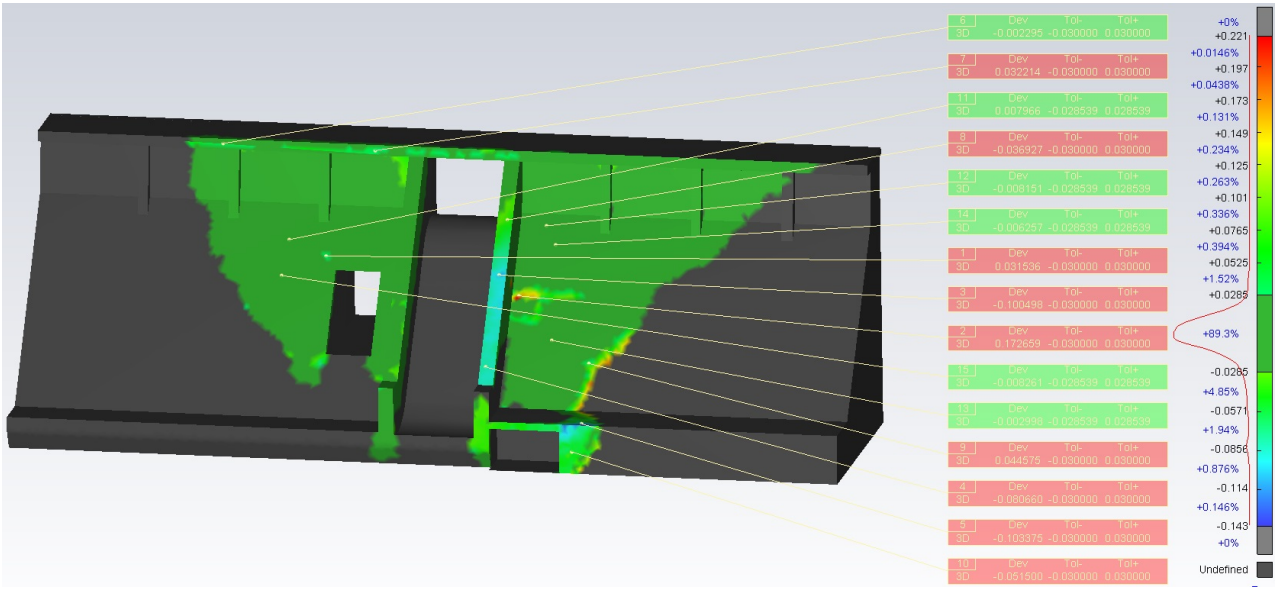
3DReshaper Meteor Practical Exercise

Ex3 - Best-Fit and 3D Comparison



Introduction

Comparing two shapes or two contours to know the gap or distance between them is required when you want to inspect an imported theoretical geometry with the corresponding measured model or when you want to compare two objects at different times (a DTM for instance).

Exercise overview

In this exercise, we will see how to align two objects in the same coordinate system in order to make a 3D comparison.

The process will be as follows:

- Reading the theoretical model inside the software (.stl or in case of CAD model, .iges or . step).
- Reading the "as built" model as a point cloud from the digitization.
- Alignment or registration of the scan data on the theoretical model.
- Performing distance computation and color texture mapping.
- Adding labels.
- 3D inspection report edition or export.

The file used in this tutorial is **HydraulicDam.rsh**

The two objects need to be placed in the same coordinate system to be compared. This is why you first have to do a manual alignment or a coarse pre-positioning registration and then use the best fit computation to make the fine registration.

