Importing Polytec data into SCN | AN 68

Application Note to the KLIPPEL Analyzer SYSTEM (Document Revision 1.0)

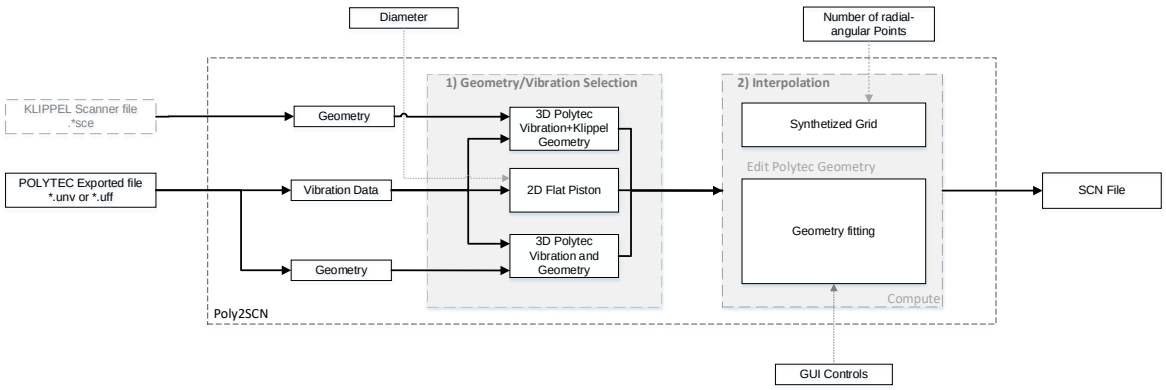
Measurements performed with Scanning Vibrometers are the basis for loudspeaker cone vibration and radiation analysis. Relevant information concerning the loudspeaker behavior can be obtained by performing the decomposition techniques available in the SCN software.

This Application Note provides step-by-step instructions to import vibration and 2D/3D geometry data measured with Polytec Systems into the Klippel Scanner Software by using the POLY2SCN Interface. This application note deals with circular and rectangular drivers.

CONTENT

1 General Procedure

1.1 From universal file to SCN file



Vibration data measured with Polytec Scanning Vibrometers can be imported easily and fast into the Klippel SCN Software using the Poly2SCN Interface. Arbitrary measurement grids generated in the Polytec scanning process can be edited and interpolated to an optimized grid for a suitable post processing using the SCN software.

To generate the SCN file *.ksp from the exported *.unv/*.uff file from a Polytec measurement, it is only required to **load the file** and **edit the geometry** to fit the SCN grid with suitable parameters.

1.2 Objectives

The main purposes of the vibration importing process into the SCN software are:

- To generate an optimized interpolated data set for the Klippel scanner software
- To exploit all the features and benefits of the Klippel scanner software using vibration data measured with different Polytec systems

2 How to Install

For the installation of the Poly2SCN Interface please follow the next steps:

1) Install/Update the dB-Lab RnD version included in the provided pack
2) After finishing the previous installation, run the ***Poly2SCN*** *Klippel Update Package (.klpack).* This action will open the *Klippel Install Helper.*
3) Please select the two items Poly2SCN 1.13 and Poly2SCN.lib 1.13 from the box located at the left side of the window and click Install.
4) After installing the Interface in dB-Lab open the ***Poly2SCNTemplate.kdbx*** database provided. Double click on the *Sample Driver* operation under the *Poly2SCN* object and run it.
5) It will load the Poly2SCN Graphical User Interface, which is now ready to be used.

