



Functions, Menus and Settings

Version 1.40/26

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Thank you for choosing **SATlive**.

License / Registration / Terms of use

- If you like SATlive after some testing, you can order the full version which does not contain any limitations.
- Please use the demo to check the program's compatibility with your hardware and operating system.
- If you're facing troubles with the demo, the full version will not fix them. In this case please feel free to contact me, so we can try to solve your problem prior to registration.
- Please understand, that no liability can be take for the proper function of the software with a specific hardware configuration. This case does not establish any claim to refund.
- According to today's level of engineering it is impossible to build a software which is properly working on all hardware / OS configurations.
- Please report all kind of problems to the forum or via e-mail (SATinfo@take-sat.de).
- The process of demo registration starts with the request of a demo key. The demo key has to be enabled after you received it via e-mail.
- To get and install a full version license, please follow the steps shown in the full key menu
- There are two kinds of registration:
 - **FULL**: This license is linked to one computer and no physical device is used.
 - **DONGLE**: An external hardware device, a so called dongle is used to enable the software. Therefore the license is not tied to a certain computer.
- The current price list can be found in the internet at <http://www.take-sat.de/english/order.php>, where you could place your order, too.
- After the purchase is completed, then in case of Full registration the buyer (license owner) gets the KEY-files via e-mail, which enable him to create a full-version basic-key. For the completion of the registration, he needs to send the full-version basic-key via e-mail to Registration@take-sat.de. In return he receives a key-file which will unlock SATlive on the PC on which the full-version basic-key was created.

- For the **dongle** version, the buyer (**license owner**) gets a small hardware device, which could be plugged into any usb port. **SATlive will operate as long as the dongle is attached to the computer.**
- All following updates and versions (until recalled) are licensed to the license owner. Just look on the sat-page (<http://www.take-sat.de>) and when you see a higher version-number just download the newest version.

Demo version

The following limitations apply to the demo version:

- When starting the program there is a **DEMO** display for 10 seconds.
- The program stops after **10 minutes** of operation.
- The program runs only for **30 days** after first start.
- You can register for a **30 days** full featured demo using the demo basis key.

Terms of license

Demo:

- You are allowed to handle the demo to other computer-users, so that they can also test the program. This is only allowed on the condition that all files are handled completely and in unchanged original state
- Remark for online-representatives, shareware-dealers and shareware-distributors: This demo can be put on CDs or be offered in online-services.
- The newest version is available for download on <http://www.take-sat.de>

Both, full version and demo:

- There is no liability on the declarations made in this help file and I reserve the right to change it without notice. There is no liability for the correctness of the declarations and descriptions in this file.
- Your report of problems or bugs helps to make the program and the help better.
- I don't take any guarantee for the suitability of this program and/or other programs for a special case of application or special hardware-configuration.

- **I take no liability for any kinds of damages which result from the application of this program or the inability to use this software. This includes the loss of profit, the loss of data and all other material and immaterial damages and deduced damages. This applies also in the case that I've been informed of the possibility of that kind of damage.**
- Any bug report can help to make SATlive better. So please report bugs using the error reporting window.
- It is not allowed to disassemble and/or to patch this program or parts of this program or any other file supplied with this demo or full version.

Full-version

- I grant you, the user and owner, the license to copy the software on one computer and to use the program on that computer. It is allowed for other persons to use it on that computer too.
- Both licenses, full and demo are valid for one computer only. The user selects this computer by creating the basic-key on that machine. The keys will work only on the machine where their basic-key was created.
- The user declares his convenience with these terms of license without any limitations by installing and using this program.

LIMITATIONS on the FULLVERSION

- This software is only dedicated to the user and license-owner. It is not allowed to handle the license to other people, to sell or rent the software, the key-files or the dongle either temporary or lasting. To do so, a written permission is necessary.

FINALIZATION of the LICENSE




The license is valid until finalization. The license is finalized, even without notice, by any offense against these terms of license. After finalization you must destroy the original license and all kinds of copies of this program. On demand you have to confirm the destroying of the program and of the copies by a written statement.

All product- and company's names are trademarks of the corresponding manufacturer.

Request a Demo Key

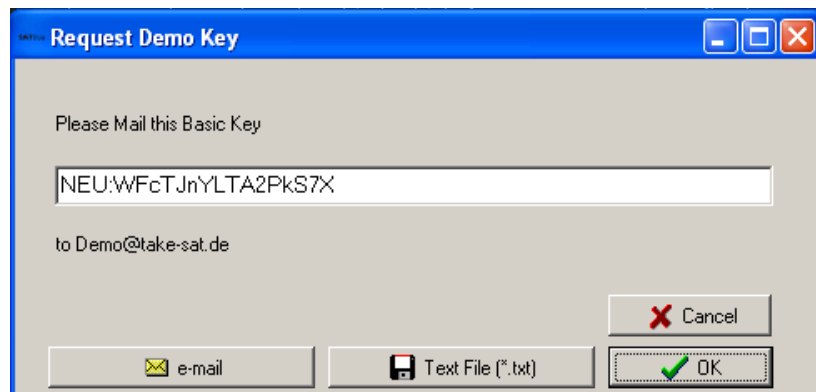
The first step to get the 30 day unlimited demo is to request a demo key.



Open the  **Request Demo Key** window located at  **Help menu** ->  **Registration** -> **Demoversion**.

Now mail the demo basic-key shown in the window to the e-mail address Demo@take-sat.de.

You can either create the e-mail by your own and add the demo basic-key using copy




and paste, or simply click on the  **e-mail** button to let SATlive create the mail.

If your PC is not connected to the internet, you can store the information into a text file using the **Text File** button. Use a portable device to carry the file to a PC with an internet connection.

In return you'll receive the demo key, which you need to activate.

Hints:

- The demo key you'll receive is valid only on the computer where the demo basic-key was created on.
- Please use the  **e-mail** option to avoid typos, which would delay the delivery of the demo key.
- Please check the date and time settings of your computer before the creation of the demo basic-key.
- The demo-key handling is not automated, so please allow some time for response.

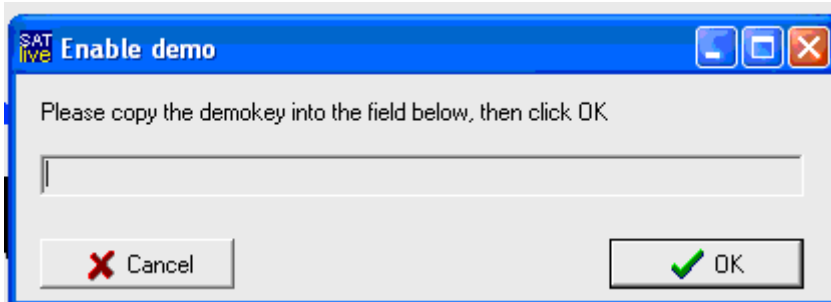
Enable the Demo-key



After the request of the demo key

you'll receive the demo key via e-mail. Open the **Enable Demo window** located at

Help → **Registration** -> **Demo version**



Just copy and paste the demo-key from the e-mail into the editor field on the enable demo window. Then click on **OK** and restart SATlive.

Hints:

- The demo-key you'll receive is valid only on the computer where the demo basic-key was created.
- Please check your date and time settings before creation of the demo basic-key.

Dongle

An external hardware key device for the USB port, a so called dongle, is available for SATlive. The dongle enables SATlive on the computer on which it is plugged in.

SATlive locks if you remove the dongle.

If the dongle is plugged in again, then SATlive unlocks and you can go on working.

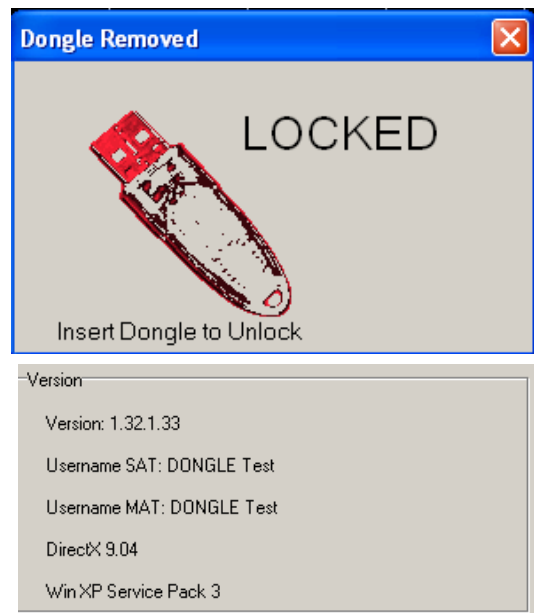
If you close the window, SATlive terminates.

You can check for a valid dongle in

Setup -> **Internal Configuration**.

Hints:

- The dongle must be plugged in before SATlive is started.
- The current display settings are stored on the dongle.

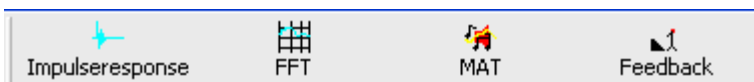


Basics

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- The author does not take any liability for damage caused by the usage of this software.
- This program is able to create sounds, which can destroy technical equipment and cause damage to human hearing.
- We suggest that you start with very low level and then adjust them to the level needed.
- For proper usage of this program you need basic knowledge of working with a computer and of acoustic measurement.

SATlive consists of four different modules:



- **Impulse response:** Here you can measure the system's impulse response using a maximum length sequence (MLS), or calculate it by comparing two signals.(Music Impulse Response (MIR)). An oscilloscope and a sweep based measurement can be found here as well.
- **FFT:** Shows phase and amplitude response of the impulse response measured in impulse response module. Furthermore you can compare and analyze traces
- **MAT:** Performs a dual channel FFT, shows the 'classic' RTA display or a FFT of one or both input channels.
- **Feedbackfinder:** This tool searches for the frequency with the highest level, and displays the corresponding filter of a 10/15 or 30 band equalizer.

And some support modules:

-  **Setup** Allows you to customize SATlive to meet your needs.
-  **Clock** Shows the current time or counts down to a given time.
- **Project management** Eases the handling of larger speaker configurations.
-  **Help** Information access to the help file and the registration menu.

How to invoke a module?

To invoke a module, simply click on the particular button in the upper menu bar.

If you want to create a FFT of a measured impulse response, just invoke the FFT from within the impulse - response module.

What are the different areas in SATlive?

Because you can move the menus, the positions mentioned below refer to the default positions.

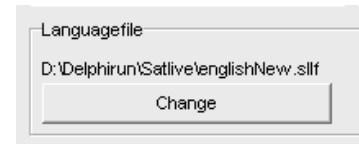
- **Upper menu-bar** located directly below the module - selection menu. Here you find the main measurement functions.
- **Infodisplay** located at the top of the trace display window. Shows information about the values at the cursor's position.
- **Tracewindow** the main window, showing the current trace(s). In most cases its pop-up menu contains tools and functions for analyzing the current trace.
- **Lower menu-bar** located below the trace window, it contains functions and settings for the layout of trace window. In MAT module it also contains functions for delay setting.
- **VU-meter** located right of the trace window. It shows the current input levels.
- **Right menu-bar** this menu is located below the VU-meter and features more functions.
- **Generator** located on the lower right edge. It supplies different kinds of audio-signals.

Language files

- This information is not valid for the Spanish language version of SATlive –

All the text information used in SATlive is stored in an external file, the so called language file.

You can select the language file you want to use in the **Setup** -> **Features** window by clicking on the change button in the lower area.

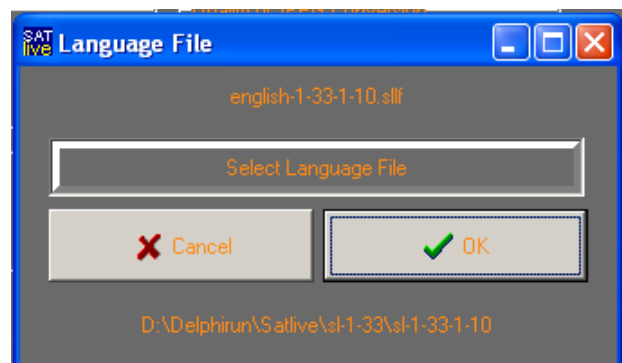


This opens the language file selection window.

To select the language file you want to use, click on **Select Language File**.

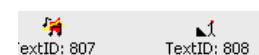
The top most line shows the name of the currently selected language file. If no valid file is selected, then this line shows ---.

The bottom line shows the folder in which the currently selected language file is located.




Hints:

- On the start of SATlive the software scans for language files in the current directory. If it finds more than one language file, it uses the youngest file of the selected language.
- If you're using an older language file, which may lack some strings needed, SATlive will display **Text ID:** followed by the missing index instead, and it will show the language-file selection window on each start.
- On the first start of a new version the language selection window is shown during start-up.



