ODEON APPLICATION NOTE
Importing GLL directivity data into ODEON

AR – September 25

1. Introduction

Directivity data from loudspeakers and loudspeaker arrays are generally made available in a digital format by their manufacturers. The GLL format developed by AFMG has become widely used due to its flexibility. However, GLL files cannot be directly imported into ODEON, as they are encrypted.

ODEON saves source directivities in its own native format, called SO8. There are different methods to create such SO8 files. You can read about it in Section 3.5 of ODEON's user manual.

This note explains how to access some of the directivity data in a GLL file, using the EASE GLL Viewer, and how to import it in ODEON.

Note: some alternative formats also exist. ODEON can readily import CLF files and legacy EASE files (.spk and .lob). Therefore, if you find the directivity data in one of these formats, use these directly instead. In particular, the use of CLF by manufacturers should be encouraged, as the format is readable by any simulation software – not only EASE.

Disclaimer: the presented method reconstructs the directivity balloon in ODEON using only the horizontal and vertical polar plots. The other directions are interpolated. Therefore, the resulting directivity in ODEON is not as precise as the full directivity balloon available in the GLL file. Unfortunately, there is no way of getting the entire data out of the GLL Viewer at the moment. This is why we recommend alternative formats such as CLF, if they are available.

2. EASE GLL Viewer

The EASE GLL viewer makes it possible to visualise directivity data from a GLL file. It also allows you to export polar plot data, which we will use to create an ODEON directivity file.

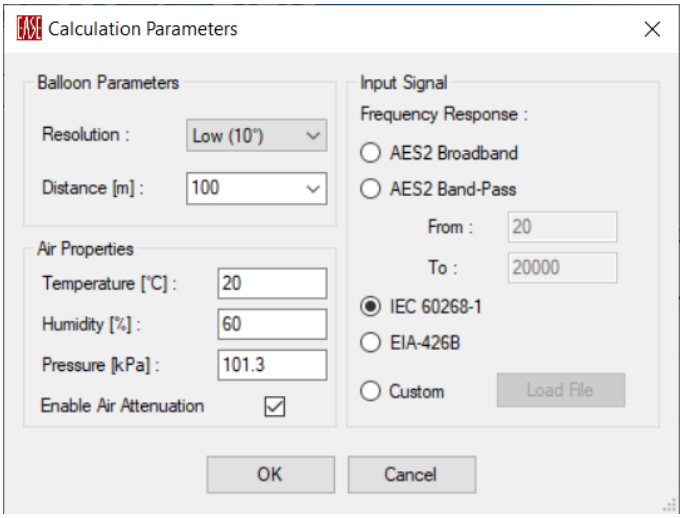
You can find the installer for the GLL Viewer on afmg.eu/en/gll-viewer.

3. Extracting relevant data from the GLL Viewer

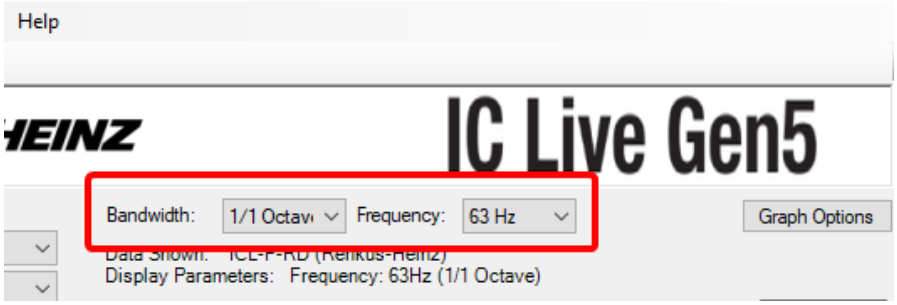
In this section, we will use the GLL Viewer to extract **directivity** and **sensitivity** data from a GLL file.

3.1. Directivity data

1. Open the GLL file with the GLL Viewer.
2. Go to the *Calculate* menu, then to *Balloon*.
3. Define a resolution of **10 degrees**, which corresponds to ODEON's polar plot resolution.

