ODEON
Quick Start Guide

Combined

ROOM ACOUSTICS SOFTWARE

ODEON Room Acoustics Software

Version 13

Quick Start Guide for Combined Edition

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1. About ODEON

ODEON is a room acoustic prediction and measurement program that uses state of the art algorithms from geometrical acoustics. The program will help you obtaining accurate predictions and measurements on room acoustics. This Quick Start Guide gives an introduction to the use of ODEON Combined, the edition that includes all features available in the Industrial and Auditorium editions. As a supplement to the Quick Start Guide we recommend that you watch some of our video tutorials at www.odeon.dk/tutorials-acoustic-simulation. For a complete understanding of the ODEON features we also recommend that you read the full ODEON manual.

Remember: To check which features are included in each edition, read the feature sheet found under the product menu on the ODEON's home page.

Buttons, hints and menus

The most common operations can be carried out using buttons. Hovering the mouse over a button will display a hint telling the function of that button. You can also operate the program using menus and short-cut keys. Less common operations are available from the drop-down menu in the top of the ODEON application window – menus will change in order to facilitate the currently selected window or indeed the selected tab-sheet in the currently selected window. If looking for a facility in a window, it is quite likely that it can be found in the drop-down menu.

Context sensitive help

Context sensitive help is available using the F1 short-cut key throughout the program. The help includes description of the facilities available in a particular window, suggestions on the choice of calculation parameters, hints on the evaluation of calculation results, etc. Answers to questions which go on a specific window are found in the context sensitive help rather than in this Quick Start Guide.

ODEON files

ODEON uses files to store all information needed for a project. All files share the same name - the name of the room - with a different extension added. Three main categories of files are used:

- **Room files**, which contain all data entered by the user. From these files both calculation and result files may be recalculated. Some of the most important extensions are *.par*, that describes the whole geometry, *.PcS* that lists the sources, *.PcR* that lists the receivers and *.Mat* that includes the materials used in the model.

- **Calculation files**, which holds data that are being reused during calculations to speed up calculation (of point response calculations). These files can be erased once job calculations have been carried out, however if they are present, future calculations are speeded up.

- **Result files**, containing all results. For example, the extension *.GXX* refers to the results in the grid response (see section 4).
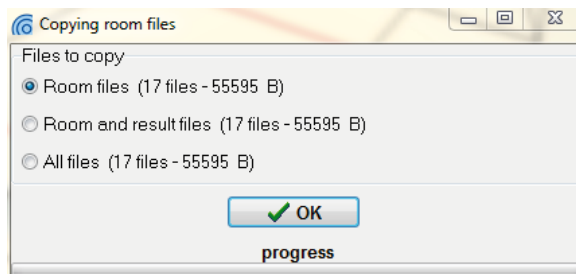
See the full list of files in the ODEON help by searching for File management.

Saving data and manipulating data

ODEON automatically saves the user-entered data, such as sources and materials with the room when the corresponding window is closed. Whenever data need to be updated in order to carry out calculations, ODEON will prompt whether to accept or discard changes. If the changes are accepted, ODEON will automatically erase results that are no longer valid, ensuring that results are always consistent with data entered.

To save a new version of the project you are working on, just click File>Copy Files, enter a new name and choose which files you want to copy. Copying only the Room files keeps all information needed for defining a project completely. You can then re-run

Tip: If you wish to delete specific files from a project, choose File>Delete files and select the particular type.

some calculations for the new version later on. Then, new Calculation and Result files will be created. So, there is no need to copy Calculation or Result files if it is fast to obtain the same files again. This will save a lot of space in your hard-disk.

Computer system requirements

Operating Systems: ODEON is a 32 bit Windows® application running on Windows® XP, Windows®Vista, Windows® 7 and Windows® 8 (32 bit version as well as 64 bit version). ODEON can in principle run on a MAC system using a Windows emulator. Many users choose this option istead of a PC, but since possible system instabilities my occur such a use is solely responsibility of the user.

RAM: recommended 2 GB.

Free Disk Space: Minimum 20 GB, recommended 300 GB. Unlike other applications ODEON is a fairly light program, consuming small space in temporary (RAM) memory, but it needs a generous space on Hard Disk. During calculations it creates files that are written on the Hard Disk, releasing the temporary (RAM) memory. Both simulation and auralisation files can be quite big, but their size depends heavily on the type of room project. So, managing the disk space is very much up to the user.

CPU: Minimum 1 GHz Pentium® recommended. Multi core processors are recommended for fast parallel calculations.

Graphics card: SVGA graphics display/adaptor.

Sound card: Sound card (for surround loudspeaker playback the sound card should typically support multiple channels e.g. 4.1, 5.1 and 7.1 - up to 50.1 supported).

Ports: USB port for plugging in the Dongle.

Tip: ODEON consumes modest amount of RAM and it is a very light software which responds very fast to the user actions.

Remember: ODEON works as a locally installed application. This means that server installation or remote desktop control are not possible. For multiple-user operation within the same Company or Institution extra licenses (dongles) are offered at a discounted price. Due to the nature of ODEON (writing many files during simulations) saving room files on a server hard disk is not recommeded. Calculation speed can significantly be reduced and the whole process can get stuck usually due to limited network capacity.

2. Get Started

For the installation procedure please refer to the full ODEON manual.

((Run ODEON Combined

You will find the ODEON Combined program at the Windows Start Menu > Program files > Odeon Combined> Odeon. It is handy to make a short-cut to the desktop by right-clicking on the application and selecting Sent to>Desktop (create short-cut). Then ODEON will be available from the desktop. Execute the program and begin the tour.

The Workspace

The workspace of ODEON Combined consists of the menu bar, the toolbar and the work area. On the right hand side of the menu bar the type of installation and the owner of the ODEON license is shown.

