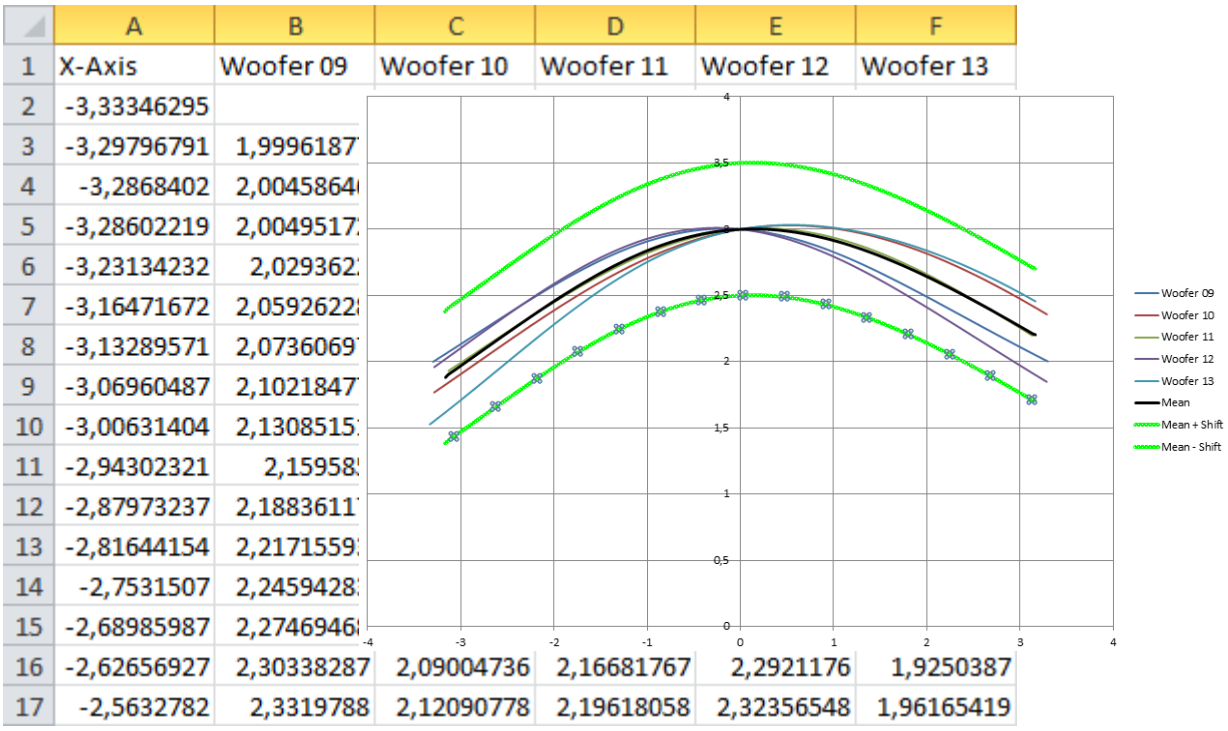
Data extraction and post processing AN43

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

There are various applications where additional software (e.g. Excel) shall be used as a postprocessor for data measured using the KLIPPEL Analyzer System. For example visualization of multiple measurements, statistics or report generation. For this purpose, KLIPPEL provides a data extraction tool *db extract* that allows storing measured data in text files, which can be read and imported by a wide range of applications.

This application note is a step by step introduction for the extraction, import and processing of measured curves in spreadsheet software (Excel). Only curves are extracted in this application note. The export of single values possible using the settings file “Single Value Extraction” (part of *db extract*’s installation).



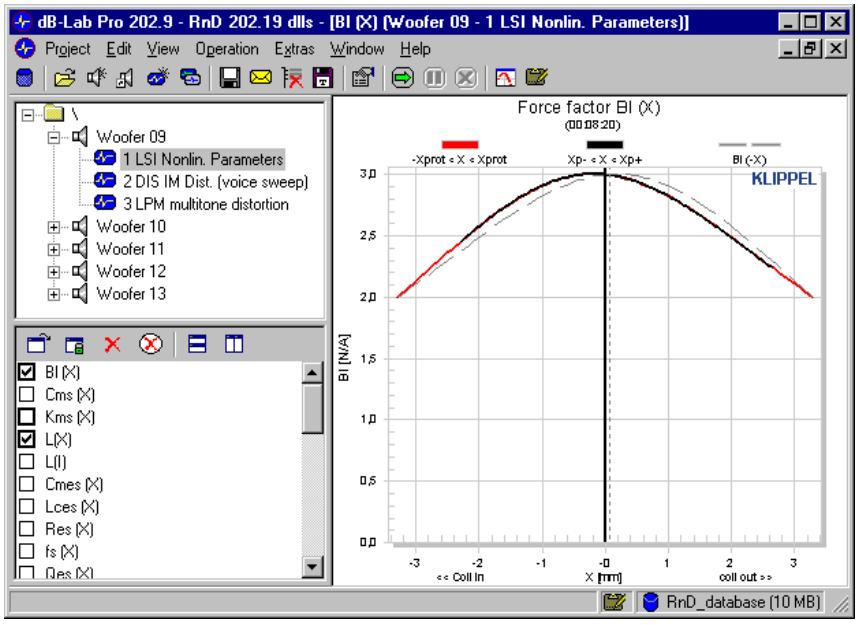
	A	B	C	D	E	F
1	X-Axis	Woofer 09	Woofer 10	Woofer 11	Woofer 12	Woofer 13
2	-3,33346295					
3	-3,29796791	1,9996187				
4	-3,2868402	2,0045864				
5	-3,28602219	2,0049517				
6	-3,23134232	2,029362				
7	-3,16471672	2,0592622				
8	-3,13289571	2,0736069				
9	-3,06960487	2,1021847				
10	-3,00631404	2,1308515				
11	-2,94302321	2,15958				
12	-2,87973237	2,1883611				
13	-2,81644154	2,2171559				
14	-2,7531507	2,2459428				
15	-2,68985987	2,2746946				
16	-2,62656927	2,30338287	2,09004736	2,16681767	2,2921176	1,9250387
17	-2,5632782	2,3319788	2,12090778	2,19618058	2,32356548	1,96165419

CONTENT

1 Requirements

Start Up	To perform the data extraction, please follow these steps: • Install *db extract* on your computer. • Example data is enclosed to this application note, but other databases (R&D and QC databases may be extracted as well). • In this example, we will use Excel as post processing software.