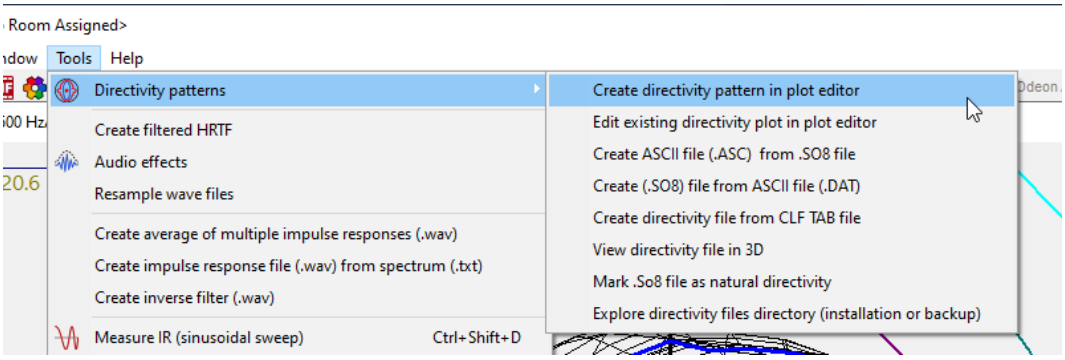


4. Click OK to calculate.
5. Go to the *Graphs* menu, then to *Polars*. This action will display a horizontal and a vertical polar plot.
6. Set the bandwidth to **1/1 Octave** above the polar plots.
7. Select frequency **63 Hz**.



8. Click *File>Send Table to Clipboard*.
9. Paste into a spreadsheet, such as Microsoft Excel.
10. Repeat for every octave band (125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz).

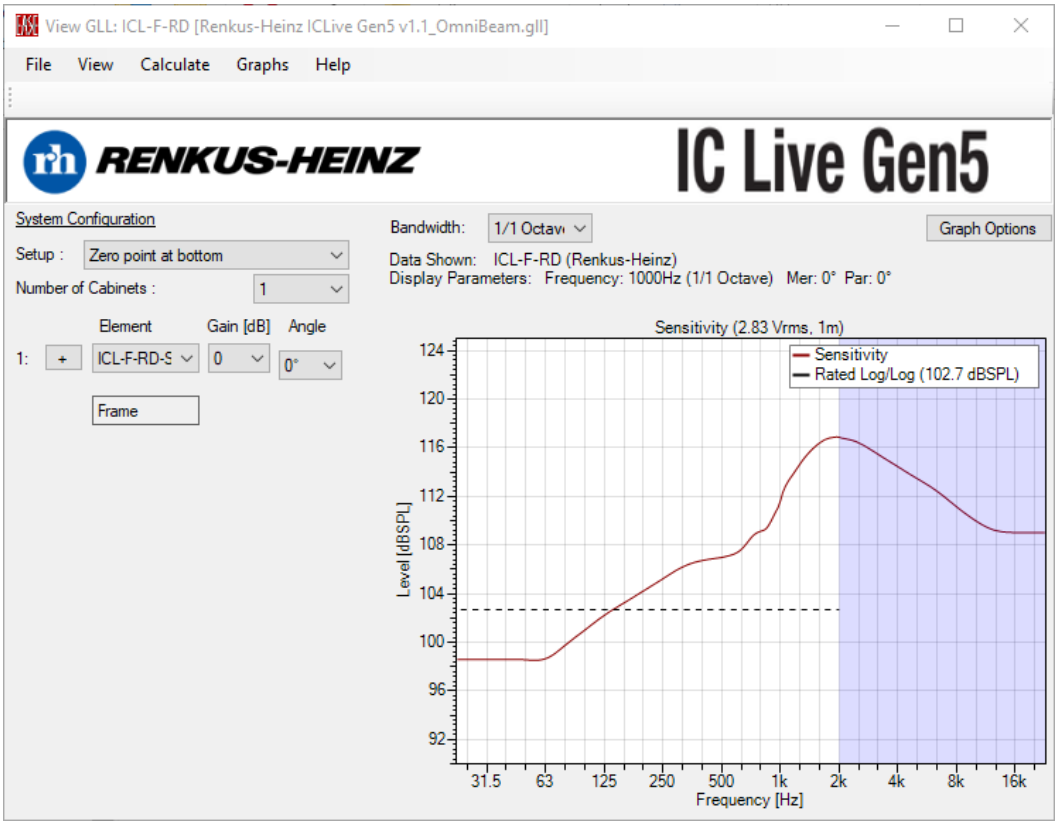
This is the data that should be imported into an ODEON directivity. This can be done directly in ODEON's polar plot editor, found in *Tools > Directivity Patterns > Create directivity pattern* in plot editor. Unfortunately, the values cannot be pasted directly from Excel.



