IMMI - Computation of sound propagation in workrooms

IMMI 2010

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1 Computation of sound propagation in workrooms

IMMI was expanded by a module evaluating the acoustic properties of work places and carrying out a detailed calculation of noise reduction measures.

Four essential components were added to IMMI. These include:

- Statistical room acoustics acc. to VDI 3760 (statistics module), on page 11
- Macro: Erect industrial hall, on page 31
- Calculation of sound power levels according to the enveloping surface method , on page 36
- Calculation/evaluation of sound decay curves , on page 40

These functions will be described below.

1.1 Computation and measurement of sound propagation in workrooms (VDI 3760) (Statistics module)

This part of the program can be used to calculate the sound propagation in working rooms according to VDE 3760. This standard defines various descriptions of the room, the diffuser significance and the classification of the calculation methods (VDI 3760, Tables 2, 3 and 4). The table below presents the methods used by IMMI. The higher the description depth, the better (in more detail) the conditions inside the room are reflected.

To open the statistics module, select <**Extras | Computation of sound propagation in workrooms | Statistics**>.

Table 1: Description of rooms (acc. to VDI 3760, Table 2)

Description depth	**Description of the rooms**	**IMMI**
1	The room is only described through its volume and the average absorption coefficient; the shape of the room and the position and geometry of the room limiting surfaces and the absorption surfaces are not taken into account.	
2	The only geometry taken into account is the geometry of cuboid rooms (approximation of room shapes by means of cuboids). Uniform absorption coefficients for each room limiting surface.	
3	Approximation of room shapes by means of cuboids. Different absorption coefficients in the room limiting surfaces are taken into account.	Statistics module
4	Any room geometry, any position and geometry of room limiting surfaces and any distribution of absorbing surfaces are taken into account.	Noise in working rooms and

		multiple reflection

Table 2: Description of diffusers (acc. to VDI 3760, Table 3)

Description depth	**Description of diffusers**	**IMMI**
1	Structures are not taken into account as diffusers.	
2	Average values of diffuser density and absorption are assumed for the entire room.	
3	Average values of diffuser density and absorption are assumed for partial areas of the room.	Statistics module
4	The actual geometry and position of diffusers are taken into account.	Noise in working rooms and multiple reflection

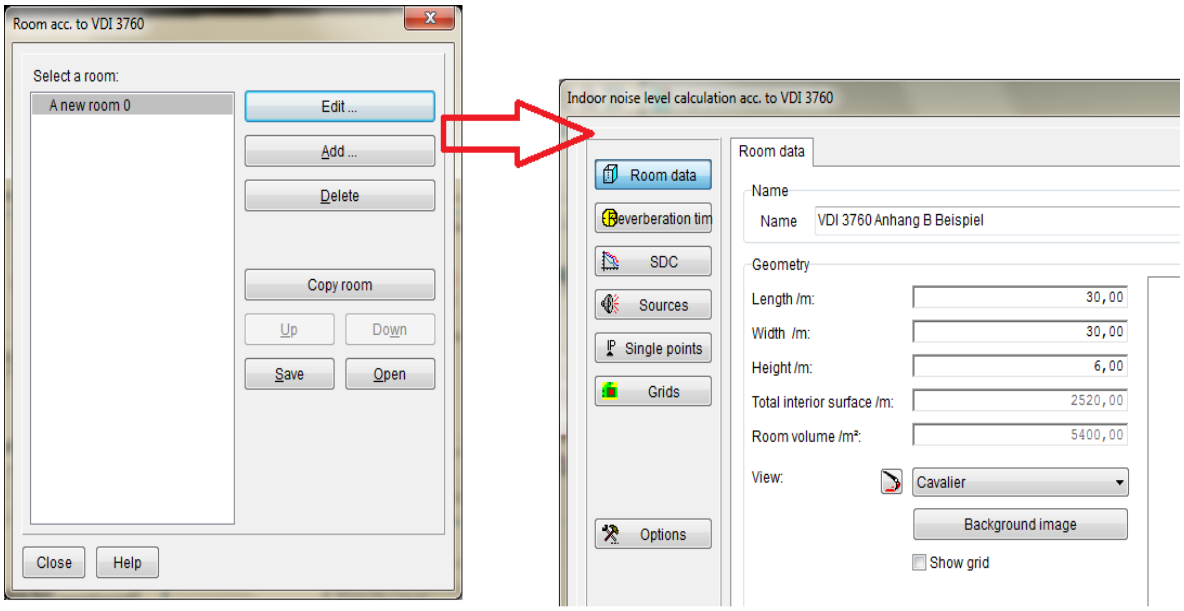
Table 3: Classification of calculation methods (acc. to VDI 3760, Table 4)

No.	**Description of diffusers**	**IMMI**
1	Statistical theory according to Sabine	
2	Image source methods without ray tracing and without diffusion	
3	Image source methods with diffusion (without ray tracing, overall diffusion)	Statistics module
4	Image source methods with ray tracing (the geometry of diffusers is taken into	Noise in working rooms and

	account)	multiple reflection
5	Sound particle method	

1.2 Description of the room, the diffusers and the calculation

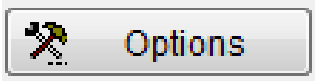
Rooms can be created according to VDI 3760. These rooms are managed in the usual lists. Just click on the "Edit" button to open the statistics module with the room selected.



Clicking the buttons described below will open the corresponding dialog boxes of the statistics module.

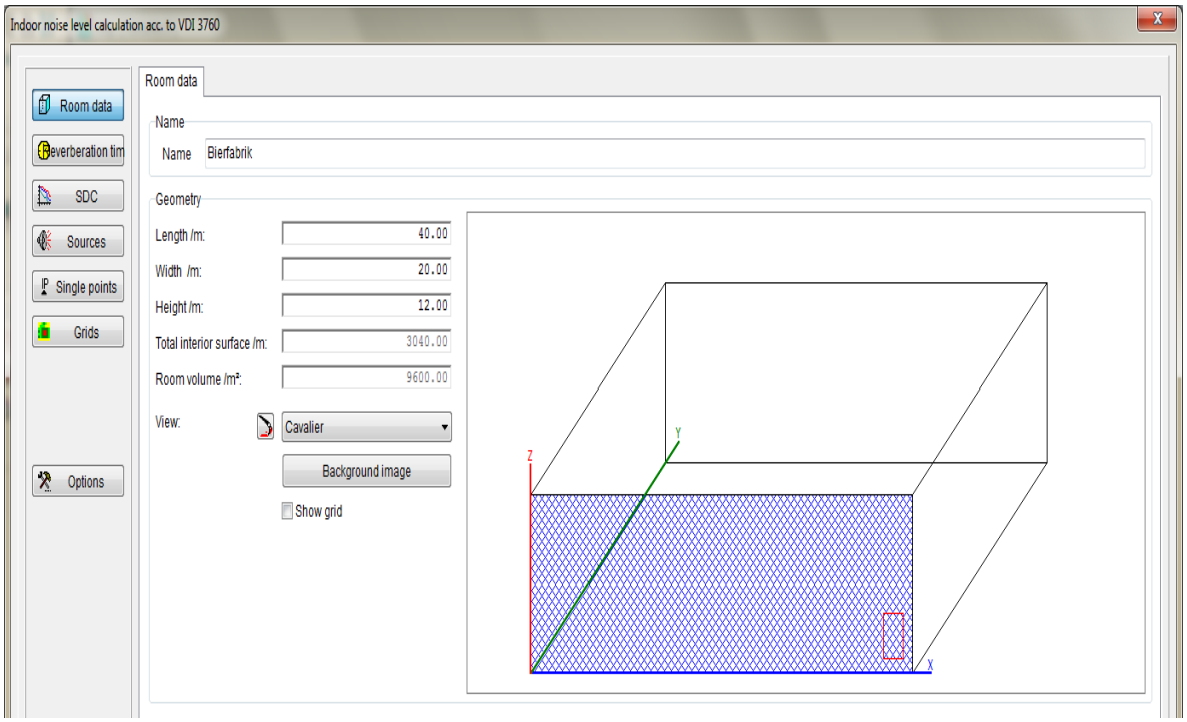
- Room data: Enter room data, geometry and absorption properties.
- Reverberation tim: Calculate the reverberation time.
- SDC: Calculate and evaluate sound decay curves (SDC).
- Sources: Define sources and calculate the average room indoor level.
- Single points: Calculate single points in the room.

- 

: Calculate grids in the room.
- 

: Set options.

1.2.1 Room data



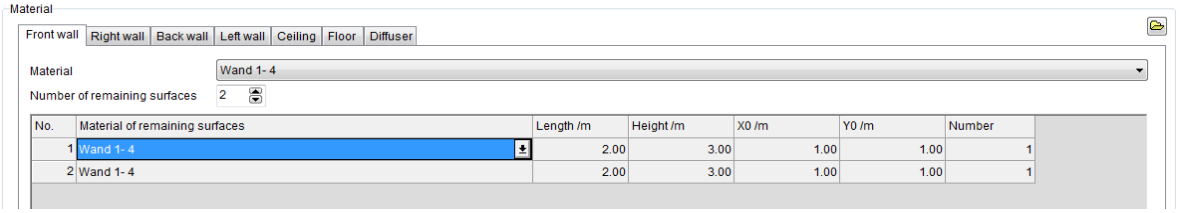
- **Name**: Enter any text describing the room.
- **Length, Width, Height**: Geometry of the room. Make all entries in m.
- **Total interior surface**: Calculated interior surface of the room in m².
- **Volume**: Calculated room volume in m³. Volume and interior surface are calculated automatically and cannot be entered.
- **View**: Set the view of the cuboid room. If the button  is activated, the room must be redrawn.
- 

: Allows using a background image. This image is always drawn at an altitude of 0 m in parallel to the floor of the hall. Call the IMMI online help to learn how to use background images.
- **Show grid**: If a grid of the hall indoor levels has been calculated, activate this check box to display the calculated grid.

The **Material** section provides input boxes where you can define the absorption properties of the four walls, the floor and the ceiling of the room as well as those of the diffusers.

An absorption (or a reflection) spectrum can be selected for each of the six limiting surfaces. In addition, further partial areas with deviating absorption properties can be defined in each limiting surface.

Note: The partial areas of a room limiting surface must be completely inside the room surface and may not overlap each other.



