Introduction of Auswertungstool GUI

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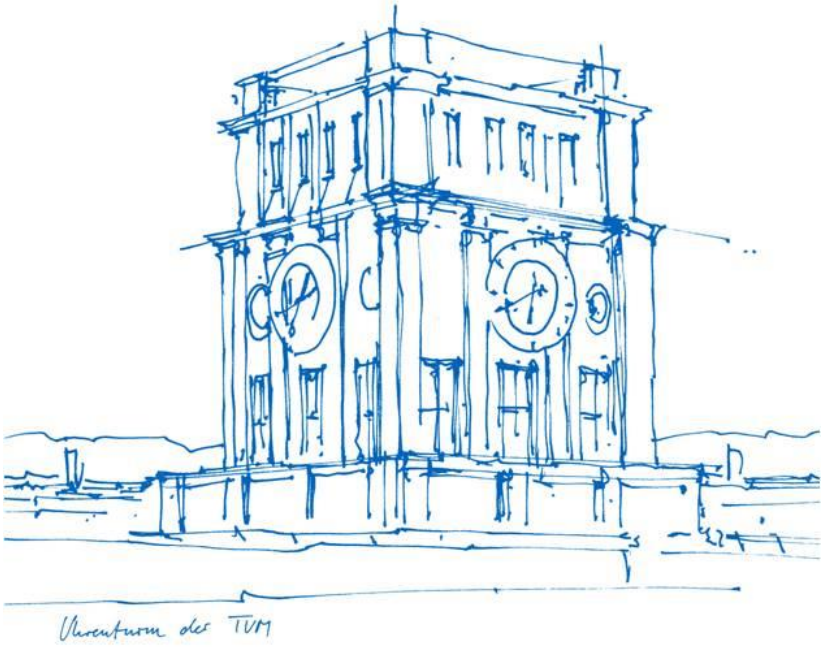
Garching b. München, 04. Juni 2018



Einführung in das Auswertungstool GUI

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Agenda

1. GUI overview
2. Input panel
3. Analysis panel
4. Advanced panel

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An overview of Auswertungstool GUI application

Figure 1-1 shows an overview of Auswertungstool components and how they are laid out. This section provides a brief overview of each component.