About this document

- Button's names and menu entries are shown in bold letters: Button  **Save** means that you need to click with the left mouse button on the button labeled 'Save'.
Please be aware that in some modes, the buttons carry only the icon, not the label.
- When you need to select an item from a menu or a list, the different steps are separated by an arrow. **Setup -> Options** means: Do a left click on the button Setup then select Options from the pop-up menu.
- Nearly all buttons and displays in SATlive contain a pop-up menu. On the buttons this is indicated by a small arrow at the button's right side. To open a pop-up menu, you can either perform a click with the right mouse button on the button or a click with the left mouse button on the arrow.

Hint:

- SATlive features two kinds of menu layout which can be changed in the **setup -> display** window.

Terms

- **Live Trace** and **Current Trace** are used to label the result of the current measurement. Depending on the module, the measurement can be still active or finished.
- The **Selected Trace** is used to indicate the trace currently selected for processing. By default the Current Trace is also the Selected Trace.
- The **Current Measurement** is the measurement which created the Current Trace.
- **Pop-up menu:** A pop-up menu, also known as context menu, contains specific functions for related area. You can open it with a click with the right mouse button on the related area (button, display and so on).

In a **menu bar** a pop-up menu is indicated by a small arrow at the button's right side. You can click on the arrow with the left mouse button to open the pop-up menu.




- In SATlive the term **Peak** is used for the point with the highest absolute value.
 - In the impulse - response module, the position of the Peak is very helpful for the time alignment and can be used as the reference for the window's position or the group delay.
 - In the MAT and FFT module the Peak is the point with the highest amplitude value.
 - Use the shortcut **P** to place the cursor at the current trace's Peak.
- The **FFT Resolution** indicates the distance between two points calculated by the FFT algorithm. The **FFT Resolution** is displayed in the selection of the FFT size. A better resolution means a larger FFT size.

Memory trace

In the impulse - response module, in the FFT module and in the MAT module you can copy the live trace into a memory using the shortcut **F5**.

This copy, called the memory trace, gets exactly the same settings (Gain, smoothing) as applied to the live trace. The shortcut **F6** toggles the memory trace's visibility.

Hints:

- The memory trace is lost when you exit the program or assign a new memory trace.
- In the impulse - response module the current impulse response is assigned to the second impulse response trace, i.e. in that case **F5** is similar to a click on the **Assign** button in the top menu bar.
- To read out the values of the memory trace you select it as the **selected trace**.
- You can use the function **Load memory trace from file** in the  **Tools** menu to assign a stored trace to the memory trace.

Move the cursor using keys

The following keys can be used to move cursor in SATlive:

- **Cursor right**, **Cursor left** move the cursor one step in desired direction.
- **Cursor right/left** and **Shift** move the cursor by **ten** steps.
- **Cursor right/left** and **Ctrl** move the cursor by one hundred steps.
- **Home** Set the cursor on display's right border.
- **End** Set the cursor on display's left border.

Averaging

Averaging is available for all measurements in SATlive.

If you use averaging then the same measurement is performed more than one time and a mean value of all results is calculated and displayed. This reduces the influence of ambient noise to the measurement's result.

- In the impulse - response module the trace is shown after all measurements are done.
 - The amount of measurements to be averaged is selected in the measurement's setup.
 - In setup advanced sampling you can select the way SATlive handles differences in the single measurements.
- In the MAT module all measurements are performed consecutively and a so called FiFo averaging is used, except for the **Average All** setting.

In a FiFo (**F**irst **I**n, **F**irst **O**ut) averaging the results of the older measurements remain in memory. When the memory is filled up, then the oldest measurement is replaced by the current measurement's result.

After each measurement, the mean value of all data in memory is calculated.

There are two options for the calculation of the mean value in the MAT module.

- First one is the **complex averaging**, which is performed prior to the calculation of amplitude and phase values.
- Second one is the **RMS averaging**, which averaging calculates the amplitude value of each single measurement and averages the amplitude values. This excludes the phase from the display and makes the amplitude display more stable, especial for larger distances between the speaker and the mic.
- There is **no FiFo** averaging used MAT module ff you select **Average all Values**.

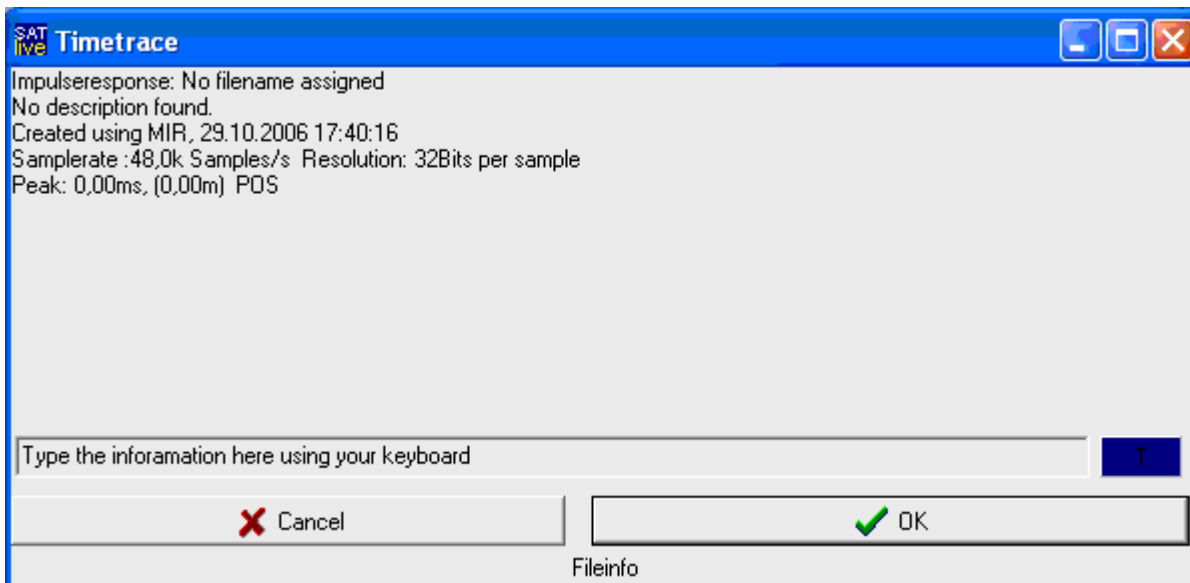
The amount of averages and the averaging mode can be set in the layout area, which is located in the bottom menu area.

Trace's description




In SATlive you can assign and edit a description to every trace.

If you select **remarks** in **Setup -> Features -> Fileinfo** then the trace's description is shown when the trace is used as calibration, overlay or mic - correction data.

You can edit the trace's description in the information window. You can toggle the trace's weighting using the button right of the editor field.



You can open the info window by:

- A left mouse button click on the symbol 
- Using the shortcut **I** on your keyboard.
- If the option **Show Fileinfo when saving** is selected in  Setup->  Features, then the info window shows up every time you save a trace.

Connections

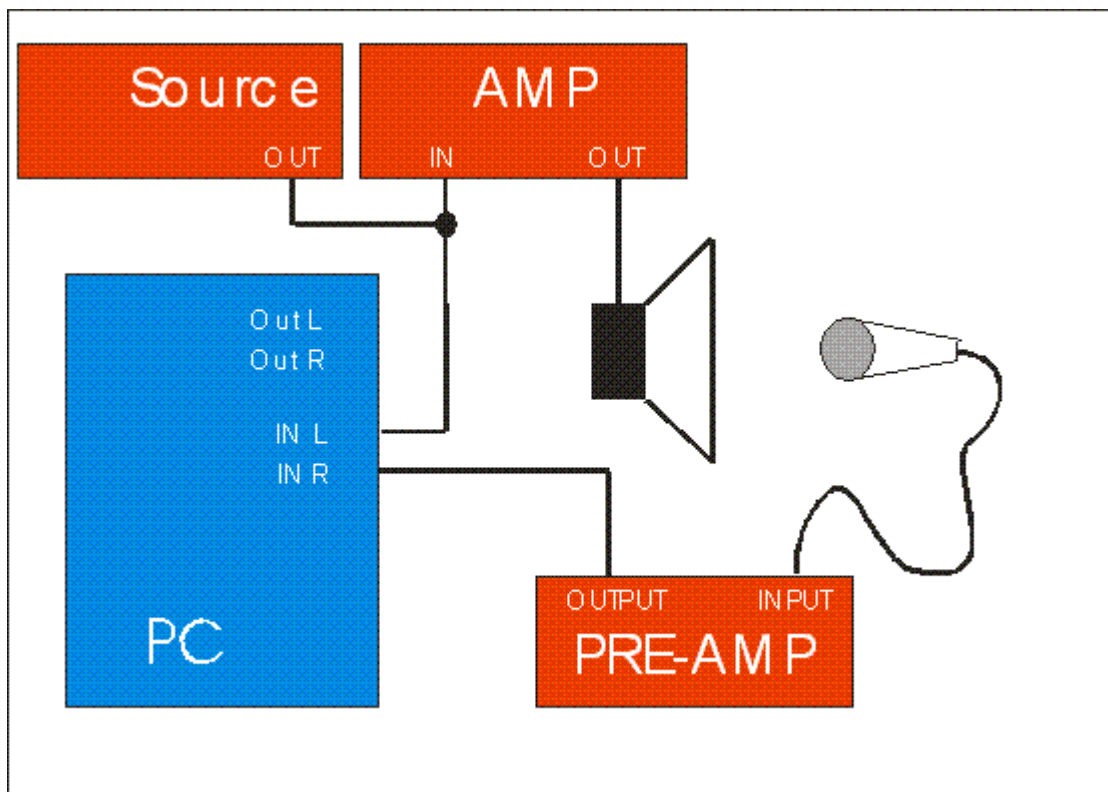
In order to do correct measurements, you must wire SATlive correctly.

WARNING:

- **Wrong connections can destroy the pc's soundcard or even other parts of the pc.**
- **NEVER connect an output or input to a speaker output or mains.**
- **Lower all external volume controls to minimum before starting SATlive.**

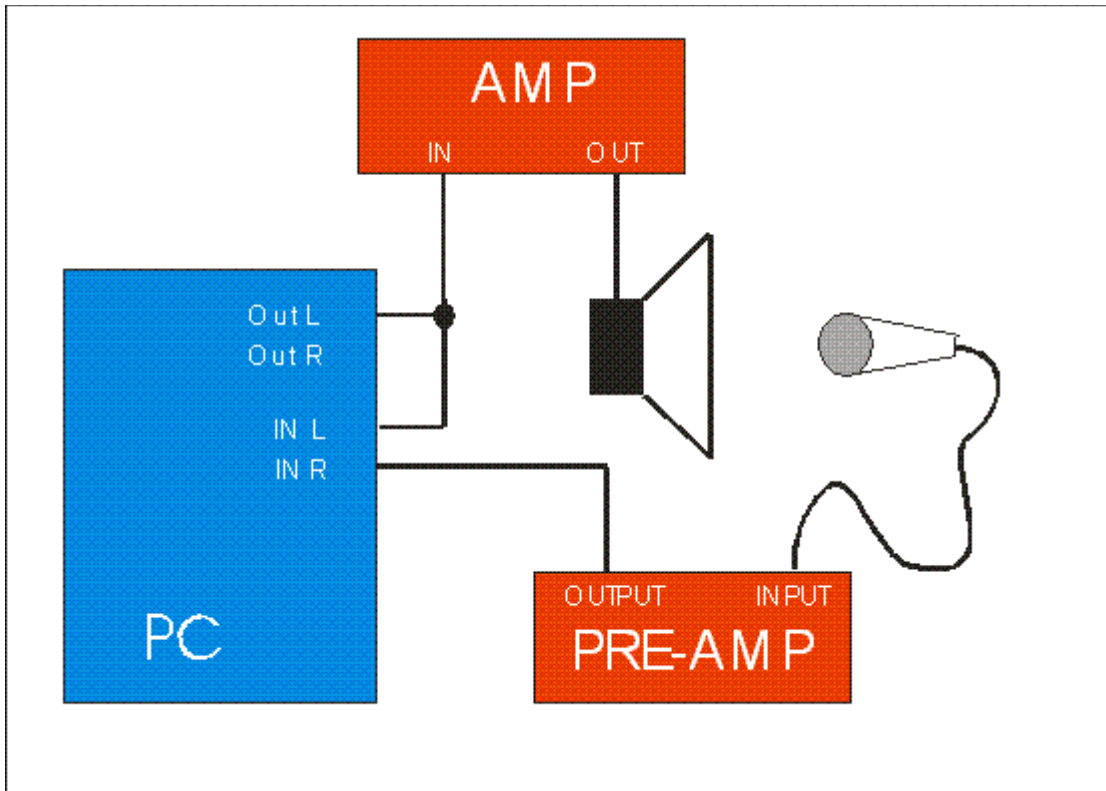
The Output signal (soundcard's Line out) should be connected to an input of the console or of the device under test.