- **Material**: Select an absorption spectrum. You can select spectra from the internal database (See menu <Project | Internal database | Reflectivity>).
- **Number of remaining surfaces**: Indicates the number of partial areas in the wall selected (or ceiling, floor), which have a deviating absorption spectrum.
  Material of remaining surfaces: Defines the absorption spectrum of the partial area.
- **Length, Height**: Dimensions of the partial area.
- **X0, Y0:** Left lower corner of the partial area. These values are not used for the statistics because the position of the partial area does not play any role in the statistical calculation. These values have two purposes:
  - On the one hand, the position of the partial area is visualized graphically;
  - on the other hand, these values are used in the Generate element model function see "Generate element model" on page 16

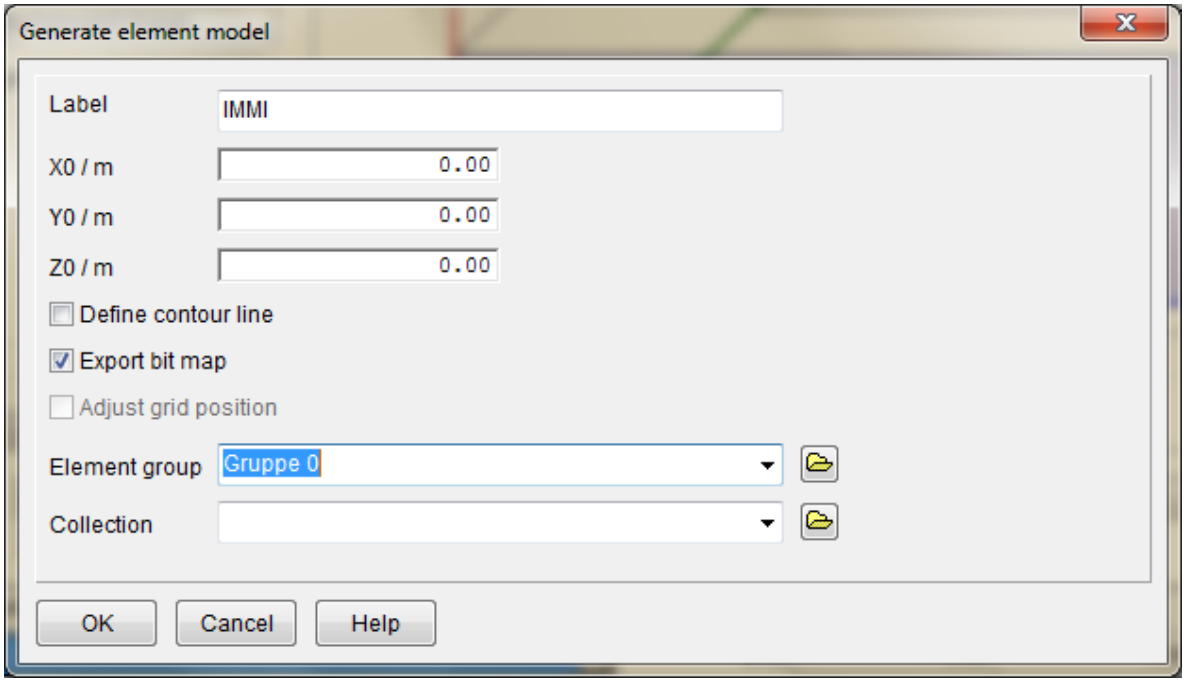
The origin of the X0, Y0 coordinates is the left lower corner of the selected wall,
as seen by the user standing inside the room in front of the wall. Since the partial areas are usually measured inside the room, the distances that are determined can be directly entered.
The following applies to the ceiling: The "left lower" corner coincides with the origin of the coordinate system plotted in the diagram. The "left lower" corner of the ceiling is then positioned vertically above that point.

- **Number**: Defines how often this partial area is present. This item allows you to easily generate several equal partial areas. However, the graphical diagram shows all of these partial areas at the same place. This means that you cannot immediately recognize that more partial areas than one are used.
-  **- Open internal database**: Click the button to edit the internal database for reflectivity/absorption losses.
- 

: Displays a list of all input data and results, see Show list on page 29.
- 

: Generates IMMI elements for a calculation model outside of the statistics module. The generated elements are added to the opened project, see Generate element model on page 16.

1.2.1.1 Generate element model



- **Label**: Enter any text to be used as element name during generation of the elements.
- **X0, Y0, Z0**: Coordinates on the map, defining the origin of the room coordinate system.
- **Define altitude line**: If you activate this check box, the ground plan of the room will be based on an altitude line with constant Z0.
- **Export bit map**: If you activate this check box, the background image of the room will be included in the list of the background images of the project and scaled such that it will be positioned on the map according to its position in the room in the statistics module.
- **Adjust grid position**: If you activate this option, the grid will be positioned on the map according to its position in the statistics module.
- **Element group / Collection**: If you select an element group and/or collection from these drop-down list boxes, the elements generated with this macro will become members of this element group/collection.

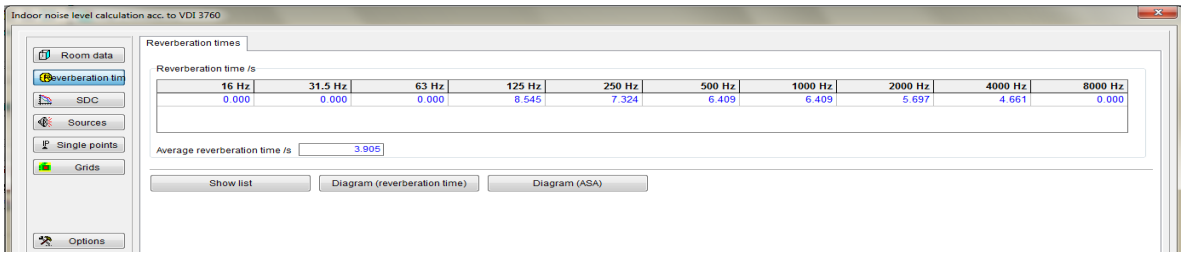
1.2.2 Reverberation time

Click the "Reverberation time" button to calculate the reverberation time RT of the room according to Sabine's formula and to display the result:

$$R_T = 0.163 \frac{V}{A}$$

where V stands for the room volume and A for the equivalent sound absorption surface.

The scope of the absorption spectra defines whether the reverberation time is output as a single value in octave bands or third-octave bands.

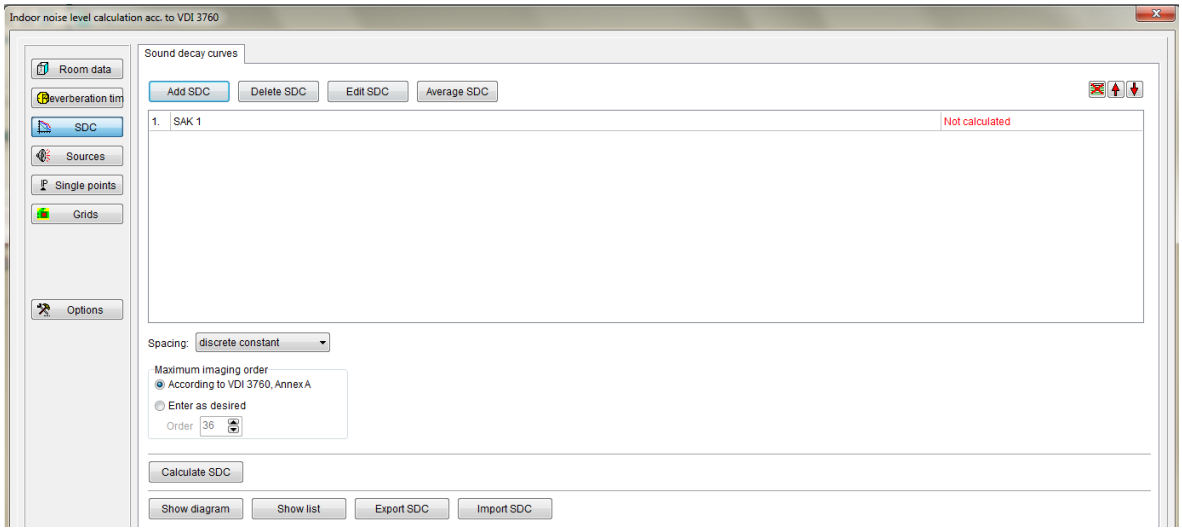


- **Average reverberation time/s**: Result of the average reverberation time
- Show list : Displays a list of all input data and results.
- Diagram (reverberation time) : Displays the diagram of the frequency-dependent reverberation time of the room.
- Diagram (ASA) : Displays the diagram of the frequency-dependent equivalent sound absorption surface (ESAS).

Note: Once you click the "Reverberation time" button, the reverberation time is immediately recalculated with all input parameters taken into account.

1.2.3 Sound decay curves (SDC)

This dialog box allows calculating up to a maximum of eight sound decay curves.



- Add SDC: Adds another SDC to the list of SDCs (no more than 8 curves), see Define SDC on page 20.
- Delete SDC: Deletes the SDCs selected from the list.
- Edit SDC: The SDC selected is edited (see "Add"). The coordinates of calculated SDCs cannot be changed. It is only possible to change the status of calculated SDCs to "not calculated". This is necessary if the SDCs are to be recalculated with new room parameters.
- Average SDC: Averages the SDCs selected from the list. The system will generate a new SDC which contains the averaging result. The status of the new SDC will then be "averaged".

Note: SDCs can be averaged even if they differ in their frequency range and their interpolation points. The decisive factor for the averaging result is the topmost of the SDCs selected from the list. This SDC defines the frequency range (A-level, octave band, third-octave band) and the interpolation points of the result. Missing interpolation points are interpolated and even extrapolated at the end of the SDCs.

-  : Click these buttons to change the order of the SDCs in the list. The order is a decisive factor in averaging.
-  : Sets the status of all calculated SDCs to "not calculated". The status of averaged and imported SDCs remains as it is. If you wish to recalculate already calculated SDCs with new room parameters, click this button to jointly change the status of all SDCs.
- **Spacing**: Defines the spacing of the interpolation points along the SDC.
  - **Discrete constant**: 1, 2, 3, 4 ... 10, 12, 14, ... 20, 24, 28, ... 40 m etc.
  - **Smooth logarithmic**: 1, 2, 3, 4, 5, 6 ... 3, 8, 10, 20, 30, 40, 50, 63, 80 m etc.
  - **According to BGI 797**: 0.75, 1.5, 3, 6, 12, 24, 48 m etc.
- **Maximum imaging order**: Define the maximum order up to which image sources are to be calculated.
  - **According to VDI 3760, Annex A**: The maximum order is calculated according to the following formula:

$$O_{max} = \frac{Log(1-10^{-\Delta L_{Rest}/10})}{Log(1-\alpha)}$$

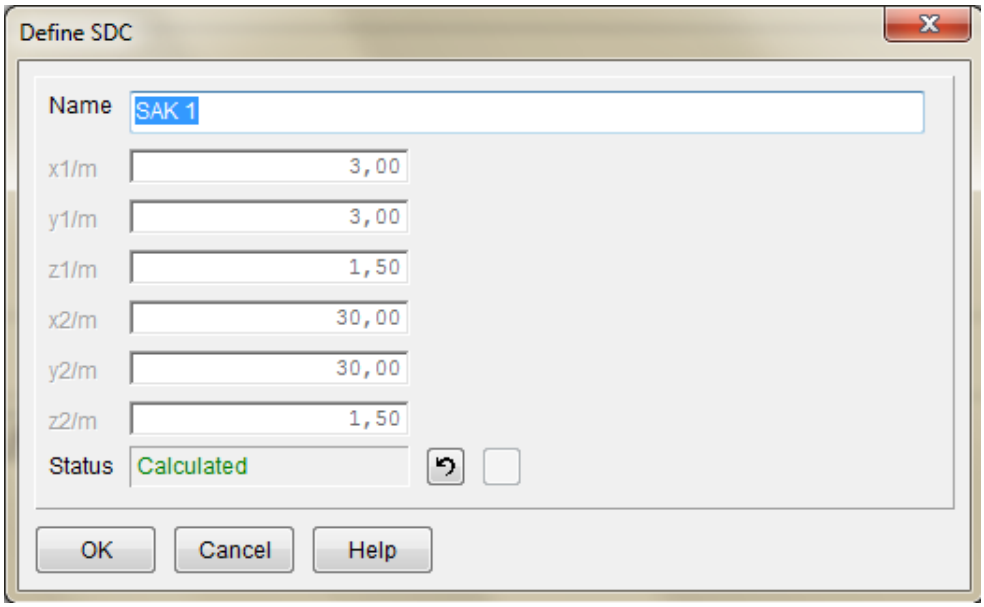
    where ΔLRest = 0.5 dB and a is the average absorption coefficient of the room.

  - **Enter as desired**: The maximum order can be entered by the user.
- 

: Starts calculation of the SDC. Curves with a status of "calculated", "averaged" or "imported" will not be recalculated.

Note: If room parameters are changed, the SDCs are not recalculated automatically. Calculation must be restarted.

