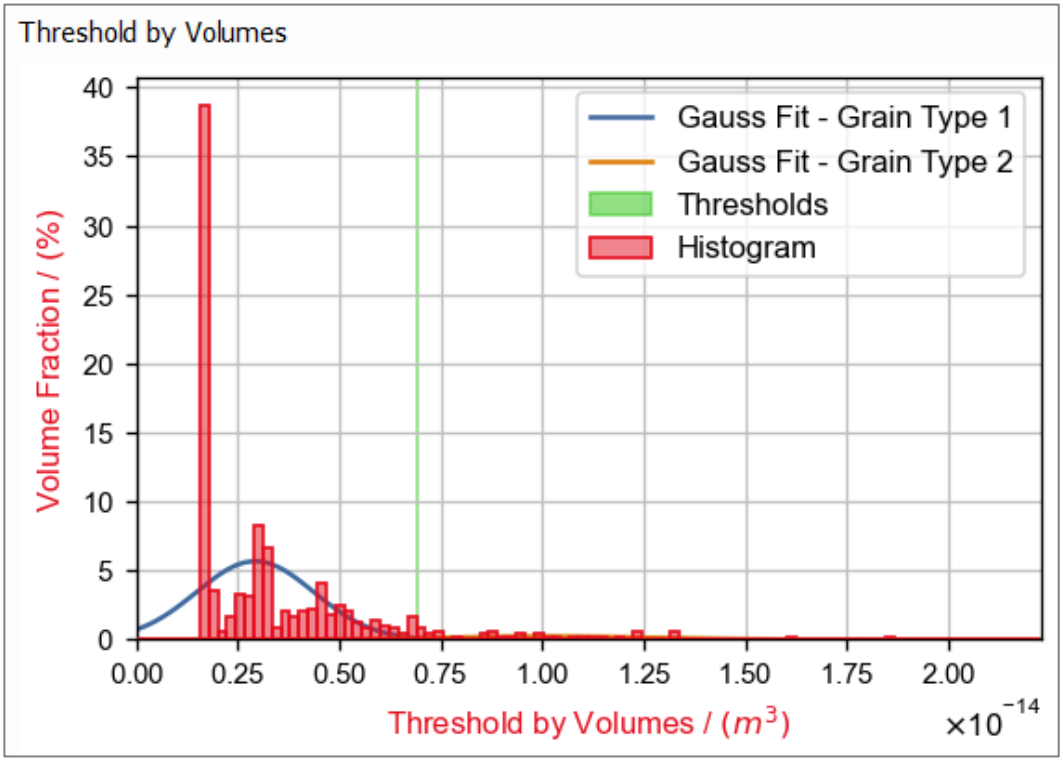
PLOTS FROM GEODICT RESULT FILES

Some result files have a **Plot** subtab under the **Result** tab of the **Result Viewer**. In the **Plot** subtab, the values are displayed using different types of plots. All data for each plot is saved in the result file's **Post Map**. If any changes are made in the plot settings or if a post-processing step is done (page 6), the result file is updated and saved. Thus, plot appearance stays the same even after closing the **Result Viewer**.

This updating and saving of plot settings can also be recorded as a macro and always appears in the session macro (for more information on session macros, see the GeoPy scripting handbook of this User Guide). This means that everything done while post-processing the plots can also be scripted/automated using Python macros.

COMPONENTS OF A PLOT

A plot contains at least one graph: a set of datapoints, which has a unique marker and color, e.g. a red line or a set of bars. All graphs in a plot share the same value range in X and Y axis directions and have unique names that are shown in the legend.

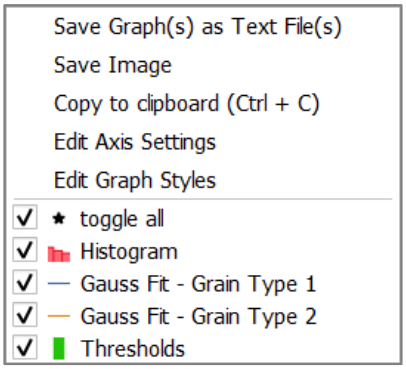


Each plot can have multiple graphs and each result can have multiple plots. Thus, some plots are grouped in other subtabs, for higher simplicity. If there are more than two plots in a subtab, the active plot can be chosen from a list. This is often the case for time sequences or similar types of data.

If there are exactly two plots in a group, both of them are displayed. The two plots are separated by a horizontal slider, such that the size can be adjusted.

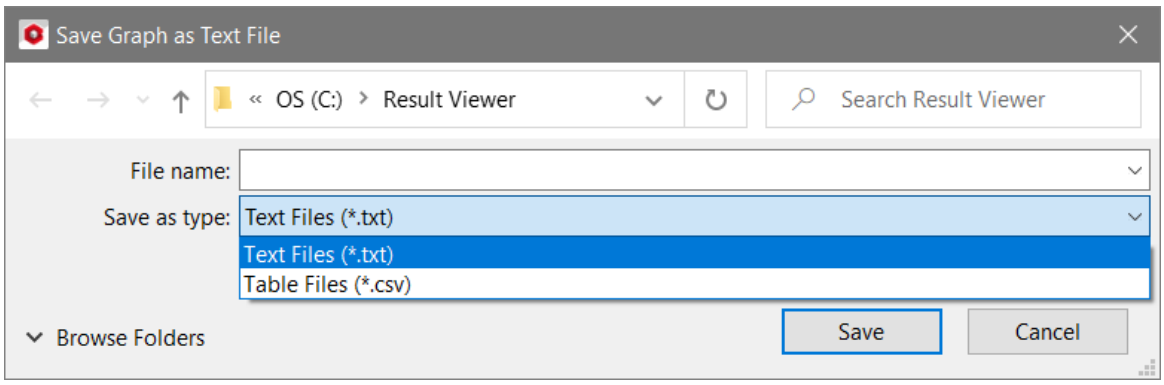
PLOT CONTEXT MENU

Right-clicking inside the plot area opens the graph context menu. Through it, the plot can be exported, and the plot settings can be changed:



SAVE GRAPH(S) AS TEXT FILE(S)