Using an external signal source



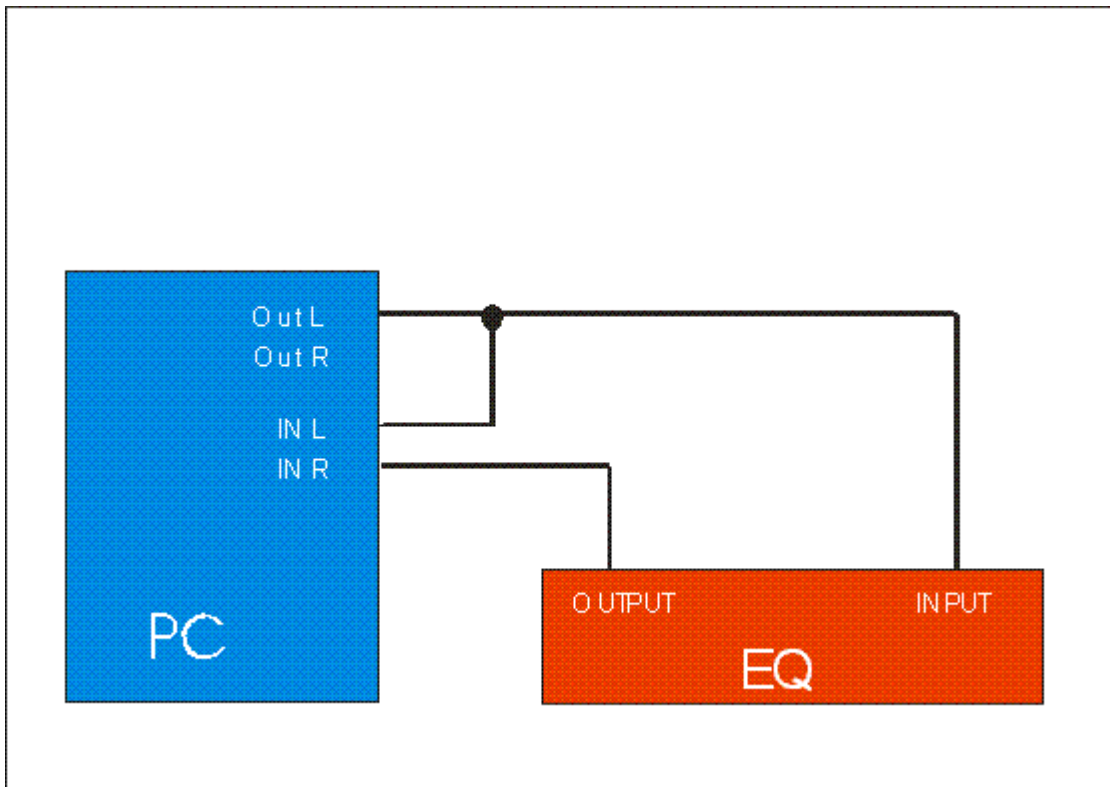
- The Reference input (By default Left In) receives the signal from the external source.
- The measurement mic is feed into the Mic input (By default Right In).
- Make sure that you feed **exactly the same** signal into the computer and into your sound system.

Using a measurement signal created by your computer




- Feed the output-signal from the computer's Audio-output into your soundsystem and in the Reference input (By default: Left Input).
- Feed the signal of your measurement mic into the MIC input (By default: Right Input).
- You can either use an external mic-preamp or an audio-interface with a build-in preamp.
- Your measurement mic will need phantom-power.

Measurement of an electronic device using the PC as signal source





- Feed the signal from the PC's audio-output into the device under test and into the Reference input (By default: Left Input)
- Feed the output-signal of the device under test into the MIC input (By default: Right Input).
- Never connect any speaker output to an audio-interface.

Setup and verification:

- Use the **VU meter** to adjust the levels. Select Pink Noise at the signal generator and start signal using the speaker symbol  or the shortcut **G**. Adjust the level using the level adjustment in the signal-generator section or the shortcuts arrow up / arrow down, the windows mixers and your hardware.
- Go to the windows mixer, select the line input for recording, and adjust level so that VU meter's left (reference) bar shows approx. -10dB.
- Now set the gain of your mic-amp so that VU meter's right bar shows approx -10dB

To **verify your settings**, please perform the following checks:

- Stop the signal generator using  or the shortcut **G**, then talk into the mic.
 - If you **can hear** your voice in the speaker, or you're faced with a feedback at the level set procedure, there is a link between input and output. You need to **disable** this 'feature', often called Direct (or zero latency) Monitoring. To do so, please refer to your manual of your audio device.
- Switch off the amp, and restart the signal-generator, using the (you remember?) the  button or the shortcut **G**.
- Now remove direct link between the output and reference input.
- If the VU meter's left side still shows a signal, you need to change your soundcard's recording mixer (set recording level for line out and mixerout to zero).
 - If only the VU meter's left side shows signal, you've just flipped the inputs.





Measurement


Important: To archive a correct result, the system must not change during the measurement. Therefore any dynamic processing like exciter, compressors and so on have to be bypassed.

Furthermore make sure that in the sound-card's mixer all 3D or the reverb effects or any other 'improvements' are disabled.

How to start a measurement?

In SATlive there are three different ways to start a measurement:

- **Starting a measurement with a mouse-click** (Impulse response module). You have to select the kind of measurement first, then you may adjust some parameters of measurement and finally start it by clicking on the button showing the selected measurement. In the complex menu layout this button is located above the trace-display window, in the simple menu layout it is in the lower menu bar. When the measurement is finished, you got a raw impulse response trace.
- **Running a macro** (Impulse response module). In this case you do not only start a predefined measurement with predefined settings, but also activate a defined treatment of the measurement's result. You can access two macros direct using **Room/Speaker**  and **Direct/Equalizer** . To reach the other macros just click on **User Macros M**. This will open a list containing all twelve macros available. You can get more information about each macro with a click with right mouse button on it and run it with a left mouse-click. You can edit macro settings at  **Setup -> M** **User Macros**.
- **Automatic start of measurement** (Feedbackfinder, MAT module). In this case the measurement starts when you enter the module. In the MAT module you can use the GO button or the **spacebar** to control the operation. A green dot indicates a running measurement and a red dot marks a stopped one. If you change the measurement mode, the old measurement is stopped, then the new measurement starts. At the MAT module you can use Delete  or the shortcut **R** to reset averaging and the **GO** button on the right or the spacebar to start/stop measurement.



How to prepare for the measurement?

- Connect your audio-interface and your hardware.
- Check your wiring and hardware settings by playing back pink noise. Watch the VU meter during this test.
- For the impulse - response module you should create either a calibration file or a complex calibration file.
- If you like to perform an absolute level measurement, you must adjust the level reference before.


How to deal with problems?

- Problems related to wiring will bring up an error message (level too high, level too low) in the impulse - response module.
- Check the wiring and the settings of the soundcard's mixer, as described in the connection topic.
- Try another soundcard or use a different audio driver. (🔧 Setup->🔌 I/O Devices).
- Try using different latency settings.
- If you cannot solve your problems, please send a e-mail with a close description of the problem to SATinfo@take-sat.de.

The Impulse - Response Module



The impulse - response module features different methods to measure the impulse-response. Furthermore it contains an oscilloscope simulation, which allows you to look on the input signals.

To invoke impulse response module click on Impulse response  in top menu bar. The result of the measurements is an impulse response.

The Impulse Response

The impulse response is the output of a system feed with a very narrow and very high single impulse.

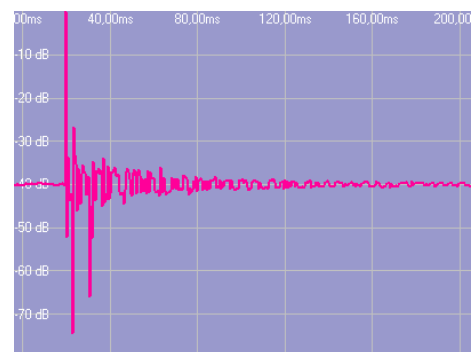
This is an ideal impulse response. There is now delay and you just see the initial impulse.

This is a real world impulse response. Here you can see the initial delay and some discrete reflections.

The main purpose of the impulse response is the analysis of time related parameters, like delays and room acoustics.

You can transform an impulse response into a frequency response using a FFT calculation.

There are different ways to display an impulse response graph.









Select Measurement and start it (complex menu layout).

You find this area in the top menu bar.



 Loop Measurement repeat the current measurement


until you stop it, and display the result after each measurement's completion. You can combine this option with averaging.


- Select the measurement you want to perform from the selection, or select it using the shortcut **F3**.
 -  **MLS White** MLS measurement using pure MLS sequence.
 -  **MLS Pink** MLS measurement using pink filtered MLS sequence.
 -  **MIR Measurement** dual Channel Algorithm to measure impulse response.
 -  **Sweep Measurement** dual Channel Algorithm using a special excitation signal.
 -  **Oscilloscope** show an oscilloscope to look on both input signals.
- **GO** the currently selected measurement's symbol is shown right to the selection box. Click on the symbol to start a measurement. The function's shortcut is **F4**.
-  **Setup** show the current measurement's setup. The function's shortcut is **F9**. The symbol changes with the measurement selected. There is no setup for the oscilloscope measurement here, because all settings for the oscilloscope are located in the right menu area.

Working with an impulse response



In the impulse - response module a measurement delivers an impulse response as result. The whole impulse response is displayed in the lower display window and it's selected part is displayed in the upper display window.









Use the **Set Cursor on Peak**  function or the shortcut **P** to set the cursor to the highest point of the impulse response, the so called peak. This point is taken as the reference for time adjustments like delay line setup. Impulse response's value on the cursor's position is displayed above the upper trace window.



Use the **Latch Cursor**  function or the shortcut **D** to copy the cursor's current position to a temporary memory. The distance between the latched and the current position is displayed above the upper display window.

Except for **smooth FFT Full** every FFT is performed with data displayed in the upper display window.

The procedure of selecting a fixed part of an impulse response (or even using the whole, also time limited, impulse response) is called Windowing.



There are different ways to perform windowing in the impulse - response module:

- Set the window's border to the mouse click's position. Either the right  or the left  border can be set. You can also click on the lower trace display.
- Set the Cursor to the desired border position, then use the **Cut right of cursor** or the **Cut left of cursor** function from the trace display's pop-up menu.
- Move the right  or the left  border using the cursor keys on the keyboard.
- Hold down the right mouse button and move the mouse to draw a selection rectangle.
- Use one of the fixed (, ) user windows, or select another user defined window from the User windowing  list. See page 142 for details about user windows.
- Use the Full Trace Display  function from the trace display's pop-up menu to show the full impulse response in upper display window. The shortcut is **F**.

Use the **FFT**  or the **smooth FFT**  to transform the selected part of the impulse response shown in the upper display window into the frequency domain. Both functions feature some options in their pop-up menus.

Using the cursor in the Impulse - Response Measurement



Move the left window border

- The option Left window border  can be found in the pop-up menu of the trace display in the impulse - response module.
- If this option is activated, then the left border of the upper trace window can be moved using the cursor keys.
- The actual value of the border is shown above the trace window.
- The upper window always shows the data used for **FFT**. The lower window shows the whole impulse response with the selected part marked in a different color. You can use the Left window border  function on both windows.

Hint:

- If the width of the upper window would get larger than the largest FFT size (64k Samples), then the right border is moved in order to keep the width of the window at 64k samples.


Move the right window border

- In the impulse - response module you find the option Right Window Border  in the pop-up menu of the trace display. In complex menu-mode it is also located in the right menu area.
- If this option is activated, then the right border of the upper window can be moved using the cursor keys.
- The actual position of the right border is shown above the trace display.
- The upper window always shows the data used for the **FFT**. The lower window shows the whole impulse response with the selected part marked in a different color. You can use the Right window border  function on both windows.


Hint:

- If width of the upper window would get larger than the largest FFT size (64k Samples), then the left border is moved in order to keep the width of window at 64k samples.


Cut right of cursor

In the impulse - response module you find this function in the trace's pop-up menu. The right border of the upper window is set to the cursor's current position. This action is enabled only if the option  **Set Cursor** is selected.

Cut left of cursor

In the impulse - response module you find this function in the trace's pop-up menu. The left border of the upper window is set to the cursor's current position. This action is enabled only if the option  **Set Cursor** is selected.

Full Trace Display





The function **Full Trace Display**  is located in the impulse - response module's trace window's pop-up menu. It sets the upper window to the maximum FFT size (or to the size of the impulse response, if it is shorter than maximum FFT size).

Hints:

- The program tries to keep the current left border of the upper window. If the right border would exceed the actual size, then the left border is readjusted.
- This option can also be accessed using the shortcuts **F** or **CTRL – F**.

Save Current Window

In the impulse - response module this function saves the current border positions of the upper trace display as an user defined window. This function is located in the trace's pop-up menu.

- Click on  **Save Current Window**.
- Select the **target** to save the current window to.
- Select the reference for the window's position. Edit the window's name.
- Use the  **User Window** function to recall the window.
- You can edit the window's parameter at  **Setup** ->  **User Windows**. See page 142 for details.