1.2.3.1 Define SDC

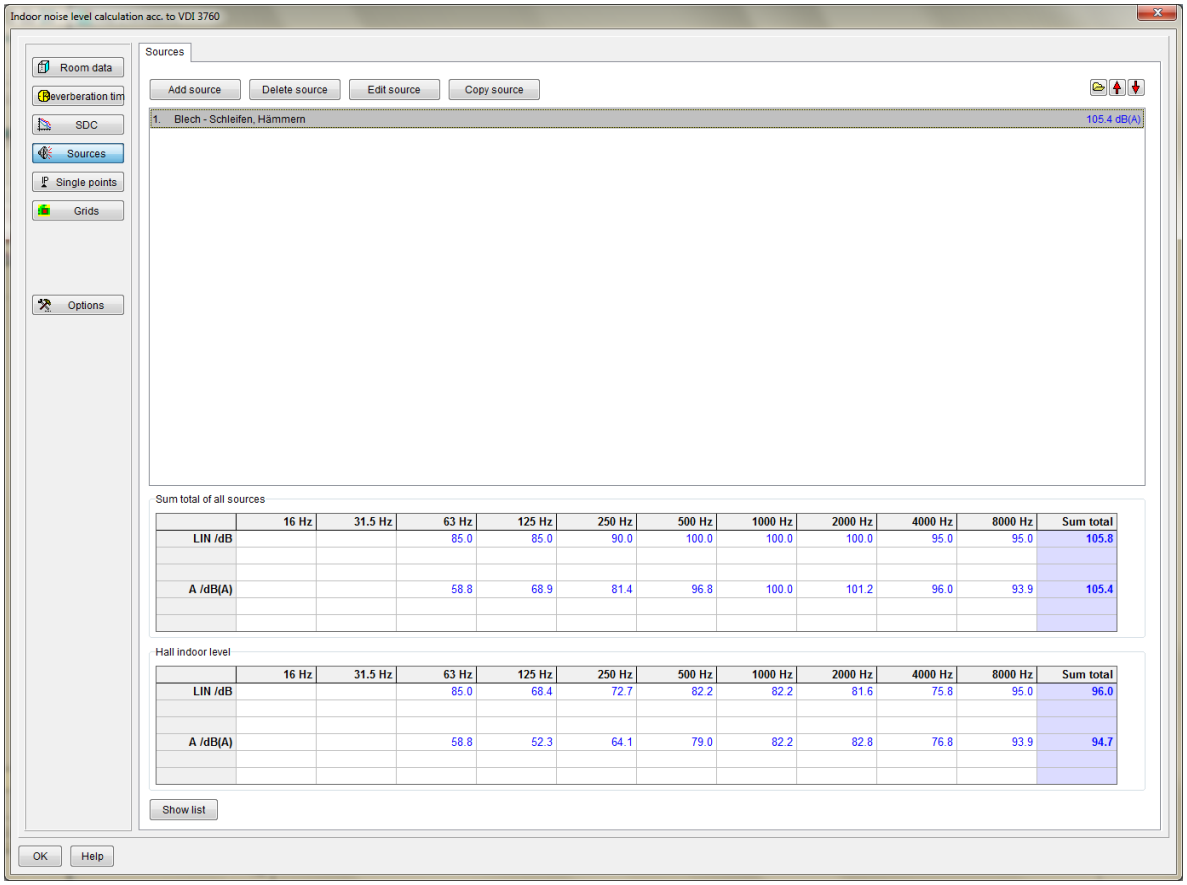


- **X1, Y1, Z1 and X2, Y2, Z2**: Start and end points of the SDCs.
- **Status**: Indicates whether the SDCs are not calculated yet, already calculated or imported.
- : sets the status of a calculated SDC to "not calculated".

1.2.4 Sources

This tab allows you to position sound sources in the room. These sound sources can be used to calculate

1) the average hall indoor level,
2) a reception point in connection with single points,
3) a grid in the room.



- Add source : Click this button to add a new sound source to the list. See Define Sources on page 22.
- Delete source : Click this button to delete the source(s) selected from the list.

- Edit source : Click this button to edit the source selected.
- Copy source : Click this button to copy the source(s) selected and add the copies to the list.
- **Sum total of all sources**: Displays the energetic sum total of all sound sources in the list. The frequency range depends on the source having the biggest frequency range.

  If a list is added to or removed from the list, the sum total is immediately recalculated.
- **Hall indoor level**: The average hall indoor level is calculated according to the following formula:

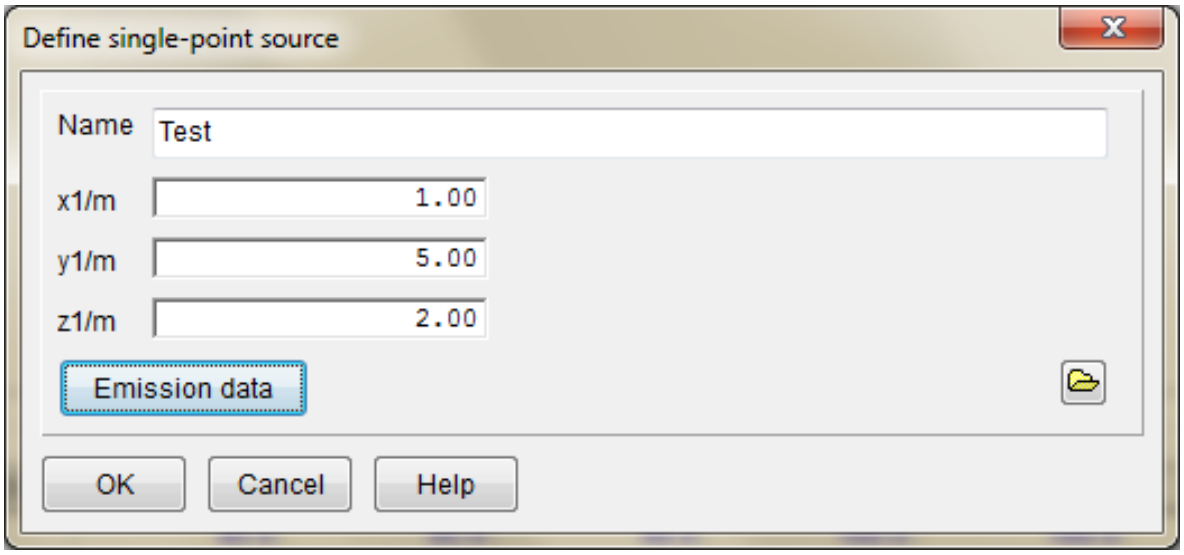
$$L_p = L_w - 10Log\frac{A}{4A_0}$$

where L_W is the sum total of all sound power levels of the sources,

A is the equivalent sound absorption surface in m², and

A0 is 1 m².

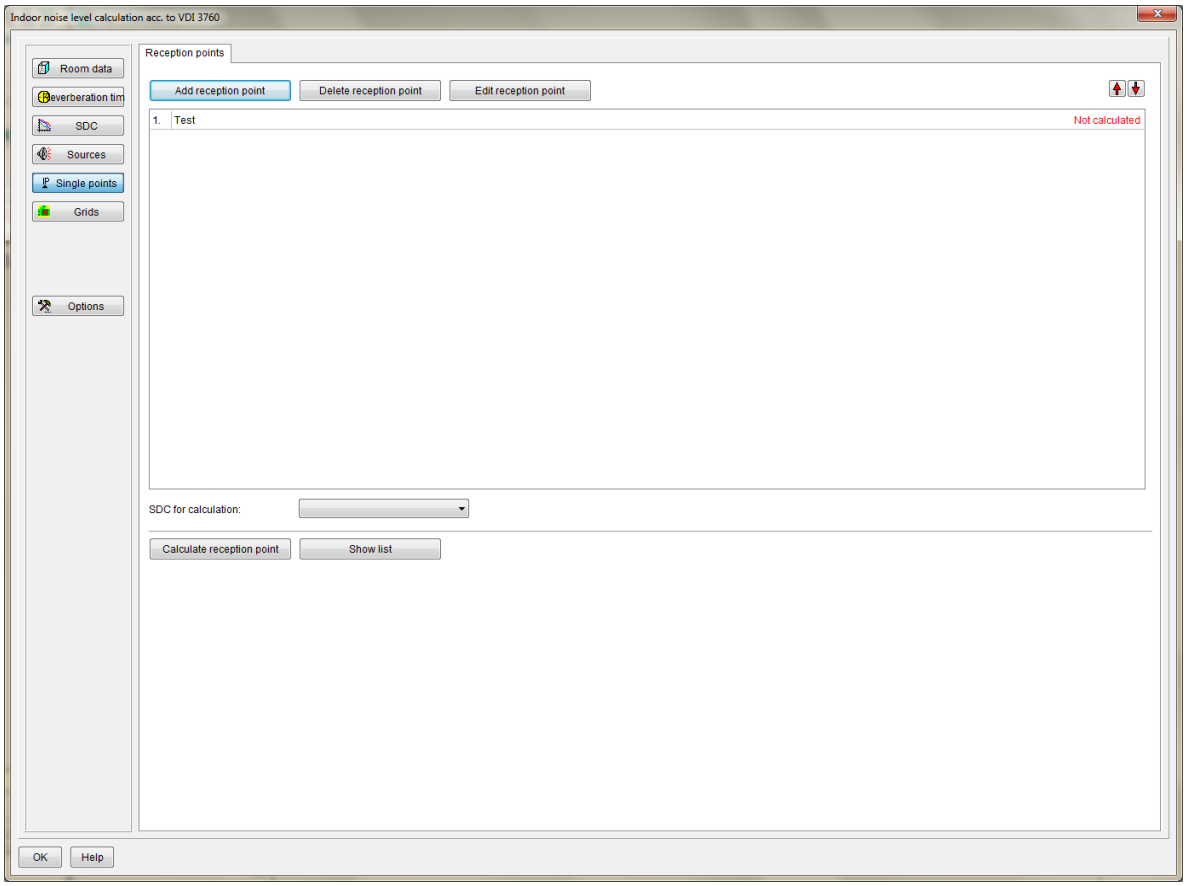
1.2.4.1 Define Sources



- **X1,Y1,Z1**: Coordinates of the source. These coordinates are required for calculating single points and grid, however, not for calculating the average hall indoor level.
- **Emission data**: Click this button to open a dialog box where you can enter the emission data of the source.
-  : Click this button to open the <Internal database | Emission spectra> dialog box.

1.2.5 Single points

Click this button to define reception points (IPKT) in the room and calculate single points at these points.



- Add reception point: Click this button to add another reception point to the list, see Define reception point on page 26.
- Delete reception point: Click this button to delete the reception points selected from the list.
- Edit reception point: Click this button to edit a reception point. Opens the same dialog box as described under Add reception point.

- **SDC for calculation**: Select the SDC to be used for calculation. If there isn't any calculated SDC, it is not possible to calculate a reception point.

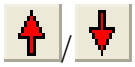
To calculate the noise impact level at one reception point, proceed as follows:

1) Determine the distance dX from the reception point for each of the available sources.
2) The total attenuation is determined from the selected SDC by adding the SDC value at the dX X-value to the sound power level of the source. (Note that SDC values are usually negative!)
3) The single values that have been thus determined for each source will be superimposed energetically.

- 

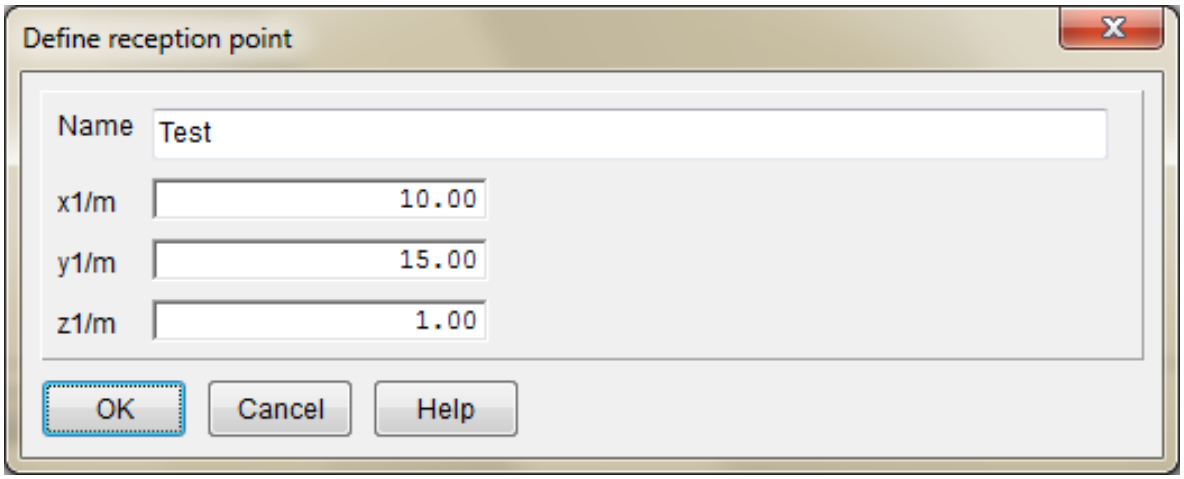
Calculate reception point Click this button to start calculation of the reception point.