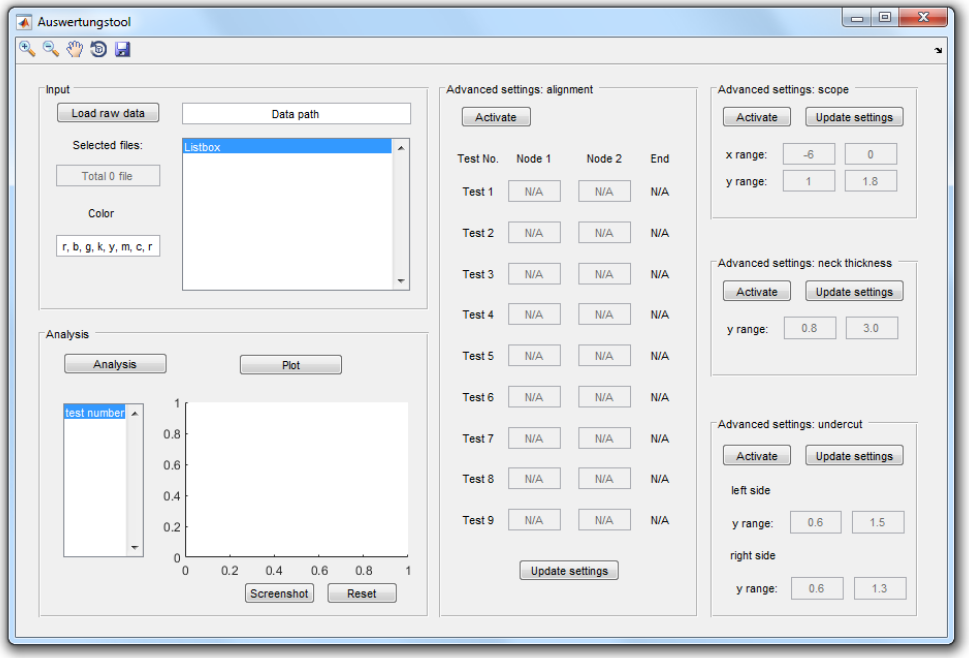

Figure 1-1

Features layout

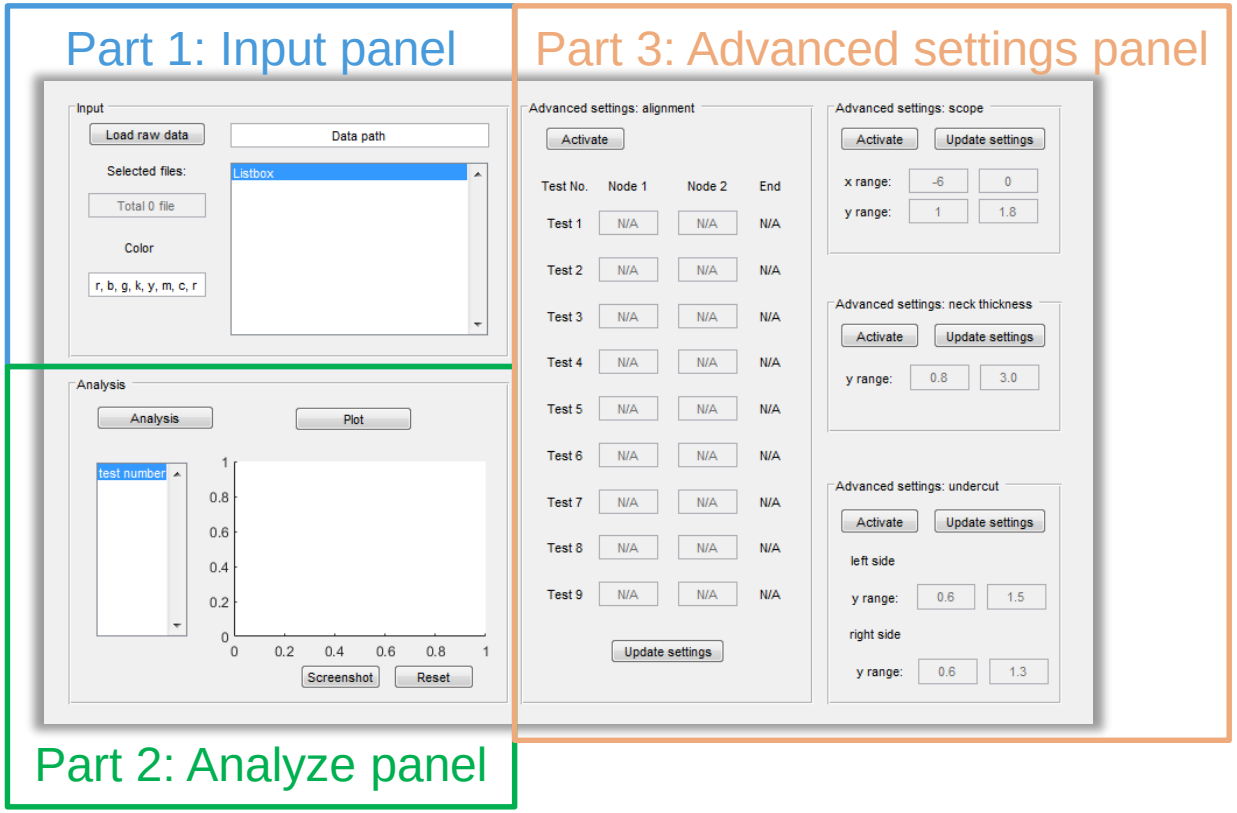

Figure 1-2

Agenda

1. GUI overview
2. Input panel
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Input data

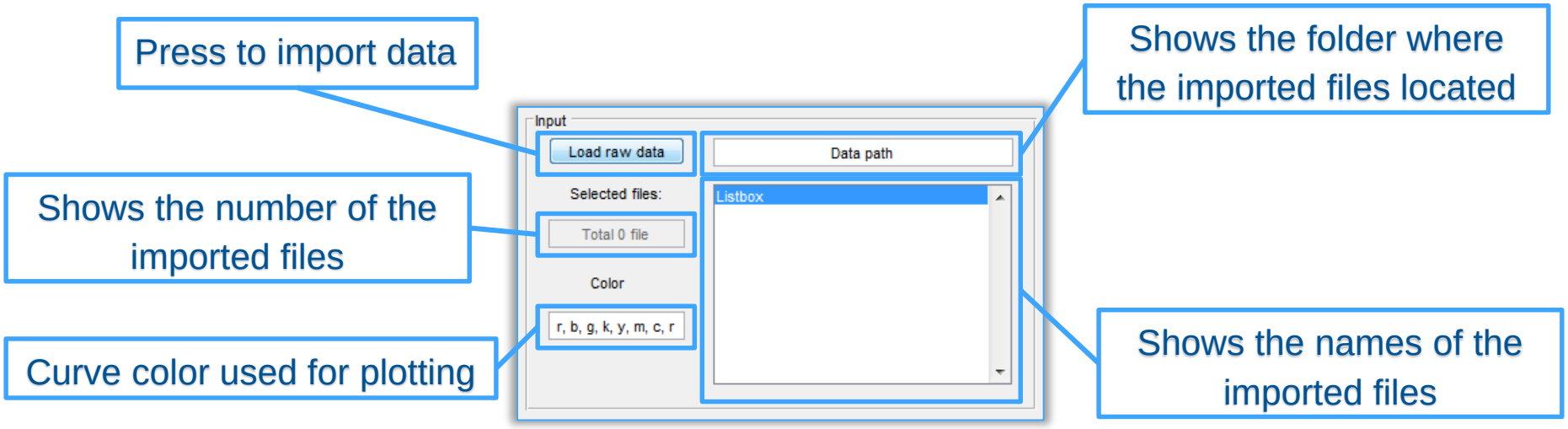

Figure 2-1

Input data

E.g. :

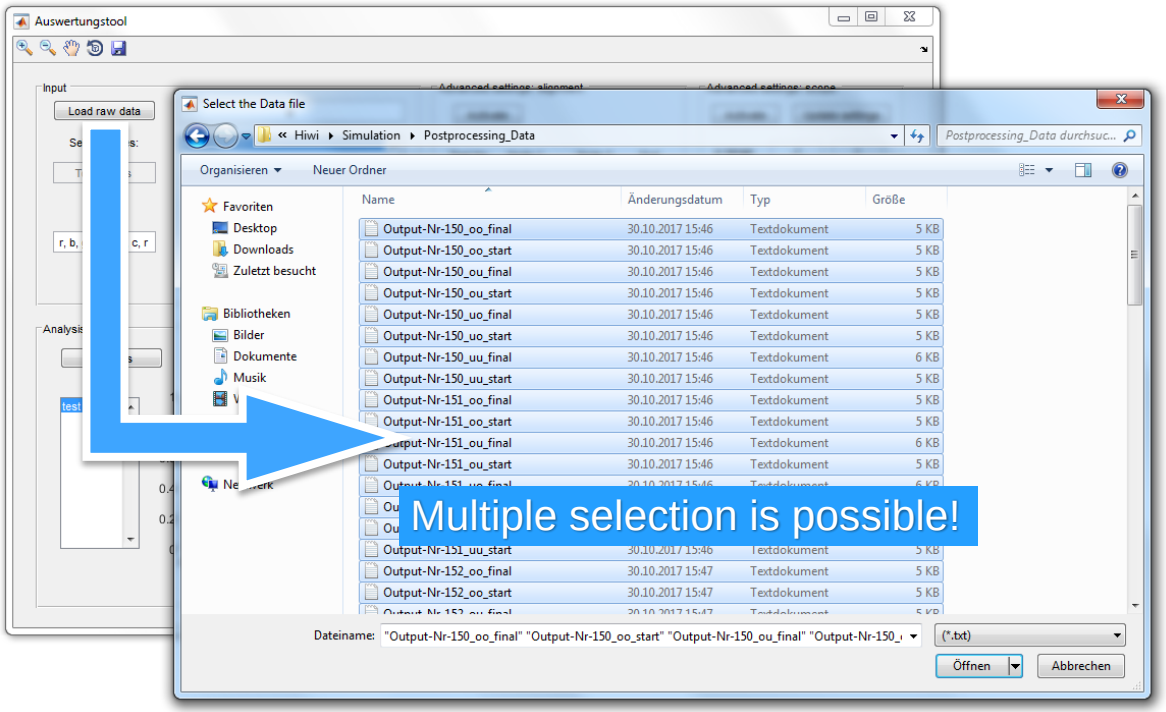

Figure 2-2

File name format

Attention! The imported files must have the following naming format:

Output-Nr-{TEST-NUMBER}_oo_start.txt
Output-Nr-{TEST-NUMBER}_oo_final.txt
Output-Nr-{TEST-NUMBER}_ou_start.txt
Output-Nr-{TEST-NUMBER}_ou_final.txt
Output-Nr-{TEST-NUMBER}_uo_start.txt
Output-Nr-{TEST-NUMBER}_uo_final.txt
Output-Nr-{TEST-NUMBER}_uu_start.txt
Output-Nr-{TEST-NUMBER}_uu_final.txt

The file names are automatically generated by the Abaqus-Python[1] script.

[1] Abaqus Output – Kontur Schleif.py

Input data

After importing the files, these file names, total number and the corresponding location will be automatically filled in the table for verification.

E.g. :

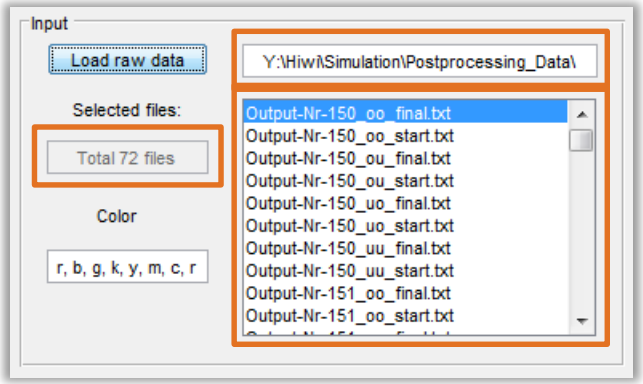

Figure 2-3

Agenda

1. GUI overview
2. Input panel
3. Analysis panel
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Analyze data

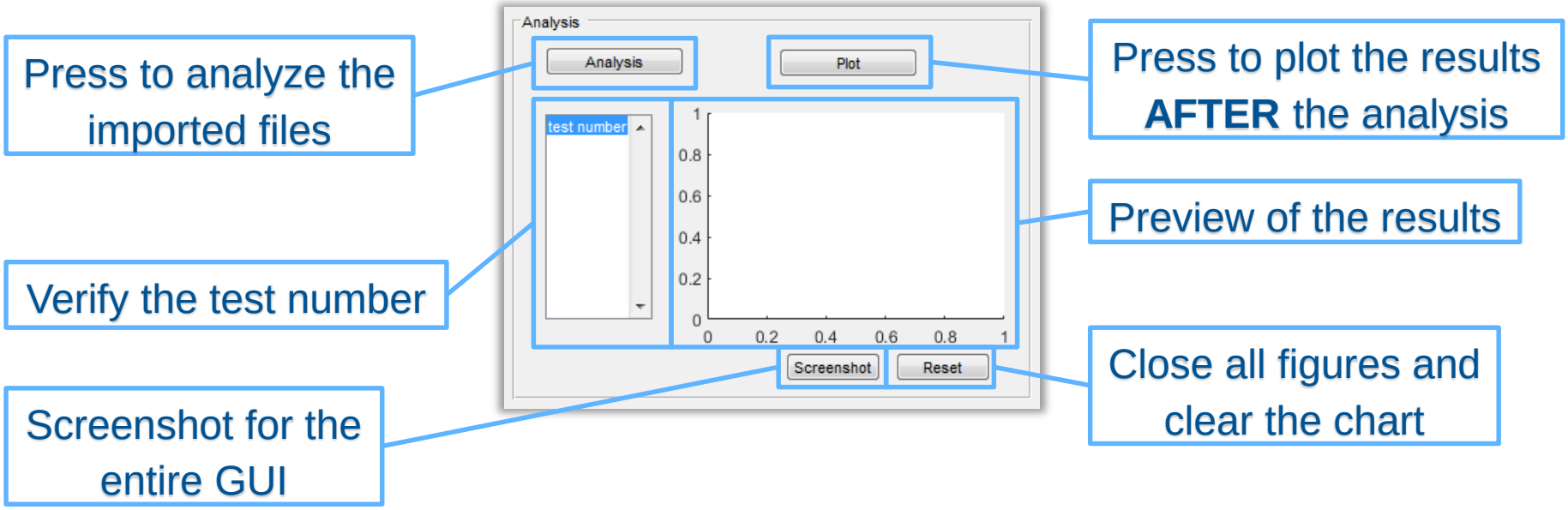


Figure 3-1

Analyze data

General operation procedures:

E.g. :