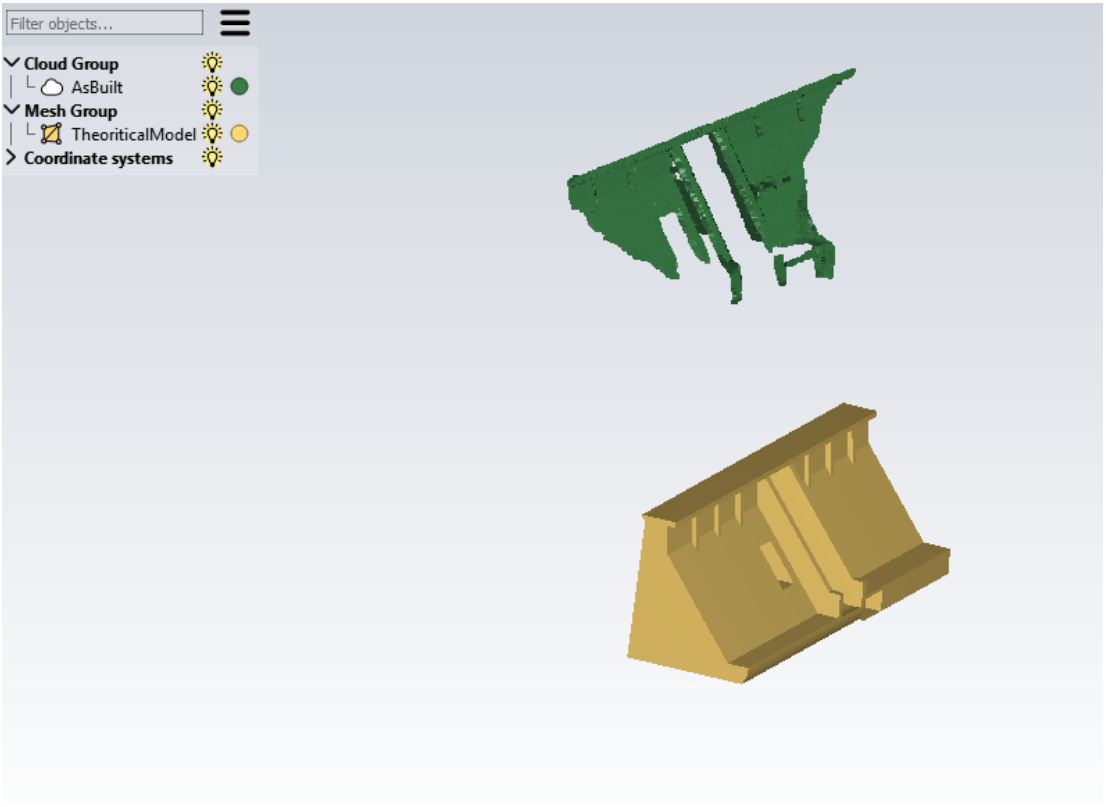


Figure 1: The measured model and the theoretical model are not in the same system

1 Align the cloud to the model

- Open the HydraulicDam.rsh file. It contains a point cloud: the measured model.
- Import the TheoriticalModel.stl file. It contains a mesh: the theoretical model.
- Select the mesh and launch the Transform \ Best Align N points command.

This command waits for point couples (departure, target) and computes the transformation that minimizes the distance between each departure point and the corresponding target.

- Select the same options as on the following picture. With the multi-view mode activated by default, it is easier to do the coupling (vertical or horizontal view).
- Click on some couples of points.
- Then make a preview, and validate.