Menu Bar   Toolbar   User name / company name
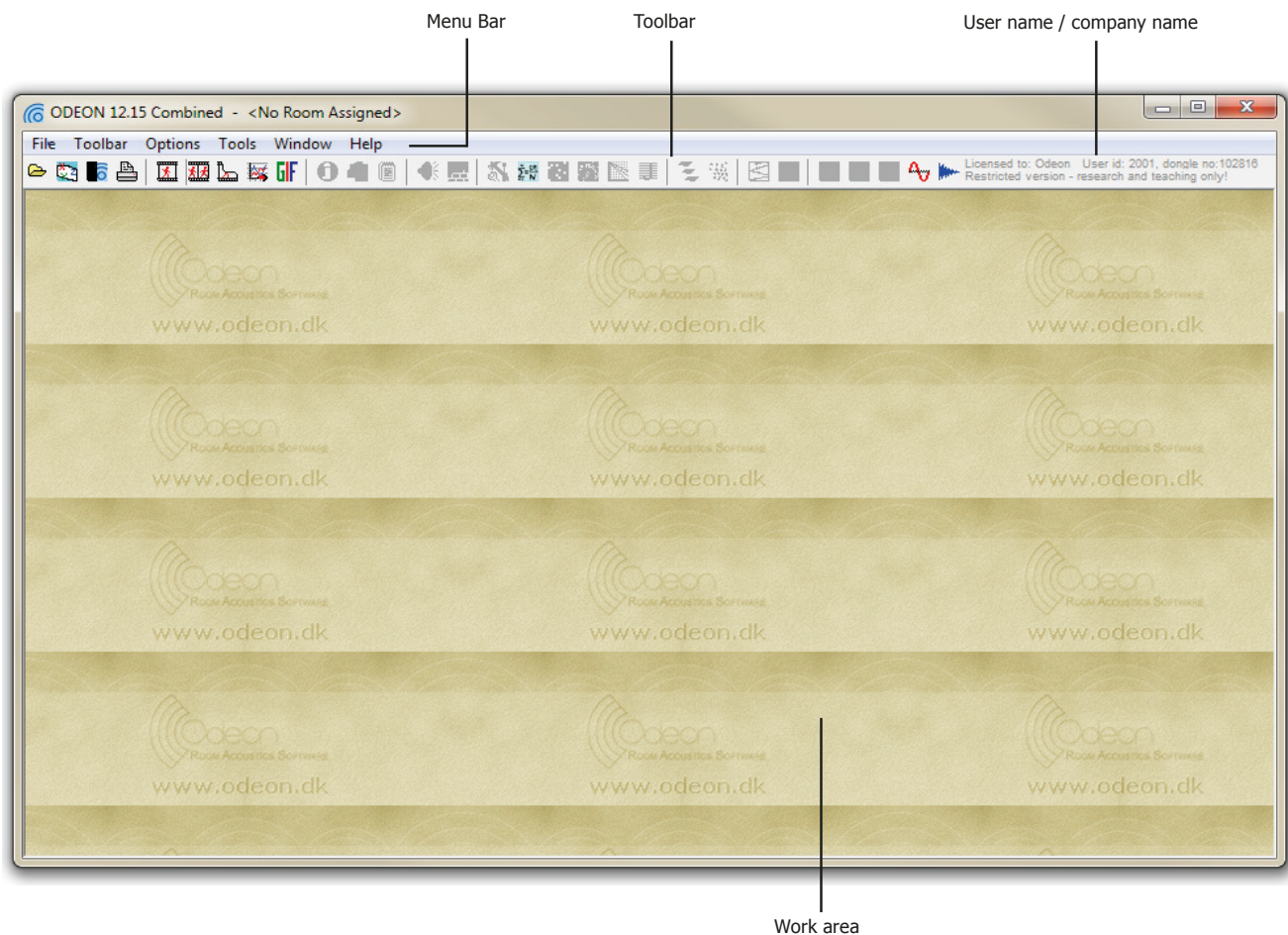
Work area

- The **Menu bar** is *dynamic,* meaning that an extra menu is added between the *Toolbar* and the *Options* menus when a new window becomes active in the work area. This menu brings options corresponding to the active window.
- Initially the **Tool bar** has many of its buttons inactive. These buttons can only be used when a room is assigned. The rest can be used any time independently of rooms. For example, the buttons associated to the measuring system are always available, since measurements can be performed without the need of a room model being assigned.

📂 Open a room model to work on

Click the Open a room model button to select a room. The room files containing the geometries for ODEON carry the extension .Par (or .Sur for compatibility with previous versions of ODEON) and are plain ASCII /text files following the format outlined in the Appendix in the full ODEON manual. Default rooms are found in the Rooms subfolder inside the main ODEON folder on your PC. The usual path is C:\Odeon13Combined\Rooms. The models in the Rooms subfolder cover different types of projects that can be investigated with ODEON. For this guided tour select the room model named Example.par.

Tip: Press **F1** to get over-view of facilities in the 3D View and their use.

The Tool bar

Once the room Example.par is loaded all buttons in the toolbar become active and can be used with this room. The buttons are grouped in an order that helps executing the tasks needed in a project.

Remember: LMB stands for Left Mouse Button while RMB stands for Right Mouse Button.

Sources and materials are the first things to be set before any calculation or investigation