Alternatively, you can import the data from a text file (.dat). Please read more in Section 4.

3.2. Sensitivity data

The GLL file also contains the loudspeaker's sensitivity, which you can also export for later use in ODEON.



1. In the GLL viewer, click on *Graphs>Sensitivity*.
2. Set the bandwidth to **1/1 Octave**.
3. Click on *File>Send Table to>Clipboard*.
4. Paste the values into a spreadsheet, such as Excel.
5. Find the sensitivity data at the centre of each relevant octave band (63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz).

4. Making a polar .dat file to import into ODEON

A relatively fast way to import the directivity data into ODEON is to use one of the text templates (.dat), provided with the ODEON installation. The template can be found in the *DirFiles* folder, inside your ODEON folder. Check Section 3.5 of the ODEON manual, specifically sub-section "Odeon directivity text import format", to learn more about the formatting of these files.

In the context of GLL files, you can use POLAR symmetry to simplify the text file. In this format, you will enter a horizontal and a polar plot and ODEON will extrapolate the full directivity balloon from these two plots.

Section 4.1 explains the steps to make the polar plot data compatible with ODEON. Alternatively, we have created an Excel template which automatically processes the data. It is presented in Section 4.2

4.1. Manual processing

This section describes how to process the exported data from the GLL viewer, so that they are in the right format for ODEON. If you don't need to know the details and want to use our Excel template, you can skip directly to Section 4.2.

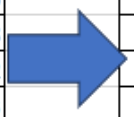
Rescaling

For each octave band, the horizontal and the vertical plots are normalised separately to their maximum value. The plots should be realigned so that they can be combined together.

The idea is to rescale the plots so that the gain is 0 dB at the front (0° for both horizontal and vertical plots). For each plot, subtract the value at 0° to the whole plot.

In the example below, we add 1.6 dB to both the horizontal and the vertical polar plots.

Angle [deg]	Hor. Polar [dB]	Ver. Polar [dB]
0	-1.6	-1.6
10	-1.7	-1.6
20	-1.7	-1.8
30	-1.8	-2
40	-1.9	-2.3
50	-2.1	-2.6
60	-2.4	-2.7



Angle [deg]	Hor. Polar [dB]	Ver. Polar [dB]
0	0	0
10	-0.1	0
20	-0.1	-0.2
30	-0.2	-0.4
40	-0.3	-0.7
50	-0.5	-1
60	0.8	1.1

After rescaling, the two plots should coincide at 0° and 180°. At 0°, both plots should have a value of 0 dB. At 180°, both plots should have the same value. There might be a slight difference at 180°, due to rounding errors. If so, you can replace it manually (e.g. average between the horizontal and the vertical value).

Note: it is very common that the maximum output is found at the front of the source. In that case, the maximum (0 dB) is found at 0° for both plots, and you do not need to rescale the data.

Sensitivity

In order to respect the spectrum of the loudspeaker, add the sensitivity value exported in Section 3.2 to all directivity values, for each octave band. In the previous example, the sensitivity for the octave band was 98.7 dB so the values are modified again as follows:

Sensitivity [dB]	98.7

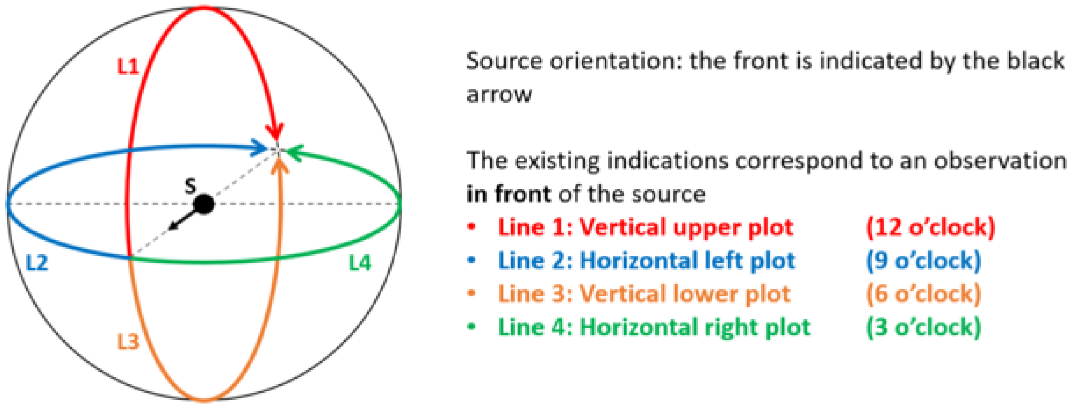
Angle [deg]	Hor. Polar [dB]	Ver. Polar [dB]
0	0	0
10	-0.1	0
20	-0.1	-0.2
30	-0.2	-0.4
40	-0.3	-0.7
50	-0.5	-1
60	0.8	-1.1