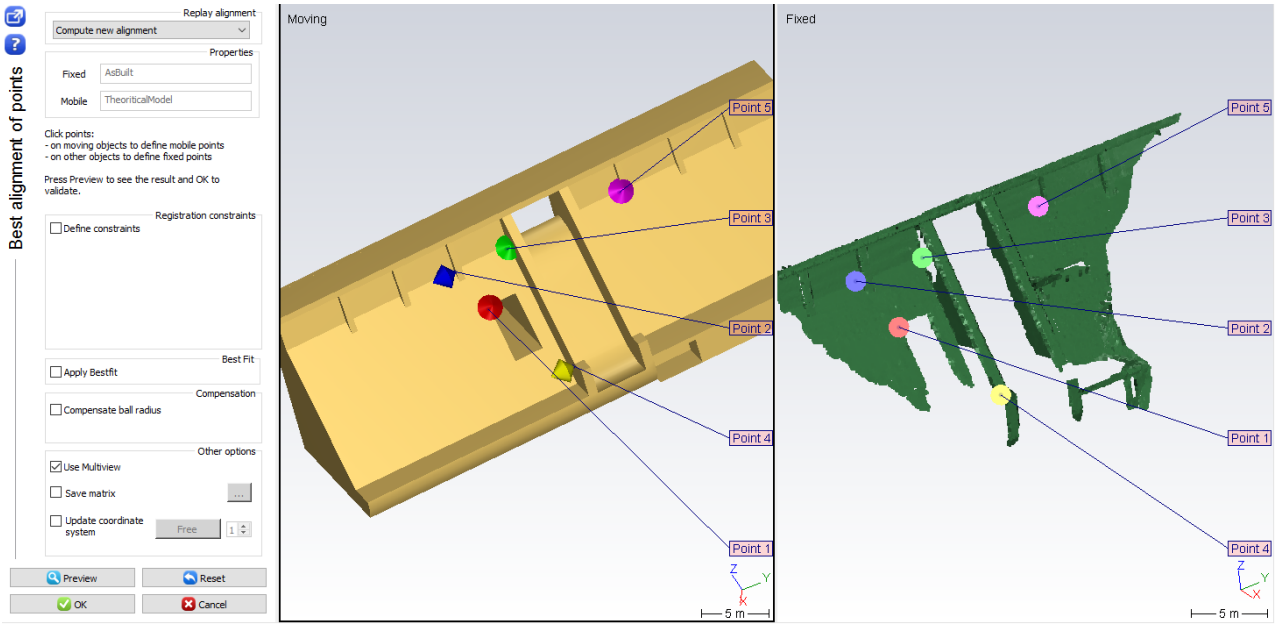


Figure 2: Align the mesh on the point cloud by clicking pairs of points

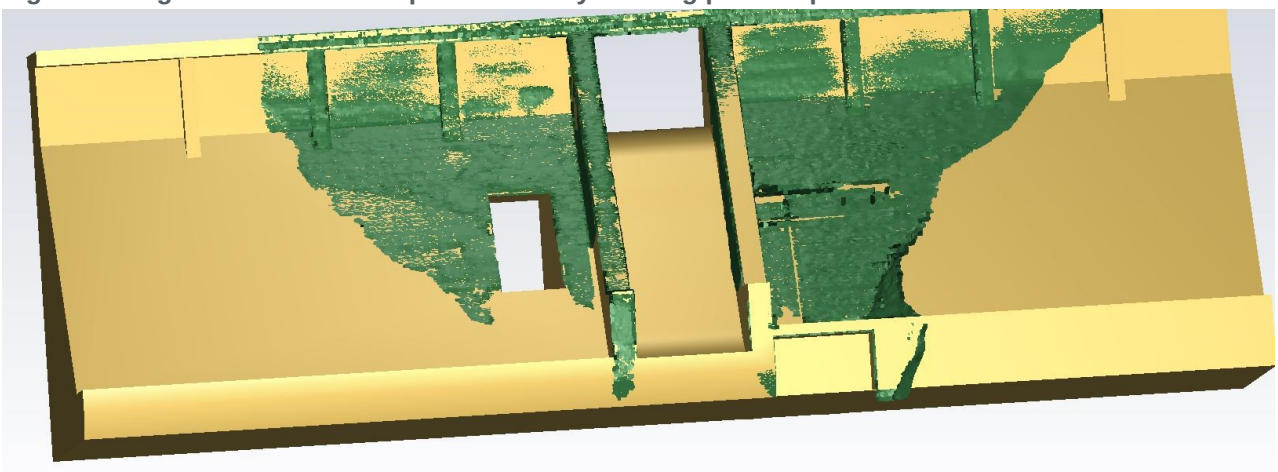


Figure 3: Manual alignment result

Note that clicking on **Preview** displays some details about the applied transformation. Then, the option **Registration constraints** may be useful to preserve the verticality during the movement for example.

Once the two objects are approximately aligned, it is useful to select the two objects and launch the command Transform \ Best fit registration. This command computes the best registration between two objects. Warning! This command can be launched only if the best fit option was not activated in the previous command.

This command analyses the overlap of selected objects to calculate the best fit of these objects. Best-fit means the transformation that minimizes the distance with the other object in a least squares sense.