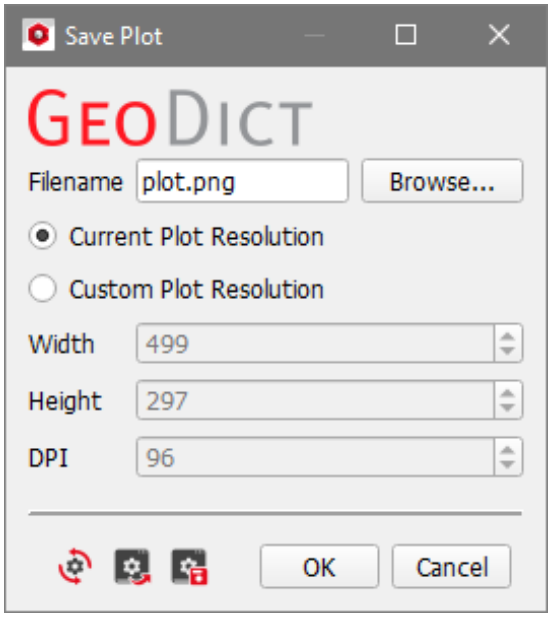
All graphs can be saved as *.txt or *.csv files. Clicking this opens the save file dialog and writes all graph points into the specified file.



SAVE IMAGE

All plots can be saved as pixel (*.png) or vector (*.svg) image by clicking on **Save Image**. In the **Save Plot** dialog, choose the filename and the resolution of the saved image.

Via the **Browse...** button, choose the image format (*.png/*.svg) or simply type in the desired filename with suffix.



With the **Custom Plot Resolution** options, choose the image size and the DPI (dots per inches) value for the export. Define a higher DPI value to increase font size and line thickness for better visibility. For example, when using the plot for presentation slides.

Copy to clipboard (Ctrl + C)

Select **Copy to clipboard (Ctrl + C)** to copy the plot data to the clipboard and then paste it (Ctrl + V) where needed.

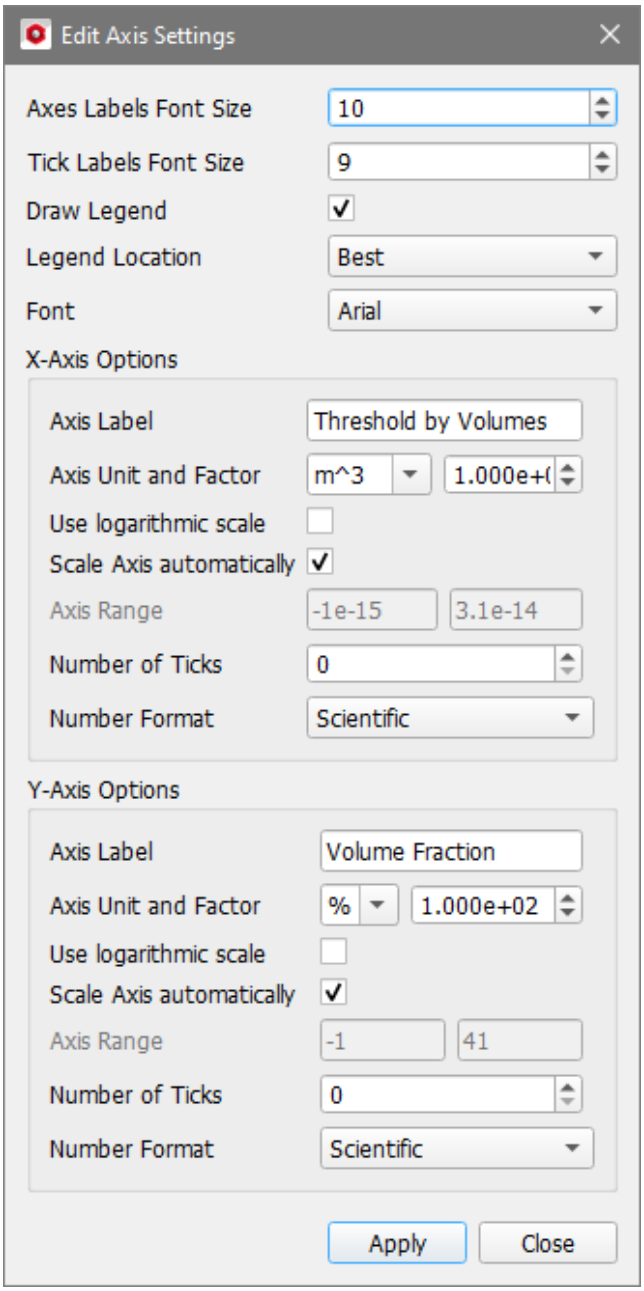
Edit Axis Settings

Selecting **Edit Plot Settings** opens a dialog for view and range settings.

Here, the font and font sizes can be changed, the legend can be toggled on or off, and the axis ranges can be edited.

Each axis has its own set of options, including the axis range. If the axis is not automatically scaled, the user can enter desired minimum and maximum values. If **Number of Ticks** is set to zero, an appropriate number of ticks is automatically chosen.

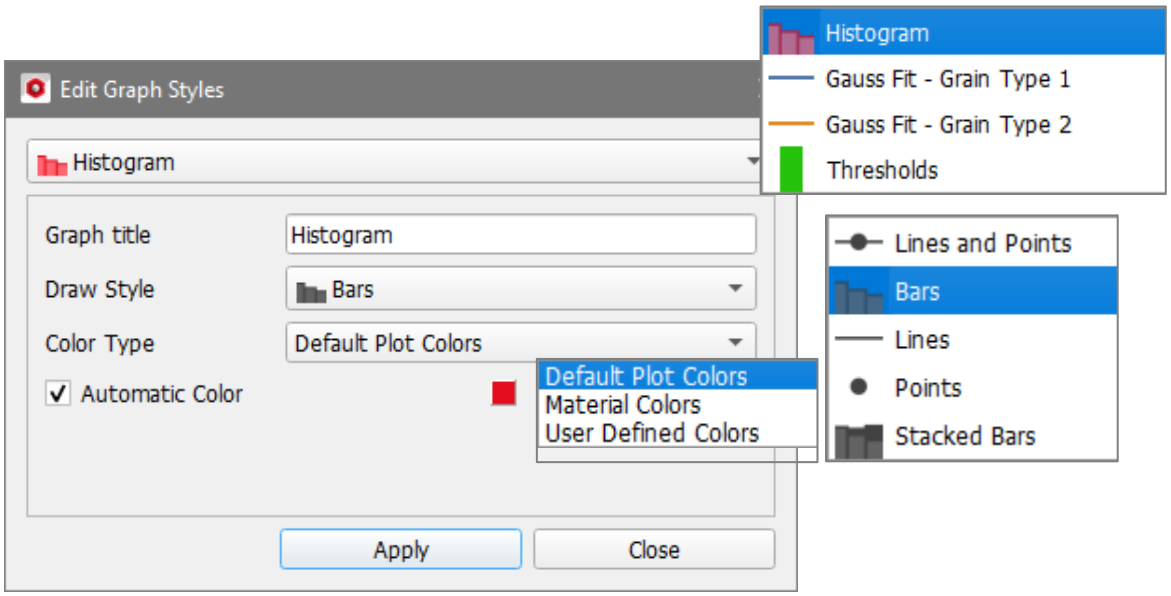
Clicking the **Apply** button updates the plot and saves the new settings via the **PlotSettingsCmd**. The new settings are automatically saved to the result file, such that the plot appearance is the same when opening the result file again.