Visual inspection of the geometry can be done with the group of 3D view buttons
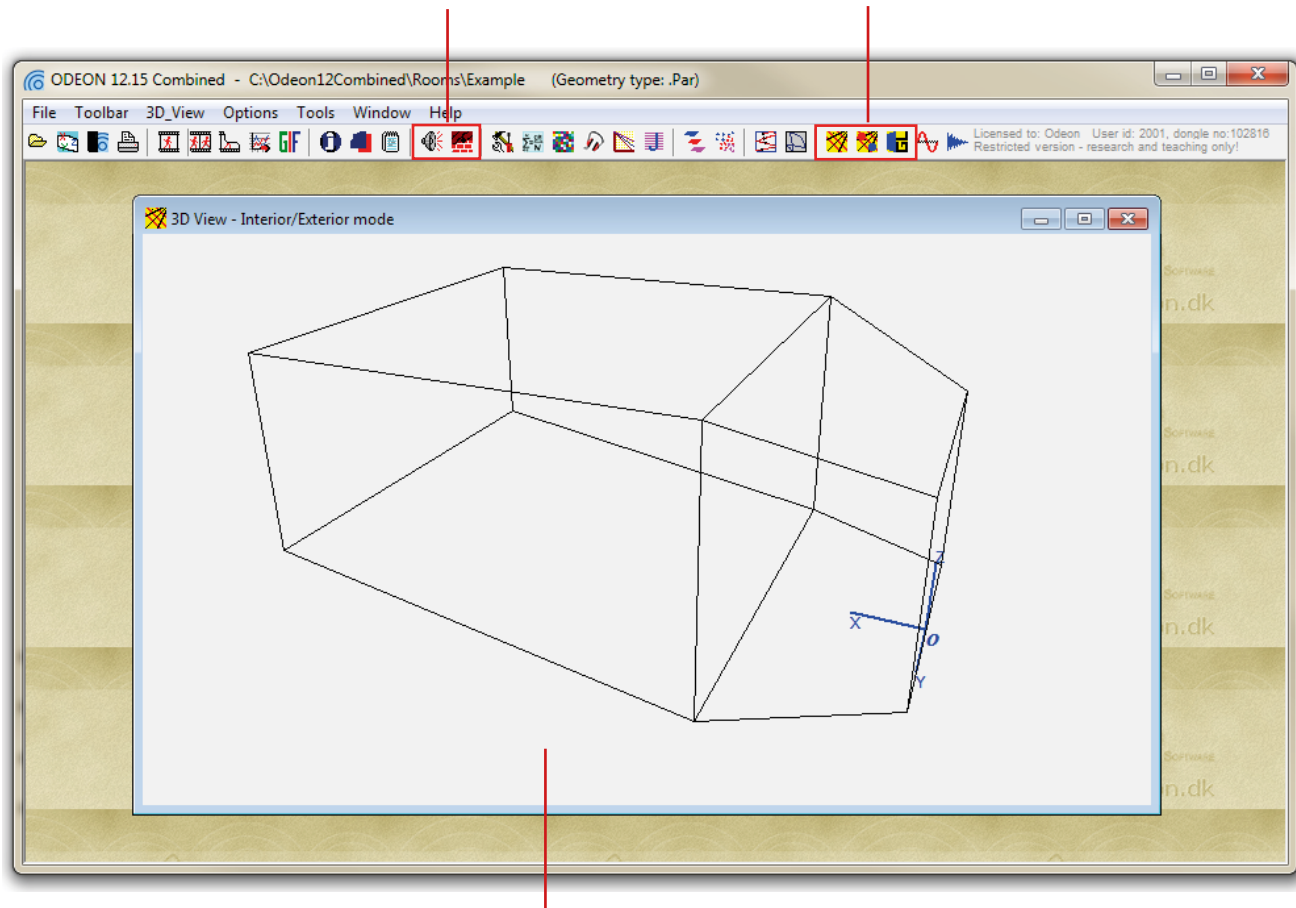
When the room is loaded it is automatically displayed in a wireframe form.

3DView

Whenever ODEON loads a room, it is displayed in a 3DView. Immediately a new menu called 3D View is added between the Toolbar and the Options menus in the Menu Bar. Have a look at the room. This allows you to investigate the geometry as a wireframe model and check it for errors.
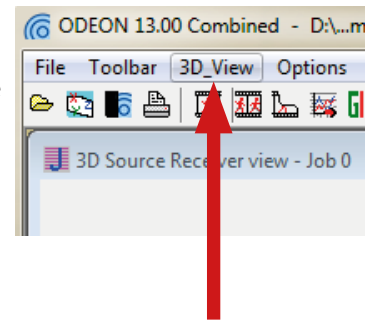
Use the mouse to:

- Rotate/orbit the geometry (LMB)

- Pan the geometry (RMB)

- Zoom the geometry (ALT+LMB - dragging from bottom left to top right)

Having assigned a room, this is a good time to get familiar with the MDI concept (Multiple Documents Interface). At this point the title bar of the 3DView will be blue (or some other colour) indicating that this is the active window. Being the active window, the 3DView menu item is added to the menu bar next to the Toolbar drop-down menu. You can operate the functions of the window using this menu or the short-cut keys displayed in the menu.

Several facilities are also available in the 3D View menu. The most important are:

- Rotation (CTRL+Left/Right/Up/Down Arrow)

- Panning (ALT+Left/Right/Up/Down Arrow)

- Zooming (CTRL+U, CTRL+I)

- Highlighting (H) of selected surfaces and corner numbers (N) etc.

- Navigating through front, side, top, perspective and other views of the model (SPACEBAR).

3. Setting-Up the Model

Define sources and receivers

Before any calculation can be carried out in ODEON, one or more sources have to be defined. Of course a receiver will also have to be defined in order to calculate a point response, but it is not necessary when calculating global reverberation time. In this guided tour we shall define a *point*, a *line* and a *surface source*. Finally we define a receiver.

Click the Source-receiver List button at the Toolbar to open the Source-receiver List from which sources and discrete receivers are defined.
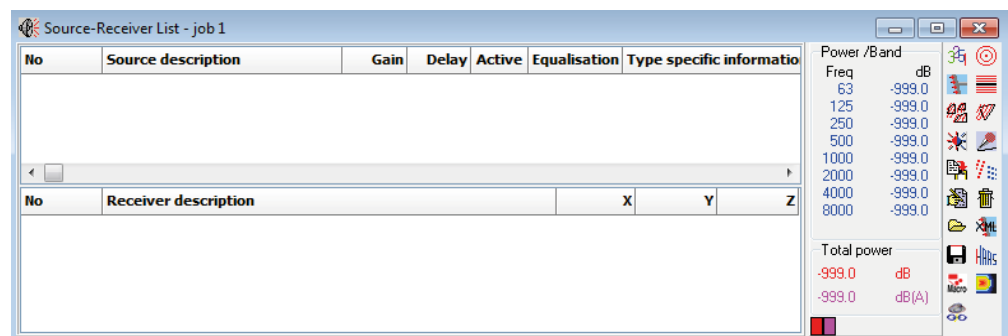
Local Toobar

◎ Define a point source

Click the New point source button in the Local Toolbar at the right side of the Source-receiver List to open the Point source editor. Enter the values x = 3 (metres), y = 2 (metres) and z = 1.2 (metres). If you are not sure of the position of the source, you can select the 3D Edit Source display. If you do so, you should notice how the menu item 3D Edit Source appears on the *Application Bar,* when this window becomes active. All navigation commands available in the 3D View are available in the 3D Edit Source (eg. SPACEBAR to switch between different predefined views). Finally set the overall gain to 65 dB (65
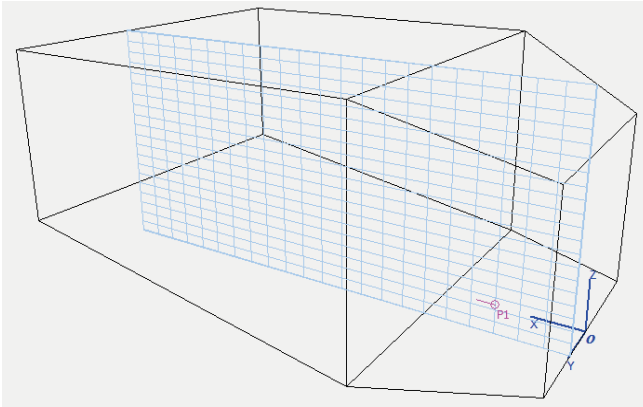
is just an arbitrary value). Keep the default values for the rest fields. To save the new source just close the Point Source Editor. New sources are by default turned OFF, therefore it will not be visible in the 3D Edit Source display. Press the SPACE key to activate the source or tick the *Active* check box in the Source-receiver List.