3 Data Export

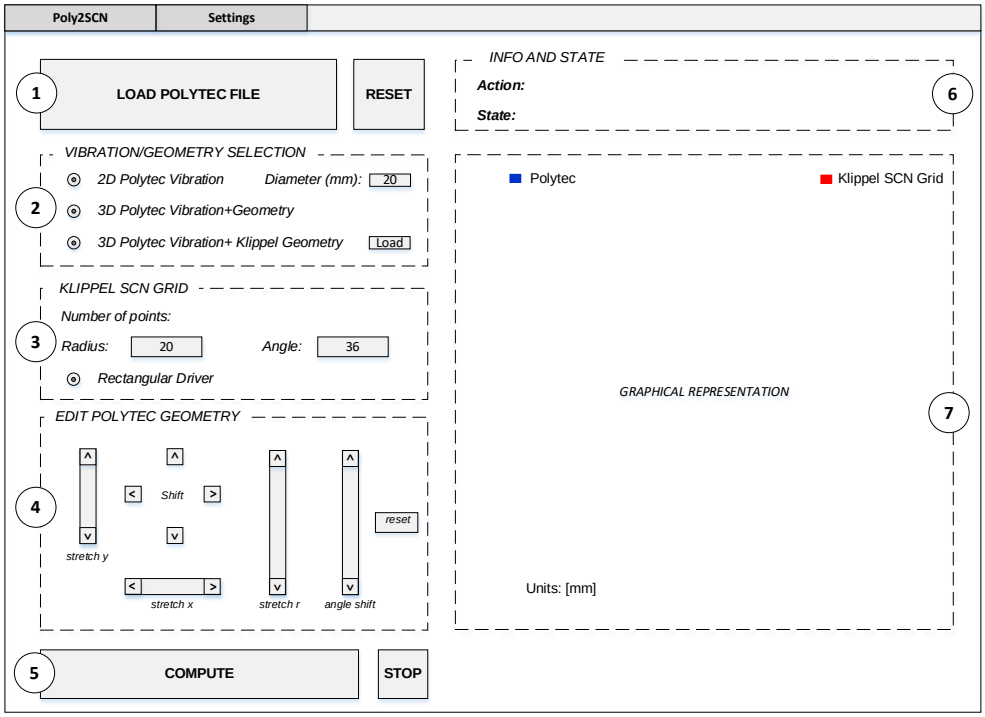
3.1 Import

The vibration and geometry data is read from external **.unv* or **.uff* files. (Please refer to *File format* section of the Specification)

3.2 Synthetized Grid and Interpolation

The interface creates a new grid to combine the Polytec data and Geometry called synthetized grid. The definition parameters of the synthetized grid can be modified via the GUI in the section *EDIT GEOMETRY Number of Points.* The vibration- and geometry data of the scanning files is interpolated to this grid points.

3.3 Use of the GUI



The Poly2SCN consists of an easy to use GUI, designed to do the import data process intuitively and simple, see **Graphical User Interface** section. The GUI consists of seven sections. The first five sections (1-5) allow the user to interact with the interface, loading files, modifying geometry parameters and computing while the sections (6-7) provide information about the state of the process and indicate what to do next and represent data. Each section is described hereafter:

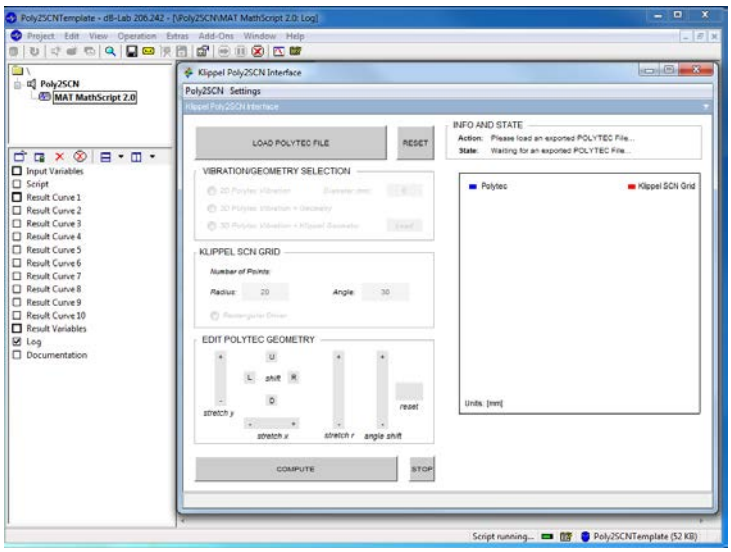
1) Load Polytec File and Reset	LOAD POLYTEC FILE button is the first button that should be pushed by the user. This action will open a browser window which allows to select the Polytec exported *.unv or.*uff file containing the vibration data-geometry to be imported into the Klippel SCN software. RESET. This button sets the interface in the initial state, it will set the parameters to a default value. It deletes the Polytec and Klippel datasets.