Edit Graph Styles

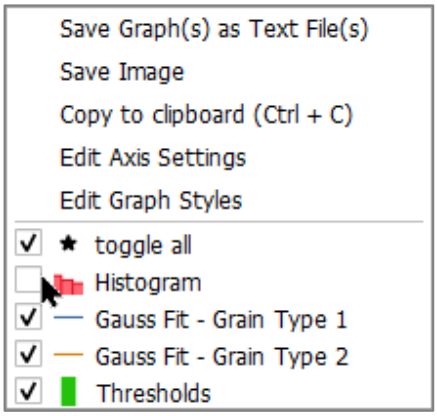
Clicking **Edit Graph Styles** lets the user choose new names for each of the contained graphs:

Changes made here are saved to the result file and recorded via the **PlotStyleCmd**.



Graph list

The bottom part of the context menu contains a part to activate / deactivate the graphs in the plot.



Clicking **toggle all** deactivates the visibility of all the entries in the plot.

Unchecking one of the entries deactivates the visibility of this particular graph in the plot visualization.

Combining Result Data from GeoDict Result Files

Combining results can be very useful to identify parameter correlations, especially when using **GeoDict Vary Macros** (see the GeoPy scripting handbook of this User Guide). The corresponding plots from the different result files are combined into one plot for easy comparison and custom plots can be generated from the map parameters.

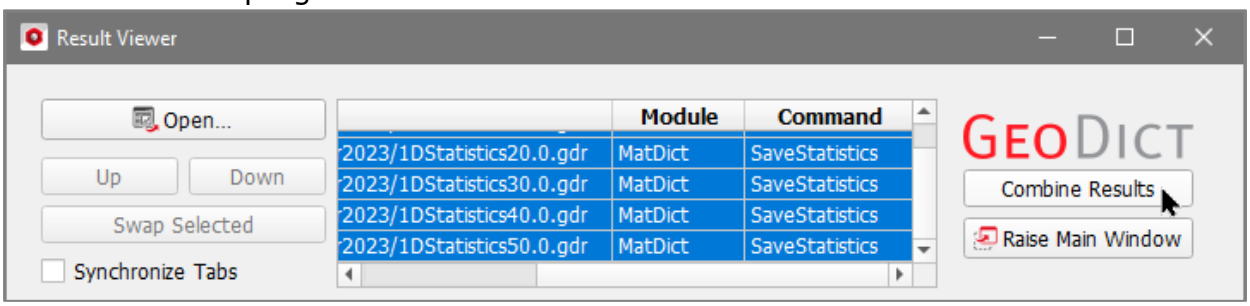
From a set of result files, it allows to condense the important values in a well-arranged plot or table. In this way, result values that are not changed by differing input parameters are separated from result values of importance. This procedure makes it easy to qualitatively identify parameter correlation.

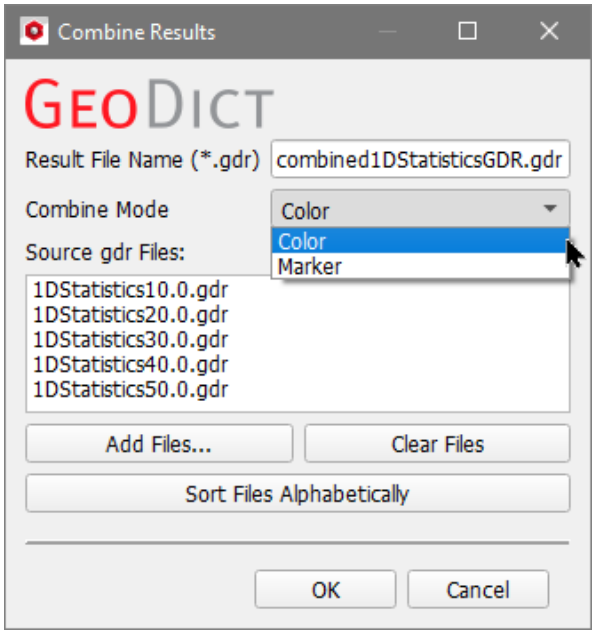
Just some examples:

- A generated structure with varying Solid Volume Percentage (SVP) for which the user wants to know the corresponding percolation path diameter
- A flow simulation with varying fluid viscosity, for which the user wants to know the corresponding pressure drop
- An imported 3D gray value image with varying binarization threshold, for which the user wants to know the corresponding relative diffusivity

Combined Result Files

Several result files may be combined into one single file by clicking **Combine Results** located at the top right of the Result Viewer's **Header section**.