Tip: In ODEON 13 it is possible to change source position directly on the 3D Edit Source display using CTRL+LMB. As you rotate the geometry a grid is adjusted to the visible plane to help anchoring the source on its nodes. In the next figure the grid is displayed for the XZ plane.

Remember: Depending on the language selected on your computer '.' or ',' is used as decimal point. The decimal separator to use internally in ODEON may also be selected from the Options>Program settings>Other settings entry.
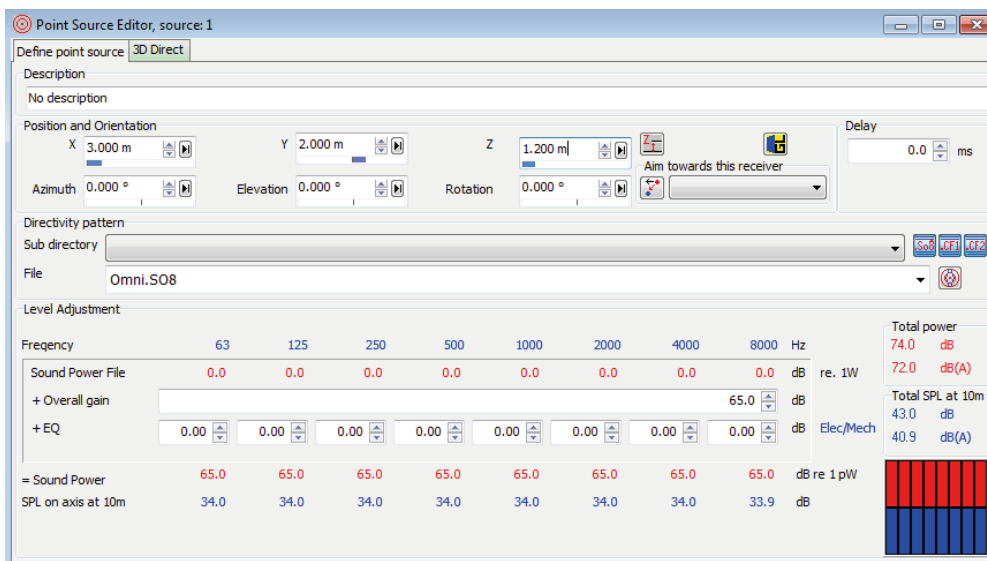
The Combined edition of ODEON offers extra types of sources, such as line and surface sources. These are used whenever the source is not so small to be represented by a point source (eg. the mouth of a human speaker). Traffic noise in a high-way for instance can be modelled by a line source. An engine can be assumed to radiate sound from the entire body, so a multi-surface source can be used in this case.

≡ Define a line source

Click the New line source button in the Local Toolbar to open the line source editor. Enter the values x = 4 (metres), y = 2 (metres), z = 2 (metres), Length = 2 (metres) and Azimuth = 135°. Finally set the Overall Gain to 65 dB. To save the new source just

Warning: The coordinates of a source or receiver must be within the maximum and minimum coordinates of the room. If a bigger or a smaller number is entered in the coordinate fields ODEON replaces it with the maximum or minimum allowed value.

close the Line Source Editor.

Define a multi surface source

Click the New multi surface source button to open the Multi surface source editor. Select surface 2001 End wall behind podium for this source and click the Invert normal button or press the short-cut CTRL+I to make the multi source radiate into the room (a surface in a multi surface source can radiate energy from one of its two sides or from both sides). Finally set the Overall gain to 65 dB. To save the new source just close the Multi surface source Editor and confirm.

Surface source

The facilities of the Surface source are fully included in the Multi surface source – the Surface source is only available for backwards compatibility.

Define receivers

Click the New Receiver button to open the Receiver editor. Enter the values x = 1.5 (metres), y = -0.5 (metres) and z = 1.65 (metres). To save the new receiver just close the Receiver Editor.
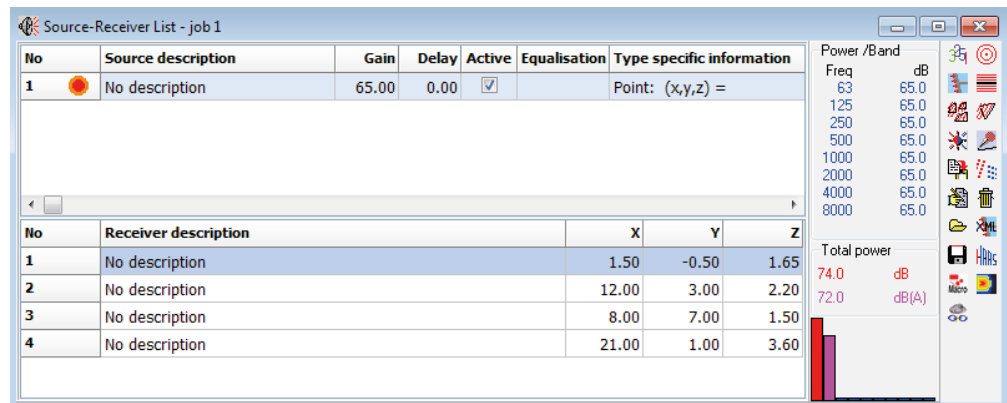
Define other receivers at:

       (x, y, z) = (12; 3; 2.2) meters

       (x, y, z) = (8; 7; 1.5) meters

       (x, y, z) = (21; 1; 3.6) meters

Now the source-receiver list should look like the following figure:

We will get back to the receivers and the activated sources in section 4.

Assign materials

Open the Material List by clicking the Material List button or by choosing Toolbar>Material List (SHIFT+CTRL+M) and have a look at the various tools in the Materials menu, in the *Menu Bar*.