Roundedge

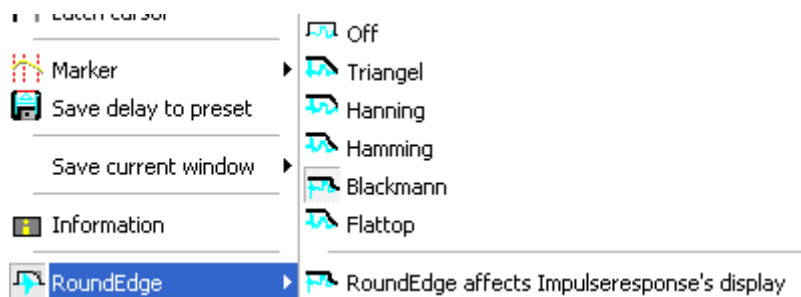
RoundEdge applies a half window to the right half of the data used for the FFT and the smooth FFT calculation.

A window can be seen as a kind of 'Fade Out' applied to the end of the impulse response. This avoids a sharp cut at the end of the impulse response which may produce interference in the frequency domain.

You can activate the Roundedge for each user macros at **Setup** → **M User Macros**.

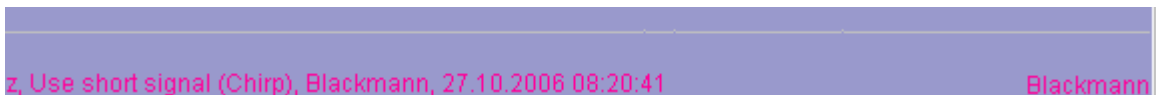
You can activate the Roundedge for non macro measurements in the pop-up menu of the trace display.

If the complex menu layout is selected then you can activate the roundedge in the right menu bar, too.



If roundedge is activated, then it is always applied prior to the calculation of the FFT.

You can select the **Roundedge affects impulse response's display** option if the currently selected Roundedge window should be used for the display of the impulse response in the upper window as well.



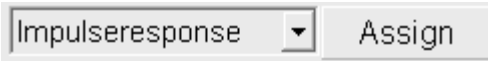


If Roundedge is activated then the name of the selected window is shown at the right in the lower display.

If the Roundedge is activated and the **Roundedge affects impulse response's display** setting is selected, then the name of the window used is shown in the measurement's description on the left in the lower display, too.

Second impulse response trace

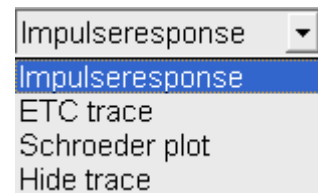
In the impulse - response module SATlive supports two impulse response traces, which can be displayed at the same time.

There are two ways to assign a trace to the second trace:

- Copy the current trace to the second trace  using either the **F5** key or click on the **Assign** button in the top menu bar.
- Load the second trace from a file using the  **Load second IR** function from the menu  **Tools**.


If a second trace is assigned then a trace display mode selection is shown above right above the trace display.

In that selection you can select the kind of display used for the second trace. For the second trace this selection also contains the



Hide Trace option which sets the visibility of the second trace to false.

How to save the impulse response?

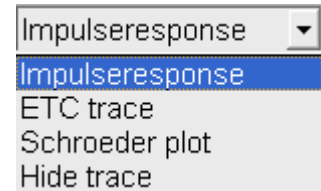
Use the **Save**  function to write the current impulse response to a file. If enabled in **Setup -> Features**, then the info window is shown prior to saving where you can edit the trace's description prior to saving.

If you want to save the impulse response for the use with other software or for the use as complex compensation data, then you have to select the type of file from the save button's pop-up menu. See page 46 for details about complex compensation.

Kind of trace display used in impulse response module

In the impulse - response module the impulse response can be shown in three different ways.

The desired kind of display can be selected from a selection box located above the trace display window.

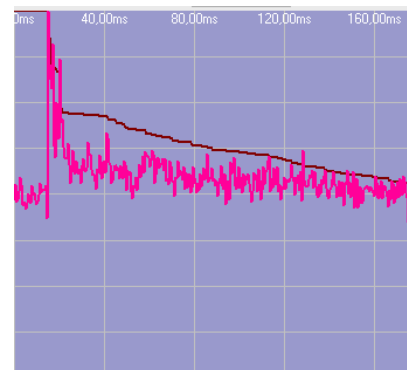


The option **Hide Trace** is available for the second impulse response trace only.

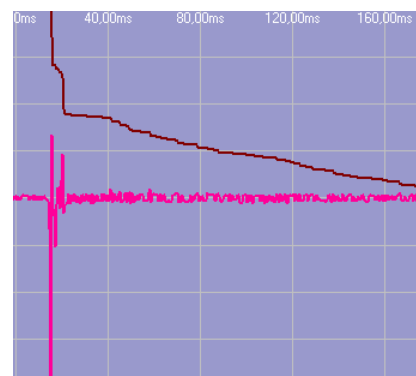
- **Impulse response** show the calculated impulse response using a linear scale.
- **ETC trace** show the energy distribution over time (Energy Time Curve), using a logarithmic (dB) scale.
- **Schroeder plot** show the backward integrated energy of the impulse response. This plot is mainly used for the estimation of room acoustic parameters. You can take this trace as the slope of a lot averaged ETC measurements.

The following pictures show the same basic trace using the three different display possibilities.

- First trace Impulse response, second trace ETC trace.



- First trace Impulse response, second trace Schroeder Plot.

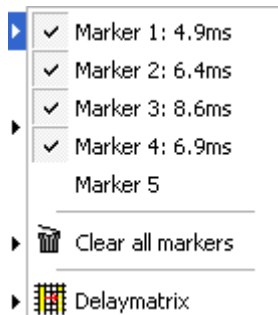
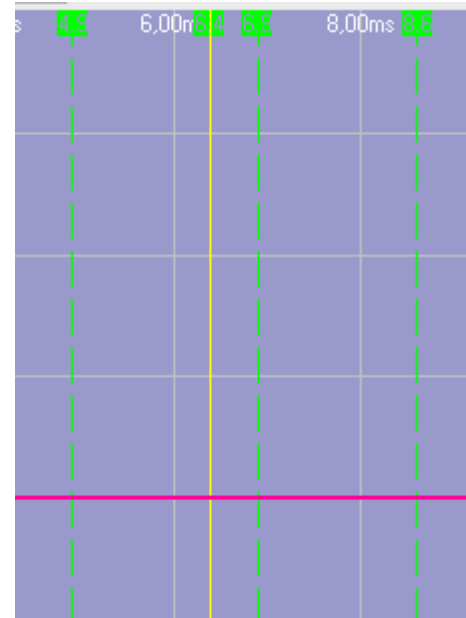


Time marker and Delay matrix

In the impulse response display you can assign the position of the current cursor to one of the five time markers. This markers can be used as labels for positions of interest.

To assign a marker simply press the shortcut **Ctrl + 1 .. 5** on the keyboard. This assigns the cursor's current position to the marker, according to the number you selected.

Use the same shortcut to toggle the marker's visibility. You can replace an existing marker using the shortcut **Alt+ 1..5**.



The pop-up menu of the trace contains the **Marker** sub menu. In that sub menu you can also toggle the visibility, clear all markers and invoke the delay matrix.

In the **delay matrix** you can see the distances between the markers, the current cursor's position (C) and the latched cursor's position (M).

The value is calculated by the position of the marker on the top minus the position of the marker on the left. This means that the value shown is the delay that you need to add to the position on the left marker to get it time aligned to the position at the top.

If you select a field by clicking on it, all the information are shown below the matrix.

	9,10ms	10,58ms	12,79ms	11,10ms	4,19ms	13,40ms
M	3,13m	3,63m	4,39m	3,81m	1,44m	4,60m



Latched cursor: -4,19ms, D2: 6,40ms, Delta: 10,583ms, 3,63m

✔ Close

Room Acoustic Analysis

Speech Transmission Index (STI)

The **STI** Speech Transmission Index (STI) is a value used to determine the intelligibility at the position of the measurement microphone. The value considers the loss of modulation during the transmission of the sound, but not its frequency response. SATlive uses the impulse response to calculate the STI value. You

can invoke the calculation of the STI from the   **Tools** menu and, if the menu mode complex is selected then you can use the button **STI**

STI in the upper menu bar, too.

The loss of modulation is calculated for different frequencies used for modulation, and for different octave bands of the audio signal. There is a total of 98 values, which are averaged using different weighting factors to get one number as result.

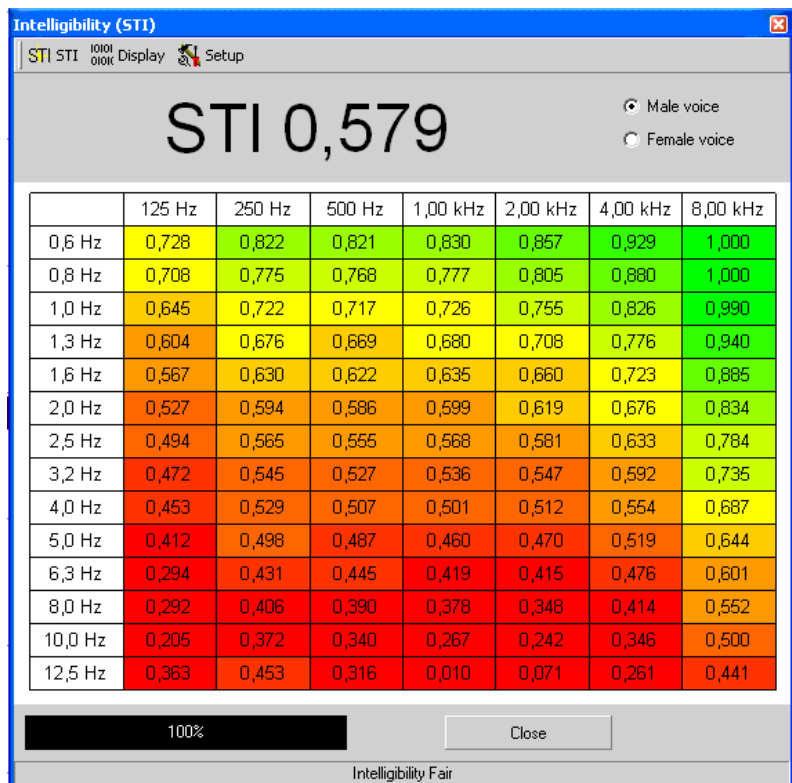
On the top you see the result, below the single modulation indexes are shown, depending on the frequency of modulation and the audio band.

The voice selection determines the weighting factors used for the calculation of the result.

Male voice is the commonly used default setting.

In the status-bar at the bottom of the window you can read a short judgment of the calculated STI value.

Use the **close** button to return to the impulse - response module.



Intelligibility (STI)

STI STI 100% Display Setup

STI 0,579

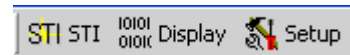
Male voice
 Female voice

	125 Hz	250 Hz	500 Hz	1,00 kHz	2,00 kHz	4,00 kHz	8,00 kHz
0,6 Hz	0,728	0,822	0,821	0,830	0,857	0,929	1,000
0,8 Hz	0,708	0,775	0,768	0,777	0,805	0,880	1,000
1,0 Hz	0,645	0,722	0,717	0,726	0,755	0,826	0,990
1,3 Hz	0,604	0,676	0,669	0,680	0,708	0,776	0,940
1,6 Hz	0,567	0,630	0,622	0,635	0,660	0,723	0,885
2,0 Hz	0,527	0,594	0,586	0,599	0,619	0,676	0,834
2,5 Hz	0,494	0,565	0,555	0,568	0,581	0,633	0,784
3,2 Hz	0,472	0,545	0,527	0,536	0,547	0,592	0,735
4,0 Hz	0,453	0,529	0,507	0,501	0,512	0,554	0,687
5,0 Hz	0,412	0,498	0,487	0,460	0,470	0,519	0,644
6,3 Hz	0,294	0,431	0,445	0,419	0,415	0,476	0,601
8,0 Hz	0,292	0,406	0,390	0,378	0,348	0,414	0,552
10,0 Hz	0,205	0,372	0,340	0,267	0,242	0,346	0,500
12,5 Hz	0,363	0,453	0,316	0,010	0,071	0,261	0,441

100% Close

Intelligibility Fair

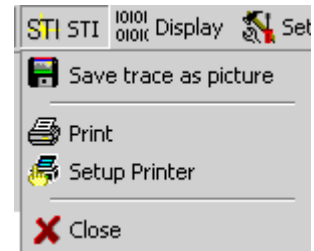
The menu bar of the STI window



The menu bar of the STI calculation offers some options for the post-process and the display of the calculated result.