2) Export to SCN	EXPORT TO SCN mode allows the user to choose different configurations for exporting data depending on the available information: • *2D Polytec Vibration:* This mode assumes a flat geometry (flat piston approximation). It is used when no 3D vibration data is contained in the Polytec file. In that case the user should specify the **Diameter** of the driver by clicking on the **Diameter edit box** and entering the desired value in the dialog window. Note that the external points of the Polytec data should coincide with this value. If the 3D geometry is contained in the Polytec file, this value will be updated automatically and the user can only click on the OK button. Note that the graphical representation of the data (in section 7) only appears if the user inserts or accepts the diameter. • *3D Polytec Vibration + Geometry:* This mode interpolates the vibration data and the geometry measured with Polytec system on the synthetized grid. (This mode will be only active if 3D geometry data is available in the Polytec file). The graphical representation is displayed automatically. • *3D Polytec vibration + Klippel Geometry:* If a Klippel geometry is available, the Polytec vibration data can be projected onto it by using the synthetized grid. In this case, the Klippel Geometry should be loaded by clicking on the **Load** button. Note that the graphical representation of the data will appear only if the user loads the Klippel geometry.
3) Synthetized Grid	SYNTHETIZED GRID allows the user to modify the parameters (number of points) of the grid that will be used in the interpolation and in the generation of the SCN data. They are defined by: • *Radius:* Number of points to be used in the radial direction • *Angle:* Number of points to be used in the angular direction • *Rectangular Driver:* Used for rectangular geometries such as micro-speakers or TV speakers. It removes the points that are not contained in the Polytec grid area.
4) Edit Polytec Geometry	Due to the angle of incidence of the leaser on the loudspeaker surface, the polytec position points may not be perfectly adjusted to the geometry of the transducer, for this reason some small modifications should be done to reach the best fitting in between the measured distribution and the synthetized grid. This section provides a set of tools that can be used to modify the Polytec geometry. The action of the controls will be reflected immediately in the plot window (section 7). The controls are: • *Shift:* Displacing the geometry up, down, left and right as indicated by the buttons. • *Stretch x:* Stretching or compressing the geometry in x direction. • *Stretch y:* Stretching or compressing the geometry in y direction. • *Stretch r:* Stretching or compressing the radius of the geometry. • *Angle shift:* Rotating the geometry. • *Reset:* Returns all the edit geometry parameters to its initial states.
5) Compute-Stop	Click on **COMPUTE** button starts the data loading, the frequency interpolation and the spatial interpolation process. This button should be pushed when the best fitting has been reached with the geometry. This action generates the *.ksp (Klippel Scanner Project), *.sce and the binary files that can be opened with the Klippel SCN Software. The stop button will abort the computation. When the exporting data is finished, a new

	message window is opened allowing to the user to open the exported data with SCN software or to open the folder containing the generated file. ***Important Note:*** *Please use standard characters when calling the files and folders to be used for the interface.*
6) Info and State	Some messages regarding the actions that should be taken by the user (**Action:** line) as well as information about the state of the Interface (**State:** line) will be displayed here.
7) Graphical Representation	In this section will be plotted the Synthetized grid (in red) and the Polytec point distribution (in blue) and is to be used to see in real time the modification of the geometry using the controls in sections 3 and 4. The menu **POLY2SCN** can be used to close the window. In the **Settings** menu the **Number of Frequencies** option can be found which allows to type the number of frequencies to be exported, that will be logarithmically distributed in the complete spectrum provided by the Polytec file. By default this value is 200 frequencies.

4 Use of the Interface

4.1 Launch POLY2SCN Interface



After installing the Interface, please open the Poly2SCN_template database, which contains the Object Poly2SCN and the operation *Sample Driver.*

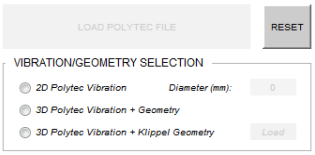
To launch the Interface click on the operation and run it. (In this application note, the *Sample Driver 2D/3D* is used which can be found in the *Samples* folder provided in the Installer pack). Note that the name of the operation can be changed to a desired name; it will as well modify the name of the SCN file to be created.