The Material List has two main sections. On the left hand side the list of all surfaces in the room is shown. When clicking any line the corresponding surface is highlighted by red color in the 3DView.

On the right hand side of the Material List the ODEON default materials are shown, each one defined by a series of absorption coefficients for the octave bands 63 Hz to 8000 Hz.

Assign your first material:

- Click on material No 11001 on the right side.
- Click on surface No 1001 on the left side.
- Press the Assign Material (Ins) button on the List of available tools to confirm the assignment.

Material No 11001 has now been assigned to surface No 1001.

Remember: You don't have to worry on saving a project in ODEON. Whenever a change is made, for example whenever a source is created, ODEON stores the information directly on the hard disk.

Scattering coefficient   List of surfaces in the model   Local toolbar   List of default materials

Absorption Coefficients of material assigned to the specific surface.

Absorption Coefficients of selected material and color spectrum.

Apart from the absorption coefficient, each material is associated with a scattering coefficient which controls the way sound is reflected from the wall. For scattering coefficient equal to 0 (or 0%) the reflection is purely *specular*, meaning that the angle of reflection is equal to the angle of incidence. For a scattering coefficient equal to 1 (or 100%) the reflection is purely *diffuse*, meaning that the angle of reflection is completely random. It is also said that a diffuse reflection is a *memoryless* reflection. The scattering coefficient depends on the geometry of the surface and therefore it is adjusted in the list of surfaces (left hand side of the Material List). By default ODEON suggests a scattering coefficient of 0.05, as a minimum value, meaning that in reality no surface can reflect sound completely specularly and it is often more realistic to assume at least 5% of scattering. More information can be found in the full manual.

Tip: Hit the F1 short-cut to learn more about scattering coefficients and other material specifications.

Tip: A scattering coefficient of eg. 50% can be entered as 0.5 or 50. ODEON takes care of any necessary conversion.

Assign the following material data to the surfaces in the model:

Surface Number	1001	1002	2001	2002	2003	2004	3001	3002
Material	11001	11005	4042	4002	4042	4042	4042	4042
Scattering Coefficient	0.7	0.7	0.05	0.05	0.05	0.7	0.05	0.05

Notice that high scattering coefficients are used on the floor and side walls in order

Remember: Even if you are able to change only one value of scattering coefficient per material ODEON in fact extrapolates this value for lower and higher frequencies, so that the whole range between 63 Hz and 8000 Hz is taken into account.

to represent machinery and beams, which are not included explicitly in the model. Such simplification is common practice in 3D models that are used in room acoustic calculations.

Quick Estimate

From within the Material List run the Quick Estimate calculation to get an idea of the global reverberation time in the room. Notice the longest reverberation time among octave bands. This calculation is very useful while assigning materials for direct evaluation of different configurations and their impact on the reverberation time. However since this calculation is based on very simple formulas (Sabine, Eyring and Arau-Puchades) the results might deviate significantly from the more advanced simulations in the Job List (follows in Sec.4). Before leaving the Quick Estimate you may want to try different materials and see the change in the reverberation time. It is possible to select among the defined sources at the bottom of the window. However, the source position will only have minimal effect on the global estimated reverberation time, unless strong coupling effects are present in the room.

Room setup

At this point you should have an idea of the order of magnitude of the reverberation time. To continue the series of calculations you should enter the Room setup (Toolbar>Room Setup) and specify the *Impulse response length*. The Impulse response length should cover at least 2/3 of the decay curve - or T_{30} cannot be calculated. In this case 2000 ms should be sufficient. To learn more about the other parameters available from this page, use the F1 shortcut.

4. Performing Calculations

The job list

Now you are ready to make point response calculations. The calculations will be done in the Job List, the interface where different ODEON tasks can be defined. Up to 300 jobs (tasks) can be defined for a room in order to obtain various acoustic results for different source(s) - receiver(s) combinations.

List of available sources

List of jobs (tasks)   List of Receivers   Local Toolbar
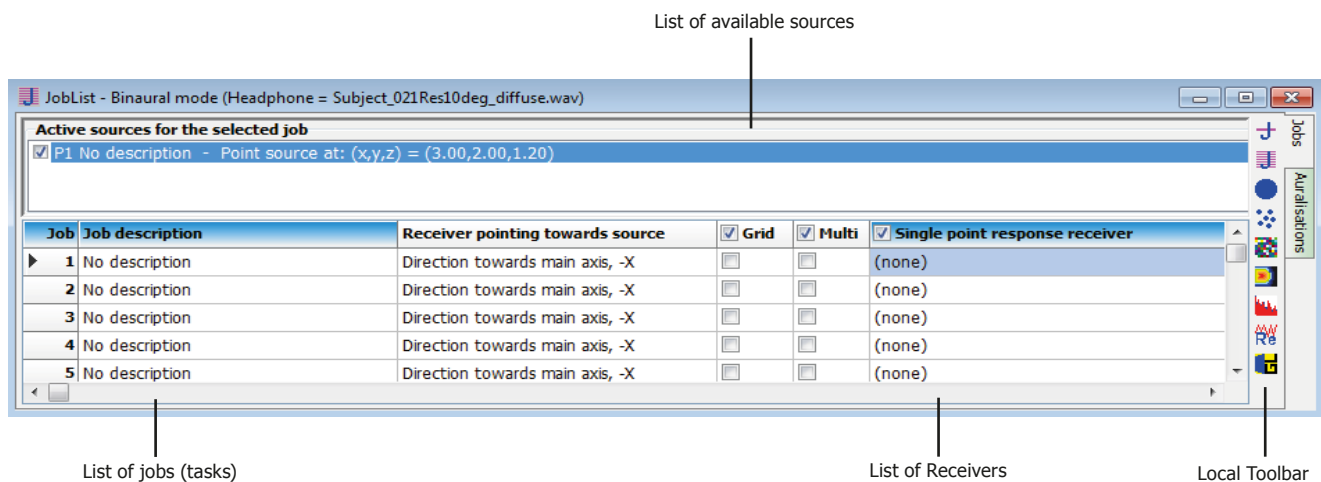
Three main types of calculations are available in the Combined edition:

- Single Point Response that offers detailed calculation results and auralisation options for one selected receiver.

- Multi Point Response which offers room acoustical parameters and statistics for all the receivers defined in the Receiver list at the Source-receiver list.