On the left there is the menu **STI STI** which contains this options:

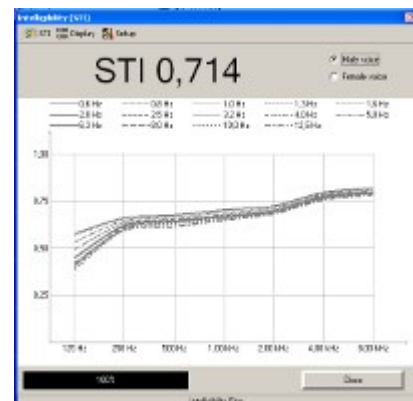
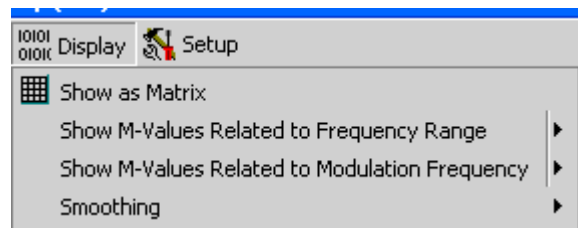
- **Save trace as picture** use this function to save the current display of the STI values. Select the format of the picture in the save dialog.
- **Print** use this function to print the current display, information about the impulse response used as base for the calculation and a remark, which the SATlive prompts for.
- **Setup Printer** use this function to change the printer and its properties.
- **Close** closes the window and returns to the Impulse Response module.



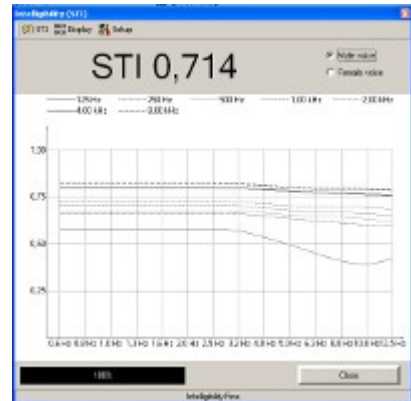
The next menu is the menu **10101 0101k Display**

You can select how to display the results of the STI calculation.

- **Show as Matrix** shows all values as numbers in a table. If the option Results colored in the menu **Setup** is selected then the background color of each value is set according to the value.
- **Show M-Values related to Frequency Range** draws the values as a function of the different audio bands used for calculation. For each frequency of modulation a single trace is drawn. You can enable the display of individual traces in the option's sub menu.



- Show M-Values related to Modulation Frequency draws the values as a function of the different frequencies used for modulation. For each band of the audio signal a single trace is drawn. You can enable the display of individual traces in the option's sub menu.
- Smoothing in the function's sub-menu you can select how much smoothing is applied to the traces.



The rightmost menu is the menu **Setup** menu.

- Results colored assign a background color to each value according to its value. This setting affects only the **Show as Matrix** display.
- Show grid shows a grid separating the individual values in the Show as Matrix display.
- Low Color Reference sets the threshold for the red color. Any values below this value is shown in full red in the Show as Matrix display. A value of 1.0 is shown in full green. This setting affects the layout only if the **Results colored** option is activated.

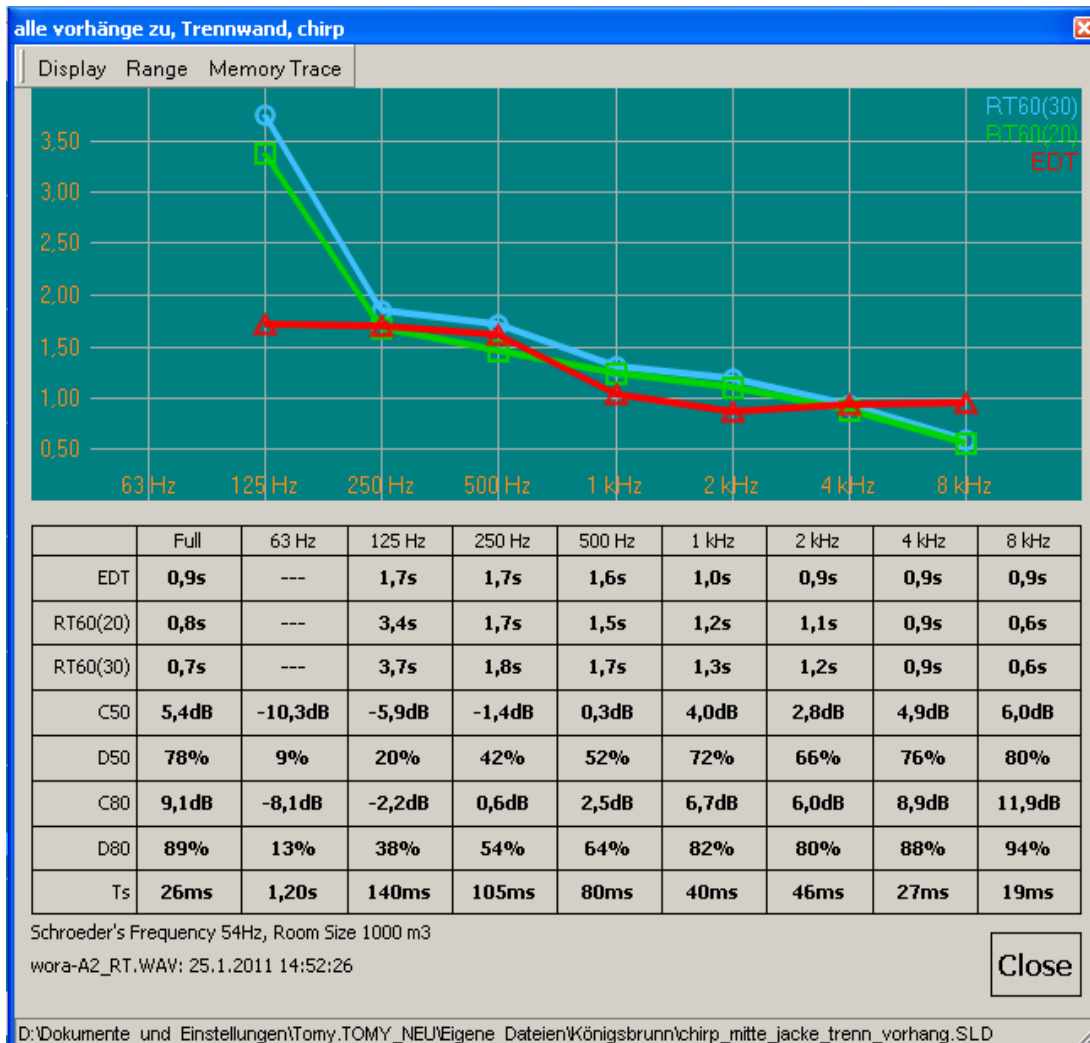
The screenshot shows the 'Setup' menu with the following options:

- Results colored
- Show Grid
- Low color reference: 0.50
- 0.45
- 0.40
- 0.30
- 0.20
- 0.10
- 0.00

Below the menu is a matrix display with the following data:

Hz	250 Hz	500 Hz
28	0,822	0,82
08	0,775	0,76
45	0,722	0,71

Room Acoustic Calculation




SATlive offers a room acoustic tool which calculates room acoustic values using an impulse response. The quality of the results relates to the quality of the impulse response used, so you should take care to create a good impulse response (use long impulse responses).

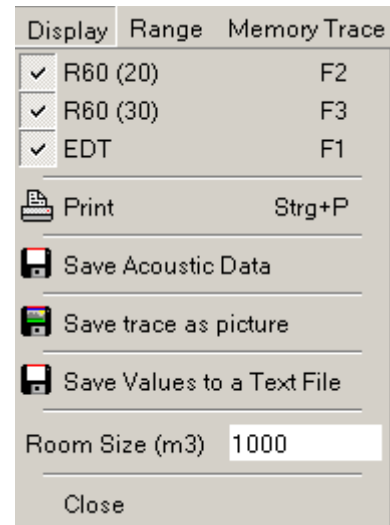
The **room-acoustic tool** is invoked in the menu **Tools**.

The values are calculated when the window shows up, therefore there could be a small delay until you can see all values.

The traces for the three reverberation times are shown at the top. Below the graphic there is a table containing the numerical values of the reverberation times and other room - acoustic parameters.

The menu Display

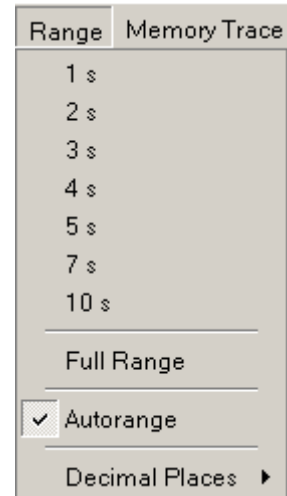
- **RT60(20)** show/hide the RT60(20) trace in the display.
Shortcut: **F2**
- **RT60(30)** show/hide the RT60(30) trace in the display.
Shortcut: **F3**
- **EDT** show/hide the EDT trace in the display. Shortcut:
F1
-  **Print** prints the room acoustic parameter and the reverberation graph.
- **Save Acoustic Data:** Saves the results of the acoustic calculation in a SATlive specific format. You can use the Memory Trace menu to load and display a saved acoustic-data file.
- **Save Trace as Picture** save the graphic to a file. You can select the kind of picture you want to save it to in the selection on the bottom of the save dialog.
- **Save values to a Text File** saves the numerical values of the room acoustic parameters into a text file.
- **Room size** enter the room size used for the calculation of the Schroeder's frequency. The units can be changed in the **Setup -> Options** window.
- **Close** closes the window and returns to the impulse - response module.



The menu Range

Use the menu **Range** in the top menu bar to change the vertical range.

- You can choose the desired vertical display area by selecting one of the topmost entries in this menu.
- If you click on **Full Range**, then **SATlive** adjusts the display in way that all of the values are shown.
- If you enable the **Autorange** option, then the vertical range is adjusted to keep all of the traces displayed in the display area. This acts similar as the *Full Range* function, but this option adjusts the display range every time the values to display change. This setting is memorized and will be restored when you re-enter the room-acoustic tool.
- Use the **Decimal Places** sub-menu to adjust the display of the room-acoustic values in the lower half of the window according to your needs. Just select the desired amount of decimal places from the sub-menu.
 - *No Decimal Place*: The values show as whole numbers: 8 sec
 - *One Decimal Place*: One decimal place is shown: 7.9 sec
 - *Two Decimal Places*: Two decimal places are shown: 7.92 sec
 - *Three Decimal Places*: The highest amount available here: 7.921 sec



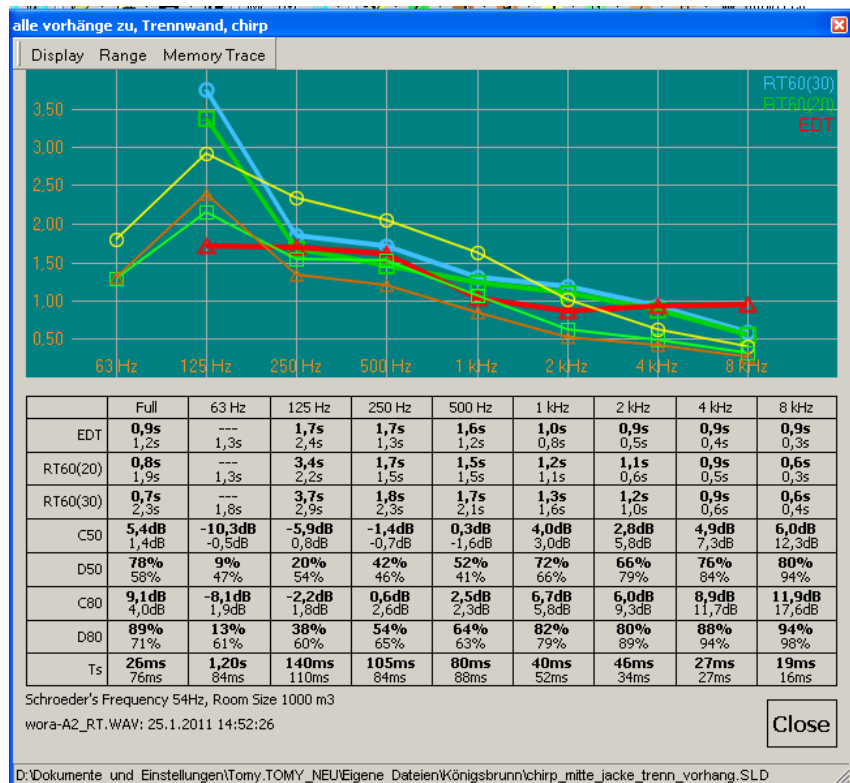
The menu Memory Trace

You can load a saved result of the acoustic calculation into a second trace, which is called memory trace.

Uses this trace to compare the acoustic values of different impulse-response measurements.



- **Show Memory Trace** show or hide the currently loaded memory trace. This option is available only if an valid set of acoustic data is loaded. Hotkey **F6**.
- **Load Acoustic Data** opens a dialog where you can select the set of acoustic data which you want to use as the memory trace data.
- The values of the memory trace are drawn as thin lines, and written using a normal font. The values of the main impulse response are drawn using thicker lines and the values are shown in a bold font.
- If valid acoustic data has been loaded then the file name is shown in the lower left area of the acoustic - calculation window.
- The values calculated using the current impulse-response is drawn with a thick line. The values are written using a **bold font**.
- The values loaded from the acoustic – data file is drawn with a thinner line. The values are written using the default font.



Room - Acoustic Parameter

The numeric results of the room acoustic calculation are shown in a table below the graphic display of the reverb – time values.


The values are calculated for the full - frequency scale and using the octave-band filtered signal.