2 Measurement in KLIPPEL dB-Lab

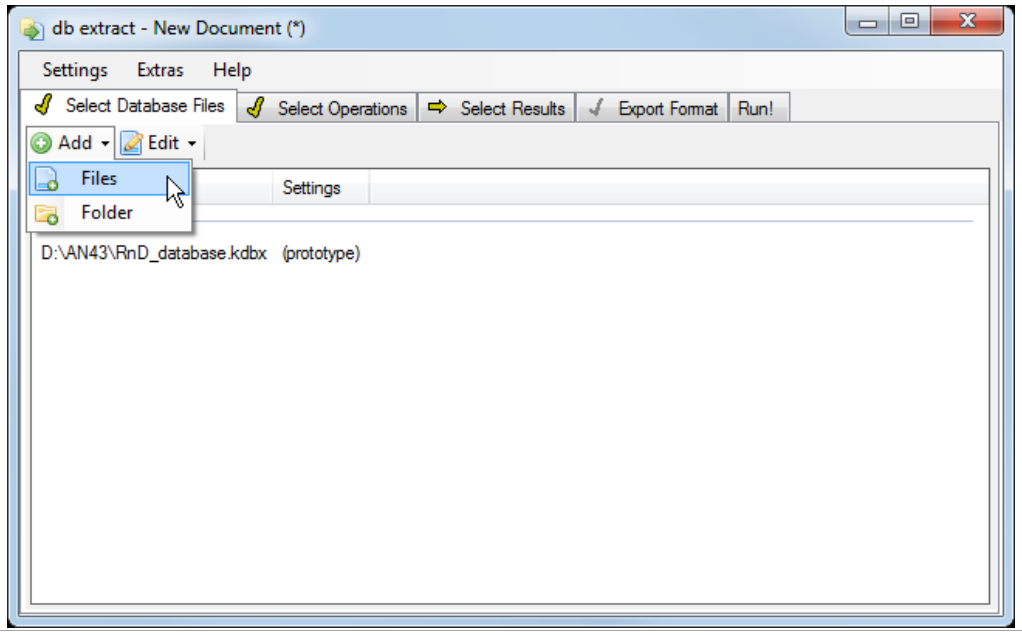
Measuring multiple speakers	For this example, we measured some woofers with following modules: • LSI – for the nonlinear parameters Bl(x), Kms(x) and L(x) • DIS – for harmonic and intermodulation distortion • LPM – for multitone distortion  This set of measurements will give us a good overview of the speakers' properties.

3 Data Extraction

Motivation	Using KLIPPEL databases measurement results, it is possible to evaluate each speaker individually. But for many purposes it is necessary process the data in 3rd party software. Therefore, it is necessary to collect and extract the required data to an open format. In the following steps we will export the measured DIS, LPM and LSI curves of all speakers into text files. We will import those files into Excel to do some very basic statistic calculations, draw some charts and calculate limits using a macro. Furthermore, we will show how to re-import curves calculated in Excel into dB-Lab.

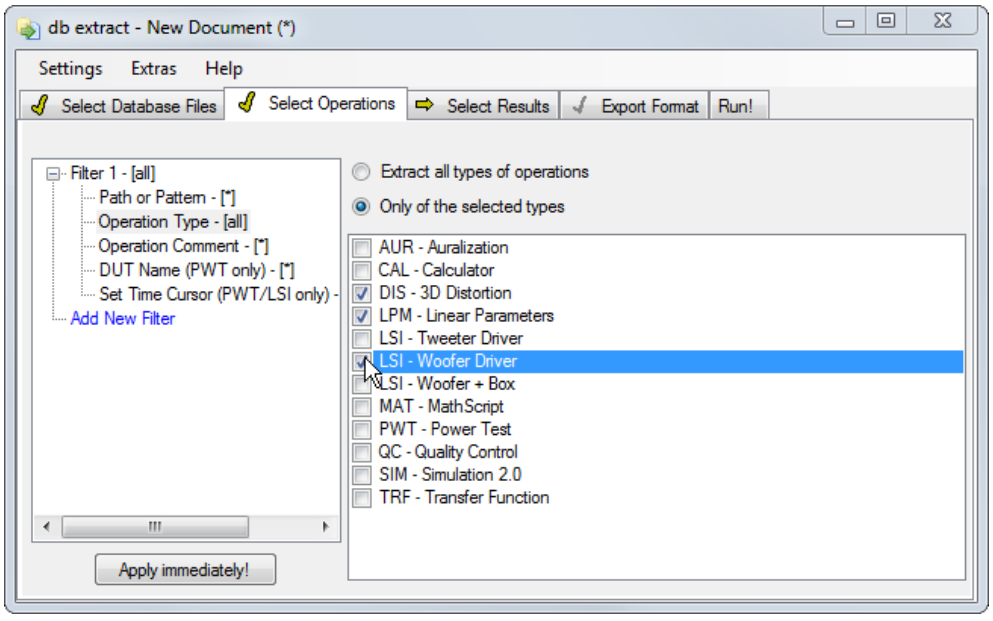
Select the database files

How to do it: Start *db extract* and create a new settings file by selecting 'Settings→New' from the menu. Add the database(s) containing the measured data.



Select Operations

How to do it: Select the filter 'Operation Type' of Filter 1 in the next tab page 'Select Operations'.



Using this filter, it is possible to select the type(s) of measurement operations we want to export. As described above, we are only interested in DIS, LPM and LSI – Woofer measurements. Using this filter will avoid extracting data from other operation types by accident if undesired operations are included in the input data.

Select Results

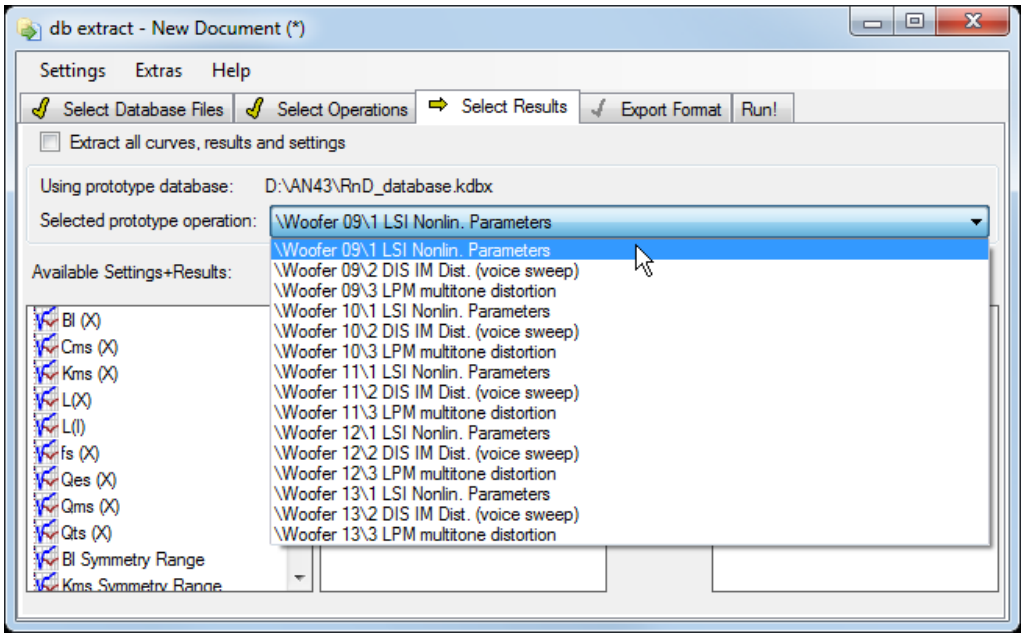
How it works: Go to the next tab page 'Select Results'.

On this tab page we will select which curves to export. This works by first selecting a measurement operation from a database as prototype. In the second step one can select curves from the available charts in that 'prototype operation'.

Later, during the extraction run, all selected operations in all databases will be checked whether these selected curves are available. If they are, the data will be extracted.