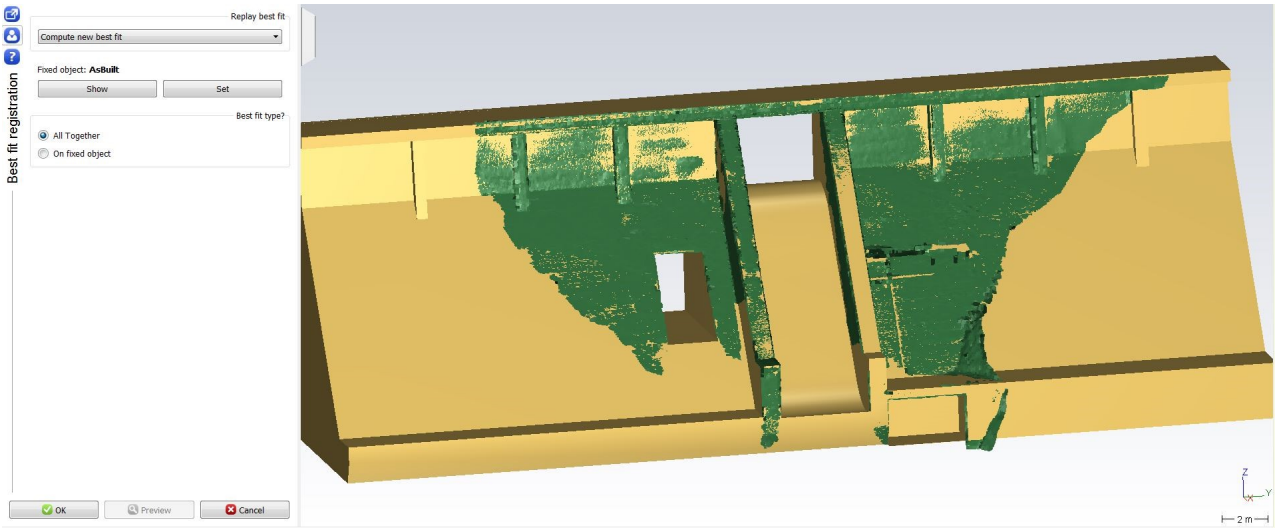


Figure 4: Best-fit registration (the preview displays the transformation information)

Note that a click on **Preview** displays some details about the applied transformation. Then, the option **Registration constraints** in advanced parameters may be useful to preserve the verticality during the movement for example.

2 Clean the cloud to remove the aberrant zones

Once the two objects are in the same coordinate system, we can see clearly that the cloud contains some parts that are not present on the model. These zones must be removed because they influence the best fit in a wrong way.

- Orient the view like on the next picture (click **Y** on keyboard).
- Select the point cloud and launch the command Cloud \ Clean / Separate Cloud(s).
- Make a contour similar to the one on the picture and press "Enter" key.
- Rotate the view, press **Shift** key and drag one of the red balls to take only the aberrant points inside a box.
- Click on the bin icon and validate your cleaning with OK.