Note: If an SDC is defined for calculation, the noise impact levels are calculated automatically as soon as the Single points button is clicked.

-  : Click these buttons to change the order of reception points in the list.
- 

: Click this button to show the results list.

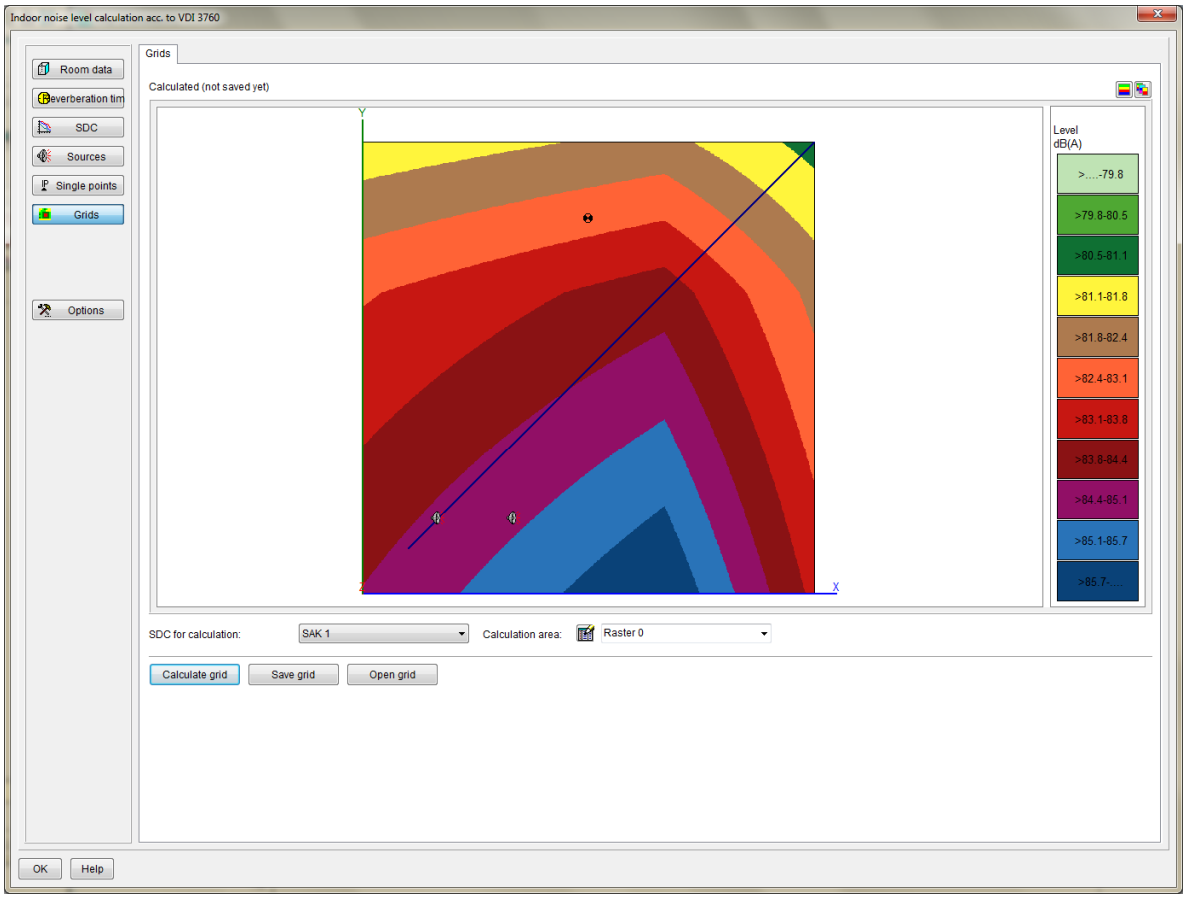
1.2.5.1 Define reception point

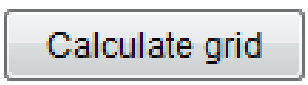


- **Label**: Enter any text describing the reception point.
- **X1, Y1, Z1**: Coordinates of the point.

1.2.6 Grid calculation

This dialog box allows calculating a level grid in the entire room or in a partial area of the room.



- **SDC for calculation**: Grids can only be calculated if there is an SDC available.
- **Calculation area**: This function can be used to select one of the predefined calculation areas for grid calculation.
-  : Click this button to open the Grid dimensions dialog box where you can define new calculation areas.
- 

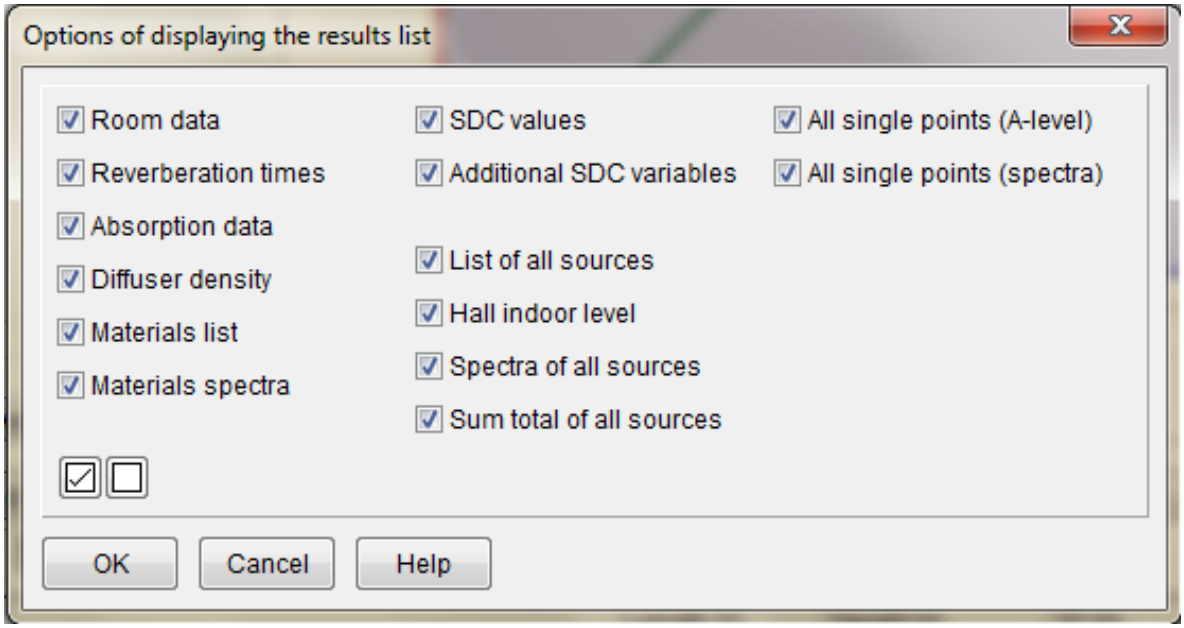
: Click this button to start calculating the grid.

Note: If room parameters or sound sources are changed, the grid is not automatically recalculated. Calculation must be restarted.

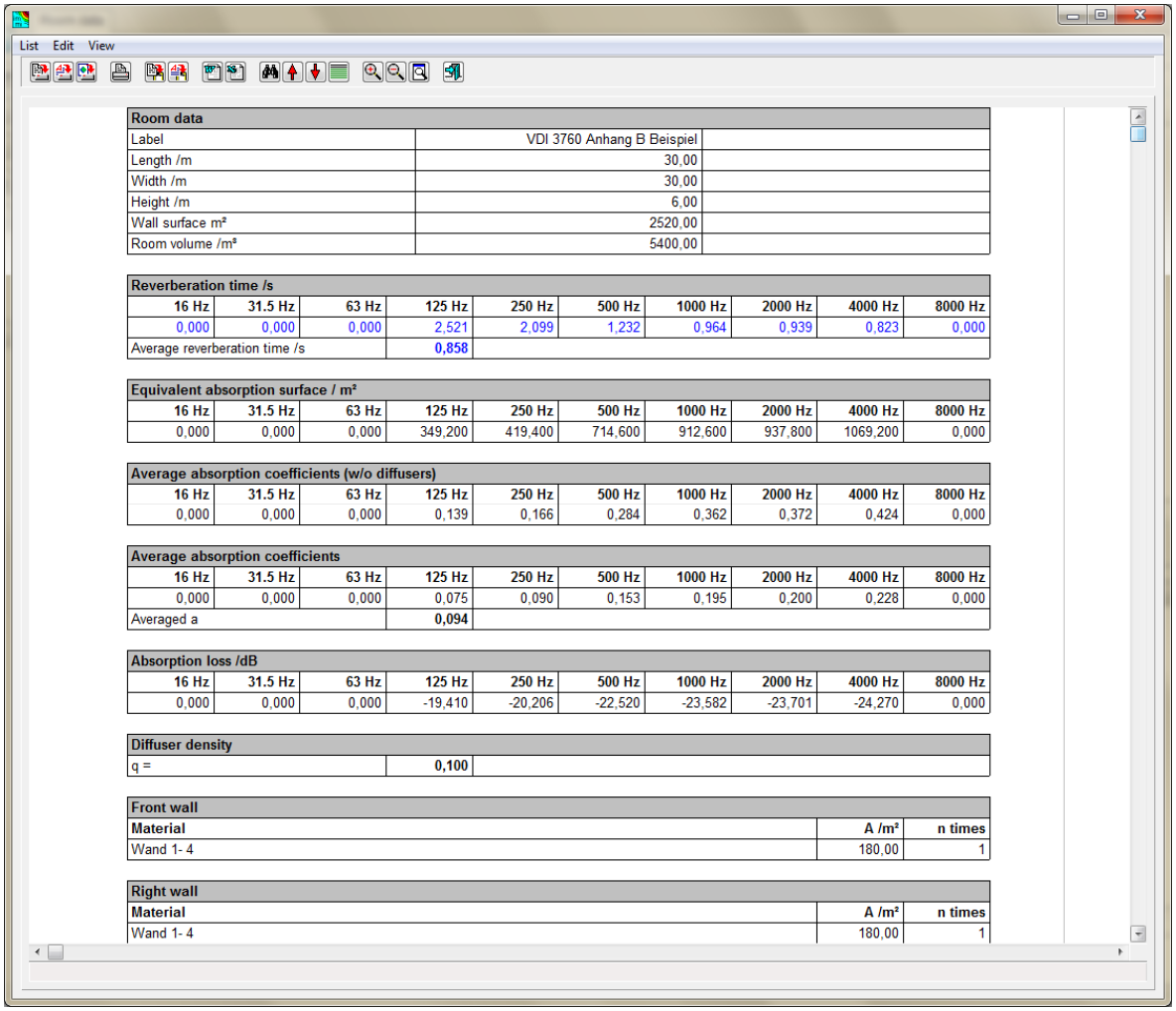
- Save grid : Click this button to save the calculated grid to the disk. The name of the saved grid is displayed above the graphical diagram. Grids which have been saved in this way can be edited outside of the statistics module (e.g., under Calculate | Calculation Control Centre).
- Open grid : Click this button to open and display a grid that has been saved.

1.2.7 Show list

Displays a list of all input data and results.



OK button opens the list.