Angle [deg]	Hor. Polar [dB]	Ver. Polar [dB]
0	98.7	98.7
10	98.6	98.7
20	98.6	98.5
30	98.5	98.3
40	98.4	98
50	98.2	97.7
60	99.5	97.6

Copying data in the .dat file

You can use the POLAR_OMNI.dat file found in your Odeon folder (DirFiles \So8_ASCII_input_file_samples) as a template. This file can be open by any text editor of your choice.

For each octave band, the directivity data is entered as four lines, each representing a different half-circle around the source, as illustrated below.



This means that you have to copy/paste the exported GLL data as follows:

- **Line 1:** vertical plot from 0° to 180°.
- **Line 2:** horizontal plot from 360° to 180° in **decreasing** order.
- **Line 3:** vertical plot from 360° to 180° in **decreasing** order.
- **Line 4:** horizontal plot from 0° to 180°.

The 360° values are the same as the 0° ones.

All 4 lines should share the same first value and the same last value.

4.2. Using the Excel template

We have made an Excel file in which you can directly paste the data from the GLL file and where the data is properly processed for import into ODEON. You can find this file in odeon.dk/downloads/spreadsheets.

1. In the **Raw data** tab, paste the values you exported from the GLL Viewer. You need a horizontal plot and a vertical plot for each octave band, as well as the eight sensitivity values.