Once the interface is started, it is blocked until the user loads the Polytec File. Note that the section INFO AND STATE displays the Action to be taken next and the State of the interface in this case: **Action:** *Please load an exported POLYTEC File…*and **State:** *Waiting for an exported POLYTEC File…* note that the plot axes does not contain any data.

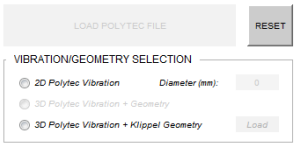
5 Step-by-Step Instructions

5.1 Loading Polytec File

Load the Polytec file by clicking the LOAD POLYTEC FILE button. This process opens an Explorer window in which the *.unv/*.uff file should be selected. If the file contains 3D geometry data, all three options in the EXPORT TO SCN section will be enabled but if the file contains no 3D data, the *3D Polytec Vibration + Geometry* mode is not enabled.



Polytec data with 3D Geometry

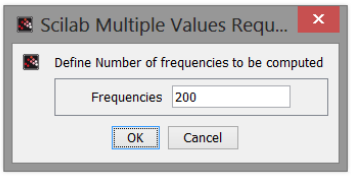


Polytec data with only 2D Geometry

Please note that when the Polytec file is loaded the LOAD POLYTEC BUTTON is inactive. If a new file needs to be loaded, the RESET button will set the Interface in the Initial state allowing the user to choose another Polytec file.

5.2 Number of frequencies

In some cases, a linear distribution of frequencies in the spectrum of analysis leads to an excess of resolution at high frequencies producing redundancy in the data to be analyzed and it requires large memory space to be processed. To avoid that, Poly2SCN takes a reduced set of frequencies logarithmically distributed along the bandwidth measured by the Polytec System. Change the number of frequencies to be imported in the SCN Software by going to -> *Settings* menu in the upper left corner of the interface and select -> *Number of Frequencies*.



By default the value is set to 200 frequencies, please change the value to a suitable number and click ok.

5.3 Selecting Export mode

Choose one of the three exporting modes available in the Poly2SCN Interface:

2D Polytec Vibration

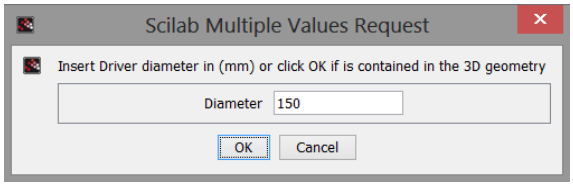
3D Polytec Vibration and Geometry

3D Polytec Vibration + Klippel Geometry

If *2D Polytec Vibration* mode is selected:

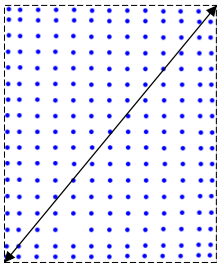
The first mode is suitable for data containing no 3D geometry information. This vibration data will be interpolated onto a flat piston. In that case the relative Polytec geometry needs

to be adapted to an absolute grid with defined dimensions by using the diameter of the measured driver. (Note that the external point of the data should coincide with the specified diameter). To do that click in the diameter value box and insert the value in mm in the emergent window:



Once the Diameter Values are specified, **the Polytec and the Klippel SCN Grid are plotted in the Visualization axes**. The interface is ready for the next step.

If the **Measured driver is rectangular**, the diameter to be specified should be the diagonal connecting the lower and upper opposite corners as follows:



Note: If the file contains 3D data the diameter will be automatically updated and the user only has to click on the OK Button.

If *3D Polytec Vibration and Geometry* mode is selected:

This mode is only enabled if the Polytec file contains 3D geometry data.

The Polytec and the Klippel SCN Grid are directly displayed in the axes and the interface is ready for the next step.

If *3D Polytec Vibration + Klippel Geometry* mode is selected:

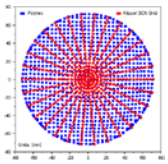
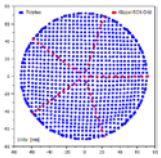
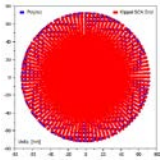
This mode is useful when Polytec vibration data is available for a driver which geometry was measured with a Klippel SCN software.

If this mode is selected, the LOAD button in front of it will be automatically enabled and will be used to find the Klippel geometry *.sce file. Once this operation is finished, **the Polytec data and the synthetized grid will be plotted in the visualization axes**. The interface is ready for the next step.