- Grid Response offering a calculated color map of room acoustical parameters, as long as a grid has been specified from the Define grid menu.

Remember: Do note that a result cannot be viewed before it has been calculated. Once a result has been calculated the relevant cell in the Job List will turn green in order to indicate that this result is available.

Setup and run a Single Point Response:

- Optionally: Select source number 1 as the Receiver pointing towards source for each of the jobs 1 – 4. Notice how the blue cross changes into red in the 3D Source-Receiver view, indicating that it has been selected as orientation of the receiver for the selected job.

- Select receiver number 1 as the Single Point receiver for job 1, 2, 3 and 4.

- Activate source 1 in job one, source 2 in job two, source 3 in job three and all three sources in job four. You can see which sources are active in a selected job by looking at the 3D Source Receiver View.

- Click the Run all 🔲 button in the Local Toolbar at the right side to run the jobs. The four Single Point response responses will be calculated. Finishing the calculations should be a matter of a few seconds under normal circumstances.

Remember: Defining direction of a source is relevant for calculating directional parameters, such as LF_{80}, and for auralisation.

🔵 View Single Point Response

Select job number 1 in the Job List and click the View Single Point response button when the calculations have ended, to see the results. You will find nine tab-sheets available in the Single Point Response window displaying:

- Parameter Curves,

- Energy parameters,

- Decay curves,

- Reflection density,

- Reflectograms,

- 3D reflection paths,

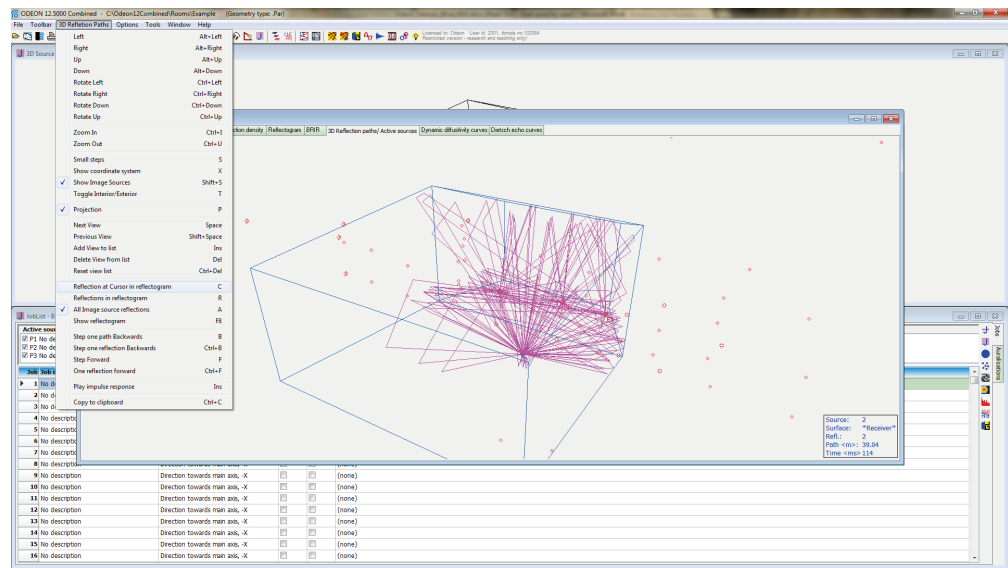- Binaural Room Impulse Response (BRIR) filters

- Dietsch echo curves.

You can view results for each of the four jobs by first selecting the job in the Job List, then clicking the View Single Point Response button. To learn more about the results and options available from the Single Point Response window please press F1 to consult the online help. You may also select the tab-sheet of interest and investigate the dynamic menu that appears at the top Application Bar within the single point response window. In the **dynamic menu** all available functions are listed together with their short-cuts. Of particular importance are the short-cuts for navigating through different acoustic parameters:

- Use the Left/Right arrow keys to change parameter.

- Use the Up/Down arrow keys to change frequency.

As a last option play the Binaural Room Impulse Response through headphones using the Ctrl+I shortcut.

Calculate Multi point

Activate the Multi option from the Job list, by checking the Multi option for job 4; then click the Run all or Run Selected Job button. When calculations have finished, select job number 4 in the Job list and click the View Multi button to view the Multi point response results. The display can have two modes *Simulated* and *Measured*, which allow seeing results from simulations or measurements (if any) respectively. You can alternate between the two modes by pressing M. Nine tab-sheets are avilable:

- 3D Sources and Receivers
- Energy parameter curves (1)
- Energy parameter curves (2)
- Parameter versus distance
- Statistics
- Spatial decay curves
- STI versus distances
- Energy parameters
- Measured versus Simulated

Note that point responses calculated using the Multi point response option are calculated much faster than Single point responses because no filters are created for auralisation use. If a tab-sheet is irrelevant for a job it will be invisible.

Define a receiver grid

Enter the Define Grid menu and select the two floor surfaces (surface 1001 and surface 1002). Specify the Distance between receivers to 2 (metres) then click the Show grid button in the local toolbar. Close the Define Grid dialog to save the grid definition. The auto grid detection will automatically find the surfaced from which a elevated grid can be reached with direct sound from the defined source.

Calculate a Grid Response

Click the Job list button again. Activate the Grid option for job 1. then click the Run all ![icon] button or Run single Job button ![icon]. ODEON will now start calculating the Grid response for this job. This may take a while. When calculations are finished, select job number 1 in the Job list and click the View grid button ![icon] to view the grid results. To learn more about the results and options available from this display press F1.

![icons] Calculate Reflector Coverage

Enter the Define reflector surfaces menu ![icon] from the application bar and select the podium-ceiling surface (surface 3001). Then click the Calculate reflector coverage button ![icon] on the main toolbar to calculate the reflector coverage for the selected surface(s).

Reflector coverage calculates the coverage provided by chosen reflecting surfaces, at the specified order of reflection. This is an efficient tool for investigating whether the receiver area is covered by the reflectors or not and if the reflectors are positioned correctly. The 3D billard display may also be useful for this purpose. Several options are available to facilitate the reflector investigation:

- Use of layer colors for display of coverage.
- Display coverage as points or rays (Draw rays option).
- Include rays from reflector and/or source.
- Adjust number of rays used to track the coverage.
- Adjust order of reflection included.