Name
Link

Paste data from GLL file in dB

	Polar plots															
	63 Hz		125 Hz		250 Hz		500 Hz		1000 Hz		2000 Hz		4000 Hz		8000 Hz	
Angle [deg]	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
0	-1.6	-1.6	-1	-1	0	0	0	0	0	-3.3	0	0	0	0	-0.2	0
10	-1.7	-1.6	-1	-1	0	-0.3	0	-0.6	-0.1	0	0	-0.6	-0.1	-5.5	0	-13.1
20	-1.7	-1.8	-1.1	-1.2	-0.1	-1	-0.2	-3.2	-0.4	-3.4	-0.3	-4.9	-0.6	-16.5	-0.2	-4.5
30	-1.8	-2	-1.2	-1.5	-0.2	-2	-0.6	-7.7	-1.1	-4.9	-0.7	-11.9	-0.9	-16.5	-0.2	-8.6
40	-1.9	-2.3	-1.3	-1.9	-0.4	-3.4	-1	-13.3	-1.9	-10.1	-1.5	-14.9	-1.3	-15.2	-0.7	-10.2
50	-2.1	-2.6	-1.3	-2.3	-0.7	-5	-1.5	-16.6	-2.9	-13.4	-2.5	-15.8	-2.2	-16.3	-2.5	-15.4
60	-2.4	-2.7	-1.4	-2.7	-1	-6.6	-1.9	-17.6	-4	-19.6	-3.8	-17.7	-3.6	-18.2	-4.6	-17.7
70	-2.3	-2.7	-1.4	-2.9	-1.4	-8	-2.7	-18.8	-5	-28	-5.3	-19.5	-5.6	-19.3	-7.1	-17.4
80	-2.3	-2.8	-1.4	-3.1	-1.5	-8.8	-3.3	-19.6	-6.1	-31.3	-6.8	-20.8	-7.5	-20.5	-9.7	-18.5
90	-2.3	-2.7	-1.4	-3.1	-2	-9.2	-3.2	-19.1	-6.9	-32.7	-8.2	-23	-10	-22.5	-12.5	-21.7
100	-2.3	-2.9	-1.7	-3.3	-3.2	-9.5	-4.4	-19.9	-7.6	-32.7	-9.6	-23.1	-11.9	-22.1	-14.8	-26.9
110	-2.4	-2.8	-1.7	-3.1	-3.1	-8.8	-5.8	-20.7	-8	-32.2	-11	-25.2	-14	-25.7	-17.3	-28
120	-2.5	-2.8	-1.5	-2.7	-3	-7.8	-6.8	-21.5	-8.8	-25.5	-12	-25.8	-15.2	-27.5	-19.4	-30.3
130	-2.3	-2.7	-1.1	-2.1	-3.1	-6.6	-6.7	-20.3	-9.1	-20.5	-12.4	-28.2	-16.6	-27.9	-21	-30.5
140	-1.6	-2	-0.7	-1.4	-2.8	-5.3	-6.5	-16.2	-10.6	-18.6	-12.8	-27.8	-17.3	-28.7	-22.1	-28.5
150	-1	-1.1	-0.5	-0.9	-2	-3.5	-6.1	-11.7	-11	-14.5	-14	-23.6	-16.7	-33.4	-21.9	-29.1
160	-0.6	-0.6	-0.2	-0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-16.9	-16.9	-16.5	-33	-21.7	-27.2
170	-0.3	-0.3	-0.1	-0.1	-0.2	-0.4	-5.3	-5.8	-9.5	-9.6	-14.2	-12.8	-21	-19.7	-22.1	-36.3
180	0	0	-0.3	-0.2	-0.2	-0.2	-5.2	-5.2	-8.6	-11.8	-12.1	-12.1	-15.4	-15.4	-19.2	-19
190	-0.1	-0.3	0	0	-0.3	-0.5	-5.5	-6.2	-9.4	-10.9	-13.6	-14.2	-20.5	-22.7	-23.1	-36
200	-0.4	-0.5	-0.2	-0.2	-1.1	-2	-6.3	-9	-10.8	-13.9	-17	-20.4	-16.9	-33.1	-22.5	-27.5
210	-0.8	-0.8	-0.5	-0.6	-2.1	-4	-6	-12.6	-10.8	-15.9	-14.4	-26.1	-16.9	-30.9	-22.6	-27.7
220	-1.5	-1.3	-0.7	-1.2	-2.9	-5.8	-6.7	-17.1	-10.8	-18.5	-12.6	-27.8	-17.8	-28.1	-21.9	-28.6
230	-2.2	-2	-1.1	-1.9	-3.2	-7.2	-7.1	-20.3	-9.6	-21.9	-12.6	-24.8	-17.5	-26.5	-20.7	-29.9
240	-2.4	-2.4	-1.4	-2.5	-3.1	-8.2	-7.1	-20.9	-8.9	-24.7	-12.5	-23.9	-15.7	-25.4	-19.1	-29.6
250	-2.3	-2.3	-1.6	-2.9	-3.2	-9.1	-6	-19.9	-8	-27.1	-12	-23.8	-14.3	-24.9	-17.4	-28.5
260	-2.4	-2.2	-1.7	-3	-3.3	-9.7	-4.7	-19	-7.5	-28	-10.6	-23.4	-12.1	-23.7	-15	-25.5
270	-2	-2.1	-1.4	-2.9	-2	-9	-3.2	-18.2	-7.3	-27.7	-8.4	-23.5	-10.6	-24.7	-12.9	-23.6

Sensitivity	
Band [Hz]	Sensitivity [dB]
63	98.7
125	102.2
250	105.2
500	107
1000	111.6
2000	116.9
4000	114.4
8000	111.2

2. You don't need to do anything in the **Rescaling** tab, in which a few checks are automatically done on the data. In particular, the horizontal and vertical plots are set to match at 0° and 180°.