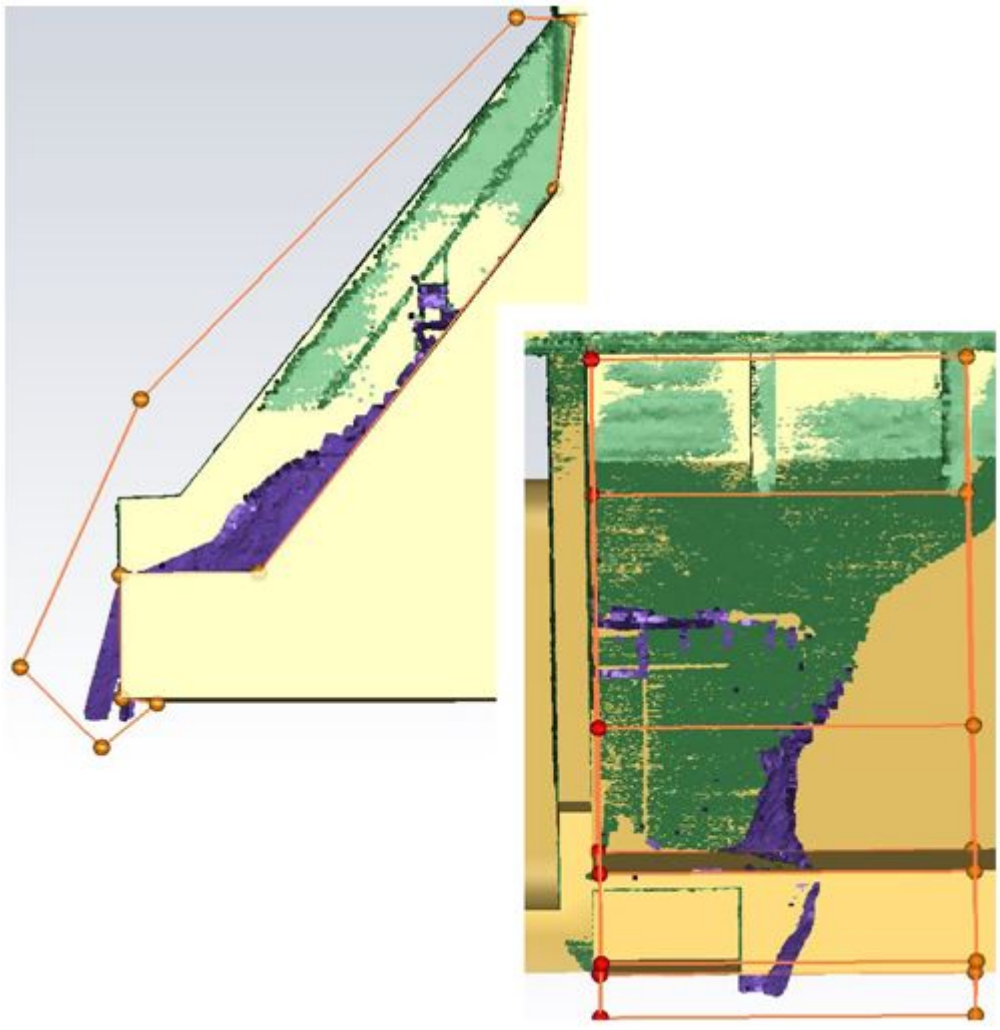


Figure 5: Clean the cloud to remove the aberrant zones

Now, after the cleaning, the best fit must be computed again to obtain a better result.

- Select the mesh first, because it must stay immobile, then select the point cloud.
- Launch the command Transform \ Best fit registration.

- Select the option **Compute new best fit**.
- Click **Preview** then **OK**.

3 Compare and Inspect the two objects

- Select the two objects.
- Launch Measure \ Compare / Inspect.

The first selected entity is considered as the reference object.

It is possible to choose the object to color (In this case, we want to see if the theoretical model fits with the point cloud, so we will color the theoretical model).

(You may have values different from those listed below, depending on how the user made the filter)