5.4 Klippel SCN Grid Parameters

This step is the same for all the modes that could be chosen above. After completing step 2, the interface should display the Polytec and the Klippel SCN Grid.

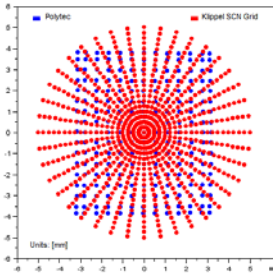
Select the number of radial and angular points by clicking on the *Radius* and *Angle* edit text boxes of the KLIPPEL SCN GRID section and press enter each time the value is changed. Note that the red points corresponding to the Klippel SCN grid will be automatically updated to the parameters specified by the user.

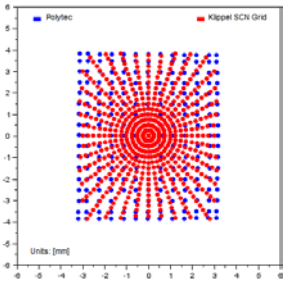




The red points should be dense enough to capture the characteristics of the Polytec grid as much as possible, but it should not be more dense than the Polytec grid since it will cause strange behavior in the interpolating data. A good compromise for this example can be found in the left figure. Not suitable distributions are shown in the center and the right pictures.

Rectangular driver:

If the measured file has a rectangular shape such a micro-speaker or a TV speaker, please select the *Rectangular Driver* option.

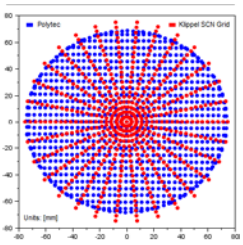


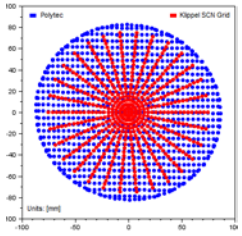


This option will remove the points, which are not contained in the Polytec data. This operation disables the synthetized grid section, if some modifications in the number of radii or angles are required, the user can disable the radio *Rectangular Driver* button to unlock the edit boxes of this section. Once the changes are the desired ones, the *Rectangular Driver* option can be activated again.

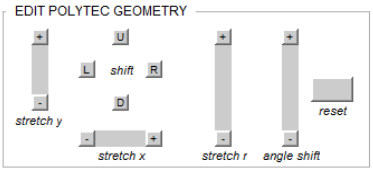
5.5 Matching Polytec Geometry

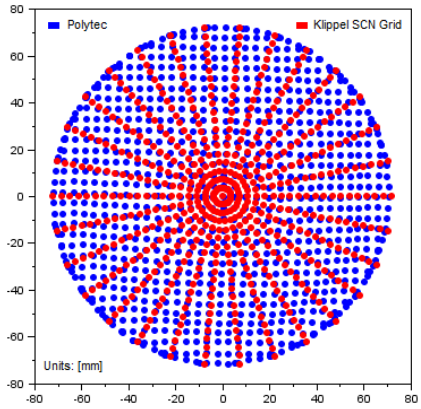
Some Polytec measurements are carried out at some considerable distances from the driver and the sensor could not be located totally perpendicular to the vibrating surfaces producing irregular shapes:





To correct some of these imperfections, use the edit controls located in the EDIT POLYTEC GEOMETRY section to adjust the Polytec geometry to the Klippel SCN Grid. It will require some vertical or horizontal shifting, stretching or compressing and rotation of the geometry. (Special attention should be paid to the external points.)



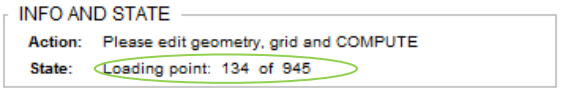


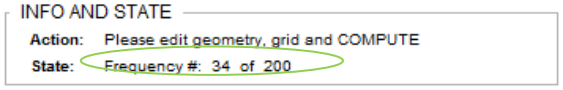
5.6 Computing and opening the results in SCN

Once the Polytec Geometry fits with the Klippel SCN Grid, the data can be exported to the SCN Software by clicking on COMPUTE button. This action could take some time, depending on the number of points scanned by the Polytec System. Note that all the functions of the Poly2SCN are disabled during exporting process.