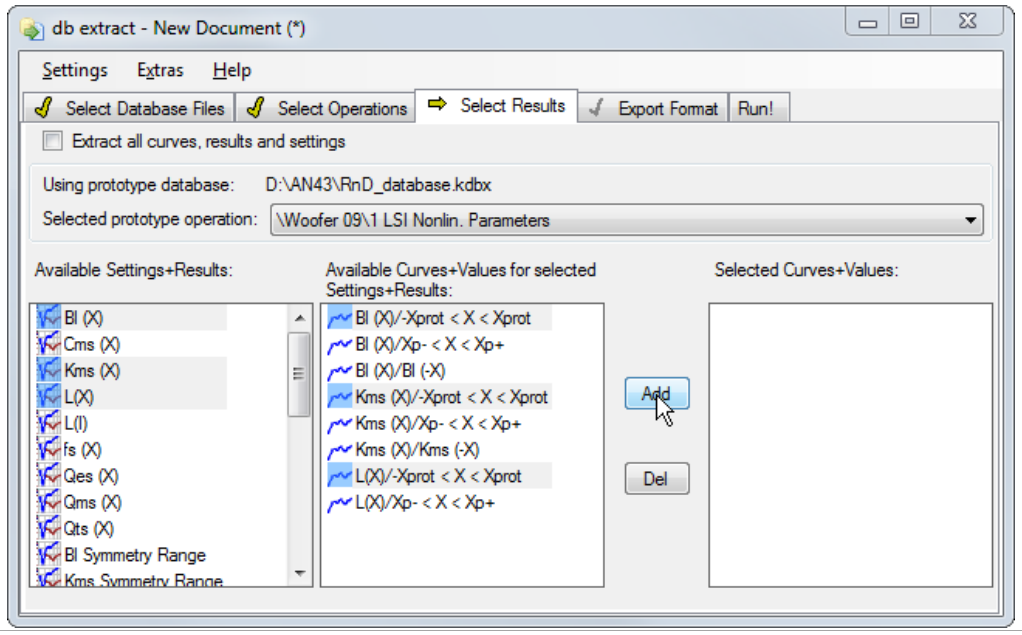
The user interface shows: Using prototype database: "…\RnD_database.kdbx" and below that: Selected prototype operation: "\\Woofer 09\1 LSI Nonlin. Parameters".

From the dropdown box you can select any operation available in the prototype database. In case, we selected more than one database, we could choose one as prototype on the 'Select Database Files' tab.

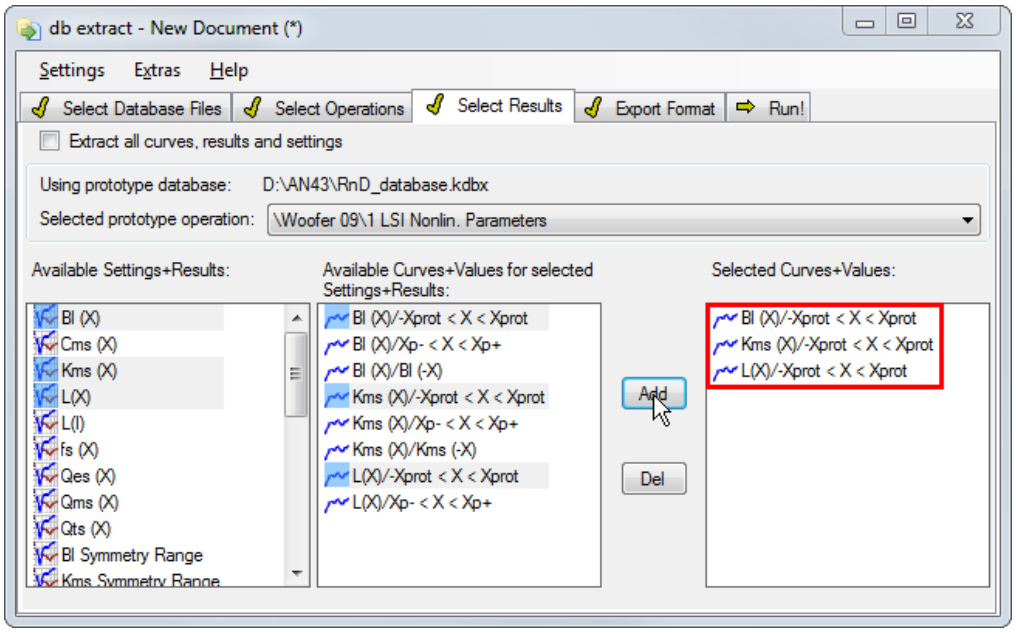


Selecting curves:

First we select any LSI operation. From the available charts we select 'Bl(X)', 'Kms(X)' and 'L(X)'.

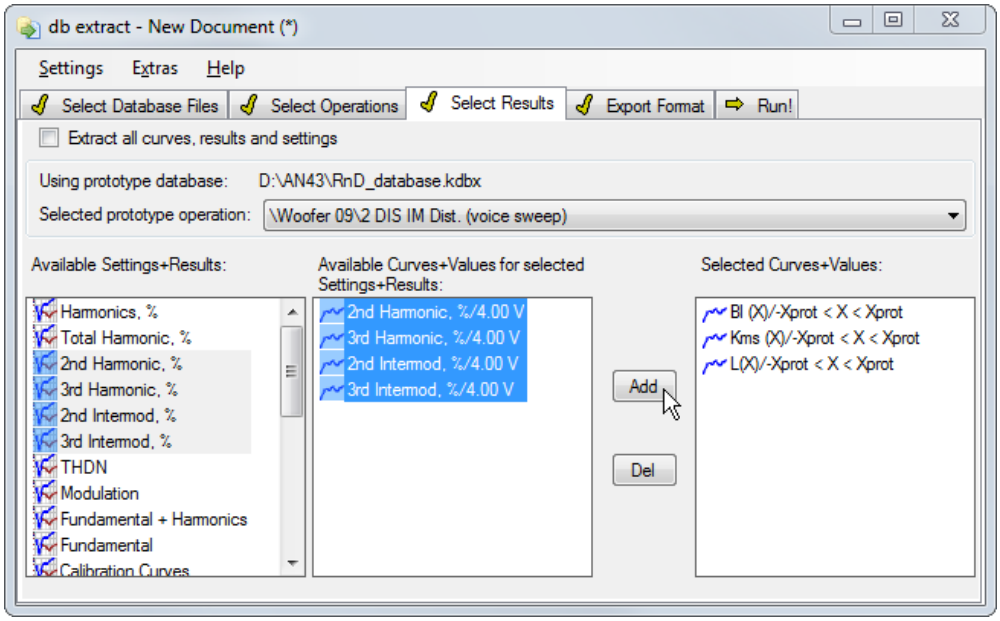


After using the 'Add' button, the selected curves are shown in the selected list.