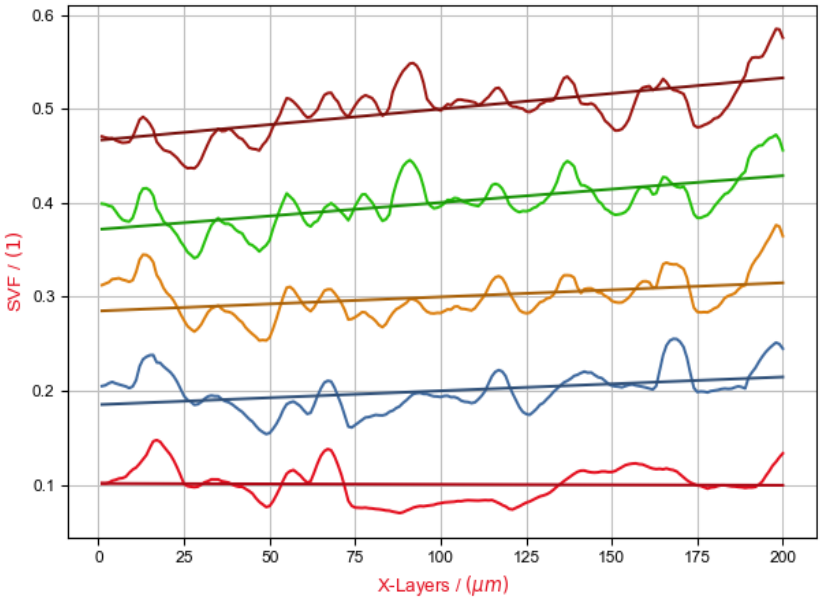




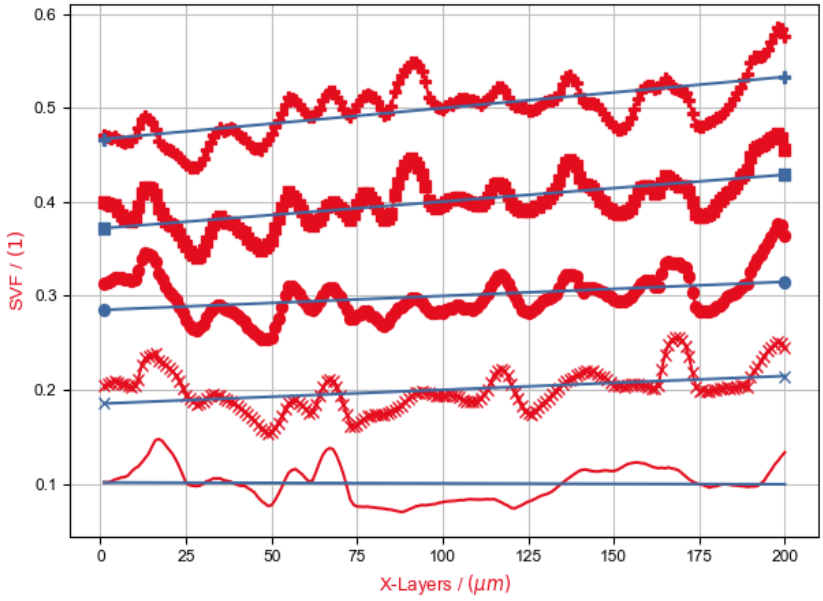
This opens the **Combine Results** dialog to define combine settings and input files.

The two **Combine Modes** – **Color** and **Marker** - change the appearance of **automatically combined plots**.

With the **Color** mode, plots originating from one result file share the plot color, while with the **Marker** mode, they share the plot markers.



Color mode



Marker mode

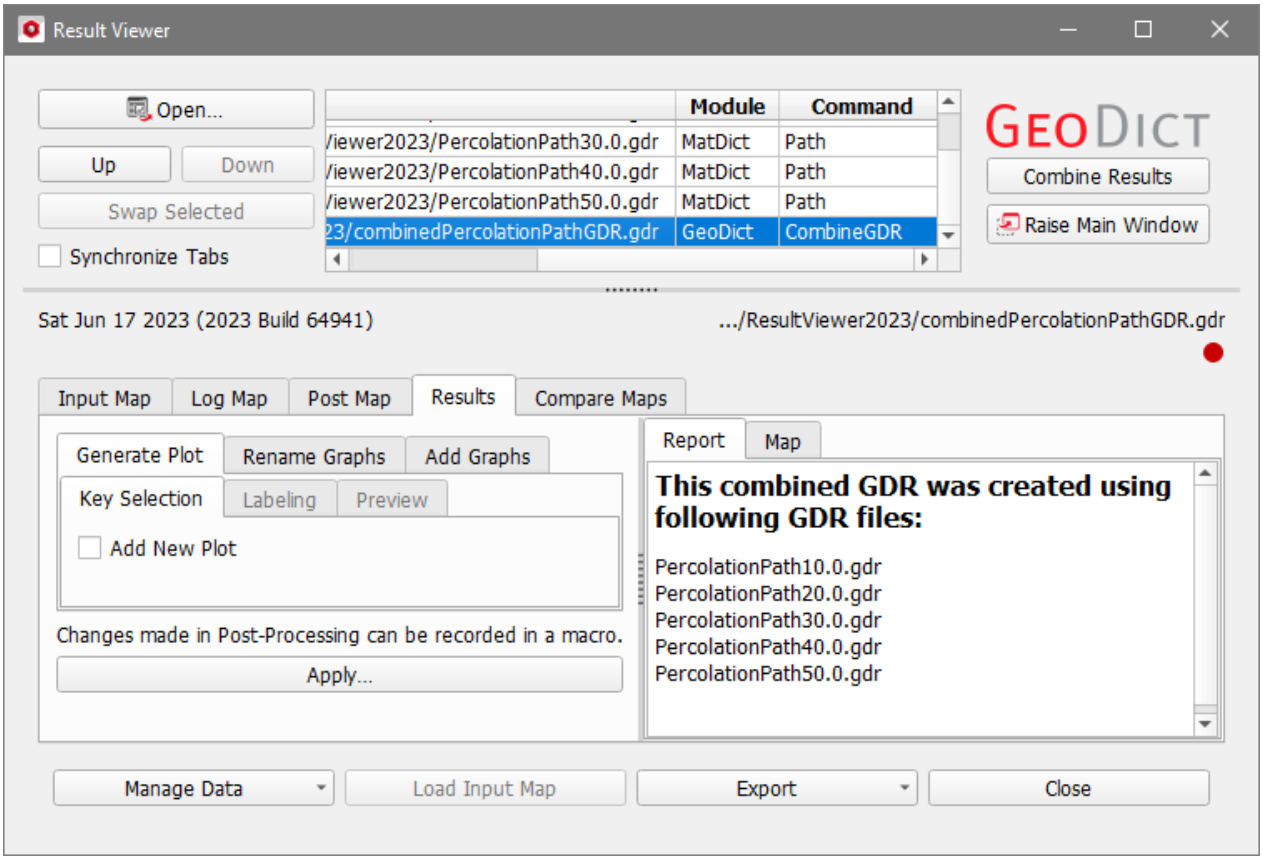
At the bottom of the **Combine Results** dialog, files can be added and sorted for combining. The list already contains all files that have been highlighted in the Header section box of the Result Viewer. Add one or multiple files by clicking **Add Files...**. Clicking **Clear Files** empties the list completely and clicking **Sort Files Alphabetically** sorts the list in alphabetical order. The files can also be sorted manually by drag and drop in the list. Note, the order of files in this list mirrors the ordering of files (and plots) in the combined result.