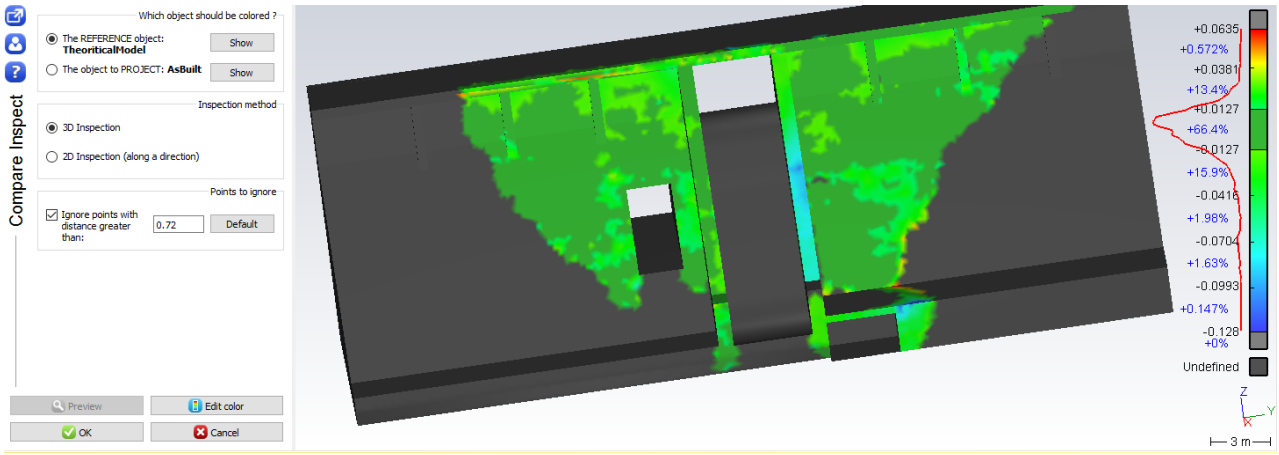


Figure 6: Color map applied on the mesh to see the deviations
The **Edit Color** button diplays the following information:

- Max and min values which correspond to the minimum and maximum point distance.
- Number of levels that the user can change.
- Adjustment of each value (using the arrow or entering the value).
- Dynamic modification of the colors, the scale and the threshold values.
- Display of the distribution graphic.

Note that other options are available in expert mode to save your inspection parameters for further use. You can access and modify the deviation map when you want from the command Measure \ Edit colors (including with the free viewer of the software).

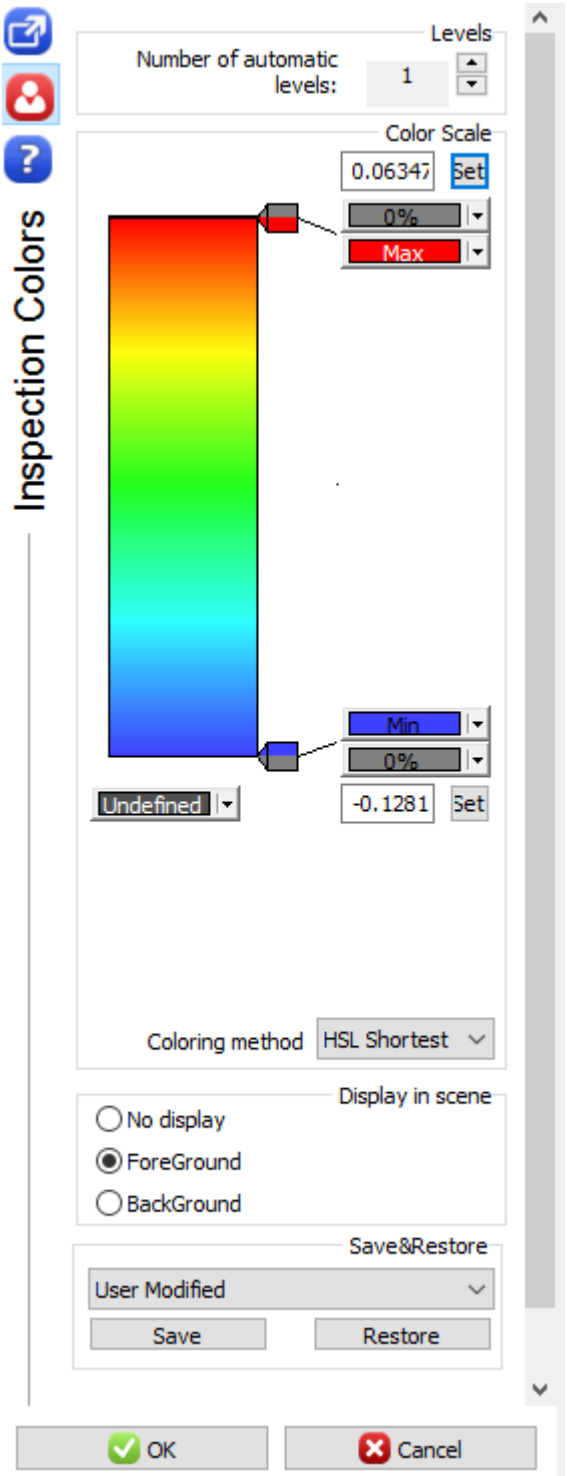


Figure 7: Edit the deviation map parameters

4 Add labels

To add labels, launch Measure \ Create / Edit Label command and then click on the colored object.