List Edit View

Room data		
Label	VDI 3760 Anhang B Beispiel	
Length /m	30,00	
Width /m	30,00	
Height /m	6,00	
Wall surface m²	2520,00	
Room volume /m³	5400,00	

Reverberation time /s									
16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
0,000	0,000	0,000	2,521	2,099	1,232	0,964	0,939	0,823	0,000
Average reverberation time /s			**0,858**						

Equivalent absorption surface / m²									
16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
0,000	0,000	0,000	349,200	419,400	714,600	912,600	937,800	1069,200	0,000

Average absorption coefficients (w/o diffusers)									
16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
0,000	0,000	0,000	0,139	0,166	0,284	0,362	0,372	0,424	0,000

Average absorption coefficients									
16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
0,000	0,000	0,000	0,075	0,090	0,153	0,195	0,200	0,228	0,000
Averaged a			**0,094**						

Absorption loss /dB									
16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
0,000	0,000	0,000	-19,410	-20,206	-22,520	-23,582	-23,701	-24,270	0,000

Diffuser density		
q =	**0,100**	

Front wall		
Material	A /m²	n times
Wand 1- 4	180,00	1

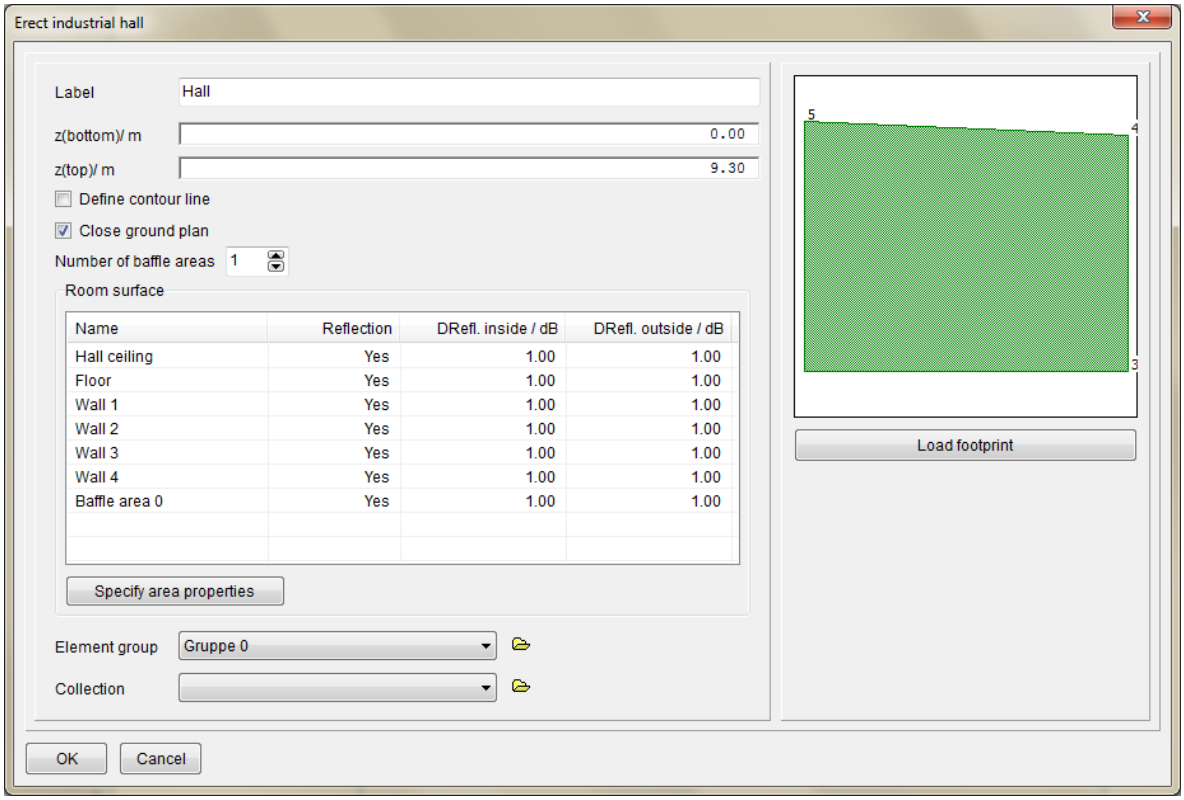
Right wall		
Material	A /m²	n times
Wand 1- 4	180,00	1

1.3 Macro: Erect industrial hall

In IMMI, an industrial hall is a closed area which is limited by wall or reflection elements in all three directions. This macro helps the user to generate these elements and set the reflection properties. In addition, it supports the generation of vertically suspended reflection elements which can be used to model baffled ceilings.

This macro is available via the <**Extras | Computation of sound propagation in workrooms | Erect industrial hall**> menu item or by clicking the Erect industrial hall button from the input dialog box of the help line [HLIN] element.

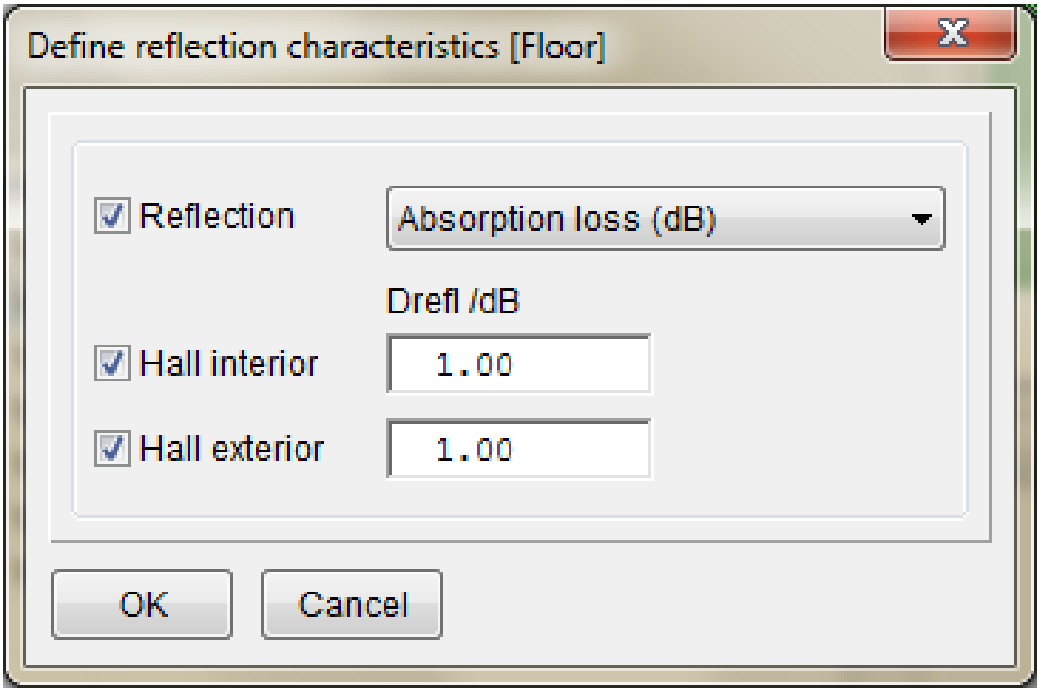
The macro is based on a help line which forms the ground plan of the hall. If the macro is activated from the input dialog box of a help line, this help line is used as ground plan. If the macro is activated via the Extras menu, a help line must first be selected as ground plan.



- **Label:** Enter any text to be used as element name during generation of the elements.
- **z(bottom) /m and z(top) /m**: Defines the bottom and top edges of the wall elements. The ceiling element is at z(top) and the floor element at z(bottom).
- **Define contour line**: Generates a contour line with the geometry of the ground plan. The z-coordinate is set to z(bottom). If the terrain where the hall is to be erected is uneven, this option causes generation of a hall which is positioned horizontally at terrain height z(bottom).
- **Close ground plan**: Closes the polygon used as ground plan for erection of the hall.

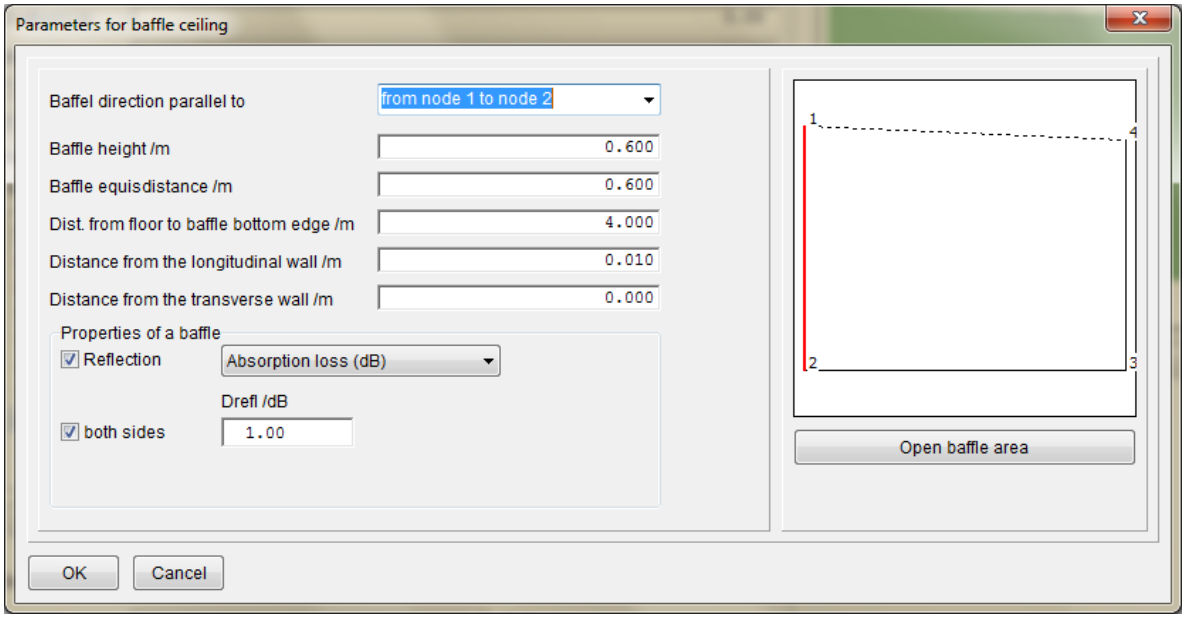
- **Number of baffle areas**: An industrial hall can contain one or more areas where baffles are suspended to reduce noise locally. Baffles are equally spaced reflection elements with strong absorption properties, which are suspended vertically and freely in parallel to one room direction. The number in this box defines how many of such areas will be present in the hall.
- **Room surfaces**: This list contains the room surfaces to be generated, i.e., wall surfaces, hall ceiling, hall floor, and baffle areas. It also shows the reflection properties of the individual elements.

  Double-click an element to open the following dialog box where you can define the reflection parameters.



- **Defining the baffles** (on page 34): Double-click a baffle area to open a dialog box where you can define the position and size of the baffles for this area.
- **Specify area properties**: Clicking this button has the same effect as double-clicking an entry in the list of room surfaces and baffle areas.
- **Element group / Collection**: If you select an element group and/or collection from these drop-down list boxes, the elements generated with this macro will become members of this element group/collection.

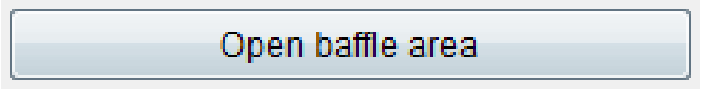
1.3.1 Parameters for baffle ceiling



To model the baffles, follow the 3 steps below:

1. Select the area where the baffles are to be provided.

Select this area by clicking the



button. Then select a help line specifying the area for the baffles.

2. Baffle position and size

- **Baffle direction parallel to**: The baffles are arranged in parallel to a section of the polygon of the area (reference section).
- **Baffle height**: Height of the baffle in Z-direction.

- **Baffle equidistance**: Horizontal spacing between two neighboring baffles.
- **Distance from floor to baffle bottom edge**: Horizontal position of the baffle.
- **Distance from the longitudinal wall**: Distance of the baffle which is nearest to the reference section.
- **Distance from the transverse wall**: Distance of the baffles from the wall which is perpendicular to the reference section.

3. Data on reflection/absorption

Select the reflection properties of the baffles.