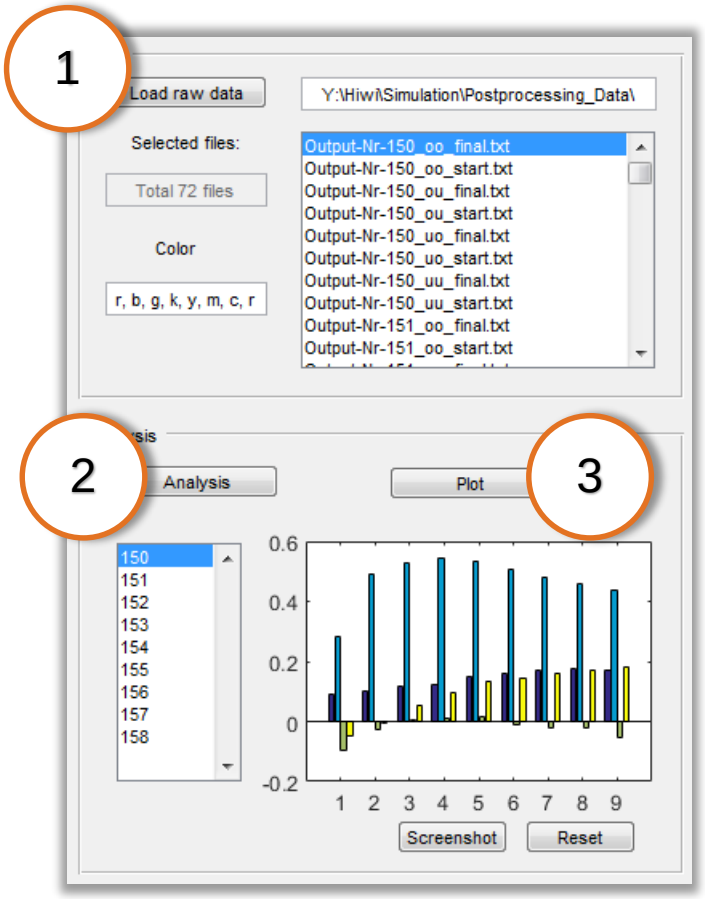
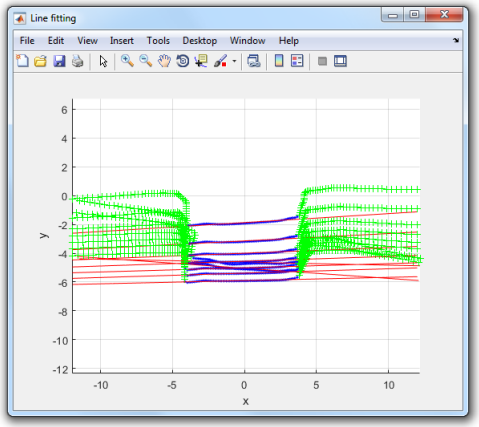


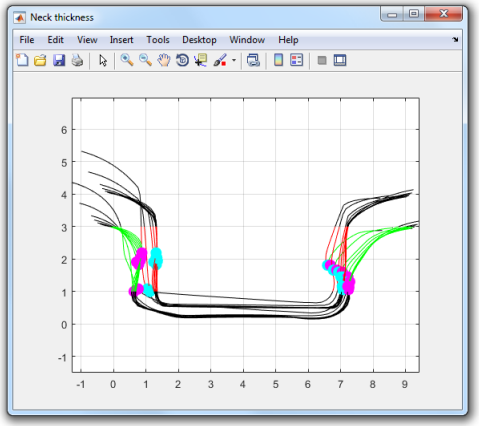
Figure 3-2

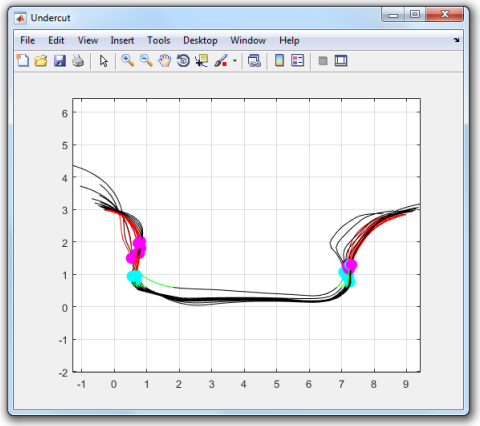
Analyze data

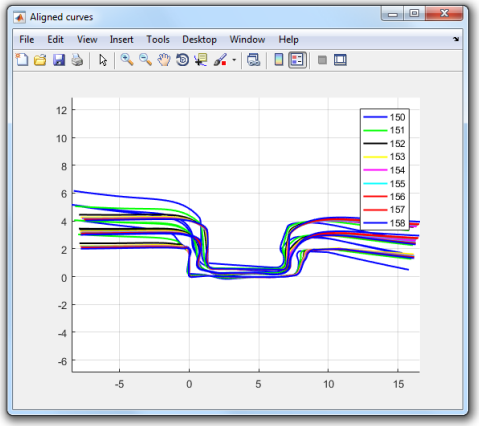
The figures of the analysis process will also be displayed accordingly.

E.g. :









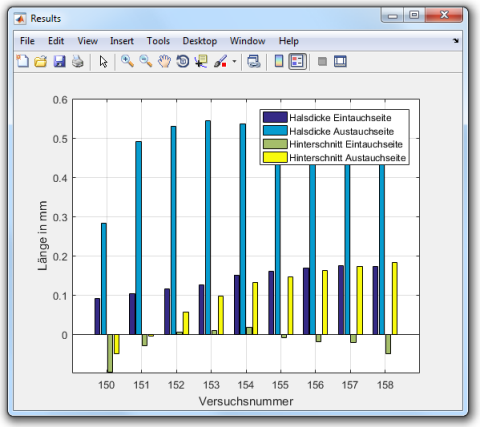


Figure 3-3

More details later

Default configuration

The above tests are based on the following parameters.

- Roller distance: *200 mm*
- Clinch point size: *8 mm* (diameter)
- Sheet thickness: *1 mm* (both)
- Scaling: *1*

In the process of designing this GUI program, these parameters are also set as default parameters.

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Advanced settings

The default configuration does not necessarily apply to all tests. In some cases, the settings need to be fine-tuned for special tests accordingly.
Advanced settings are designed for this situation.

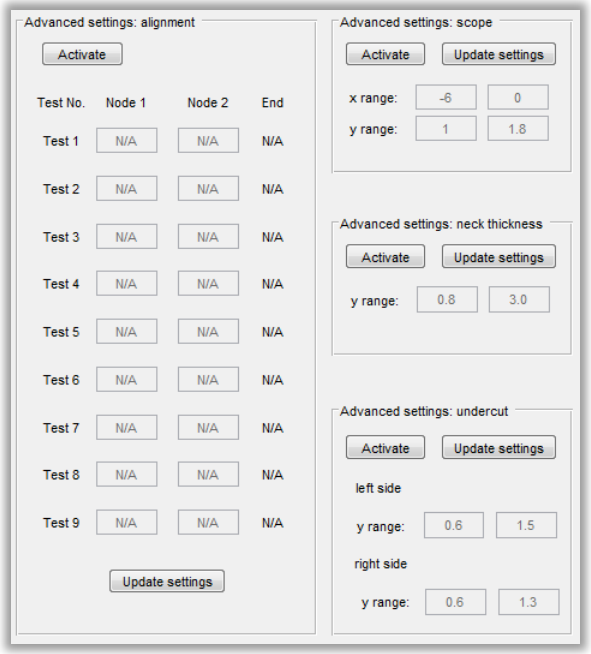


Figure 4-1

Measurement principle

For better understanding the logic behind advanced settings, it is important to explain the measurement principle first.