Clicking **OK** starts the combining process. It combines all values into one file and enables post-processing on the combined results. If possible, plots from the original result files are merged into one plot.

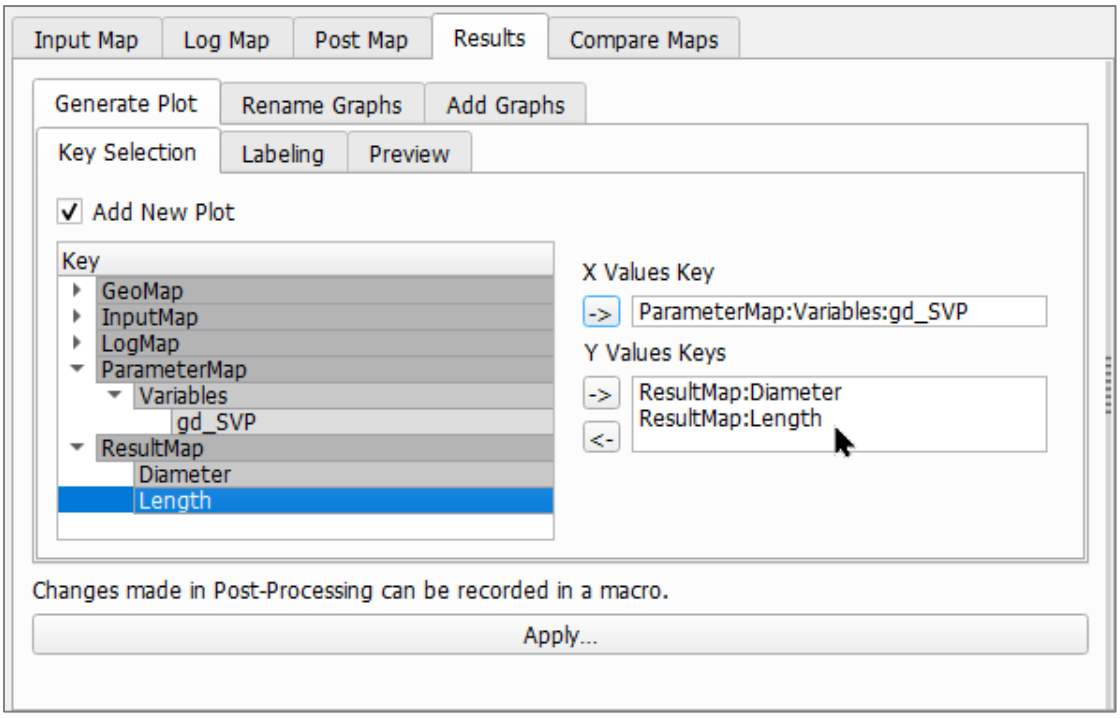
The Result Viewer of the combined result file opens automatically and, like any other result file, it can also be opened at any time by selecting **File → Open Results (*.gdr)...** in the menu bar. The combined result file offers some post-processing actions to generate plots from the result values.

PLOT GENERATION FROM THE COMBINED RESULTS

After a combined result file has been generated, it opens automatically and it is possible to run post-processing, as well as generate custom plots.



In the **Generate Plot - Key Selection** subtab, check **Add New Plot** to start customizing the plot.



Now, in the subtab, a list (**Key**) contains the keys that can be used to generate the custom plot. These keys have values that differ amongst the original result files – those that have been shown in **orange** or **red** color in the comparison table view (see Comparing Results, page 23).

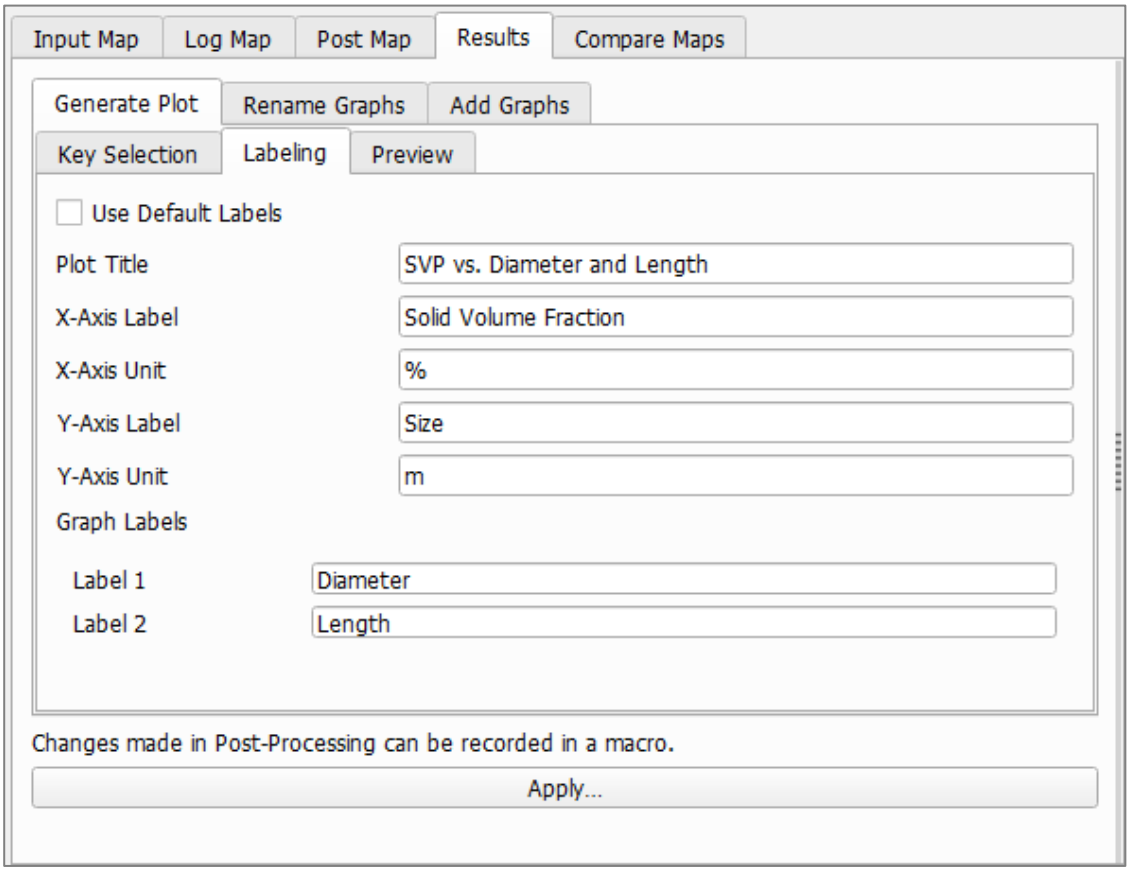
Various parameters from the result file are available as keys for new plots. In this example, the *.gdr result files for the Percolation Path were created by a GeoPy script with the variable gd_SVP, containing the Solid Volume Percentage (10%, 20%, 30%, 40%, and 50%). The variables that were used in the script can also be used now as keys in the combined gdr result file as follows:

- Click on one of the keys from the **Key** list to highlight it.
- Then, click on the -> icon to add it to the **X Values Key** or **Y Values Keys**.

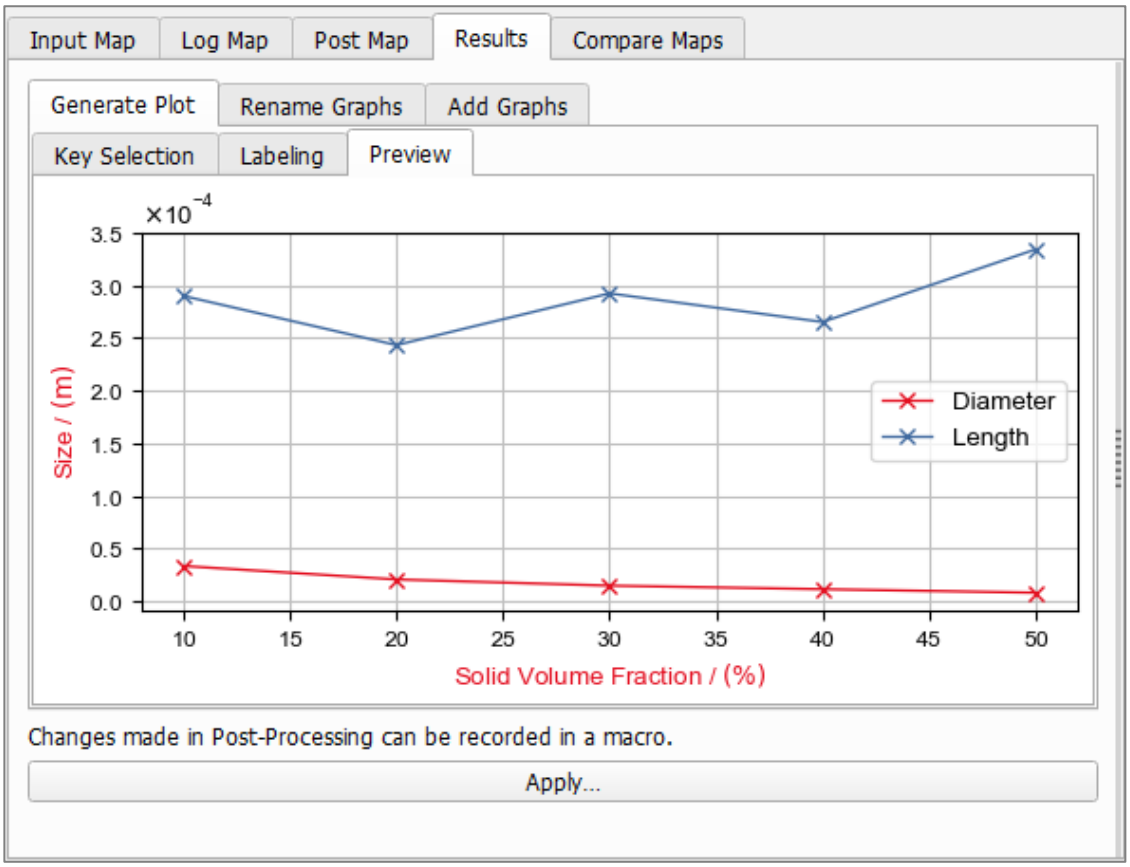
The X Values Key entry is overwritten when clicking the -> icon again.

The Y Values Keys can have multiple entries. Single keys can be removed from the Y Values Keys again by clicking on the <- icon**.**

In the **Generate Plot - Labeling** subtab, disable **Use Default Labels** to define custom plot labels.