![icon] 3D Investigate Rays

This tool visualises the ray tracing as it is carried out during any point response calculation. By default its calculation parameters are also set up as the parameters used for the multi-point response calculations. This display is a very valuable tool for debugging new models, e.g. to detect missing or misplaced surfaces. It may also give an impression of what is happening in the calculations, e.g. the effect of the scattering assigned to the surfaces. Click the OK button, then click the Single forward button a few times and note the behaviour of the ray tracing.

![icon] 3D Billiard

The 3D billiard display is a tool that can be used for investigating or demonstrating effects such as *relfections*, *scattering*, *flutter echoes* or *coupling effects*. A number of billiard balls are emitted from the source and reflected by the surfaces in the room.

- To speed up the process, set the Dist. per update to a higher value.
- To enlarge the balls increase the Ball size.

To visualize a flutter echo, a large Number of billiard balls should be used, e.g. 10000 balls. It's easier to visualize a flutter echo if rays are only emitted in the relevant plane (XZ, YZ or XY). If the geometry is complicated it may be hard to see the billard balls. In that case toggle interior and exterior parts of the geometry off using the T short cut.

Tip: The grid may also be used for easy positioning the point sources and discrete receivers, which are usually defined in the Source-receiver list. To learn how to operate the 3DGrid display, select the display (and the 3DGrid tab in that window) - then select the 3DGrid| Parameters dropdown menu.

Tip: Run the Free run function for tracking leaks in a room model. You can enable the Display sticky lost rays only option to obtain a cleaner view of the places of leak in the model.

Remember: In the 3D Billiard balls change color every time they hit on a wall. No information about absorption and energy decay can be seen with this tool, which is mostly intended for investigating geometrical issues.

5. Auralisation (Listen to the Rooms)

At this point you have tried calculation of room acoustical parameters, operating visual display like *decay curves*, *3D reflection paths*, *reflectograms* etc. It is time to move on, trying to play sounds in the model and listen to the result as if you were inside the real room. This is done with the auralisation tools in ODEON. Auralisation is the art of combining (convolving) a sound clip (signal) with the impulse response of the room and playing it back through headhones or a specified loudspeaker system. You can read more about auralisation in the ODEON manual.

Two ways of auralisation are available in ODEON:

- **Real-time /streaming convolution** which produces one or two channel auralisation on the fly (with some latency) and does'nt store any files. Auralisation on the fly means that convolution and auralisation of different sound clips happen almost simultaneously. So the user does not have to wait for a convolution to be finished when switching sound clips for the same impulse response.

- **Off-line convolution** which requires a pre-calculated convolution for any sound clip chosen. Off-line convolution can perform mixing and auralisation with up to 300 simultaneous channels which may be assigned individual signal, delay and level. The result of the off-line convolution is stored in .WAV files for later playback. Off-line convolution supports binaural auralisation using headphones as well as auralisation using a loudspeaker setup (surround sound).

Setting up for binaural auralisation

Before performing any auralisation you have to make sure that a binaural or surround impulse response is created.

- Click the Auralisation setup button 🎧.
- Make sure the Create binaural impulse response file option is checked.
- Select the HRTF and Headphone settings as in the figure below.
- Close the window to save the changes.
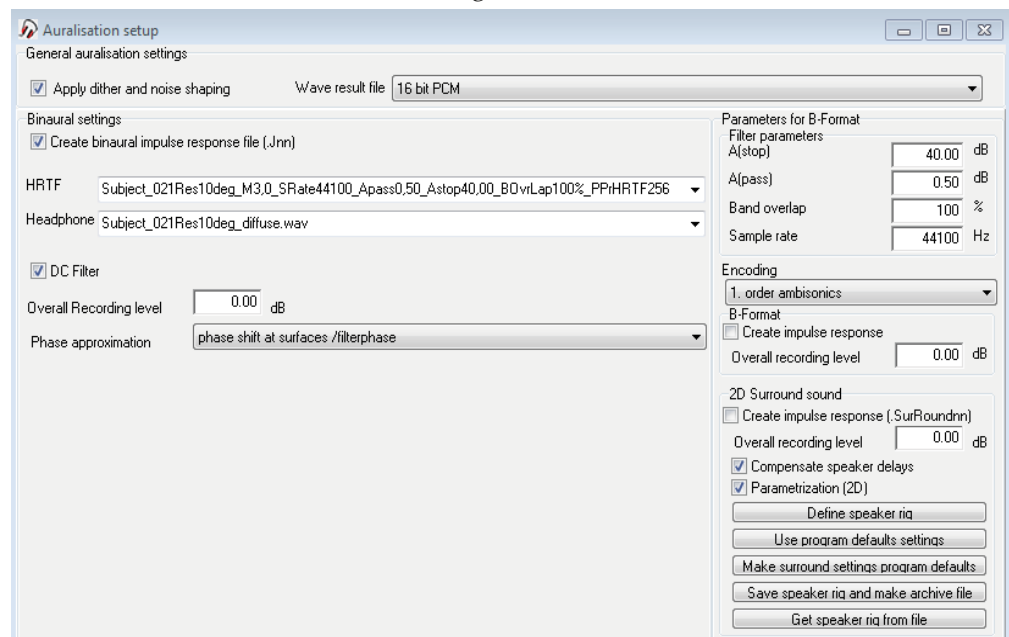
Listen to the binaural auralisation

Select job number 1 in the Job List and click the Streaming convolution button 🎛️ in the local toolbar. This will open the Streaming convolution dialog. Select the *Voice Sabine Short* file in the Source signal field (this is an anechoic recording of voice stored in a Windows Wave file residing in the directory set in the Options>Program setup>Auralisation>Wave Signal file Directory). ODEON will start convolving the selected signal file with the selected Binaural Room Impulse Response (BRIR), in this case the BRIR for job 1. Listen to the output over **headphones**, to benefit from the binaural quality of the auralisation.

The real-time auralisation facility allows auralisation with two simultaneous channels, e.g. simulating the left as well as the right part of an orchestra using a stereo recording as input signal. Before leaving this example you may want to try the Listen to input signal option, which plays the sound clip.

Setting up for stereo setup auralisation

The next example will demonstrate how to set up a 'classic' stereo setup with a receiver position and two loudspeaker positions. To run this example, you need to have a stereo recording stored on your hard disk as a Windows wave file, at a sampling rate of 44100 Hz. This file, which does not need to be an anechoic recording for this demonstration, should be residing in the directory set in the Options>Program setup>Auralisation>Wave signal file directory.