First of all, in order to facilitate the measurement of the neck thickness and the undercut, the obtained profile curve must be rotated and moved to an appropriate position. Specifically, the bottom of the clinch point is adjusted to the horizontal direction, and the horizontal bottom edge is translated to the x-axis while the left side wall of the joint point is shifted to the y-axis (end effect as the picture shows).

To obtain the angle to rotate and the distance from the x-axis to translate, the points of the bottom must be fitted to a straight line so that its slope and the intersection of the y-axis can be calculated. In this process, it is necessary to exclude the irrelevant points, such as the points of the side wall of the joint point.

E.g. :

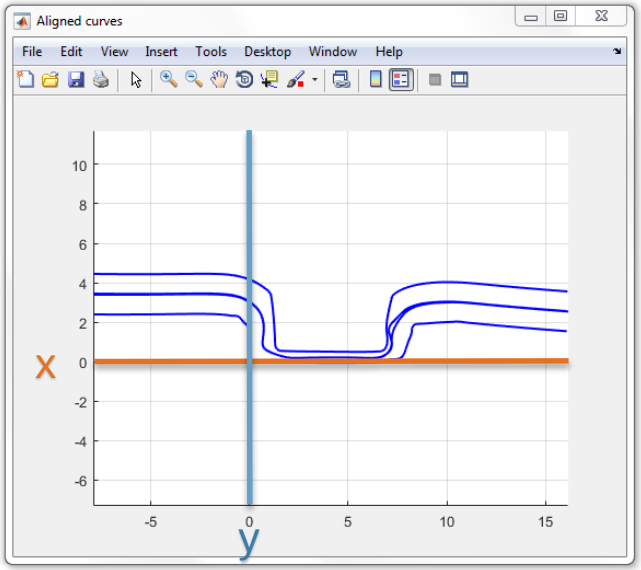


Figure 4-2

Alignment

E.g. :

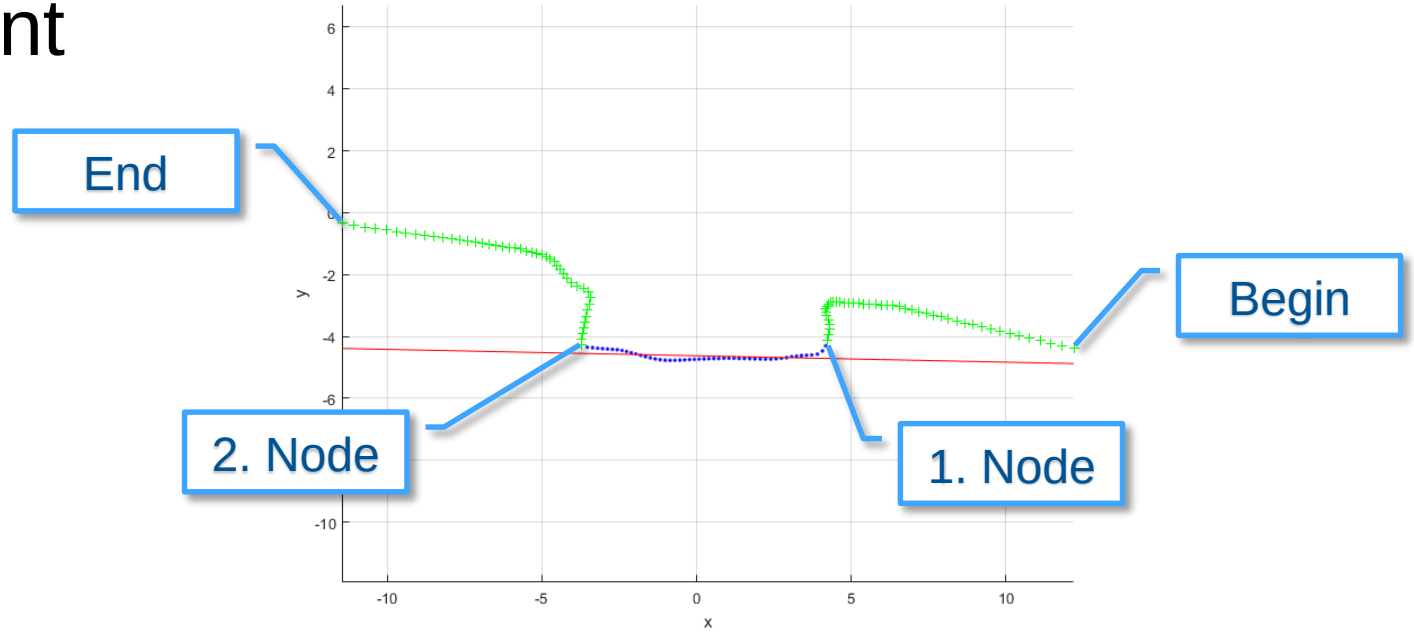


Figure 4-3

As shown in the figure, the green points need to be ignored during the fitting process.

To exclude irrelevant points, you need to specify the sequence numbers of the first and second nodes in the program.

By default, the first node is number 45 while the second is 95.

Alignment

The default values may no longer be applicable when different scales, sizes of metal sheets or punch point are used in the simulation.

In that case, the user is required to manually adjust the node parameters for each simulation and check through corresponding preview window. E.g. :

It is highly recommended to note the adjustment parameters for each test.

The program will automatically calculate the number of the last node, so there is no need for users to worry about.