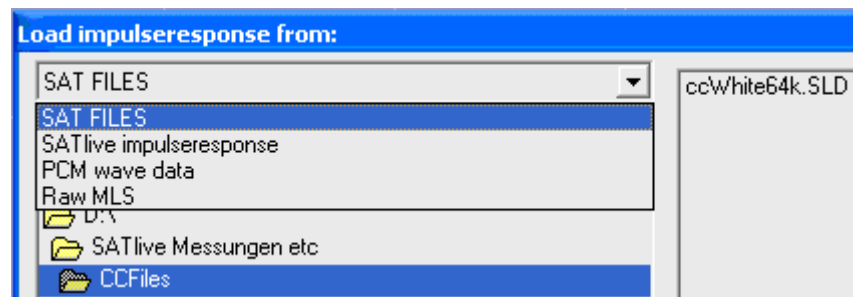
	Full	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
EDT	0,9s	---	1,7s	1,7s	1,6s	1,0s	0,9s	0,9s	0,9s
RT60(20)	0,8s	---	3,4s	1,7s	1,5s	1,2s	1,1s	0,9s	0,6s
RT60(30)	0,7s	---	3,7s	1,8s	1,7s	1,3s	1,2s	0,9s	0,6s
C50	5,4dB	-10,3dB	-5,9dB	-1,4dB	0,3dB	4,0dB	2,8dB	4,9dB	6,0dB
D50	78%	9%	20%	42%	52%	72%	66%	76%	80%
C80	9,1dB	-8,1dB	-2,2dB	0,6dB	2,5dB	6,7dB	6,0dB	8,9dB	11,9dB
D80	89%	13%	38%	54%	64%	82%	80%	88%	94%
Ts	26ms	1,20s	140ms	105ms	80ms	40ms	46ms	27ms	19ms

- **RT60** is the most common value used in room acoustics. It is the (theoretical) time a sound needs to decay to 60dB below it's initial level.
 - According to the ISO 3382 it is calculated as twice the time the sound needs to decay from -5dB to -35dB. This value is labeled RT60(30).
 - If it is not possible to measure down to -35dB due to noise or other problems then ISO 3382 suggest using three times the decay time from -5dB down to -25dB. This value is labeled **RT60(20)**.
 - Optimum values for the RT60 depend on the size of the room. The literature suggests approx 2 seconds for music and approx 1 second for speech.
- **EDT** means **Early Decay Time**, which is another reverberation time. It is calculated by six times the decay time from 0dB to -10dB. In normal situations the EDT is the reverberation time that you 'feel' in a room and the RT60 is a more technical value used for calculations. For music the EDT value should be approx 2.2 seconds.
- **C50** and **D50** are values which relate the energy arriving in the first 50 milliseconds to the whole energy (D50) or to the energy arriving after the first 50 milliseconds (C50). This values are useful hints for intelligibility. Values greater then 0dB (C50) or 50% (D50) indicate a good intelligibility.

- The calculation of the **C80** and **D80** values is similar to the calculation of the C50 and D50 values, with the difference that they relate to the energy arriving in the first 80 milliseconds. This value is used for judging the musical sound of a room. A good music reproduction is archived if the C80 value is between -3dB and +1dB, which is the same as a D80 value of around 50%. The **center time** marks the center of gravity of the energy-time area. It is a measure for position of the main energy. Its value should be below 80 milliseconds for speech and between 100 and 150 milliseconds for music reproduction.
- The Schroeder's frequency depends on the room size, which can be set in the **display menu** of the room-acoustic window. Below of the Schroeder's frequency you need to take care of discrete modes of the room, above you need to use reverb based calculations. The Schroeder's frequency is shown in the status-bar at the bottom of the room-acoustic window.
- You can use the **Decimal Places** sub-menu in the range menu to adjust the display of the values.

Load impulse response from file

The  **Load Timefile** function opens a file selection window, where you can select the desired type of file from the selection box at the upper left.



- **SAT Files** new SATlive file type (*.SLD).
- **SATlive Impulse response** older version of time data files.
- **PCM Wave Data** impulse response saved as mono pcm wave file.
- **Raw MLS** imports a pcm file, that containing recorded audio from a MLS sequence.

Hints:

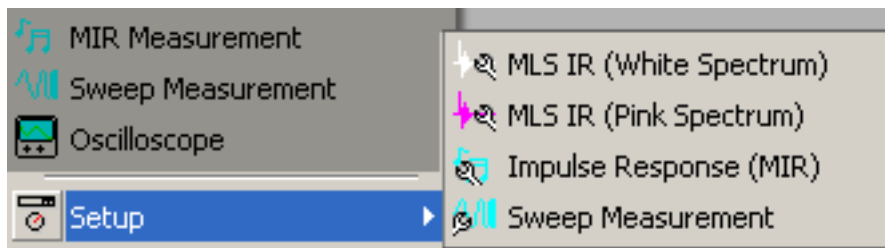
- The function's pop-up menu contains a list of the most recent used files.
- You can use the **Raw MLS option** together with the **MIsToPCM** software (available on request) to perform a MLS measurements without your PC.


Set the parameter of the current measurement

The parameters of the measurements in the impulse - response module are set in an additional setup window.

There are different ways to open this setup window:

- In the **simple menu layout** the setup is located in the pop-up menu of the start measurement button in the bottom menu bar. The setup is located in the sub menu . Setup.



- In the complex menu layout you find a dedicated bottom  for the setup right to the start measurement button in the top menu bar. The button's icon varies depending on the currently selected measurement. There is no setup button if the oscilloscope type measurement is selected.
- Use the button **F9** to invoke the setup window of the current measurement.
- When you edit user macros, then the button **Edit** in the area Impulse Response invokes the setup.

Hint:

You can find the description of each parameter in the topic related to the selected measurement.

Complex Compensation

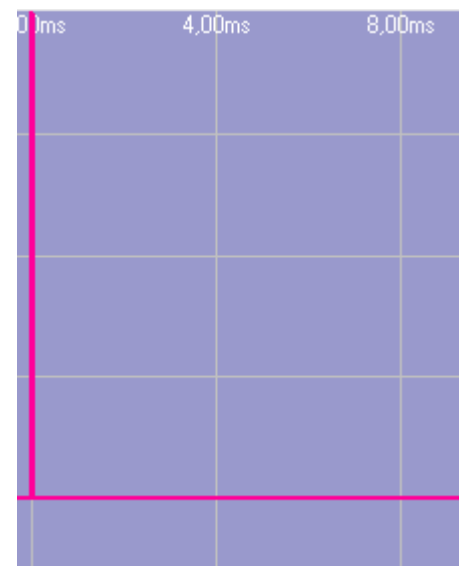
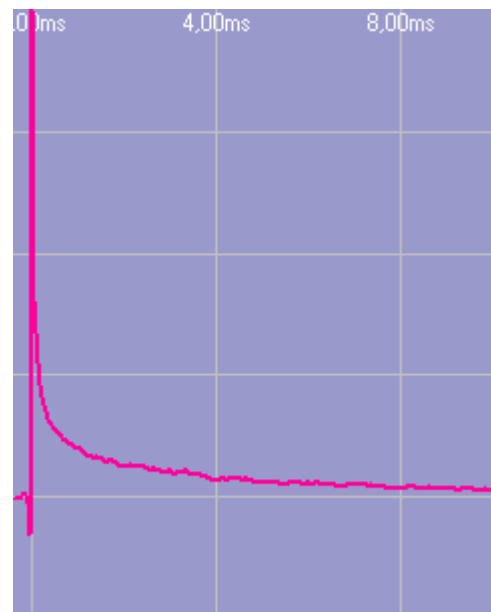
Starting with the version 1.30, SATlive is extended with some tools for examining the impulse response. Therefore a need for a calibration mechanism comparable to the calibration for the FFT arises for the impulse response only measurements.

This is the reason for complex compensation, which is a compensation mechanism for the impulse response using a flat reference file with the same settings (size and samplerate) to compensate the influence of the measurement equipment like the preamp and the audio interface and, if needed, also to remove the filtering applied to the measurement signal.

- To perform a complex compensation you must first create a complex compensation file. This is done by performing the same measurement with just a wire, i.e. with the output directly linked to the input.
- Then save the impulse response using the Save as Complex Compensation function.
- Now open the measurement's setup window, select the complex compensation file you saved in the last step, and activate the use of the complex compensation by checking the USE option. To check the complex compensation just repeat the measurement. It should result in a perfect impulse response.

Hints:

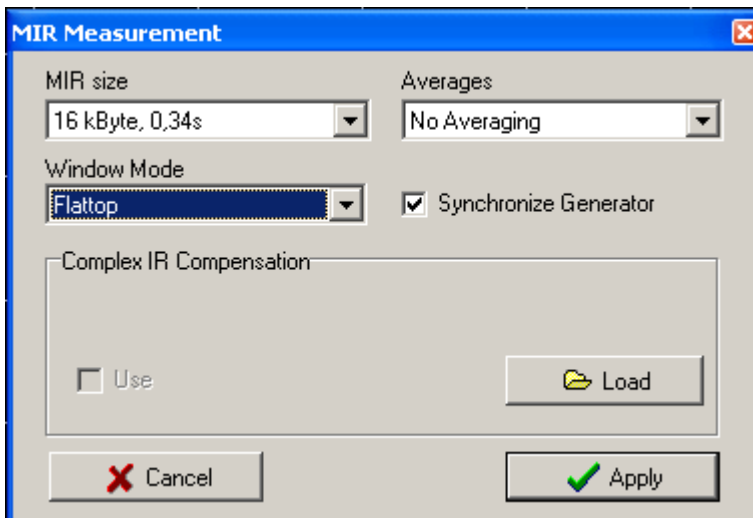
- You can use the complex compensation to compensate the influence of 'colored' measurement signals like the pink MLS signal.
- You can activate and assign complex compensation files in the macro setup.
- You can combine the complex compensation with the calibration of the FFT. But be careful not to overcompensate.



Measurements in the Impulse - Response Module

MIR Measurement

The MIR Measurement is a measurement based on comparison of two channels, like the Dual Channel FFT. Opposite to the Dual Channel FFT, the MIR measurement's result is an impulse response. Therefore there is no need to adjust the delay prior to measurement. In measurement's setup you can edit following settings:



- MIR Size select the length of the audio signal used to calculate the impulse response from. A higher number delivers a better result, but needs more time to perform.
- Window mode select the window applied to both input signals (measurement

and reference) prior to the calculation. When the expected time delay between both signals is small related to MIR size, you should use the Flattop window. Otherwise rectangular window must be used, in order not to affect the impulse response.

- Synchronize Generator links the start/stop of the signal generator with the start and end of the MIR measurement.
- Averages select the amount of measurements to be averaged before the calculation of the impulse response.
- Complex IR compensation select the file used for the complex compensation. Check use if you want to apply the selected compensation file. See page 46 for details about complex compensation.

Hints:

- In order to improve the quality of the result you should increase the MIR Size instead of increasing the amount of Averages. If your measurement is spoiled by unwanted external noise, you should increase the amount of averages.
- MIR measurement is located in the impulse - response module, but it's connections differ from those used for the MLS measurements.
- To get a high quality impulse response, the reference signal must contain all the frequencies of interest. Using pink noise will produce the best results. When you use music it should contain a wide frequency range.
- You can use the shortcut **F3** to select the measurement, the shortcut **F4** to start and the shortcut **F9** for the setup of the selected measurement.
- If you want to measure only the frequency response, you should use the transfer function measurement in the MAT Module which contains possibilities to validate the result and a continuous display.

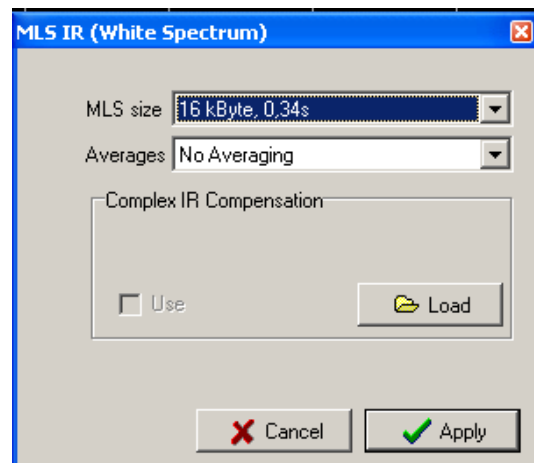
MLS white

The MLS is a quick algorithm for the calculation of the impulse response.

It uses a special audio stimulation signal, called maximum length sequence, which has the same spectrum ('sound') as white noise.

The impulse response is calculated very quickly.

One disadvantage of the MLS is the need for a special stimulation signal.



In the measurement's setup you can edit these settings:

- **MLS size** select the length of the MLS stimulation signal used. The Impulse response calculated from this measurement will have the same length.
- **Averages** select the amount of measurements to be averaged prior to the calculation.
- **Complex IR** compensation select the file used for the complex compensation feature. Check use to apply the selected compensation. See page 46 for details.