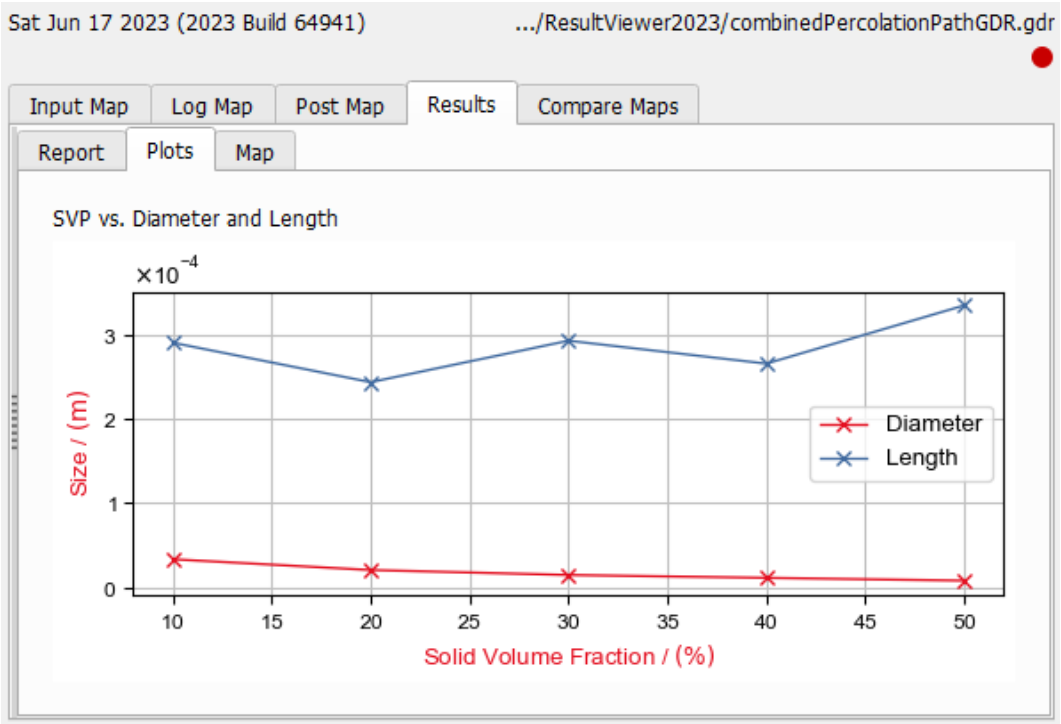


Without clicking yet **Apply...**, go to the **Generate Plot - Preview** subtab, where a preview of the custom plot is shown. Changing settings in the other tabs updates the preview plot immediately.



With clicking **Apply...**, the plot is permanently saved to the combined result file (here combinedPercolationPathGDR.gdr) and appears under the **Results - Plots** subtab of its Result Viewer afterwards.

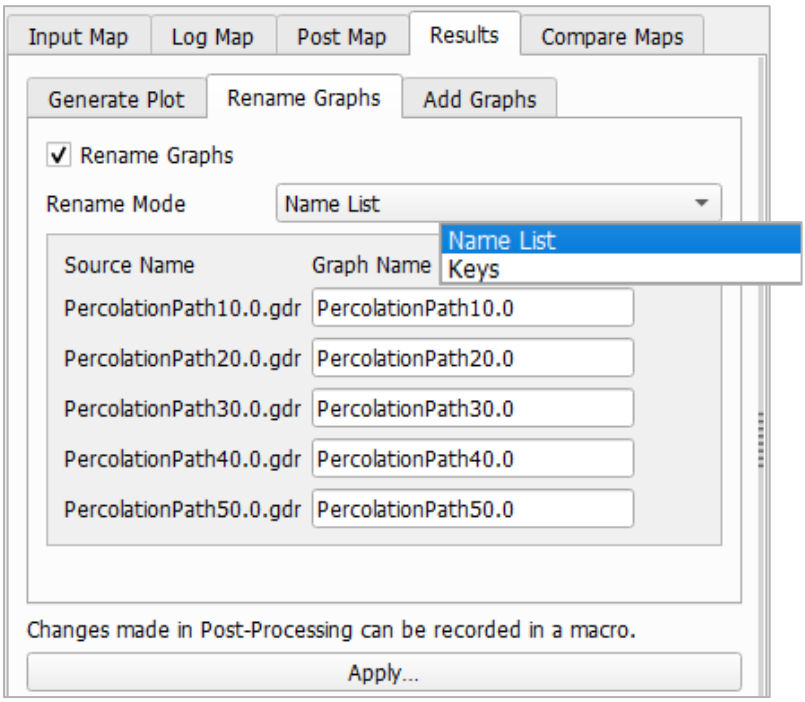
The generation of custom plots is saved in the automatically recorded macro of the GeoDict session (session macro) and can be recorded using a python macro.



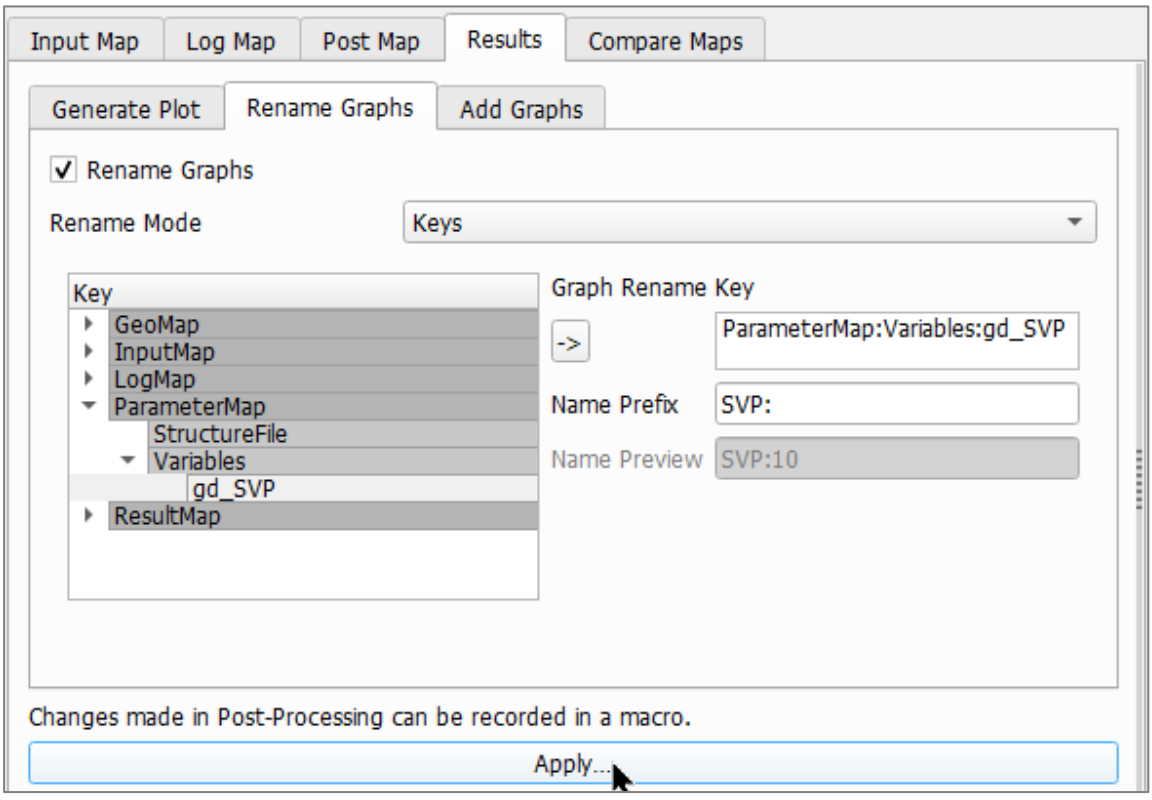
RENAMING GRAPHS

Under the **Rename Graphs** subtab, the labels of combined plots can be changed to fit the result files from which they originate.