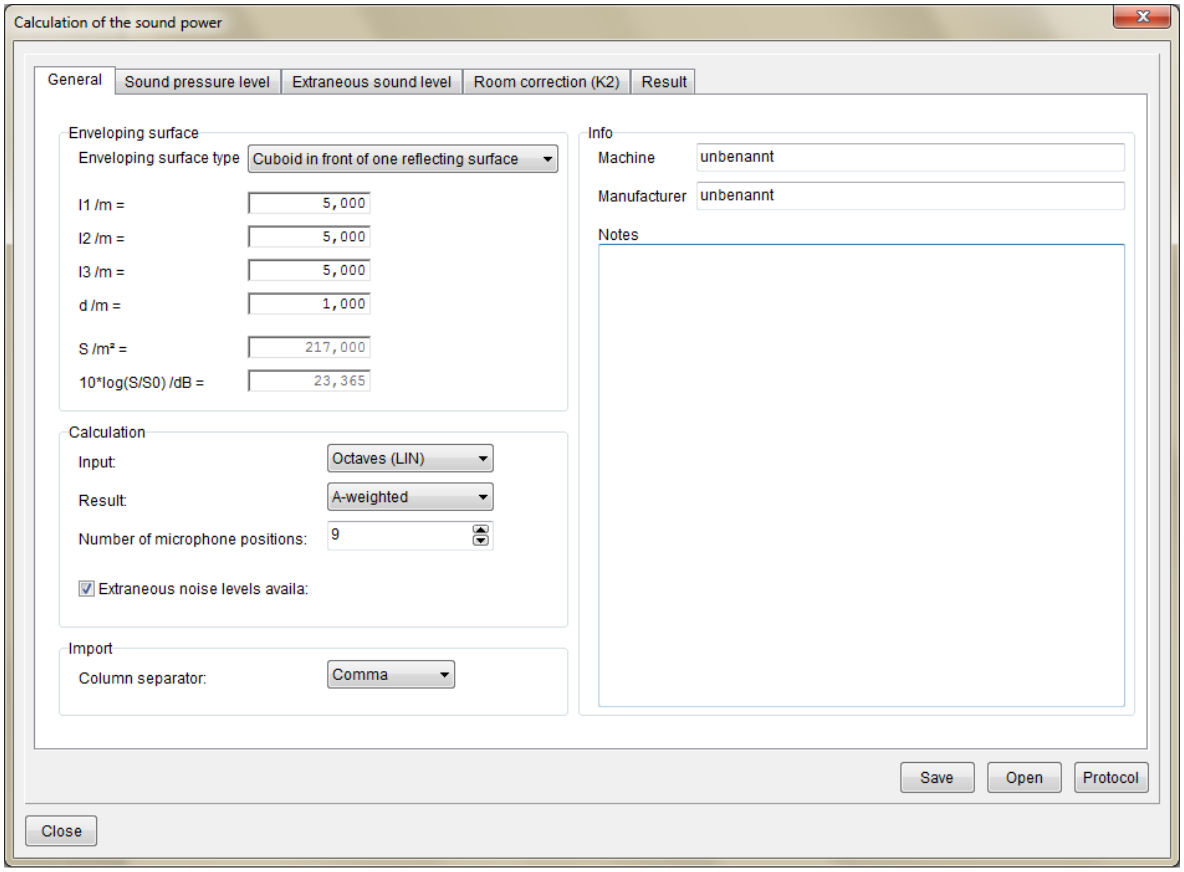
All baffles have the same reflection/absorption properties.

The two sides of each baffle have identical properties.

1.4 Determine sound power

Open the <**Extras | Computation of sound propagation in workrooms | Determine sound power**> menu item to calculate the sound power. This function calculates the sound power using the enveloping surface method. For more detailed information on this method, please refer to EN ISO 3744.

To start calculation of the sound power, first set the General parameters.



- **Enveloping surface**: Specify the position of the unit under test in relation to reflecting walls or floor.
  - Cuboid in front of one reflecting surface
  - Cuboid in front of two reflecting surfaces
  - Cuboid in front of three reflecting surfaces
  - Semispherical measurement surface

- Enter measurement surface manually

  If the measurement surface is a cuboid, length (l1), width (l2) and height (l3) as well the microphone distance (d) can be entered in meters.

  If the measurement surface is semispherical, the radius r has to be entered.

  Cuboid and semispherical measurement surfaces are calculated by the system and cannot be changed by the user.

  If you select the **Enter measurement surface manually** enveloping surface type, you can enter the measurements surface directly.

- **Input**: This item defines how the measured sound pressure levels, extraneous noise levels and room corrections (K2) can be entered. The options available are A-levels, linear third-octaves, A-weighted third-octaves, linear octaves, and A-weighted octaves.
- **Result**: The calculation result can be A-weighted or linear. Whether the results are output as A-levels, octaves or third-octaves, depends on the setting under Input.
- **Number of microphone positions**: Defines how many microphones are used for measuring. The maximum number is 25.
- **Extraneous noise levels available**: If this check box is activated, extraneous noise levels must be entered. If extraneous noise levels are unknown, just deactivate this check box. Extraneous noise levels will then not be taken into account in the calculation.
- **Column separator**: The measured sound pressure and extraneous noise levels as well as the room correction can be imported from text files. Select the column separators for these files from this list box.

Entering the sound pressure and extraneous noise levels and the room correction

The necessary entries can now be made on the corresponding tabs of the dialog box. Enter an A-level, an octave band or a third-octave band for each microphone position.

-  - Open measured sound pressure levels: The necessary input values can also be imported from a text file. The individual values of this file must be separated by the character selected from the Column separator list box. The only decimal format is the decimal point.

  The files must always contain a complete third-octave or octave band. If there is no value for a third-octave or octave band, enter -99 as a substitute value.

  Example of an octave level file for 5 microphone positions (the 16-Hz octave band of 99 shows that there is no value for it):

  -99,56.3,73.4,61.0,55,66.8,69.2,71.22,53.02,52.8

  -99,51.3,73.4,62.0,55,66.8,69.2,71.22,53.02,52.8

  -99,52.3,73.4,63.0,55,66.8,69.2,71.22,53.02,52.8

  -99,59.3,74.4,67.0,55,66.8,69.2,71.22,53.02,52.8

  -99,58.3,72.4,64.0,55,66.8,69.2,71.22,53.02,52.8

-  - Save entered sound pressure levels: Click this button to save the entries to a text file. The format of this file is the import format (see above).

The **Result tab** of the dialog box shows the calculated sound power levels.

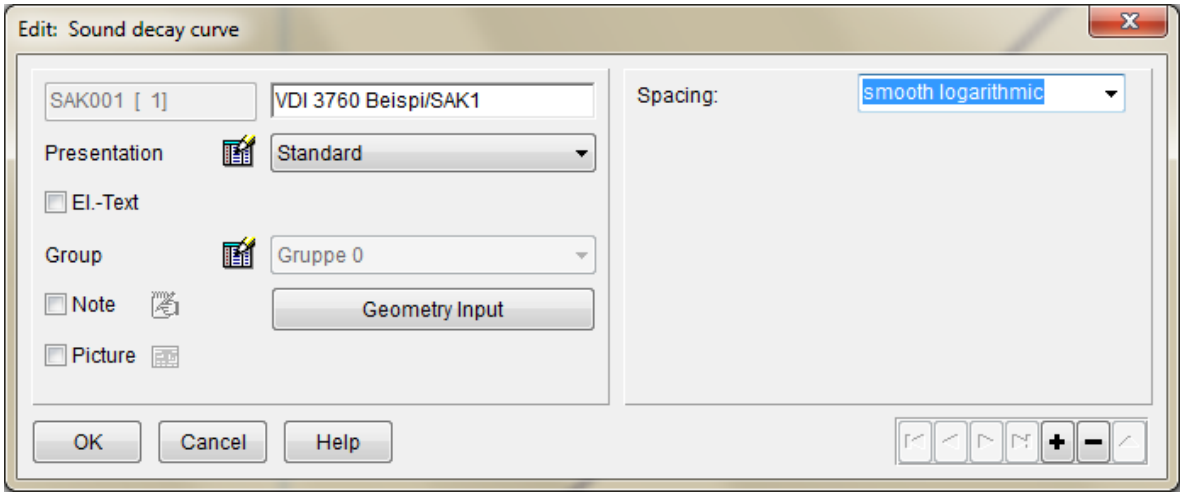
-  - Save sound power levels in the external spectrum database: Click this button to copy the calculated result to the external emission spectra database. From there, the result can then be used in any project. The name of the result, which is entered under label, is also copied to the database.
-  - Save sound power levels: Click this button to save the result to a text file. The format of this file is the import format.

1.5 Calculating sound decay curves (SDC)

IMMI provides the function of calculating sound decay curves (referred to as SDC below) according to VDI 3760. For more detailed and basic information on the calculation of SDCs, please refer to VDI 3760.

1.5.1 Element SAK - Sound decay curve

An SDC element -  - is a line element with exactly two nodes.



The position of the interpolation points k of the SDC is defined by the Spacing parameter:

- **Discrete constant**: Distance of the interpolation points from node 1 in meters; Example: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 24, 28, 32, 36, 40, 44, 48, etc.
- **Smooth logarithmic**: Distance of the interpolation points from node 1 in meters; Example: 1, 2, 3, 4, 5, 6.3, 8, 10, 20, 30, 40, 50, 63, 80, 100, 200, etc.
- **According to BGI 797**: Distance of the interpolation points from node 1 in meters; Example: 0.75, 1.5, 3, 6, 12, 24, 48, etc.

Note: According to VDI 3769, the SDC should always be calculated in octave bands, preferably in the frequency bands from 125 Hz to 4000 Hz.

1.5.2 Calculate SDC

The SDC calculation is fully integrated in the new Calculation Control Centre (CCC). In addition to reception points, façade levels and grids, this function now also allows calculation of sound decay curves.

Note: Calculation results can only be evaluated in the CCC. They cannot be represented on the map, as this is possible with grids or reception points.

Note: The SDC is calculated according to the following formula:

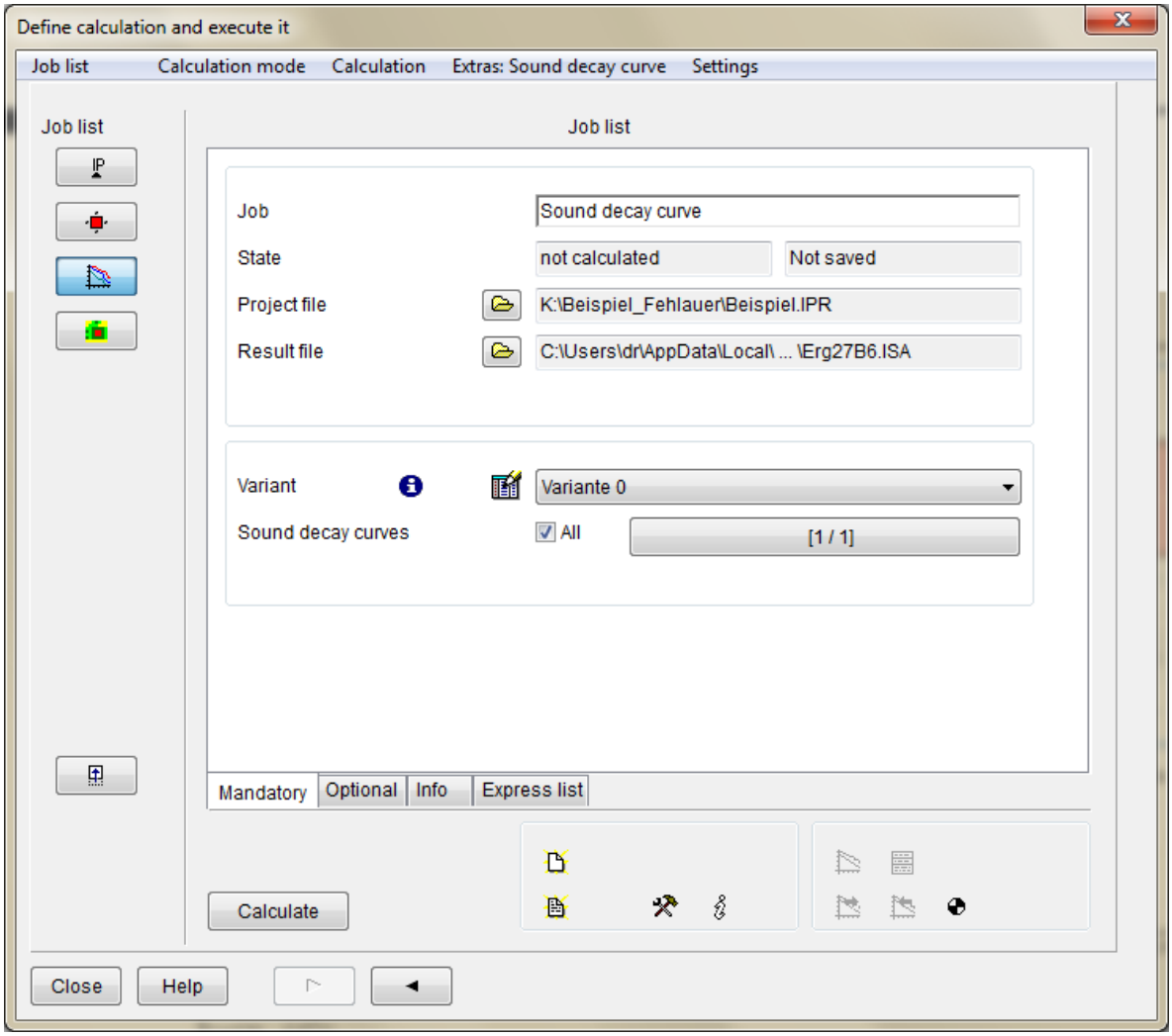
$$SAK_k = L_{p,k} - L_W$$

where

$L_{p,k}$ is the noise impact level at the interpolation point k of the SDC

L_w is the sound power level of the single-point source at the first node of the SDC