The system searches the reference coordinates, the measured coordinates and the 3D distances. This information of coordinates and distances are completed by the tolerance, label number and comment (depending on the label style).

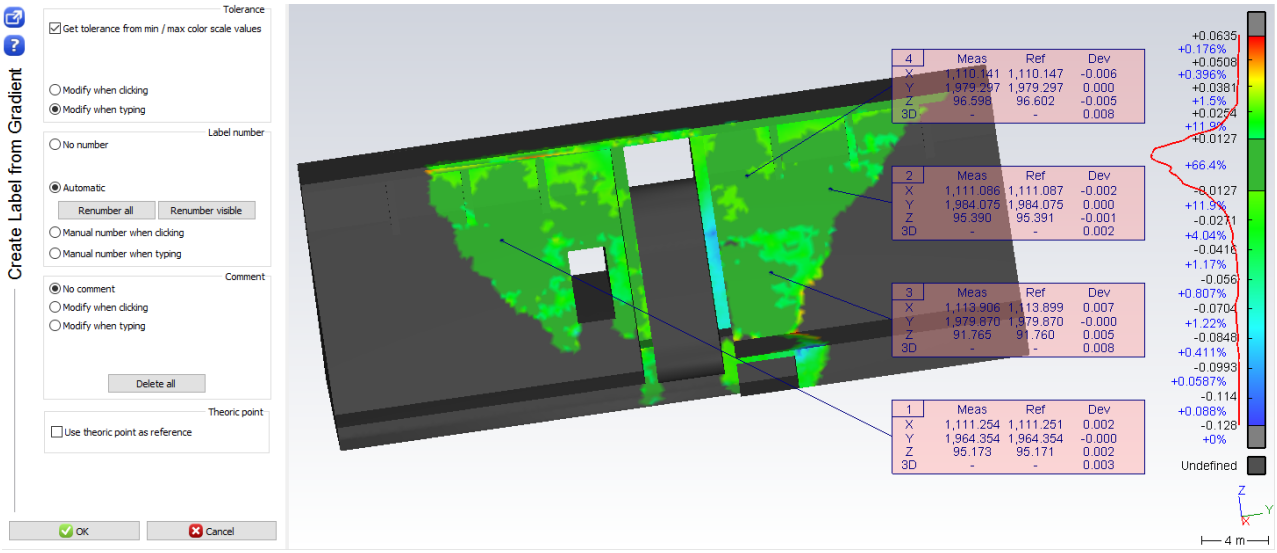


Figure 8: Add labels on specific points

If you want to modify several labels together, for example to set a new tolerance or comment, then select the labels and launch again the command Measure \ Create / Edit Label.

A double-click on a label activates the manual shifting of the label.

5 Edit the aspect of the labels

Launch Measure \ Label Aspect to set labels visual properties. You can modify the aspect of the labels: size, color, layout…