Appropriate entries are a matching list of names (**Name List**) or a key (**Keys**) that can be defined and from which the names should be generated.

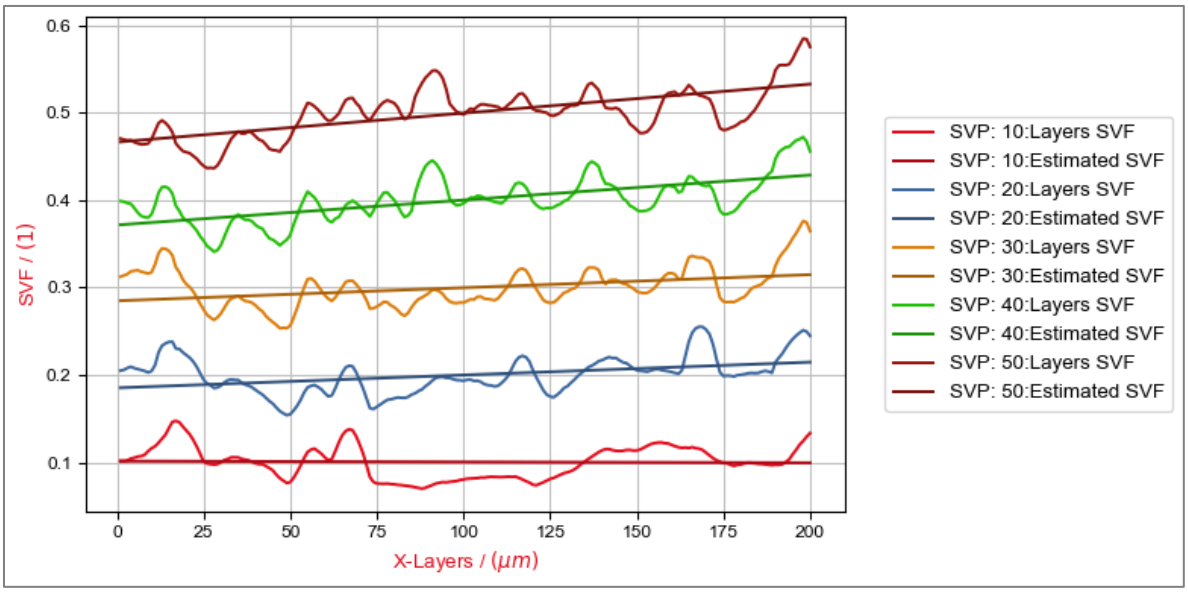


As an example: here the names are changed according to the key **gd_SVP** with the name prefix **SVP:**.



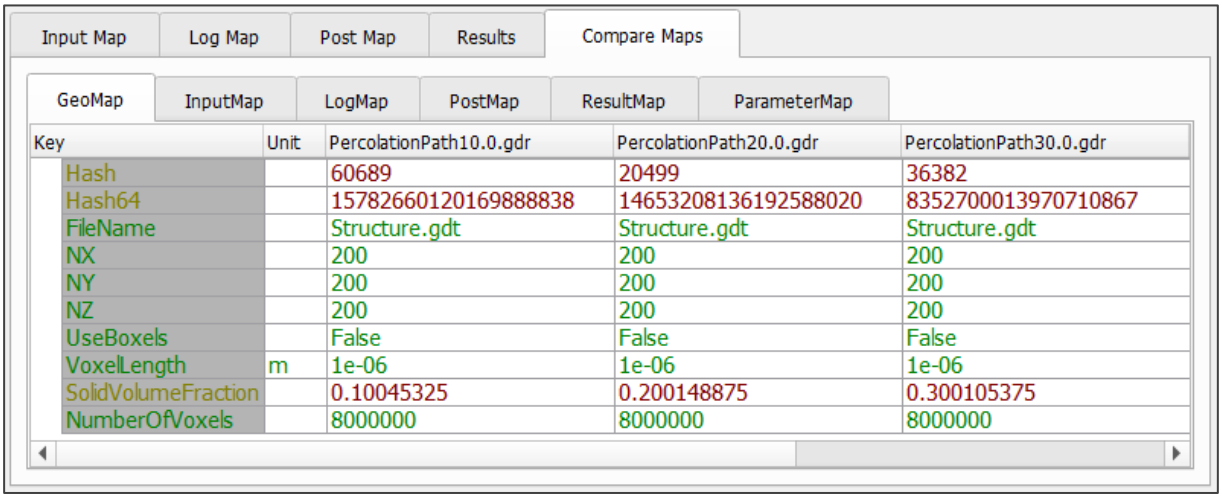
Clicking the **Apply...** button renames all **automatically generated plots** on the result file according to the set renaming rules.

Custom generated plots (see page 18) are **not** renamed in any way.



COMPARING RESULT DATA IN COMBINED RESULT FILES

Combined result files can be compared by clicking the **Compare Maps** tab. Entries in various colors are seen in the tabs **GeoMap**, **InputMap**, **LogMap**, etc., under the **Compare Maps** tab.



Key	Unit	PercolationPath10.0.gdr	PercolationPath20.0.gdr	PercolationPath30.0.gdr
Hash		60689	20499	36382
Hash64		15782660120169888838	14653208136192588020	8352700013970710867
FileName		Structure.gdt	Structure.gdt	Structure.gdt
NX		200	200	200
NY		200	200	200
NZ		200	200	200
UseBoxels		False	False	False
VoxelLength	m	1e-06	1e-06	1e-06
SolidVolumeFraction		0.10045325	0.200148875	0.300105375
NumberOfVoxels		8000000	8000000	8000000

Differences and similarities among the result files are quickly spotted through the colors of these entries .

- The value is **green** if it is the same in all result files
- The value is **red** if it differs in one of the result files
- The value is **orange** if it differs in a sub key in one of the result files

https://doi.org/10.30423/userguide.geodict

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