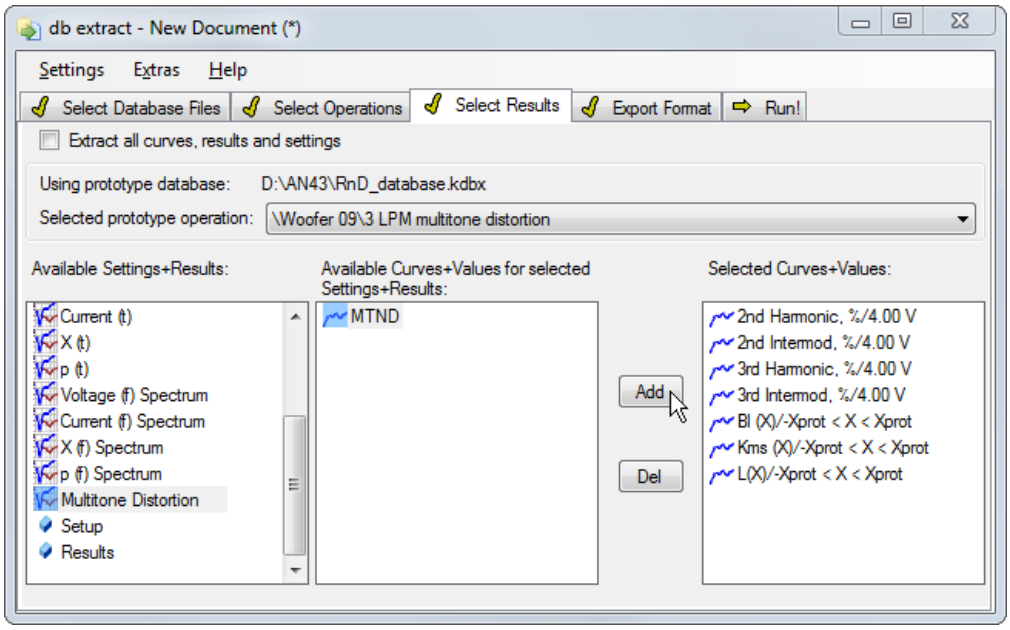


Selecting DIS and LPM Results

Select any DIS Operation from the dropdown box, and select the curves as shown below:



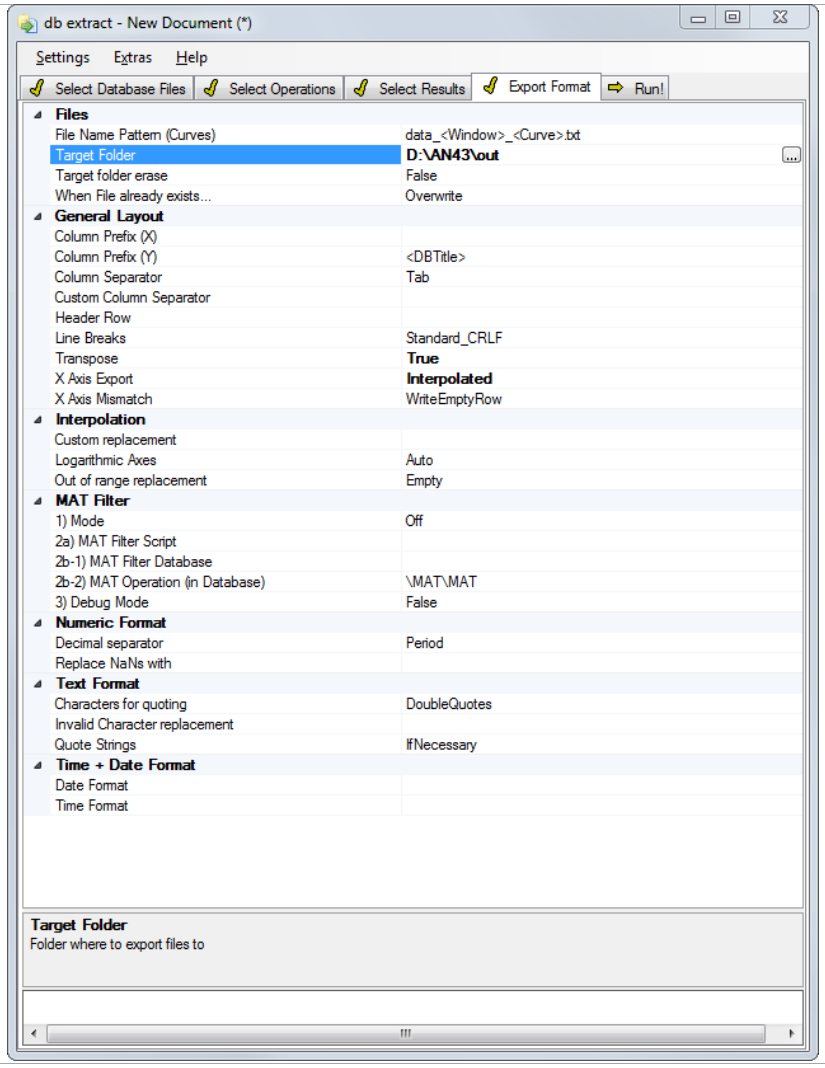
To select the Multitone Distortion Curve, choose any LPM Operation from the dropdown box and add the curve.



Export Format Settings

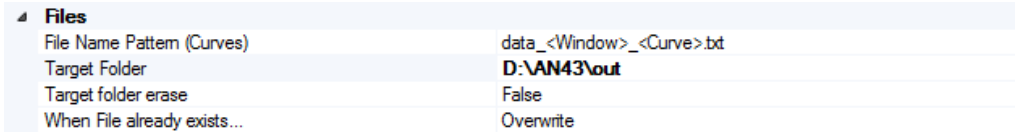
Till now, we only selected the data to extract from the KLIPPEL Databases – now it is time to define how to write the data into the text files.

The 'Export Format' tab holds many options to define the output format:



Export Format "Files"

File Name Pattern (Curves) defines not only how the exported files are named but which curve data is written to which file.



In our example, we will leave the default setting "data_<Window>_<Curve>.txt" which means that only curves with the same name from an equally named window are stored in the same file.

<Window> and <Curve> are tokens that will be replaced during the extraction.

Thus, we will generate following export files:

- data_2nd Harmonic, %_4.00 V.txt
- data_2nd Intermod, %_4.00 V.txt
- data_Bl (X)_-Xprot _ X _ Xprot.txt
- data_Multitone Distortion_MTND.txt.

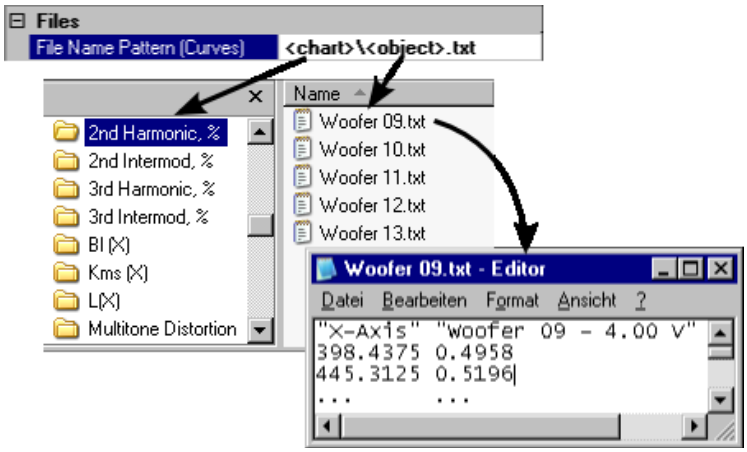
There are various replacement tokens to fine-tune the output. Please refer to the manual section 'Export Format Tokens'.