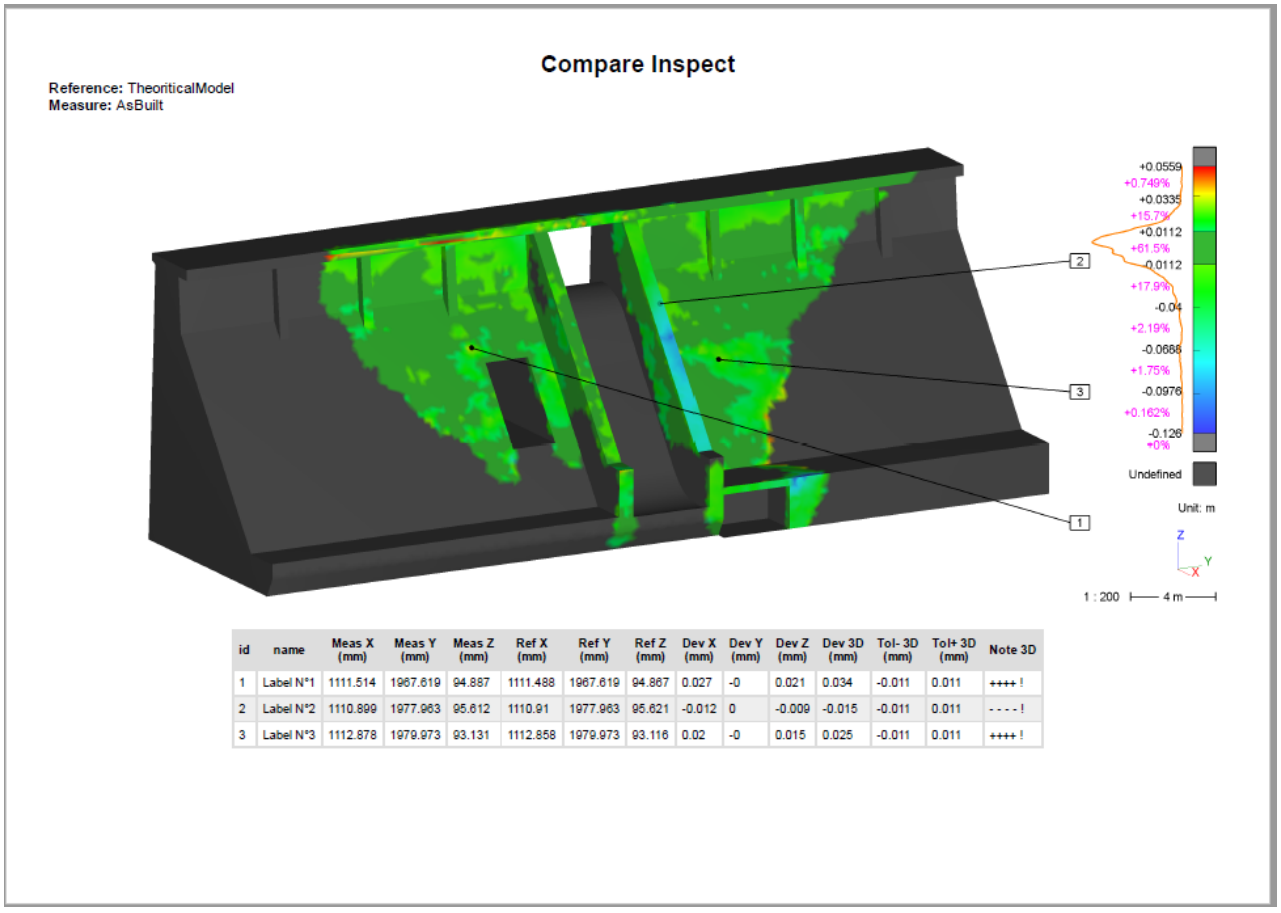
6 Create a report

A report data has been added to the treeview. Orient the 3D scene to show main defects. Then, click on the magnifying glass, corresponding to the report data object which is in the Compare Inspect folder, and update the view. This view will be available within the report editor.

Launch File \ Report Editor and edit your report. For instance:

- Remove the cover chapter (refer to Chapters panel).
- Remove header and footer (refer to Options panel).
- Modify the layout (landscape orientation, reduce the number of decimals).
- Increase the scene ratio (5/2).
- Align the table to the center.

Finally, click on **To PDF** to generate the report. You can also export the table to a .csv file using the Data panel or the button **To CSV**.



id	name	Meas X (mm)	Meas Y (mm)	Meas Z (mm)	Ref X (mm)	Ref Y (mm)	Ref Z (mm)	Dev X (mm)	Dev Y (mm)	Dev Z (mm)	Dev 3D (mm)	Tol- 3D (mm)	Tol+ 3D (mm)	Note 3D
1	Label N°1	1111.514	1967.619	94.887	1111.488	1967.619	94.867	0.027	-0	0.021	0.034	-0.011	0.011	++++ !
2	Label N°2	1110.899	1977.963	95.612	1110.91	1977.963	95.621	-0.012	0	-0.009	-0.015	-0.011	0.011	- - - - !
3	Label N°3	1112.878	1979.973	93.131	1112.858	1979.973	93.116	0.02	-0	0.015	0.025	-0.011	0.011	++++ !

Figure 9: Export the results or/and print a complete report