Rescaled values																	
	63 Hz		125 Hz		250 Hz		500 Hz		1000 Hz		2000 Hz		4000 Hz		8000 Hz	
Angle [deg]	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
0	98.7	98.7	102.2	102.2	105.2	105.2	107	107	111.6	111.6	116.9	116.9	114.4	114.4	111.2	111.2
10	98.6	98.7	102.2	102.2	105.2	104.9	107	106.4	111.5	114.9	116.9	116.3	114.3	108.9	111.4	98.1
20	98.6	98.5	102.1	102	105.1	104.2	106.8	103.8	111.2	111.5	116.6	112	113.8	97.9	111.2	106.7
30	98.5	98.3	102	101.7	105	103.2	106.4	99.3	110.5	110	116.2	105	113.5	97.9	111.2	102.6
40	98.4	98	101.9	101.3	104.8	101.8	106	93.7	109.7	104.8	115.4	102	113.1	99.2	110.7	101
50	98.2	97.7	101.9	100.9	104.5	100.2	105.5	90.4	108.7	101.5	114.4	101.1	112.2	98.1	108.9	95.8
60	97.9	97.6	101.8	100.5	104.2	98.6	105.1	89.4	107.6	95.3	113.1	99.2	110.8	96.2	106.8	93.5
70	98	97.6	101.8	100.3	103.8	97.2	104.3	88.2	106.6	86.9	111.6	97.4	108.8	95.1	104.3	93.8
80	98	97.5	101.8	100.1	103.7	96.4	103.7	87.4	105.5	83.6	110.1	96.1	106.9	93.9	101.7	92.7
90	98	97.6	101.8	100.1	103.2	96	103.8	87.9	104.7	82.2	108.7	93.9	104.4	91.9	98.9	89.5
100	98	97.4	101.5	99.9	102	95.7	102.6	87.1	104	82.2	107.3	93.8	102.5	92.3	96.6	84.3
110	97.9	97.5	101.5	100.1	102.1	96.4	101.2	86.3	103.6	82.7	105.9	91.7	100.4	88.7	94.1	83.2
120	97.8	97.5	101.7	100.5	102.2	97.4	100.2	85.5	102.8	89.4	104.9	91.1	99.2	86.9	92	80.9
130	98	97.6	102.1	101.1	102.1	98.6	100.3	86.7	102.5	94.4	104.5	88.7	97.8	86.5	90.4	80.7
140	98.7	98.3	102.5	101.8	102.4	99.9	100.5	90.8	101	96.3	104.1	89.1	97.1	85.7	89.3	82.7
150	99.3	99.2	102.7	102.3	103.2	101.7	100.9	95.3	100.6	100.4	102.9	93.3	97.7	81	89.5	82.1
160	99.7	99.7	103	102.7	104.2	103.5	100.8	98.7	100.5	101.6	100	100	97.9	81.4	89.7	84
170	100	100	103.1	103.1	105	104.8	101.7	101.2	102.1	105.3	102.7	104.1	93.4	94.7	89.3	74.9
180	100.3	100.3	102.9	103	105	105	101.8	101.8	103	103.1	104.8	104.8	99	99	92.2	92.2
190	100.2	100	103.2	103.2	104.9	104.7	101.5	100.8	102.2	104	103.3	102.7	93.9	91.7	88.3	75.2
200	99.9	99.8	103	103	104.1	103.2	100.7	98	100.8	101	99.9	96.5	97.5	81.3	88.9	83.7
210	99.5	99.5	102.7	102.6	103.1	101.2	101	94.4	100.8	99	102.5	90.8	97.5	83.5	88.8	83.5
220	98.8	99	102.5	102	102.3	99.4	100.3	89.9	100.8	96.4	104.3	89.1	96.6	86.3	89.5	82.6
230	98.1	98.3	102.1	101.3	102	98	99.9	86.7	102	93	104.3	92.1	96.9	87.9	90.7	81.3
240	97.9	97.9	101.8	100.7	102.1	97	99.9	86.1	102.7	90.2	104.4	93	98.7	89	92.3	81.6
250	98	98	101.6	100.3	102	96.1	101	87.1	103.6	87.8	104.9	93.1	100.1	89.5	94	82.7
260	97.9	98.1	101.5	100.2	101.9	95.5	102.3	88	104.1	86.9	106.3	93.5	102.3	90.7	96.4	85.7
270	98.3	98.2	101.8	100.3	103.2	96.2	103.8	88.8	104.3	87.2	108.5	93.4	103.8	89.7	98.5	87.6
280	98.1	98.1	101.8	100.4	103.7	96.6	103.8	88.3	105	88.8	109.9	95.9	106.4	93.5	101.3	90.7