Select a **Target Folder** to store the extracted data in.

Using **Target Folder erase,** the target folder will be moved to the recycle bin before extraction. (This is useful to avoid confusing new with old data after multiple extraction runs.)

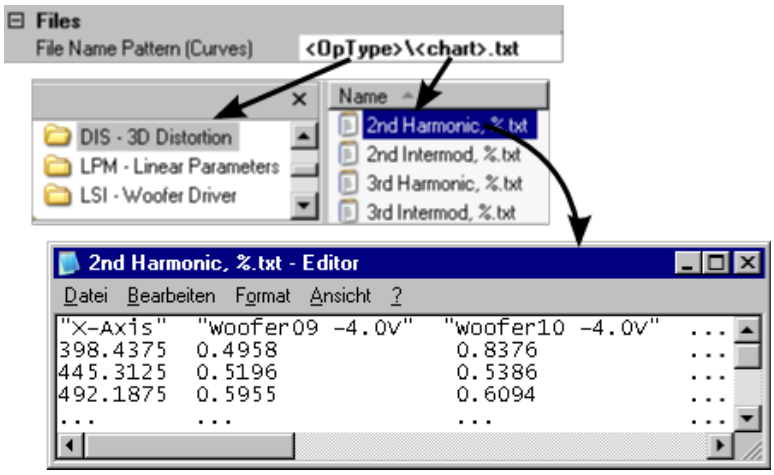
Other File Name Pattern Examples:

Using the "<chart>\<object>.txt" file name pattern, a folder for each chart is created. These folders contain a text file for each measured object. This text file would then contain all the selected curves in the chart (only one in our example).



The "<OpType>\<chart>.txt" file name pattern generates a folder for each of the measurement modules (DIS, LPM and LSI). The folders contain one text file for each chart created by the corresponding module.

In the text file you can find the curves of all measured drivers.



These examples are showing that the file name pattern allows defining how the curve data is stored in the file system structure. It is possible to create folders, subfolders and text files. One text file can contain one or multiple curves of the same or different types.

General Layout

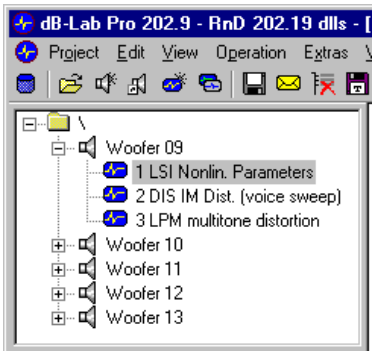
The **General Layout Section** defines how the extracted files are formatted.

General Layout	
Column Prefix (X)	**X-Axis**
Column Prefix (Y)	**<ObjectName>**
Column Separator	Tab
Custom Column Separator	
Header Row	
Line Breaks	Standard_CRLF
Transpose	**True**
X Axis Export	**Interpolated**
X Axis Mismatch	WriteEmptyRow
Interpolation	
Custom replacement	
Logarithmic Axes	Auto
Out of range replacement	Empty

To understand all the options, it is good to have an idea how the extraction works.

Generally, all data is written line-wise (row-wise). (This can only be changed by activating the Transpose option – see below.)

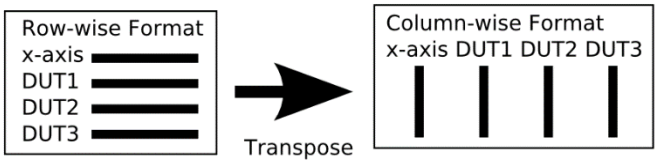
The measured curves always consist of two vectors, the x-axis and the y-axis values. Each of those is written in a line. It is possible to add a **Column Prefix** to each line saying 'this is the x-axis' or 'this is the data of speaker …'. In our example, we will do this by using the <ObjectName> replacement token. The object is the parent note of the operation - in our case this 'Object' is the driver we measured (e.g. 'Woofer 09', 'Woofer 10', etc.).

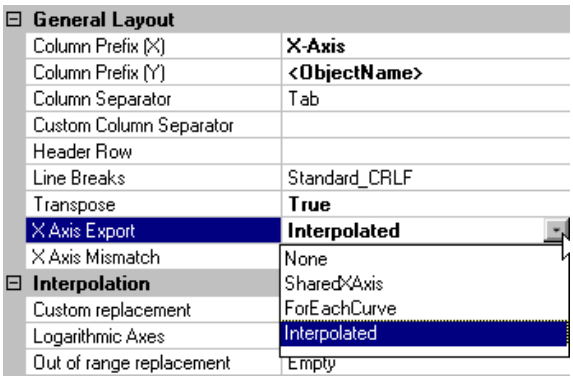
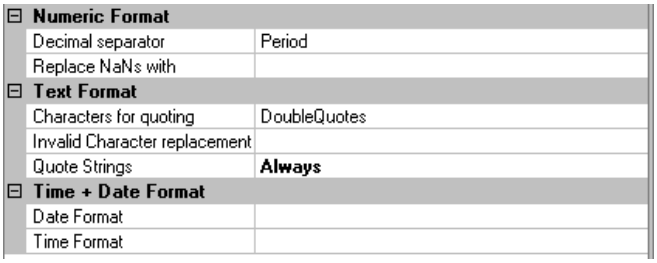


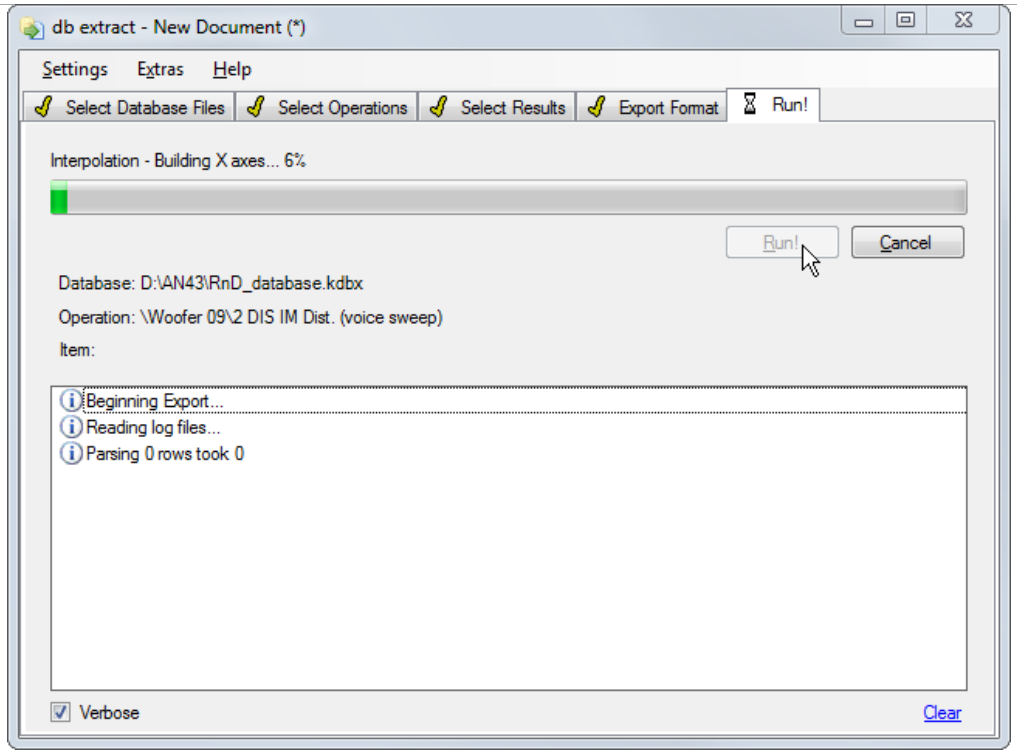
Using the options **Column Separator**, **Custom Column Separator** and **Line Breaks**, it is possible to select which characters are used to separate the columns and lines in the text file. What character to use here depends on your target software (e.g. Excel). The default values as shown above should be fine for us.