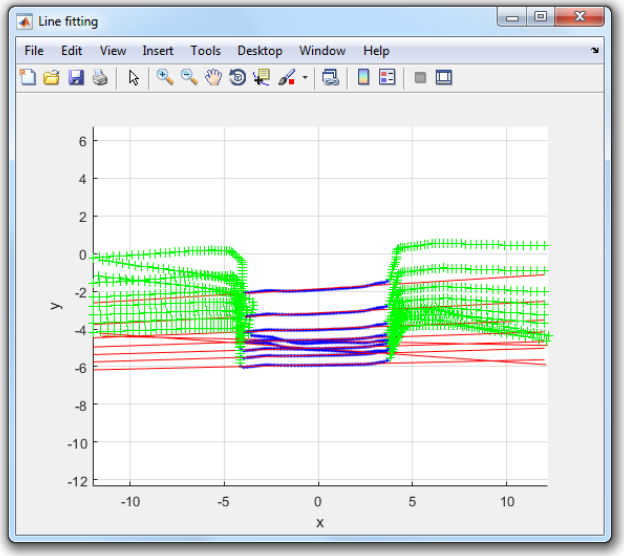


Figure 4-4

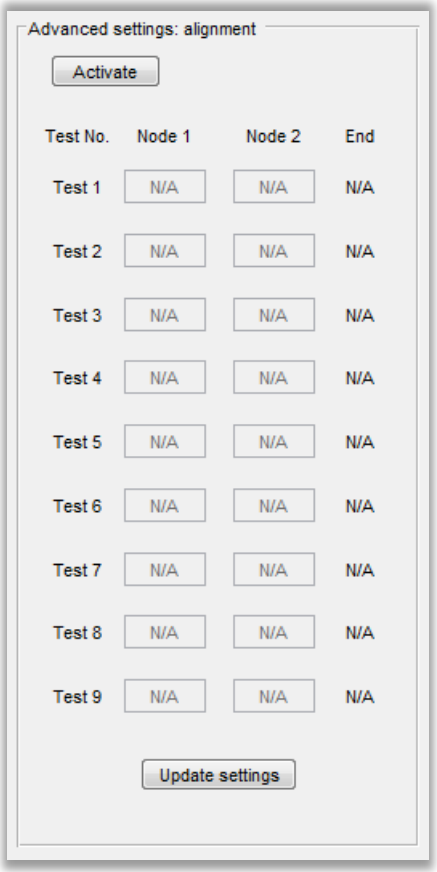


Figure 4-5

Alignment

The program supports up to 9 groups of experiments to adjust simultaneously.

Click the Activate button to enter the parameters manually. Thereafter, click the Update settings button to import the parameters.

Re-plot to see the effect of modifying the parameters.

Note that you need to close the former figures or click the Reset button on the GUI before re-plotting!

E.g. :

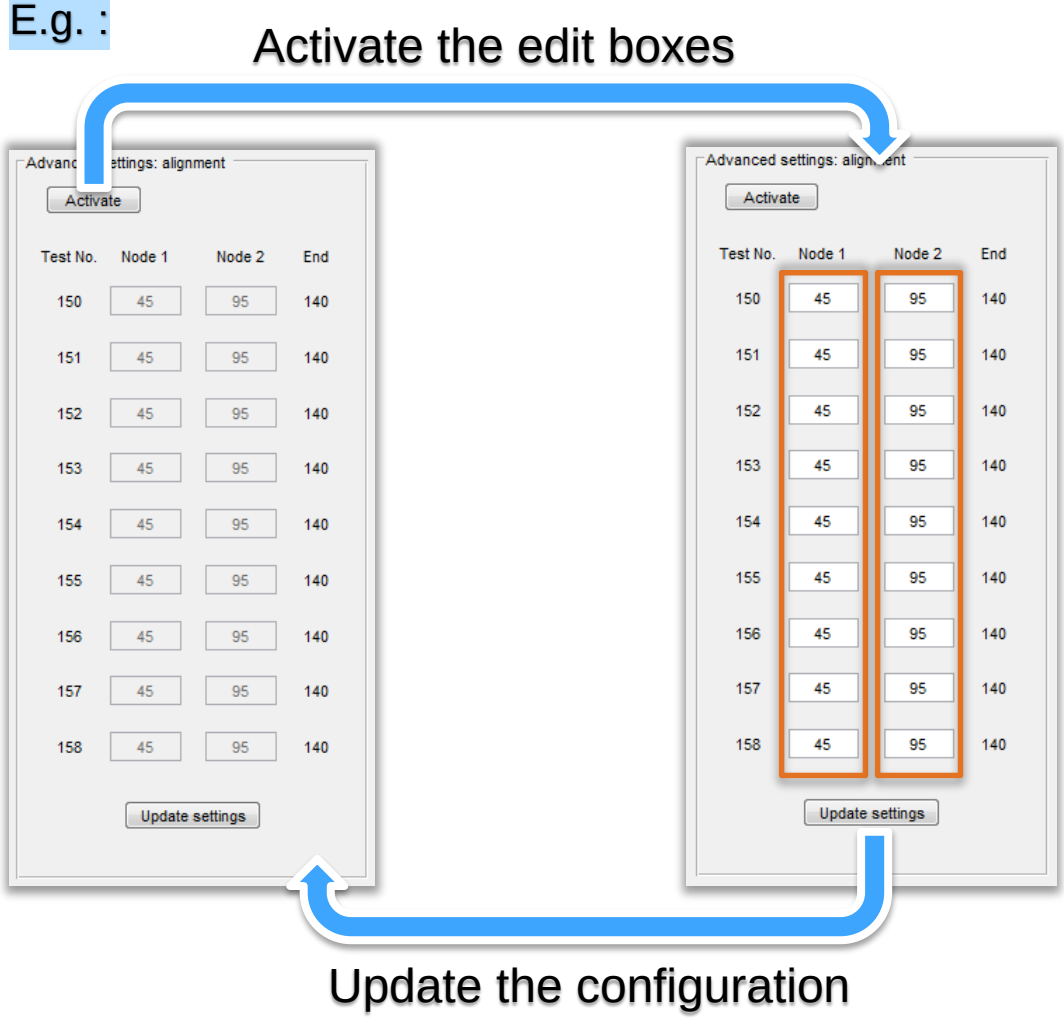


Figure 4-6

Analysis scope

After completing the previous step, the profile curve has been leveled and panned to the x-axis (note that this process is not displayed by the figure). The next step is to pan the left side wall to the y-axis.