1.5.2.1 SDC Calculation: Tab: Mandatory



- **Job**: This box describes the job. If a new job is created, the job description is automatically generated. It consists of a code of the calculation method (IP for reception point calculation), a consecutive number as well as date and time.
- **State**: This box indicates whether the job has already been calculated and, if yes, whether and how the results are saved. The calculation state can be **Not calculated** and **Calculated**.

  Calculated state: Almost all other input fields are disabled. It is only possible to edit the job description and the notes.

The saving state can be **Not saved**, **Temporarily saved** and **Saved**. For detailed information on the saving method, please refer to the section on **Result file**.

- **Project file**: The Project file box displays the name of the assigned project file. Click on the  button to select and assign another project file.

  This also automatically loads the project file!

- **Result file**: The Result file box displays the name of the file where the results are saved or are to be saved after completed calculation.

  Once a job is generated, a result file is defined which resides in a temporary folder and has an automatically generated name, e.g.: Erg53A.IRP in folder C:\Documents and Settings\Username\Local Settings\Temp.

  To save the results, choose one of the following options:

  - Click on the  button to open the **File to save results** dialogue box and select an appropriate folder and filename to be assigned to the job before you start calculating the project. After the calculation, the job will have the **Saved** state.
  - Use the automatically generated filename from the TEMP folder. After the calculation, the job will have the **Temporarily saved** state.

Note: Although the latter option allows access to the results, the location provides second-class storage only. Since the filename is assigned by random, the file can usually only be found through the job assigned to it. An unintentional deletion must always be expected during clearing of the Temp folder.
However, this option is to advantage in that you have to think about an appropriate filename only if you come to the conclusion that you wish to save the results permanently after having completed the calculation.

You will then only have to click on the button  or use the **<Calculation | Save>** menu item to save the results under an appropriate name.
If the results are not worth being saved, just forget the file. It will be deleted during clearing of the TEMP folder.

Note: If a temporarily result file is permanently saved, IMMI does not save it internally but only renames the file. This means that the original TEMP file will not be available any longer.

- **Variant**: Select the variant to be calculated (see also Element Groups + Variants). Click on the  button to have direct access to the dialog box for editing the element groups and variants. This allows you to do without the main menu and its **<Project | Element groups + Variants>** function if you wish to generate new variants or edit existing ones.
- **Sound decay curves**: Select the sound decay curves to be calculated.
  - **All**: All reception points will be calculated. If you deactivate this checkbox, the **Selection: [10/10]** button will be enabled. Click on this button to select individual points. The procedure for selecting the reception points in this dialog box is the same as that described above for selecting the variant.

1.5.2.2 SDC Calculation: Tab: Optional

- **Show while calculating**: Calculation results can be shown on the map while calculation is in progress.

  You have the following options:

  - **Do not show**.
  - **Map area**: The whole work area is shown on the map.
  - **Grid area**: If you use the point calculation mode, there will be no grid area. In this case, the grid area will be the axis-parallel rectangle which encloses all of the reception points to be calculated.
  - **Grid area + frame**: This will leave a border corresponding to 5% of the particular dimensions on all sides.

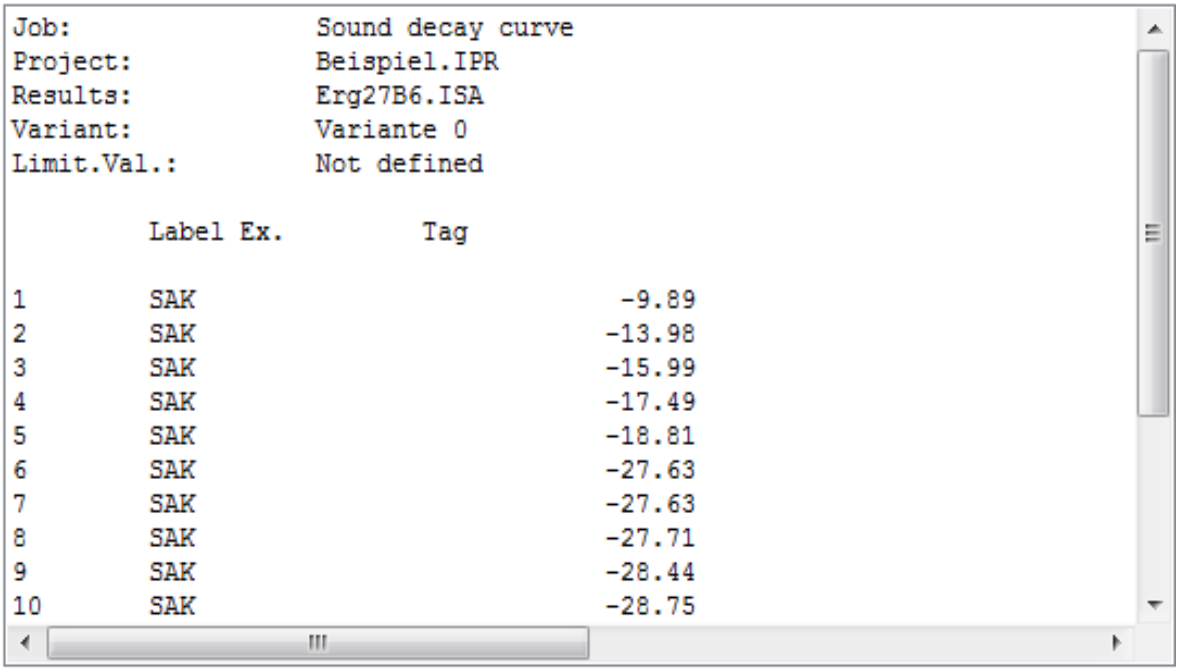
- **Keep clipping**: The clipping having existed before calculation was started is preserved.

- **Suppress warnings**: If you activate this checkbox, warnings which may be generated within the scope of the formal check before each calculation will not be displayed.

1.5.2.3 SDC Calculation: Tab: Info

Enter notes in this field as you wish.

1.5.2.4 SDC Calculation: Tab: Express list



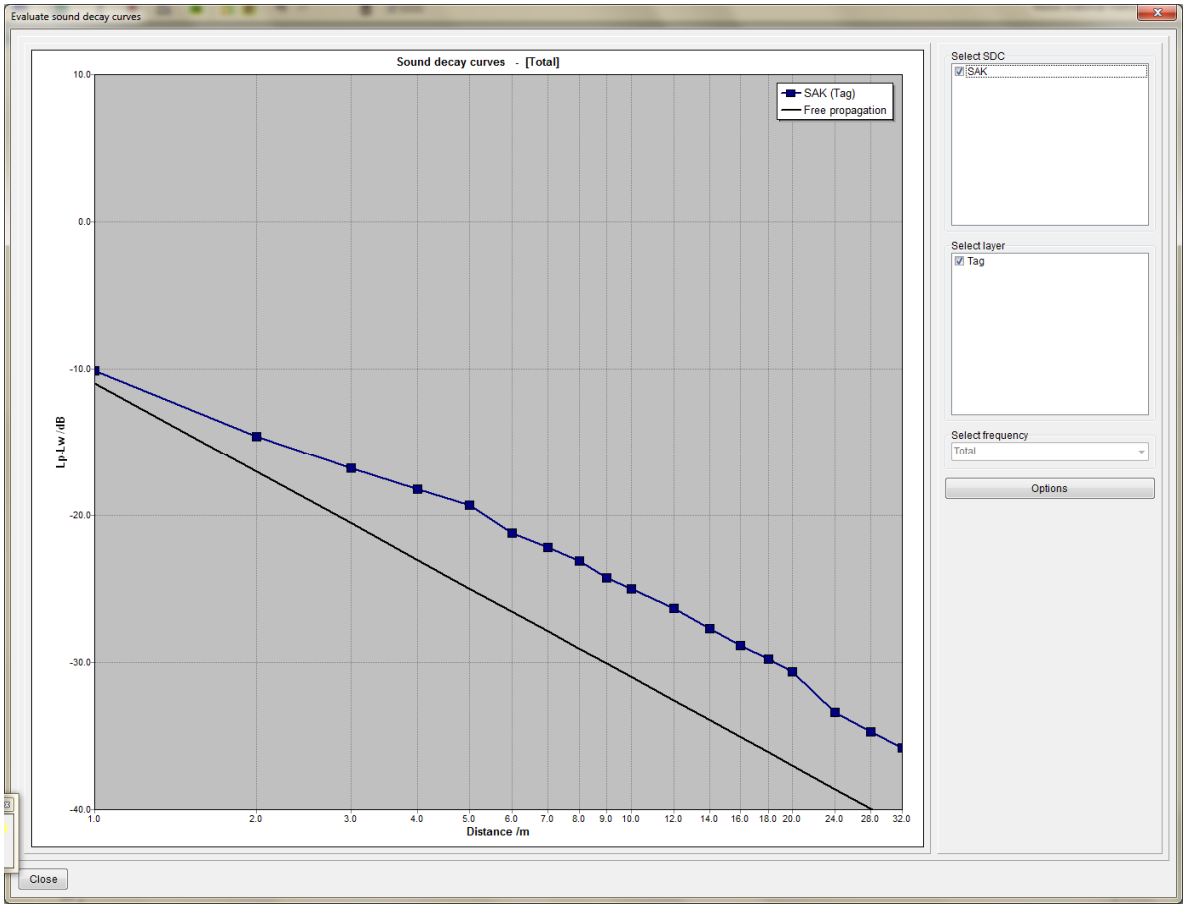
```
Job:                Sound decay curve
Project:            Beispiel.IPR
Results:            Erg27B6.ISA
Variant:            Variante 0
Limit.Val.:         Not defined

         Label Ex.         Tag

1        SAK                          -9.89
2        SAK                         -13.98
3        SAK                         -15.99
4        SAK                         -17.49
5        SAK                         -18.81
6        SAK                         -27.63
7        SAK                         -27.63
8        SAK                         -27.71
9        SAK                         -28.44
10       SAK                         -28.75
```

This tab opens a simple list (or express list). Since it is directly shown in the dialog box without you having to make your selection and open a new window, this is an extremely fast way of gaining an overview of the calculation results.

1.5.3 Extras: Sound decay curve

1.5.3.1 Show as diagram/table

The results can be output in a diagram or in a table.