The parameter **Header Row** can be used to add a header to the text file before writing the data.

In our example, **Transpose** has to be set to **True**. This will change the format of the output files from row-wise to column-wise after the extraction by performing a matrix-transposition. This is necessary for compatibility with older versions of Excel. (Those have a limited number of available columns – which causes trouble when importing curves with a large number of points.)

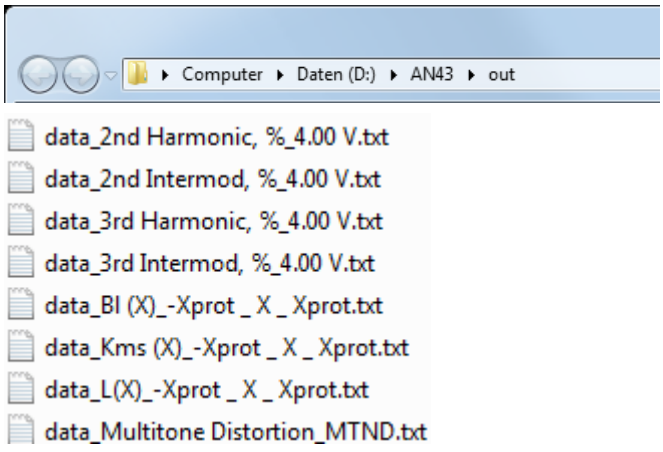


X-Axis Export	There are several possibilities to export the X-axes of the curves in one file.  As shown, it is possible to export no x-axis at all or one for each curve - both can be useful in some cases but in our case we want to do some calculations in Excel. Thus, one single x-axis is required for all y-axes in one file. This is no problem for the DIS and LPM measurements, as the y-values were measured at the same x-axis values (frequencies). This happened because the same set-up was used for all the measurements. Thus, all these measurements have the same x-axis scaling. However, the LSI curves like 'Bl(X)', 'Kms(X)' and 'L(X)' do not have the same x-values. To do calculations with these curves, it is necessary to create a new x-axis for all of these measurements and calculate the y-values at the new x-axis points using interpolation.
Format Strings	The lower part of this table contains options to format numbers, dates, times and texts as required. Important for our example is the **decimal separator.** On most of the systems **period** is fine but on some systems it needs to be set to **comma**. This depends on your local language theme and your Excel version. Change this option if Excel does not import the data as expected. (Have a look at 'Problems with Excel' section in the chapter 'Post processing in Excel'.) 
Start the Extraction	Go to the 'Run!' Tab and click the 'Run!' Button.



If everything is configured correctly, the extraction should start.

After the extraction is complete, the 'View Results' button appears - click on it to open the target folder in Windows Explorer. This folder contains all the extracted curve files and the extraction log file which provides the same information as the list box shown above.

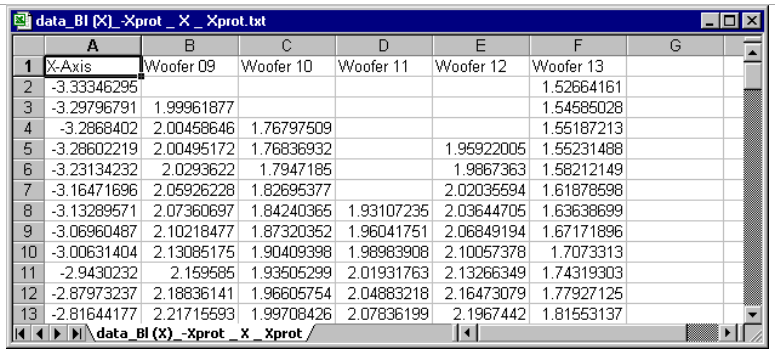


These output files can now be used in 3rd party software – as we will show in the next section.

Hint: Save the settings in a file by selecting 'Settings→Save' from the menu. This will save a lot of time next time you have to perform a similar extraction task.

4 Post processing in Excel

Use of macros	Open the file "KLIPPEL Macros.xls" in Excel and activate macros. Open one of the extracted files in Excel as well. If everything goes alright, you should see some table like this (If Excel does not import the data as expected, read the 'Problems with Excel' section below):

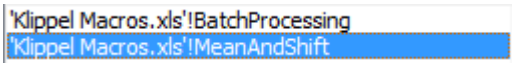


data_BI (X)_-Xprot _ X _ Xprot.txt

	A	B	C	D	E	F	G
1	X-Axis	Woofer 09	Woofer 10	Woofer 11	Woofer 12	Woofer 13	
2	-3.33346295					1.52664161	
3	-3.29796791	1.99961877				1.54585028	
4	-3.2868402	2.00458646	1.76797509			1.55187213	
5	-3.28602219	2.00495172	1.76836932		1.95922005	1.55231488	
6	-3.23134232	2.0293622	1.7947185		1.9867363	1.58212149	
7	-3.16471696	2.05926228	1.82695377		2.02035594	1.61878598	
8	-3.13289571	2.07360697	1.84240365	1.93107235	2.03644705	1.63638699	
9	-3.06960487	2.10218477	1.87320352	1.96041751	2.06849194	1.67171896	
10	-3.00631404	2.13085175	1.90409398	1.98983908	2.10057378	1.7073313	
11	-2.9430232	2.159585	1.93505299	2.01931763	2.13266349	1.74319303	
12	-2.87973237	2.18836141	1.96605754	2.04883218	2.16473079	1.77927125	
13	-2.81644177	2.21715593	1.99708426	2.07836199	2.1967442	1.81553137	

data_BI (X)_-Xprot _ X _ Xprot

Start the 'MeanAndShift' macro  :



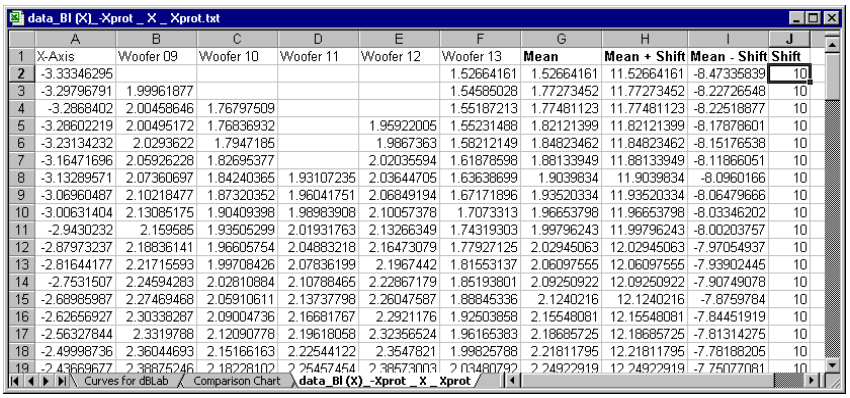
'Klippel Macros.xls'!BatchProcessing
'Klippel Macros.xls'!MeanAndShift

Post processing results

Running the macro will generate 4 new columns in the current sheet and 2 additional spreadsheets.