Hints:

- To improve the quality of the result you should increase the MLS Size instead of increasing the amount of Averages. If your measurement is spoiled by external noise, you should increase the amount of averages.
- For room measurements you use pink MLS pink, which will improve the quality of the impulse response at lower frequencies.
- For the MLS measurement to work properly, one MLS stimulus has to be played prior to measurement. Therefore a non averaged MLS measurement needs twice the time of the impulse response to perform.
- On reverberant conditions the impulse response's size (set by MLS Size) should be at least similar to the reverberation decay time (RT60).
- The MLS measurement's results can be affected by distortion and time variances of the measured system.
- You can use the shortcut **F3** to select the measurement, the shortcut **F4** to start and the shortcut **F9** for the setup of the selected measurement.

MLS Pink

The MLS is a quick algorithm for calculation of the impulse response. It uses a special audio stimulation signal, called maximum length sequence, which has the same spectrum ('sound') as white noise.

Because the white noise contains the same energy for the same frequency range (i.e. the same energy in the range from 50 Hz to 100 Hz as in the range from 5050 Hz to 5100 Hz) you notice a lot of high frequencies when listening to a white noise signal.

To adapt this signal to human hearing, one can apply a so called pink filter, which leads to the same energy content for each octave. (now the range from 50 Hz to 100 Hz contains as much energy as the range from 5.000 Hz to 10.000 Hz).

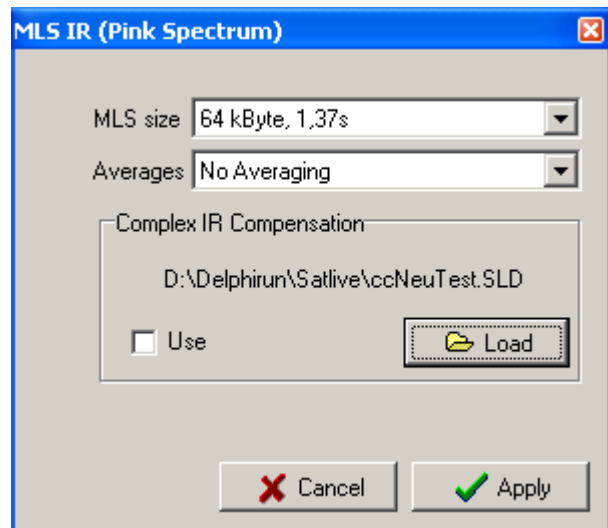
This signal is much more suitable for acoustic measurements, like speaker or speaker - room measurements.

If you use a MLS Pink measurement, you have to remove filtering after the measurement to get the right result.

Otherwise the result contains the frequency response of pink filter added to impulse-response you want to measure.

In the measurement's setup you can edit these settings:

- MLS size select the length of the MLS stimulation signal used. The impulse response calculated from this measurement will have the same length.
- Averages select the amount of the measurements to be averaged prior to the calculation.
- Complex IR compensation select the file used for the complex compensation. Check use to apply the selected compensation to the impulse response. See page 46 for details about complex compensation.



Hints:

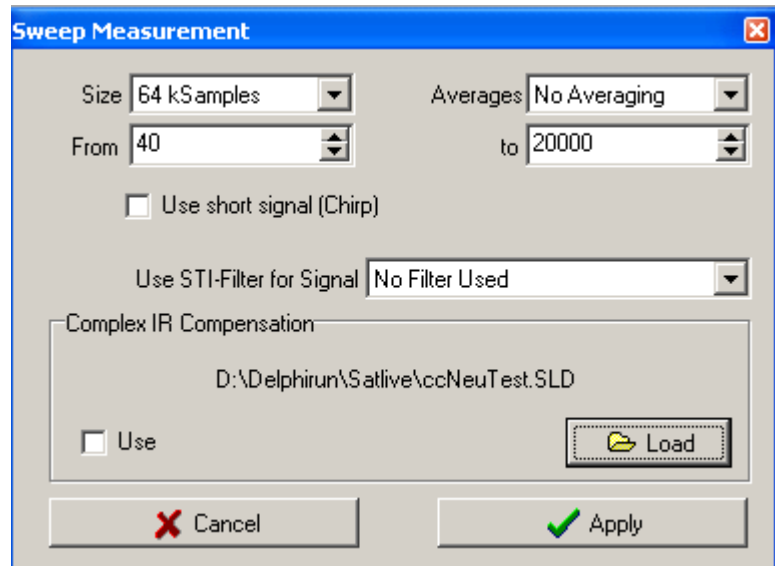
- To improve the quality of the result you should increase the MLS Size instead of increasing the amount of averages. If your measurement is spoiled by external noise, you should increase the amount of averages used.
- For the MLS measurement to work properly, one sequence has to be played prior to the measurement. Therefore a non averaged MLS measurement needs twice the time of the impulse response to perform.
- On reverberant condition the impulse response's size (set by MLS Size) should be larger or at least similar to the (expected) reverberation decay time (RT60).
- The MLS measurement's results can be affected by distortion and time variances of the measured system.
- You can use the shortcut **F3** to select the measurement, the shortcut **F4** to start and shortcut **F9** for the setup of the selected measurement.

Sweep measurement (impulse response)

The Sweep Measurement is a measurement based on the comparison of two channels, like the Dual Channel FFT, using a swept sine as the excitation signal.

The measurement's result is an impulse response.

Therefore there is no need to adjust the delay prior to measurement.



In the measurement's setup you can edit the following settings:

- **Size:** length of the impulse response. A higher number delivers a better result, but needs more time to perform. The sweep-signal length is set to half the length of the impulse response, if Use short signal (Chirp) is not activated.
- **Averages:** amount of measurements to be averaged before calculation of the impulse response.
- **From:** starting frequency of sweep, i.e the lowest frequency played.
- **To:** ending frequency of sweep, i.e. the highest frequency played.
- **Use short signal (Chirp):** shortens the time used for the sweep signal, so that only a real short sound is audible. This setting does not affect the length of the impulse response calculated.
- **Use STI - Filter for signal:** use this option to apply a digital filtering to the signal generator. This makes the energy contribution more similar to the contribution of energy in speech. You should use this filter only if you want to perform a STI calculation using the measured impulse response.
- **Complex IR compensation** select the file used for the complex compensation. Check use if you want to apply the selected compensation file. See page 46 for details about complex compensation.

Hints:

- To improve the quality of the result you should increase the Size instead of increasing the amount of the averages. If your measurement is spoiled by unwanted external noise, you should increase the amount of averages used.
- The Sweep measurement is located in impulse response module, but it's connections differ from those used for MLS measurements.
- You should use the STI - Filters only if you want to calculate the STI value, because the filter decreases the noise immunity of the measurement, especial at low and high frequencies. This is a wanted behavior for the measurement of the STI value, because intelligibility is affected by external noise.
- You can use the shortcut **F3** to select measurement, the shortcut **F4** to start and the shortcut **F9** to invoke the setup for the selected measurement.
- If you want to measure the frequency response, you should use the MAT Module, because of it's possibilities to validate the result.

Oscilloscope

The oscilloscope measurement in the impulse - response module displays the signal on the inputs directly.

There are two similar setup areas, one for the **MIC** input and the other for the **REF** input.

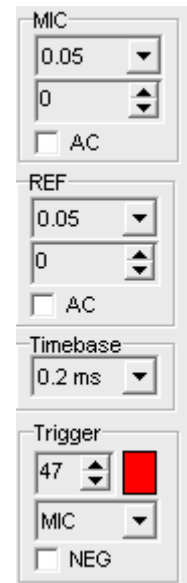
Upper selection select the vertical amplitude. The value is one division related to digital fullscale. **GND** shows a flat line, **OFF** hides the trace.

Y-Offset (lower setting) move the trace up or down. A value of 100 equals the upper display border and -100 equals lower display border.

AC show only the ac part of the input signal.

The next settings refer to both input signals.





- **Timebase** select the time per division for the x axis. Smaller values increase the processor load.
- **Trigger level** the percentage of the current display's vertical range where trace display is triggered. A green label indicates a triggered display, a red level indicates that level is too low to trigger.
- **Trigger source** select the input used for the trigger.
- **Neg** select the direction of the slope to trigger on. If **Neg** is selected, the trace must fall below trigger level in order to trigger the display. Otherwise the trace must rise above the trigger level to trigger the display.



Files and Traces (Impulse response complex menu layout)

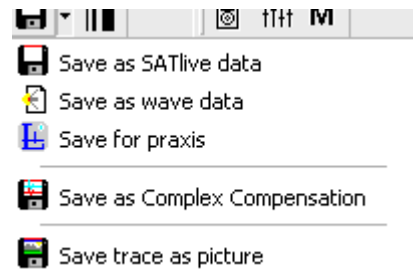
This menu is located in upper menu-bar.




-  **Save Impulse response** saves the current impulse response to a file. You can save impulse response in different types of file.
-  **Load time data** loads a saved impulse response. The pop-up menu contains a list of the recently used files. Opening an impulse response will destroy the currently displayed impulse response.
-  **Load time data into the second trace**: load a saved impulse response into the second impulse response's trace.
-  Trace width toggles the width of the trace. Shortcut **Ctrl – W**.




Save the Impulse Response

- You can save the impulse response in different types of files. The file type can be selected in the pop-up menu of the **SAVE** button





-  **Save as SATlive data** this is the default setting. The trace is saved containing all settings. If the **show fileinfo when saving** in the **Setup -> Features**

window is enabled, the current settings are shown prior to saving the file. In this case you can edit the file's description. Otherwise, you can edit the description only when you invoke the trace information window.



-  **Save as Wave** data saves the trace as a *.wav (windows pcm, mono) file. This allows post-process using other software.
- Save for praxis** save the impulse response readable for praxis (www.libinst.com) software. This great software allows, even in free demo-mode a lot of post-processing, like waterfall display.
-  **Save as complex compensation** saves the current impulse response as complex compensation data. See page 46 for details about complex compensation.
-  **Save trace as picture** saves the upper display as a picture. You can select the picture's format from the file type selection box in the save menu. The available formats may vary.



Hints

- You can select the quality of the pictures at  setup ->  features.
- SATlive can read only SATlive data and mono pcm-wave data. For easiest reuse of the impulse response in SATlive you should save it as SATlive data.

Macros in impulse response module

In SATlive a macro describes a measurement and it's post-processing performed in the impulse - response module.

SATlive features twelve different macros. The Macros one and two are directly assigned to the buttons Speaker/Room  and Direct / Equalizer 

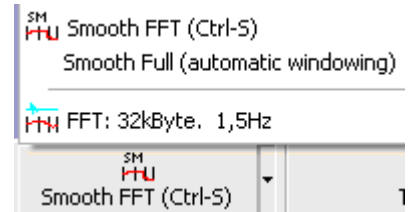
- To edit a macro, go to  Setup ->  User Macros.
- You can start the first two macros with a mouse-click on the assigned buttons.
- The other ten macros can be accessed via the macro-list. The macro-list contains the first two macros as well.



User Macros	
Speaker in Room	MLS IR (pink spectrum), 128kSamples, 2,73s, No Averaging, D:\Delphirun\Satlive\sircc.SLD, Smooth FFT, Single
EQ Measurement	MLS IR (white spectrum), 32kSamples, 0,68s, No Averaging, FFT: 32k, Repeating
Sweepy Joes	Sweep measurement, Measurement, Size: 256kSamples, From: 40,0Hz, to: 20,0kHz, Smooth FFT, Single
Chirping Bird	Sweep measurement, Measurement, Size: 64kSamples, From: 40,0Hz, to: 20,0kHz, Use short signal (Chirp), Smooth FFT, Single
Makro 5	MLS IR (white spectrum), 16kSamples, 0,34s, No Averaging, FFT: 32k, Single
Makro 6	

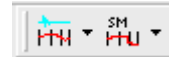
- If you didn't run a macro before then a left mouse click on the button **M** shows the macro list.
- If you'd run a macro before then a left mouse click on the button **M** repeats the last macro.
- You can open the macro-list using the pop-up menu of the button **M**.
- To run a macro from the list, just click on it's name or description with left mouse button.
- After the execution of a macro from the macro list, the macro's is assigned to the User Macro Button **M**. You can rerun the macro then by just clicking on the button. The other macros can be accessed via the button's pop-up menu.
- To get more information on a special macro, just click on it's name or description with right mouse button.

Perform a FFT using the current impulse response

- In the simple menu layout this function is located in the lower menu-bar.





- In the complex menu layout, this function is located in the top menu area.
-  **FFT** start the calculation of a FFT of the current impulse response's section which is shown in upper window, using the selected resolution. After performing the FFT SATlive changes to the FFT module. You can start the FFT using the shortcut **F7**, too. The resolution of the FFT can be selected from the pop-up menu of this button.
-  **Smooth FFT** start a Smooth FFT of the current impulse response's section displayed in upper trace window. You can also use the shortcut **F8**. The function Smooth Full, which you find in the button's pop-up menu, extends the right border of the upper display before performing the smooth FFT in order to get enough valid data for calculation.



Trace Display options in the Impulse - Response Module




This options are located in the right menu-bar.