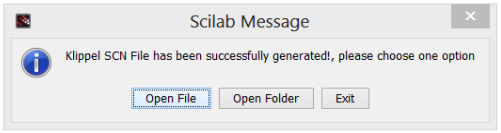
If the STOP button is pressed, the interface will ask if the user is sure to stop the loading process, if the answer is yes, the Edit geometry and the Synthetized grid buttons are enabled again allowing the user to perform some modifications. The user can COMPUTE at any moment, starting the loading process from the beginning.

Note that the section INFO AND STATE of the interface provides detailed information about the progress of the computation.





When the computation is finished the next window is opened:

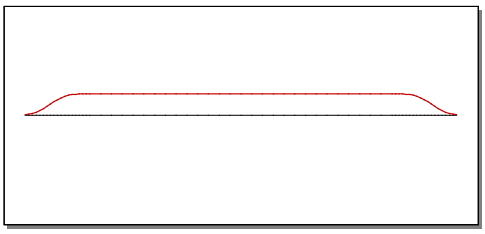


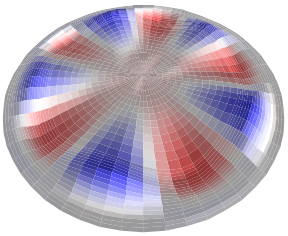
Please Click **Open File** or **Open Folder** to visualize the generated file in the Klippel SCN Software or in the explorer folder.

When the export process is finished, the interface enables the RESET button allowing the user to load a new Polytec file.

6 Viewing Results

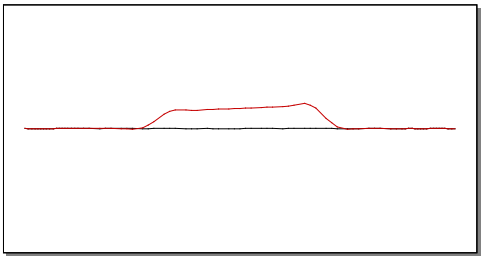
6.1 2D Polytec Vibration

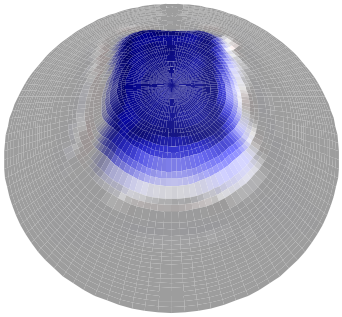


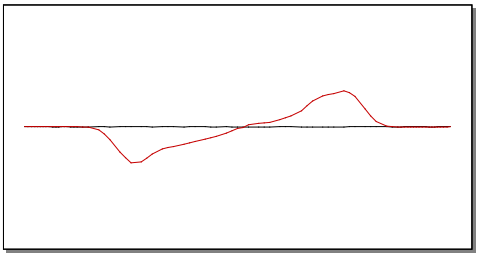


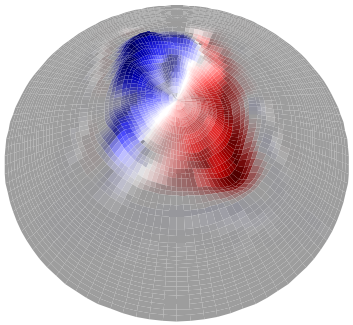
Once the generated *.ksp is opened it can be used as a normal scanner project (as if measured with the Klippel measurement system). All the features of the SCN software can be used with this data. Note that this mode does not contemplate 3D geometry but only the driver diameter in the exporting process.

Results for the rectangular driver:

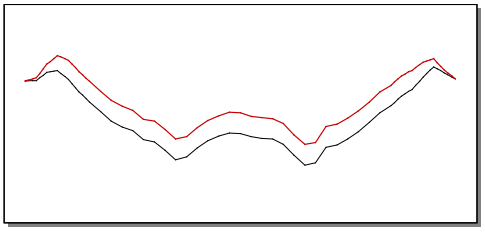


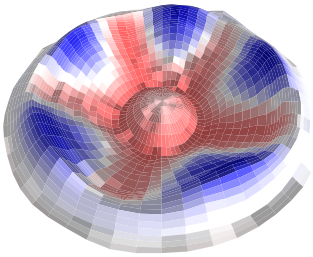






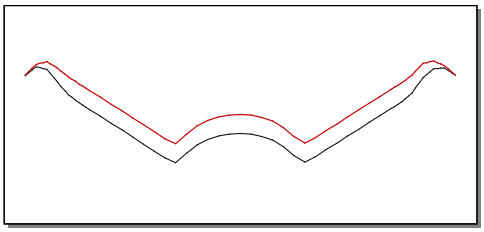
6.2 3D Polytec Vibration and Geometry

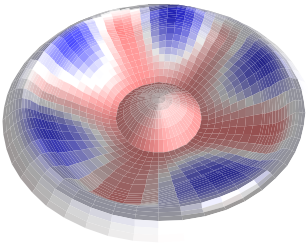




	In this case, all the Polytec data; Vibration and 3D geometry are exported.

6.3 3D Polytec Vibration + Klippel Geometry

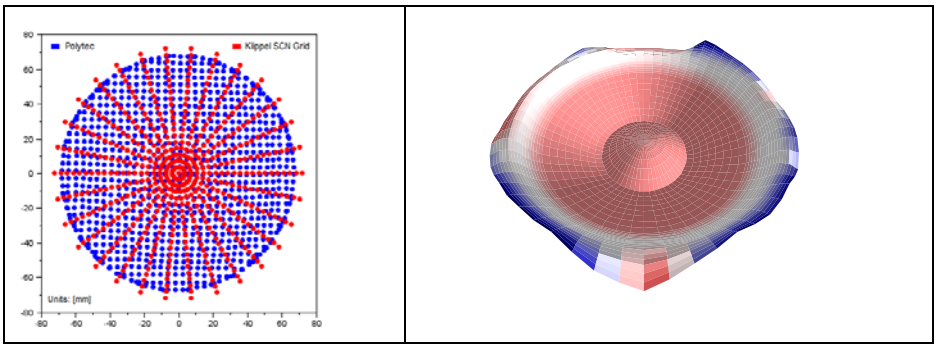




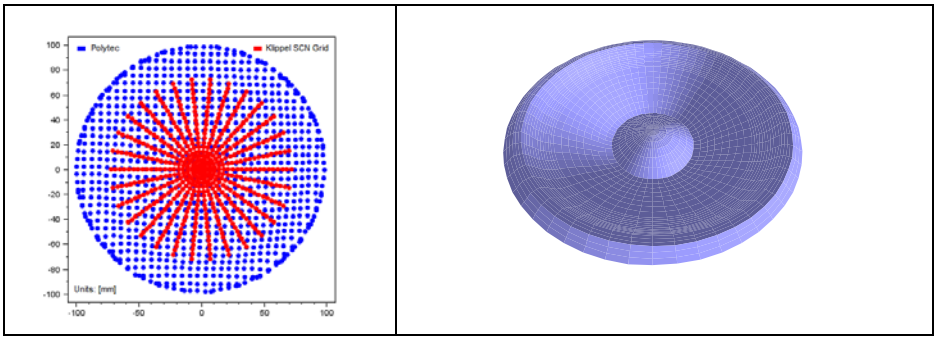
In this case, the Polytec Vibration data is interpolated on the Geometry measured by the displacement sensor provided by Klippel.

7 Possible errors in the exporting process

7.1 No accurate geometry fitting



The Polytec Geometry is not filling all the points of the Klippel SCN Grid producing unexpected behavior of the interpolation in the points where no data is found. In the example above, in the external part of the driver the interpolation generates changes of amplitude that are not included in the measured Polytec data.



The Polytec data is larger than the Klippel SCN scanner grid. In this case, the exported data will not capture the total dynamic behavior of the Driver since part of the information is being lost out of the grid. In the example, the rigid body motion produces exactly the same displacement for the boundary of the driver (surround attachment point) which is not realistic since this point should remain quasi-static.

8 More Information

Software Documentation	[1] Specification of the Klippel Scanning System, see www.klippel.de [2] Manual of the Klippel Scanning System, included in the software installation
Related Application Notes	[3] AN31 – Cone Vibration and Radiation Diagnostics

Find explanations for symbols at:

http://www.klippel.de/know-how/literature.html

Last updated: 1.6.2017