The columns contain:

- the mean curve calculated of the measured curves (left),
- a shift curve (right) and
- two curves containing the mean curve shifted up and down the shift values.



data_BI (X)_-Xprot _ X _ Xprot.txt

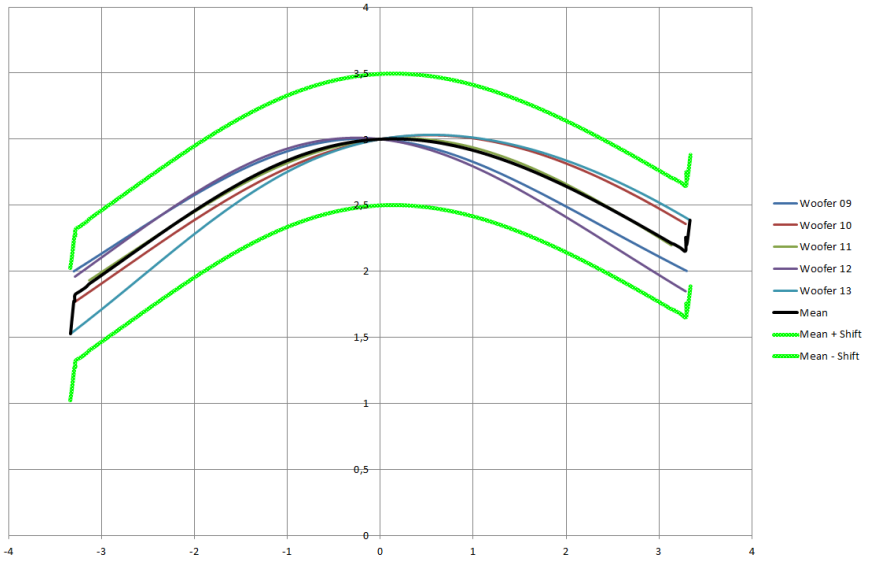
	A	B	C	D	E	F	G	H	I	J
1	X-Axis	Woofer 09	Woofer 10	Woofer 11	Woofer 12	Woofer 13	Mean	Mean + Shift	Mean - Shift	Shift
2	-3.33346295					1.52664161	1.52664161	11.52664161	-8.47335839	10
3	-3.29796791	1.99961877				1.54585028	1.77273452	11.77273452	-8.22726548	10
4	-3.2868402	2.00458646	1.76797509			1.55187213	1.77481123	11.77481123	-8.22518877	10
5	-3.28602219	2.00495172	1.76836932		1.95922005	1.55231488	1.82121399	11.82121399	-8.17878601	10
6	-3.23134232	2.0293622	1.7947185		1.9867363	1.58212149	1.84823462	11.84823462	-8.15176538	10
7	-3.16471696	2.05926228	1.82695377		2.02035594	1.61878598	1.88133949	11.88133949	-8.11866051	10
8	-3.13289571	2.07360697	1.84240365	1.93107235	2.03644705	1.63638699	1.9039834	11.9039834	-8.0960166	10
9	-3.06960487	2.10218477	1.87320352	1.96041751	2.06849194	1.67171896	1.93520334	11.93520334	-8.06479666	10
10	-3.00631404	2.13085175	1.90409398	1.98983908	2.10057378	1.7073313	1.96653798	11.96653798	-8.03346202	10
11	-2.9430232	2.159585	1.93505299	2.01931763	2.13266349	1.74319303	1.99796243	11.99796243	-8.00203757	10
12	-2.87973237	2.18836141	1.96605754	2.04883218	2.16473079	1.77927125	2.02945063	12.02945063	-7.97054937	10
13	-2.81644177	2.21715593	1.99708426	2.07836199	2.1967442	1.81553137	2.06097555	12.06097555	-7.93902445	10
14	-2.7531507	2.24594283	2.02810884	2.10788465	2.22867179	1.85193801	2.09250922	12.09250922	-7.90749078	10
15	-2.68985987	2.27469468	2.05910611	2.13737798	2.26047587	1.88845336	2.1240216	12.1240216	-7.8759784	10
16	-2.62656927	2.30338287	2.09004736	2.16681767	2.2921176	1.92503858	2.15548081	12.15548081	-7.84451919	10
17	-2.56327844	2.3319788	2.12090778	2.19618058	2.32356524	1.96165383	2.18685725	12.18685725	-7.81314275	10
18	-2.49998736	2.36044693	2.15166163	2.22544122	2.3547821	1.99825788	2.21811795	12.21811795	-7.78188205	10
19	-2.43669677	2.38875246	2.18228102	2.25457454	2.38573003	2.03480792	2.24922919	12.24922919	-7.75077081	10

Curves for dBLab | Comparison Chart | data_BI (X)_-Xprot _ X _ Xprot

The shift curve can simply be changed by setting any value in the column – all following values will automatically be set to the same value. All the dependent curves will automatically be recalculated.

On the ‘Comparison Chart’ all curves, including the newly calculated curves, are shown for comparison.

Note: The peaks on the sides of the mean and the shifted curves are caused by the fact that only one speaker has valid measurement data at these outer edges. Thus, the mean curve is equal to the curve in that range. (To remove these effects, delete the first and the last 3 values in the mean and shifted columns.)



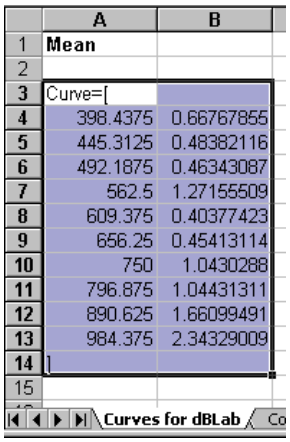
On the ‘Curves for dB-Lab’ spreadsheet, the mean and the shifted curves are represented in dB-Lab / MAT-Lab compatible format.