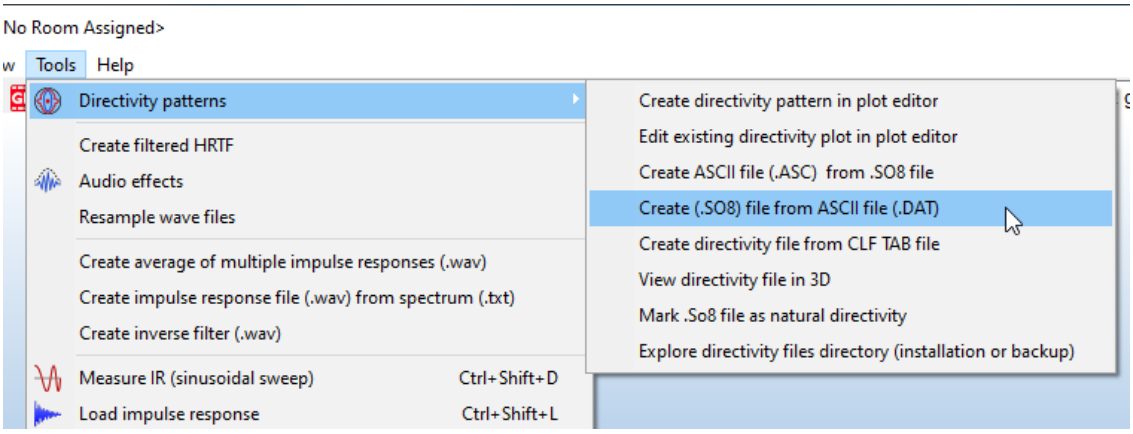
Orange cells indicate different values at 180°.

3. The **DAT output** tab corresponds to what you should save as a text file for ODEON. Copy the whole sheet and paste it into a text file. Save the text file with a .dat extension.

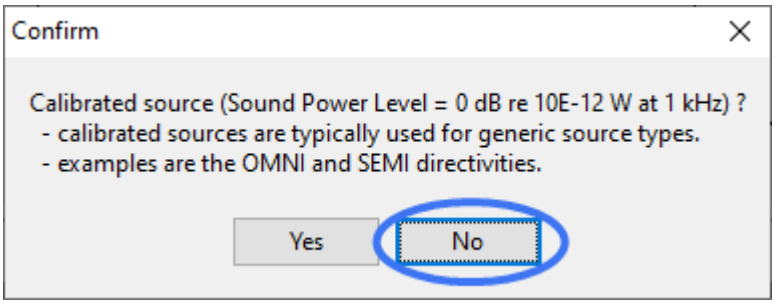
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	: Source defined from GLL file																			
2	: [GLL Reference]																			
3	POLAR																			
4	NATURAL	FALSE		Change it to TRUE if Natural Source																
5	:																			
6	:definition on POLAR directivity definition																			
7	: each frequency band in described by four lines																			
8	: each line contains 19 values for the angles 0,10....170, 180 deg {from front to rear source}																			
9	: first and last value must be equal for all plots, this is where the plots meet.																			
10	:																			
11	:first line is vertical upper plot (12 O'Clock plot)																			
12	:second line is horizontal left plot (9 O'Clock plot)																			
13	:third line is lower vertical plot (6 O'Clock plot)																			
14	:fourth line is right horizontal plot (3 O'Clock plot)																			
15	: 63 Hz																			
16	98.7	98.7	98.5	98.3	98	97.7	97.6	97.6	97.5	97.6	97.4	97.5	97.5	97.6	98.3	99.2	99.7	100	100.3	
17	98.7	98.6	98.5	98.5	98.4	98.2	98	98.1	98.1	98.3	97.9	98	97.9	98.1	98.8	99.5	99.9	100.2	100.3	
18	98.7	98.6	98.5	98.5	98.6	98.4	98	98	98.1	98.2	98.1	98	97.9	98.3	99	99.5	99.8	100	100.3	
19	98.7	98.6	98.6	98.5	98.4	98.2	97.9	98	98	98	98	97.9	97.8	98	98.7	99.3	99.7	100	100.3	
20	: 125 Hz																			
21	102.2	102.2	102	101.7	101.3	100.9	100.5	100.3	100.1	100.1	99.9	100.1	100.5	101.1	101.8	102.3	102.7	103.1	102.95	
22	102.2	102.2	102.1	102	101.9	101.8	101.8	101.8	101.8	101.8	101.5	101.6	101.8	102.1	102.5	102.7	103	103.2	102.95	
23	102.2	102.2	102	101.6	101.3	101	100.7	100.5	100.4	100.3	100.2	100.3	100.7	101.3	102	102.6	103	103.2	102.95	
24	102.2	102.2	102.1	102	101.9	101.9	101.8	101.8	101.8	101.8	101.5	101.5	101.7	102.1	102.5	102.7	103	103.1	102.95	
25	: 250 Hz																			
26	105.2	104.9	104.2	103.2	101.8	100.2	98.6	97.2	96.4	96	95.7	96.4	97.4	98.6	99.9	101.7	103.5	104.8	105	
27	105.2	105.2	105.1	105	104.8	104.5	104.2	103.8	103.7	103.2	101.9	102	102.1	102	102.3	103.1	104.1	104.9	105	
28	105.2	105	104.4	103.4	102	100.4	98.9	97.5	96.6	96.2	95.5	96.1	97	98	99.4	101.2	103.2	104.7	105	
29	105.2	105.2	105.1	105	104.8	104.5	104.2	103.8	103.7	103.2	102	102.1	102.2	102.1	102.4	103.2	104.2	105	105	
30	: 500 Hz																			
31	107	106.4	103.8	99.3	93.7	90.4	89.4	88.2	87.4	87.9	87.1	86.3	85.5	86.7	90.8	95.3	98.7	101.2	101.8	
32	107	107	106.8	106.4	106	105.5	105	104.3	103.8	103.8	102.3	101	99.9	99.9	100.3	101	100.7	101.5	101.8	
33	107	106	103.2	98.7	93.3	90.2	89.4	88.6	88.3	88.8	88	87.1	86.1	86.7	89.9	94.4	98	100.8	101.8	