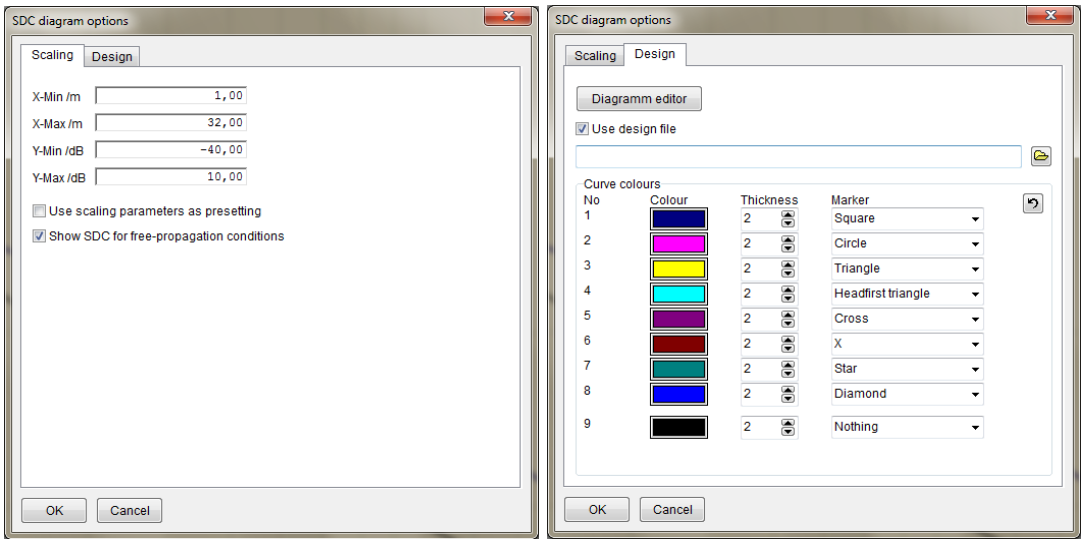
- **Select SDC:** Switch on or off the calculated SDC's.
- **Select layer/frequency**: Select the layer or/and frequency.
- **Options**: See

Local Menu (right mouse button): The local menu of the diagram provides various options of exporting the displayed diagram:

- The diagram can be saved to a file in various graphical formats (BMP, JPG, and PDF).

- The function values can be saved as text file.
- The diagram can be printed directly.
- The diagram can be exported to MS-WORD and MS-EXCEL. This requires installation of a current Microsoft® Office package.
- The diagram can be copied to the clipboard in various graphical formats (BMP, JPG, and PDF).
- The local menu also features a diagram editor where a great number of parameters can be set for designing the diagram. However, these settings are lost if the diagram is closed and reopened.
- The changes made in the diagram editor can be saved to a file by selecting the Save design item and opened and reused for the diagram by selecting the Open design item. As a result, the most essential parameters of the diagram design are saved and reopened.

1.5.3.2 Diagram-Options



Scaling

- **X-Min/m, X-Max/m, Y-Min/dB, Y-Max/dB**: Defines the scaling of the diagram. Initially, these settings only apply to the displayed diagram.
- **Use scaling parameters as presetting**: Activate this check box if you wish to use the set scaling parameters for all future diagrams.

- **Show SDC for free-propagation conditions**: This check box controls the display of the SDC for free propagation. The SDC which only takes the distance attenuation into account (without any reflections, absorptions or obstacles) can be displayed for comparison with the SDC that was actually calculated in a physical room.

Design:

- **Diagram editor**: Click this button to start the diagram editor.
- **Use design file**: The settings made in the diagram editor can be written to a file with the Save design item of the local menu of the diagram. If you wish to use the diagram design saved to that file for all further diagrams, activate the check box and enter the name of this design file in the input box below the check box.
- **Curve colours**: Since different diagrams may have different numbers of curves, it is not appropriate to save the display parameters of the curves to the design file. For this reason, the SDC diagram options dialog box provides the possibility of separately setting the line thickness and the marker type for up to eight curves. These settings are applicable to all diagrams. The colour, thickness and marker of curve no. 9 are always used for the curve of free noise propagation, if this curve is displayed.
-  - **Undo**: Click on this button to reset the colour, thickness and marker type to the default values for all nine curves.

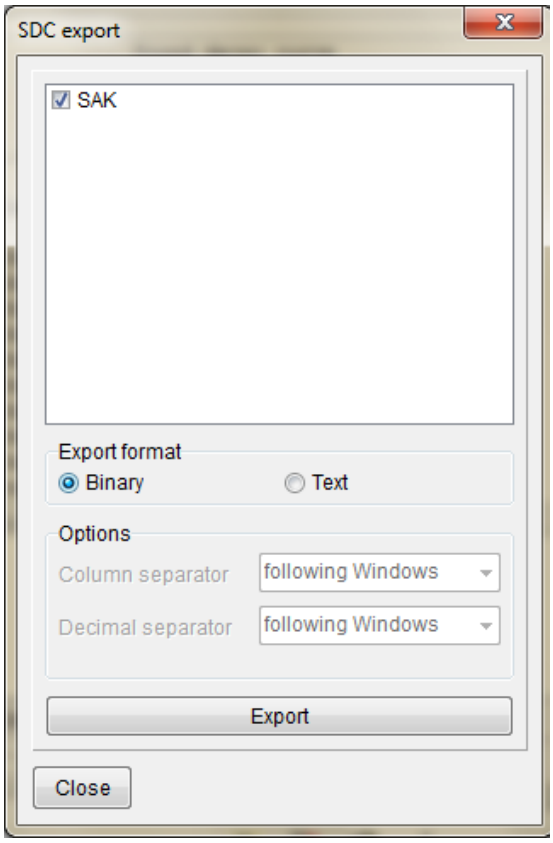
The line styles used cannot be changed by the user.

Note: All of the curves of different layers are displayed in the same colour but with different line style (continuous, dashed, dotted, etc.).

1.5.3.3 SDC - Import and Export

SDCs can be imported and exported.

- **Export SDC**: Click this button to export the calculated SDCs.



This requires that you select the curves to be exported beforehand.

- **Export format:** SDCs can be exported in binary or in text format. The binary format is not documented for the user and only serves to exchange the SDCs among the various projects.
- **Options**: The column separator and the decimal separator can be set for exporting the SDCs in text format.
- **Export**: Click the Export button to start the actual export process.

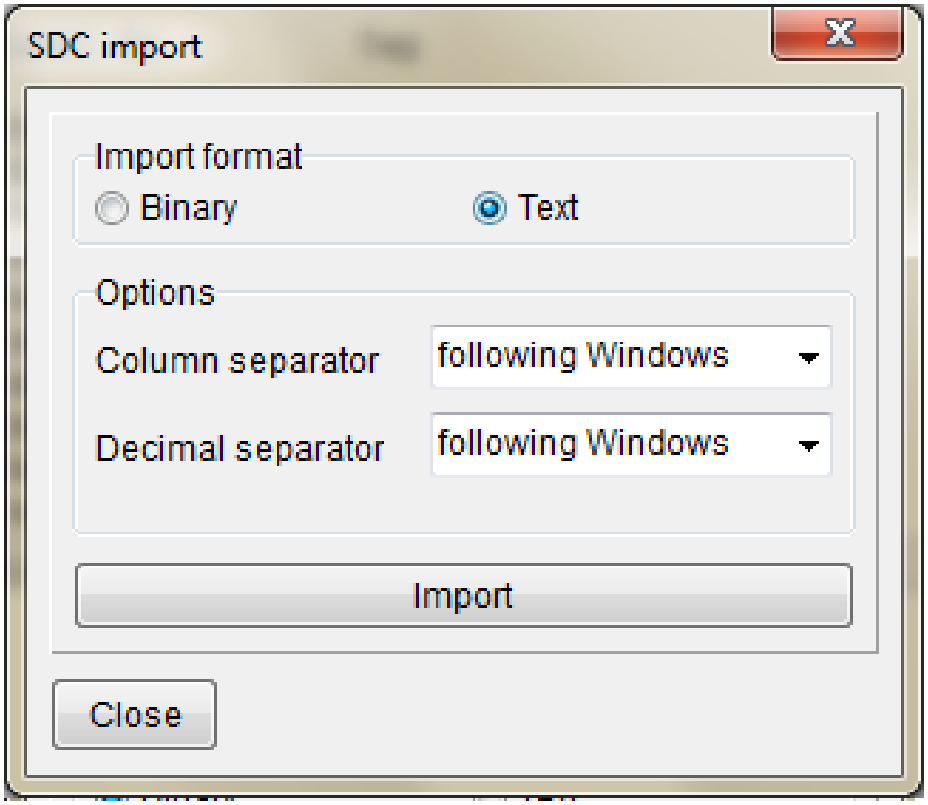
IMMIWIN---												ID for an IMMI file
IMMISDC---												ID for an SDC file
322												Version number
2												Number of SDCs in this file
3												Number of layers per SDC
SDC horizontal												Name of the SDC
OktavLin												Frequency range (overall level, octave band, third-octave band)
16												First frequency band
8000												Last frequency band
12												Number of interpolation points of this SDC
1	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	START function values: X, Y1,Y2..,total
2	-14	-14	-14	-14	-14	-14	-14	-14	-14.1	-14.1	-14	
3	-17.5	-17.5	-17.5	-17.5	-17.5	-17.5	-17.5	-17.6	-17.6	-17.7	-17.6	
4	-20	-20	-20	-20	-20	-20	-20	-20.1	-20.1	-20.2	-20.1	
5	-22	-22	-22	-22	-22	-22	-22	-22	-22.1	-22.2	-22.1	
6.3	-24	-24	-24	-24	-24	-24	-24	-24	-24.1	-24.3	-24.1	
8	-26.1	-26.1	-26.1	-26.1	-26.1	-26.1	-26.1	-26.1	-26.2	-26.5	-26.2	
10	-28	-28	-28	-28	-28	-28	-28	-28.1	-28.2	-28.5	-28.2	
20	-34	-34	-34	-34	-34	-34.1	-34.1	-34.2	-34.4	-35.1	-34.3	
30	-38.7	-38.7	-38.7	-38.8	-38.8	-38.8	-38.9	-39	-39.4	-40.3	-39.2	
40	-	-	-	-	-	-	-	-	-	-	-43	

	42.4	42.4	42.4	42.4	42.4	42.5	42.5	42.7	43.2	44.5		
50	-44.9	-44.9	-44.9	-45	-45	-45	-45.1	-45.3	-46	-47.5	-45.7	STOP function values
DLf(close)	3	3	3	3	3	3	3	3	3	2.9	-99	DLf for close range
DlLf (middle)	3	3	3	3	3	3	3	2.9	2.8	2.6	-99	DLf for medium range
DLf (distant)	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.3	0.8	-0.2	-99	DLf for distant range
DL2 (close)	6	6	6	6	6	6	6	6	6	6.1	-99	DL2 for close range
DL2 (middle)	6	6	6	6	6	6	6	6	6.1	6.3	-99	DL2 for medium range
DL2 (distant)	8.3	8.3	8.3	8.3	8.3	8.3	8.4	8.5	8.7	9.4	-99	DL2 for distant range

If an SDC has several layers, the function values of the additional layers immediately follow each other. The START function values to STOP function values block is available exactly once for each layer.

If the file contains more SDCs than one, the data of the next SDC starts directly after the DL2 line for the distant range, with the name of the next SDC, the frequency range, the first and last frequency bands, etc.

- **Import SDC**: Click this button to import SDCs having been exported with the export function to the project. Files having been generated in binary format during export can be imported directly.



A text file must have the structure described above so that it can be imported. The import of text also allows importing measured SDCs.

Note: If a text file is imported, the last column of the function values, which contains the total value, is ignored. Text files do not require this column. The DLf and DL2 variables are recalculated after they have been imported from the function values of the SDC.

1.6 Note: Database for absorption coefficients

The PTB - Physikalisch-Technische Bundesanstalt, Braunschweig has published a detailed database of absorption coefficients. This database is integrated in IMMI and accessible via the menu <**Extras | External Databases | Reflection losses**>.