	A	2	3	D	5	6	G	H
1	**Mean**			**Mean+Shift**			**Mean-Shift**	
2								
3	Curve=[			Curve=[			Curve=[	
4	398.4375	0.66767855		398.4375	10.6676786		398.4375	-9.33232145
5	445.3125	0.48382116		445.3125	10.4838212		445.3125	-9.51617884
6	492.1875	0.46343087		492.1875	10.4634309		492.1875	-9.53656913
7	562.5	1.27155509		562.5	11.2715551		562.5	-8.72844491
8	609.375	0.40377423		609.375	10.4037742		609.375	-9.59622577
9	656.25	0.45413114		656.25	10.4541311		656.25	-9.54586886
10	750	1.0430288		750	11.0430288		750	-8.9569712
11	796.875	1.04431311		796.875	11.0443131		796.875	-8.95568689
12	890.625	1.66099491		890.625	11.6609949		890.625	-8.33900509
13	984.375	2.34329009		984.375	12.3432901		984.375	-7.65670991
14	]			]			]	
15								

Curves for dBLab | Comparison Chart | data_2nd Harmonic, %_4

Re-import to dB-Lab

To re-import those curves to dB-Lab:

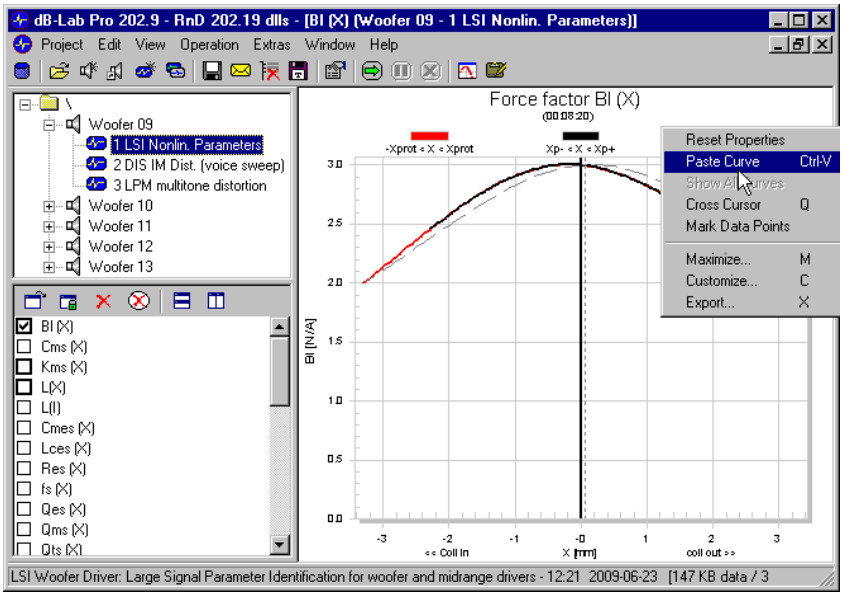


	A	B
1	Mean	
2		
3	Curve=[	
4	398.4375	0.66767855
5	445.3125	0.48382116
6	492.1875	0.46343087
7	562.5	1.27155509
8	609.375	0.40377423
9	656.25	0.45413114
10	750	1.0430288
11	796.875	1.04431311
12	890.625	1.66099491
13	984.375	2.34329009
14	]	
15		

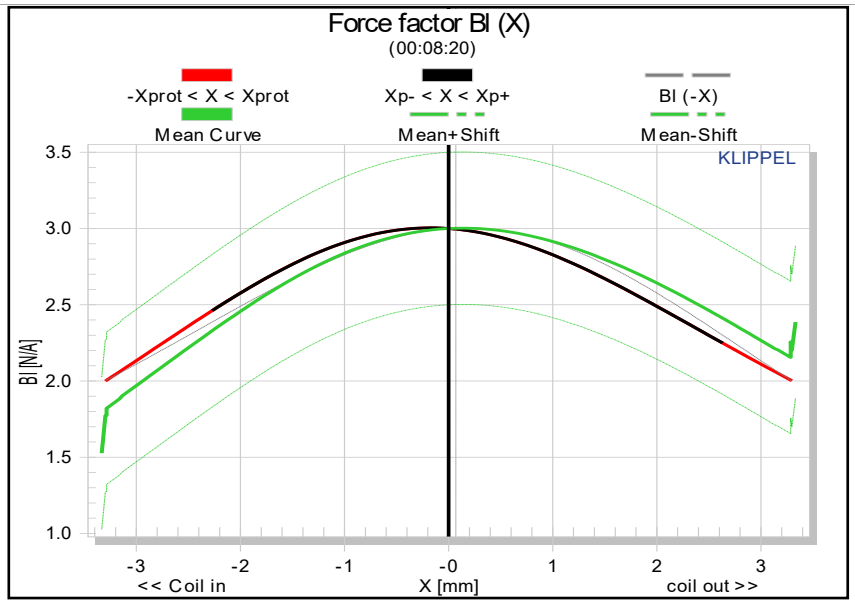
Curves for dBLab

- select the cell reading '**Curve=[**',
- hold the **<Shift>** and **<Ctrl>** key,
- press the right → and the down arrow ↓ key once.
- Now copy the selected curve (**<Ctrl>** + **<C>**).

Open dB-Lab and paste the curve in a chart.

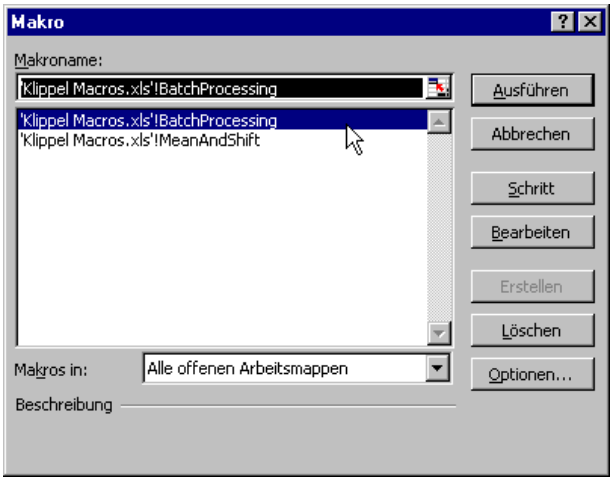


Measured Curves, Mean Curve (original and shifted):



Batch Processing

To simplify the processing of multiple extracted curve files, a batch processing macro is provided. Using this macro, it is possible to select a folder. All extracted files found in that folder will be loaded and processed by the 'MeanAndShift' macro.

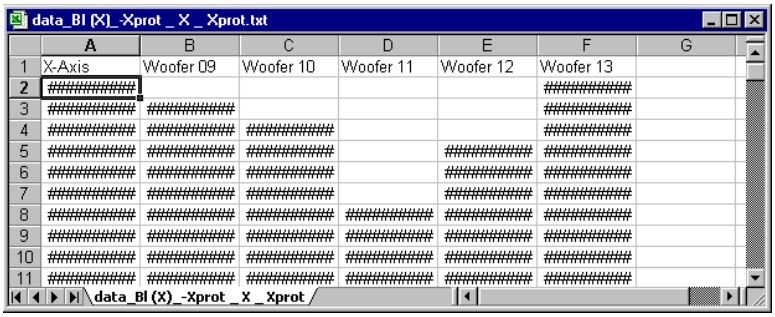


(Sometimes this does not work as expected because the files are not imported correctly into Excel. In that case, check the next section.)

Problems with Excel

In **some** cases, Excel does not import the extracted curve files correctly.

The result might look like this:



The cause is that Excel is language dependent but also has its own file import settings which do not always work correctly. This problem can most likely be solved

	by changing the *db extract* settings. Change the **decimal separator** from **comma** to **period** and run the extraction once more. Note: The re-import into dB-Lab requires decimal points. **Batch processing:** Even if loading and processing files individually works fine, it is not guaranteed that patch processing will work. If Excel fails to import files correctly, try to extract once again with altered decimal separator setting.

5 More Information

Help	Manual *db extract*

Find explanations for symbols at:

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

Last updated: Dezember 19, 2022