• Enter the Source-receiver list

Make a copy of the point source, source 1. To do this, select source 1 in the Source list then press the C shortcut to copy - this will open the Point Source Editor with the new source; change the Y-coordinate to -4 and type Left source in the Description field.

Following the scheme above, create a copy of source 4; change the Y-coordinate to 4 metres and type Right source in the Description field.

• Enter the Job list to carry out calculations

First activate source number 4 in job 5 and source number 5 in job 6 then select the receiver and point towards which the receiver is oriented. For both jobs you will be sitting in receiver position 1, looking towards source 1; therefore select source 1 as the Receiver towards source point and receiver 1 as the Single point receiver for both jobs (source number 1 is not activated in Job 5 or nor 6 we are only using this dummy source as a an aiming point for the receiver). You have now set up job 5, left speaker and job 6, right speaker for calculation of the two binaural impulse responses. Click the Run All jobs button 📋 to carry out the calculations.

Two channel real time auralisation

Select job number 5 in the Job List and click the Streaming convolution button. This will open the Streaming convolution dialog. Select your stereo input file in the Source signal field. The convolver will begin to convolve a mono version of the input signal with the BRIR which was calculated for job number 5. To obtain "stereo auralisation",

select BRIR number 6 as the Secondary BRIR for 2-channel auralisation. ODEON will begin convolving the left channel of the input signal through BRIR number 5 and the right channel of the input signal through BRIR number 6 the result being a stereo playback in our simulated room. The process involves four convolutions in parallel, mixing binaural signals, level adjustment and much more, luckily this is all taken care of by ODEON.

6. Getting further

To familiarise further with ODEON you should try to change some of the materials, sources etc. in the room and make new calculations. A suggestion is to try changing the scattering coefficient on surface 2004 (Rear wall behind audience) from 0.7 to 0.05 and listen to the change in sound quality (echo problems); Create a copy of the room using the File>Copy files option - then make the changes to this room model. In this way you will have results from both of the rooms present for comparisons.

Tip: You can find many pre-stored rooms in the main folder of your ODEON installation. The usual path is C:\Odeon12Combined\Rooms. Studying these rooms will be invaluable in understanding the main features of an acoustic model: simplicity in the geometry, correct handling of scattering and wall type etc.

Pre-calculated Rooms – Round Robins

At this point you have tried the basic functions in ODEON and may want to view results for more realistic rooms. A few pre-calculated examples are covered in the ODEON manual. The examples include rooms which were used in the 2nd and 3rd Round Robins on Room Acoustic Computer Simulations along with the measured and simulated results.

7. Review of the calculation methods

Global Estimation of reverberation time

There are two calculation methods for the calculation of global reverberation time built into ODEON. The two global estimation methods for reverberation times, estimate reverberation time for the complete room with one selected source position and independently of receivers.

Quick estimate

Quick estimate is the fast method, which is found in the Material List. This method is based on the Sabine, Eyring and Arau-Puchades formulas and as such assumes diffuse field conditions. Diffuse field cannot be assumed if:

• Room absorption is unevenly distributed.

• Room contains de-coupling effects, e.g. connected corridors or niches.

Thus the results given by Quick Estimate should not be considered to be a final result. Even so the method is useful in the initial work on assigning reasonable materials to the surfaces in the room.

Global estimate

Global estimate is a more precise method, which does not make any assumptions about diffuse field conditions and as such, it is a more reliable method for estimation of global reverberation time:

- for workrooms where all absorption is often situated in the ceiling region and sources are situated in the floor region the RT predicted by Global Estimate will typically be longer than the values predicted by Quick Estimate, a factor of two is not unlikely if walls are basically smooth.

- in auditoriums the opposite is the case, because the dominant absorption area (the audience) is close to the source.

In any case the RT's predicted by Global Estimate is the most reliable – provided that proper scattering coefficients have been entered. The principle of the method was first suggested by Schroeder (Schroeder, 1970).

Point Response calculations

The Point response calculations estimate not only RT, but also room acoustic parameters like Clarity, Definition (Deutlichkeit), SPL, SPLA, STI and LF_{80} (see the ODEON manual). The calculated results can be thought of as a simulated measurement. Calculated results relate to:

- a number of active sources
- one receiver position
- orientation of the receiver (for LF_{80}, LG_{80}, IACC and auralisation)

The orientation of the receiver(s) in a particular job is set in the Job list by selecting a point source through which the receivers are looking. There are three kinds of point response calculations; the Single Point Response, the Multi Point Response and the Grid Response.

Tip: To define a particular direction for a receiver create a source that can remain inactive (dummy source), so that it will only be used as an aiming point.

Single Point Response

The Single Point Response is calculated for a selected receiver position, which must be defined in the Source-Receiver list. The Single Point Response is the most detailed calculation method allowing:

- Prediction of room acoustical parameters (including stage parameters).
- Display of predicted Decay curves.
- Tracking of individual reflections in a Reflectogram and display and tracing the reflection(s) in 3D displays of the room e.g. for tracking down echo problems.
- Auralisation.

Multi Point Response

Multi point response calculates room acoustical parameters for all the discrete receiver positions defined in the Source-receiver list.

Grid Response

Grid Response calculates room acoustical parameters and provides statistics for a

mapped receiver area. The surfaces over which grids are calculated are selected in the Define Grid display.

Auralisation

Auralisation features are available from within the Job list. Auralisation is based on impulse responses (BRIR's and Surround Impulse responses), which may be calculated as a part of the Single Point Response. Fast and easy to use binaural auralisation is provided by the Streaming convolution facility – to learn more about this facility use the online help from within the Job List. If greater flexibility is needed a separate auralisation display appears when using the Auarisations tab-sheet in the right most side of the Job List.

8. Other facilities in ODEON

Apart from the features demonstrated in the above tour, ODEON also contains extra facilities described in the full manual:

- Importing models from external 3D modelling applications.
- Tools for detecting errors in a new model, e.g. warped or overlapping surfaces.
- Impulse response measuring system.
- Calculation of transmission through walls.
- Calculation of public address systems.
- Noise control.
- Archiving project files in one single compressed /zipped file, for efficient and safe storage or for easy posting by e-mail (available from the File menu).
- Setup for printouts (available from the Options>Program Setup menu).
- Export of calculated data in ASCII /text format for use in a spreadsheet or other post processing software.