So we need to get the position of the left side wall. By roughly dividing the interval, the program can find the points that belong to the left wall.

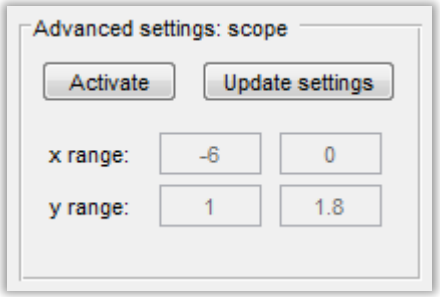


Figure 4-7

Analysis scope

The default values are in the range where x is greater than -6 and less than 0 while y is greater than 1 and less than 1.8. The user can roughly estimate from the line fitting window. It should be noted that the profile curves at this time have been translated, so the y-value estimation needs to add (or subtract) the translation amount.

Note that this range will vary with the size of the joint point.

The use is similar as before.

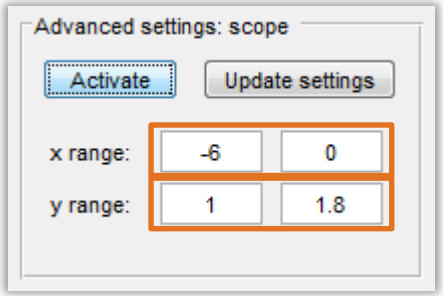
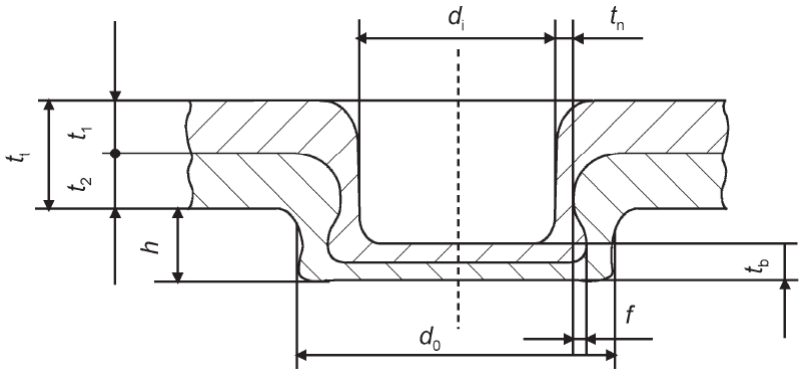


Figure 4-8

Neck thickness & Undercut



t_n: *Neck thickness*

f: *Undercut*

Figure 4-9

The neck thickness refers to the weakest point of the upper sheet on the side wall of the clinch point. Mathematically, the neck thickness is the minimum value of the difference between the x-value of the upper and lower edge of the sheet at the same height.

The undercut is defined as the depth of indentation of the upper edge of the lower panel into the upper panel on the vertical side wall of the clinch point.

Neck thickness

E.g. :

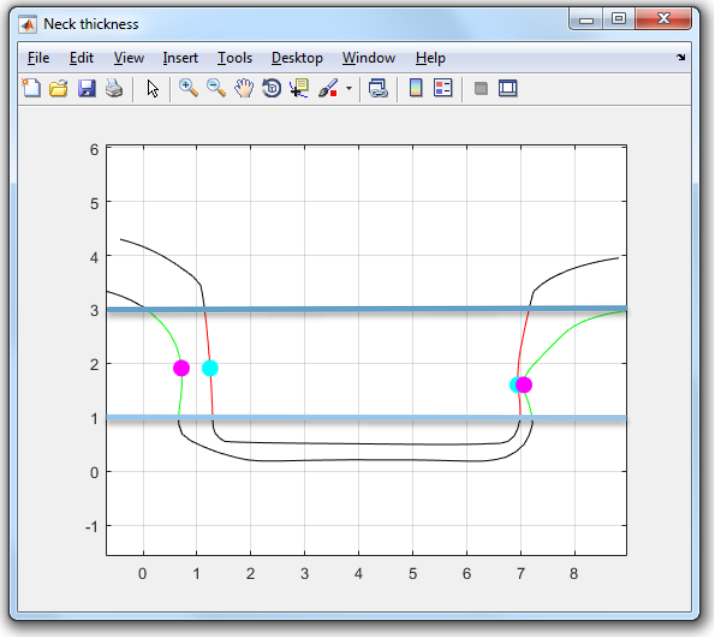


Figure 4-10

In order to measure the neck thickness, you need to specify the interval to analyze. The above diagram shows the analysis interval visually. In order to facilitate the inspection, the curves in the analysis interval are also highlighted. The program will automatically find the critical points and mark them with colored dots.

Neck thickness

Figure 4-11

Figure 4-12

By default, the analysis interval is a range of y-values between 0.8 and 3.

When the interval is no longer applicable, the user can also manually specify the y interval. The use of this control panel is the same as before.

Undercut

Similarly, when measuring undercut, you also need to specify a suitable range of analysis. This process is the most error-prone. Therefore, unlike the previous measurement for neck thickness, this control panel can adjust the left and right sides of the analysis range independently.

Figure 4-13

Figure 4-14

Undercut

Note that what here is adjusted is the y-range of the point 1 (the green one). The y-range of the point 2 (the magenta dot) is automatically set to the range from the position of point 1 to y = 3. Analysis intervals are indicated by their respective highlight colors.