5. Import the .dat file into ODEON

Once the DAT file is created, import it in ODEON by going to *Tools>Directivity Patterns>Create SO8 file from ASCII (dat)*.

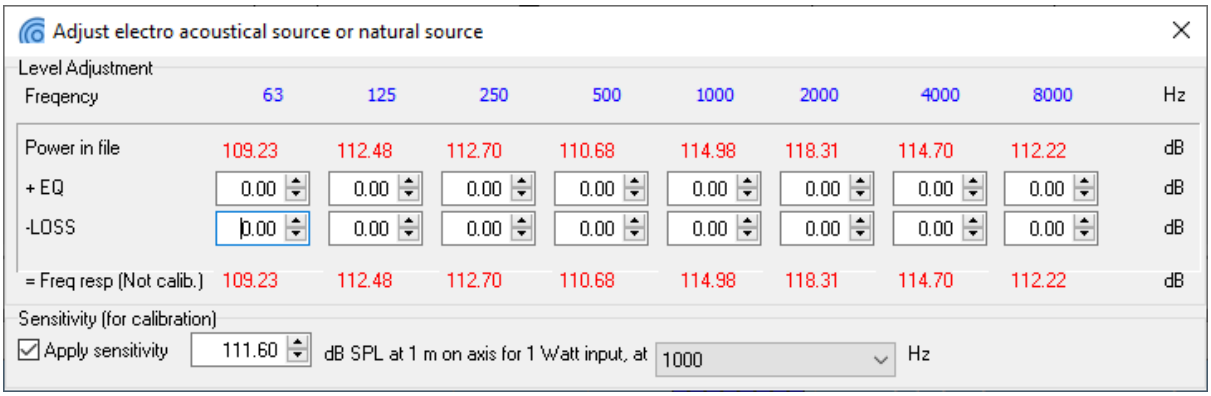


1. Find and select your .dat file.
2. Choose a name and a location for the resulting .SO8 file. The file should be saved in the *DirFiles* folder or one of its subfolders if you want to access it in ODEON.
3. When asked if it is a calibrated source, press **No**.



If you use ODEON 18 or earlier, you need to manually apply the sensitivity:

1. In the next dialog window, click on Apply Sensitivity and fill the sensitivity value in dB at 1 kHz, that you obtained from the GLL data.



2. Close the window. A dialog message indicates that the ODEON directivity file was generated.

The sensitivity adjustment is no longer required from ODEON 19.

After this step, you will be able to find the imported directivity in the Source Editor.