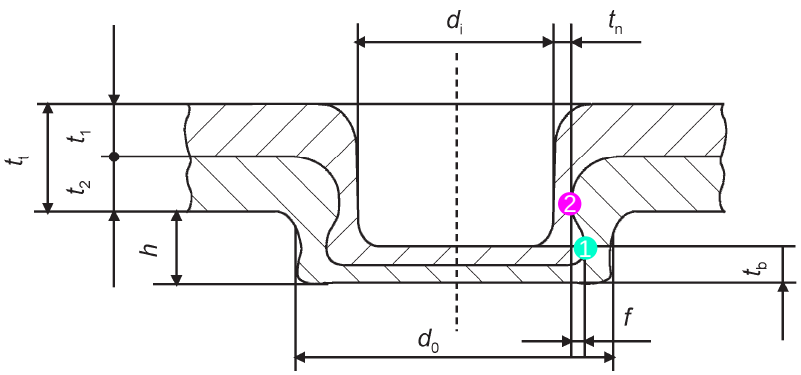


Figure 4-15

E.g. :

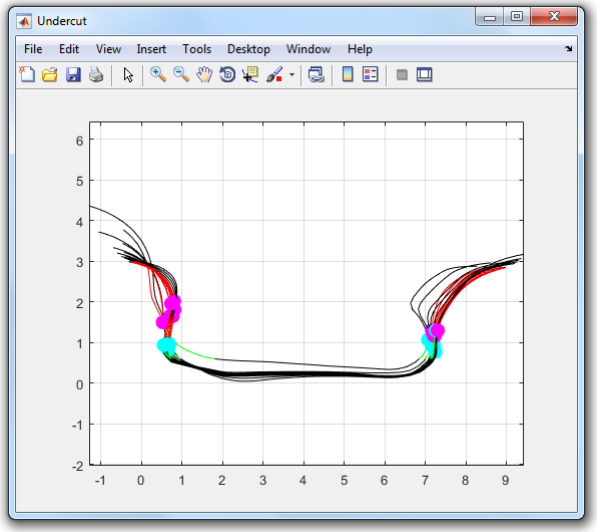


Figure 4-16

Undercut

E.g. :

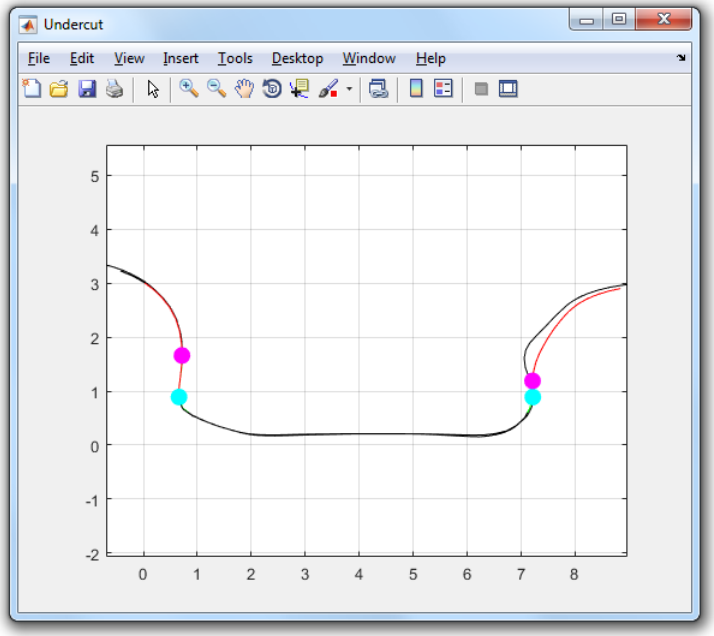


Figure 4-17

Enlarge

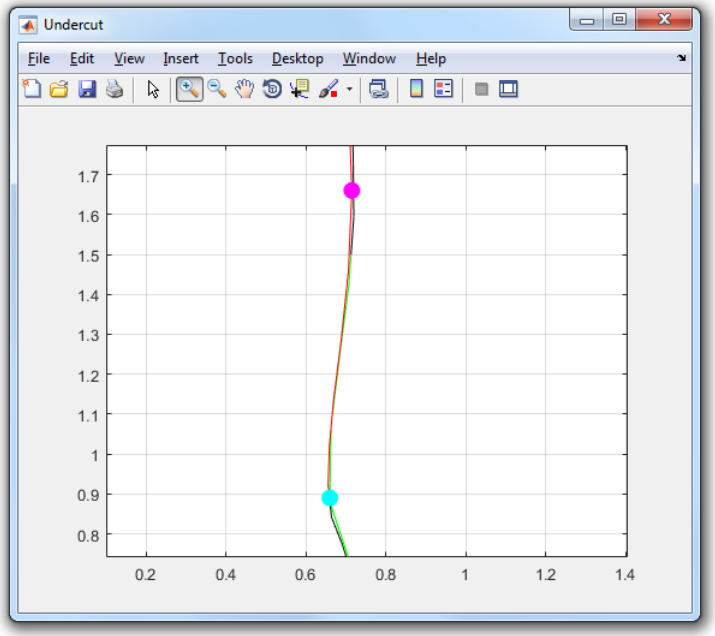


Figure 4-18

Enlarge the figure to help you see the details.

Hint: If the critical points fall at the end of the analysis range it may mean that your analysis range is not very suitable.

Result

E.g. :

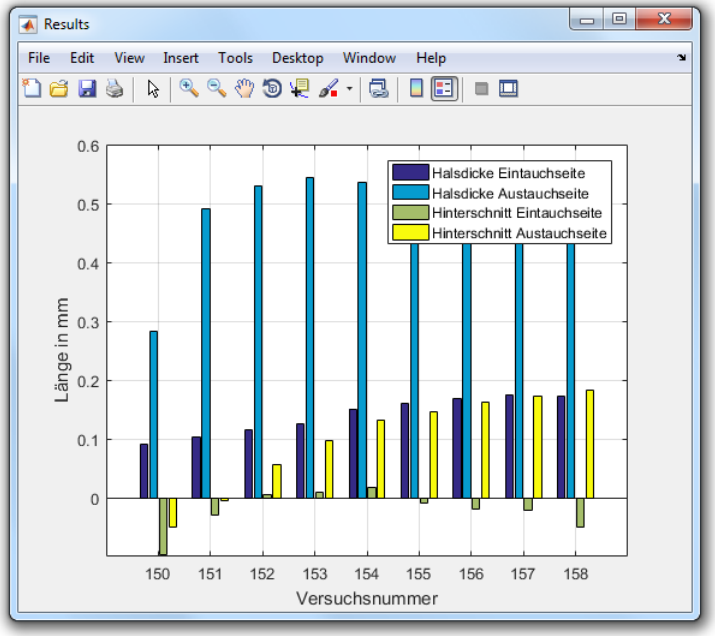


Figure 4-19

When all the parameters are right, you can see the correct analysis results!

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