-  **Roundedge** toggles the application of the roundedge window selected at the trace-display's pop-up menu prior to the FFT.
The window is always applied as a half window, i. e. it is only applied to the right half of the upper window. This is necessary to avoid spoiling of the peak, which should be in the left half. See page 32 for details about the roundedge function.
-  **Lock the Window** Avoids changing the selected region in the upper window when you run a macro. This could be helpful if you want to compare absolute phase values which always refer to the left window border.



Windowing in impulse response module

This options are located in the right menu area.

-  Apply a 10ms long window with its left border 400usec before the peak. You can use shortcut CTRL-1, too.
-  Apply a 20ms long window, with its left border 400usec before the peak. You can also use shortcut CTRL-2.
-  Show the user window list.








Hints

- You can edit user windows in **Setup -> User Windows**. See page 142 for details.
- You can assign the current window to an user window list using the Save Current Window function from the Trace display's pop-up menu.

Cursor modes

This options are located at right menu area (only in the complex menu-layout) and they are also present at trace display's pop-up menu.

This options select how SATlive reacts when you click on the impulse response's trace using the left mouse-button.

-  **Set Cursor** (Default) Set the cursor on the mouse click's position. You can also use the shortcut **C** to select this option.
-  **Cut left of Click** Set the left border of the upper window to the click's position.
-  **Cut right of Click** Set the right border of the upper window to the click's position
-  **Set Cursor on Peak** The cursor is moved to the point with the highest absolute value. This action is enabled only if the  Set Cursor mode is selected. You can also use the shortcut **Shift - P** to perform this action.















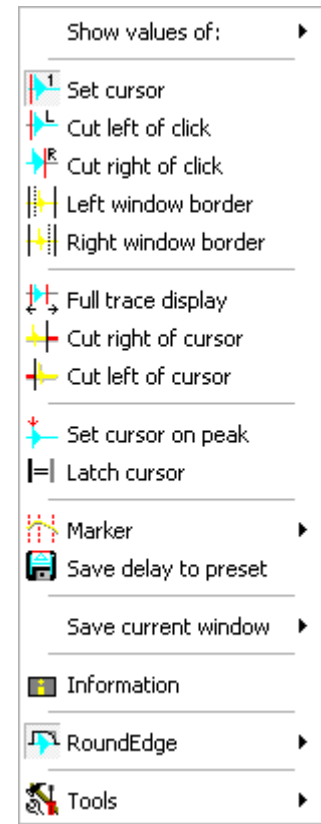
Hint:






- You can perform this options on both trace displays.

Impulse response trace's pop-up menu

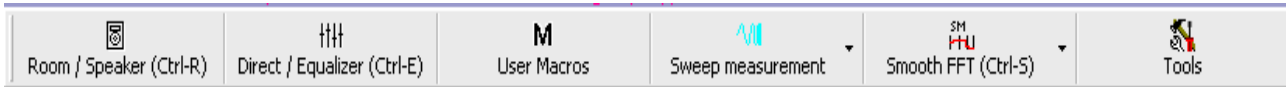
Click on the impulse response's display with the **right** mouse-button to open this pop-up menu.


- **Show values of** select the trace for cursor readout. Only traces currently displayed are enabled.
-  **Set Cursor** set the cursor on the position of the mouse-click. You can also use the shortcut **C** to select this option.
-  **Cut left of Click** set the left border of the upper window to the click's position.
-  **Cut right of Click** set the right border of the upper window to the click's position.
-  **Set left window Border** see page 26 for details.
-  **Set right window Border** see page 26 for details.
-  **Full trace display** see page 27 for details.
-  **Cut left of Cursor** the left border of the upper window is set to the cursor's current position. This action is enabled only if the option **Set Cursor** is selected.
-  **Cut right of Cursor** the right border of the upper window is set to the cursor's current position. This action is enabled only if the option **Set Cursor** is selected.
-  **Set Cursor on Peak** the cursor is moved to the point with the highest absolute value. This action is enabled only if the **Set Cursor** mode is selected. You can also use the shortcut **Shift-P** to perform this action.
-  **Latch Cursor** save the cursor's current position as a reference. If a cursor is latched, the distance between the cursor's current position and the latched cursor's position is displayed. This action is enabled only if the **Set Cursor mode** is selected. The shortcut for this function is **D**.
- **Show Difference** show the distance between the cursor's current position and the latched cursor's position and the distance related to this delay. This option is visible only if a cursor position has been latched. You can set the temperature and the units used for the distance calculation at  **Setup**->  **Features**








-  **Marker** place a marker on the current cursor position or show the delay-matrix. See the marker section of this document for details.
-  **Save delay to preset** saves the cursor's current position to one of the five delay latches used for dual-channel FFT in the MAT module.
- **Save current window** save the current border positions of the upper window to an user defined window preset.
-  **Info** show information about the current trace. You can edit the trace's description in the information window.
-  **Roundedge** open the sub-menu to set the parameters for the roundedge function. See page 32 for details about roundedge function.
-  **Tools** show the tools menu which contains more options.





Impulse response Menu bar simple Layout




If the simple menu layout is selected then a smaller amount of buttons is displayed. You can access many functions using a pop-up menu or the  tool menu.

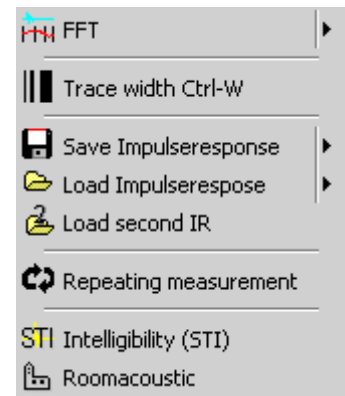
-  **Room/Speaker** starts the macro Speaker in Room.
-  **Direct/Equalizer** start the macro Direct Electric.
-  **User Macros** show the user macro list to choose a macro from. After the execution of a macro the executed macro is assigned this button.
- **Start selected measurement** you can select the type of the measurement to perform in the button's pop-up menu. The button's pop-up menu allows you to invoke the setup window for the different types of measurement. You can use the shortcut **F3** to select the type of the measurement, the shortcut **F4** to start the selected measurement and the shortcut **F9** to invoke the setup window assigned to the selected measurement.
-  **Smooth FFT** perform a Smooth FFT of the impulse response's selection shown in the upper window and then changes to the FFT module.
The button's pop-up menu contains the function Smooth Full, a smooth FFT with an automatic movement of the right border, and a 32kByte long FFT. You can use the shortcut **F7** for the FFT and the shortcut **F8** for the Smooth FFT.
-  **Tools** more functions and options for the impulse - response module.









Hints

- You can edit the user macros at  **Setup** ->  **User Macros**.
- Using the option **Start measurement on selection** at  **Setup** ->  **Measurement** you can select if the measurement starts when you select another kind of measurement, or if you need to start the measurement with a click on the button or the shortcut **F8**.

Menu Tools in the Impulse - Response Module







You can invoke this menu either using by clicking on the **Tools**  symbol in the main menu bar or via the trace display's pop-up menu.

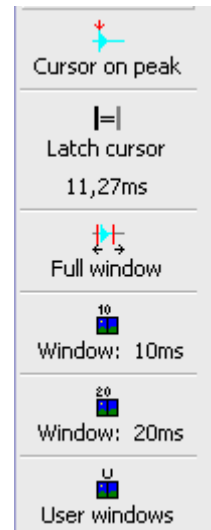


-  **FFT** start a FFT of the part of the impulse response which is shown in the upper window using the selected resolution. After performing the FFT SATlive changes to the FFT module. You can start the FFT using the shortcut **F7**, too. The resolution of the FFT can be selected in the pop-up menu of this option.
-  **Trace width** toggle the width of the current trace. You can use the shortcut **Ctrl – W**, too.
-  **Save the impulse response** save the current impulse response. You can save the impulse response to different types of file.
-  **Load impulse response** open a saved impulse response. The pop-up menu contains a list of the recently used files. Opening an impulse response will destroy the currently displayed impulse response.
-  **Load second IR** open a saved impulse response into the second impulse response trace.
-  **Repeating Measurement** if is option is selected the measurement and the post-process are repeated until the measurement is stopped by the user.
-  **Intelligibility** display the Speech Transmission Index (STI) calculated using the current impulse response.
-  **Room-acoustic** open the room acoustic parameters window using the current impulse response.


Right menu bar impulse response (simple menu layout)

As you might guess this menu is located right of the trace display window.

-  **Cursor on Peak** the cursor is moved to the point with the highest absolute value. This action is enabled only if the **Set Cursor** mode is selected. You can also use the shortcut **P** to perform this action.
-  **Latch Cursor** Saves the cursor's current position as a reference. If a cursor is latched, the distance between the current cursor and the latched cursor is displayed. The latched cursor's position is displayed below the symbol. The shortcut for this function is **D**.
-  **Full window** Set the upper window to the FFT size (or to the size of the impulse response, if this is shorter than the FFT size). The shortcut is **F**.
-  **Window 10ms** Apply a 10ms wide window with its left border 400usec before the peak. You can use the shortcut **Ctrl-1** as well.
-  **Window 20ms** Apply a 20ms wide window with its left border 400usec before the peak. You can also use shortcut **Ctrl-2**.
-  **User Windows** Show the user window list. For details see page 142.

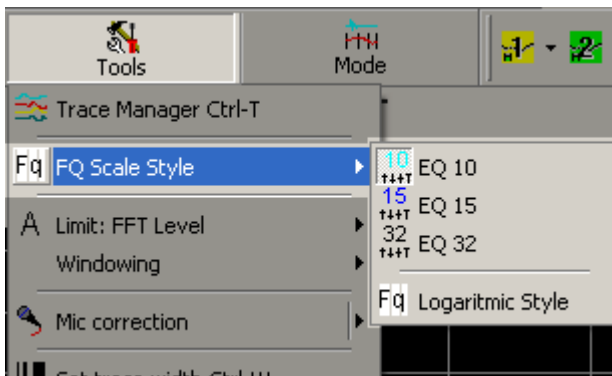



Hints

- You can edit the user windows in  **Setup** ->  **User Windows**. See page 142 for details.
- You can add the current window to the user window list using the **Save Current Window** option from the **Trace display's pop-up menu**.

Common menus for FFT module and MAT module



FQ Scale Style



This option **FQ** can be found in the FFT module and in the MAT module. It is located in the  Tools Menu.

Select the vertical (frequency) scaling you want to use from the menu:

- **EQ 10**: the scale shows the bands of a **10 band EQ**.
- **EQ 15**: the scale shows the bands of a **15 band EQ**.
- **EQ 32**: the scale shows the bands of a **32 band EQ**.
- **Logarithmic style**: the scale shows default frequency scaling.

The  **Setup** ->  **Display** contains the option **I.S.O Frequency Grid**, which shows vertical lines at the center frequency of the EQ - bands.


Otherwise the vertical lines mark the borders between the single EQ - bands.

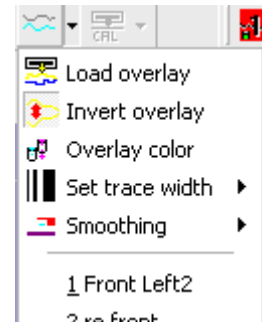
Overlay









The overlay functionality is disabled by default.

If you want to use the overlay functionality you need to enable it in the **setup -> post process** section.



In the FFT module and in the MAT module you can use the overlay function to show a trace in the display in order to compare it to the live trace or adjust the current measurement.

The  **Overlay** button's pop-up menu contains the following functions and options:



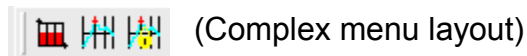
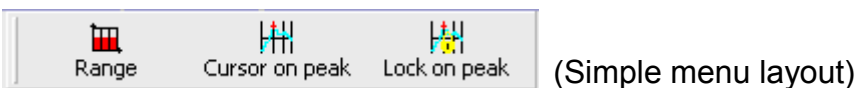
-  **Load Overlay** select an overlay file to load. You can also use the list of most recently used files at the end of the menu to open a file.
-  **Invert Overlay** mirror the overlay trace on the 0dB line, in order to allow a quick adapting of the live trace to the overlay trace.
-  **Overlay Color** change the color of the overlay trace. You can change this color at the **Setup -> Display** window as well.
-  **Set Trace Width** select the width of overlay trace from the options pop-up menu.
-  **Smoothing** select the smoothing of the overlay trace from a sub-menu. Beside assigning a fixed value, you can also link the smoothing to the live trace's smoothing (**Same as main-trace**), or use the smoothing applied to overlay trace when it was saved (**As Saved**).
- Most recent used file list select the file to open with a double click on the file name.
- The overlay button indicates the state of the overlay.
 -  **No valid overlay** loaded.
 -  **Valid overlay loaded, but not shown.**
 -  **Valid overlay loaded and shown.**




Hints:

- In the simple menu layout the Set Trace Width option is located in the **Tools** , and the Set Overlay Color function is located in the pop-up menu of the  **Overlay Gain** button.
- You can move the overlay trace up and down using the Overlay Gain setting in the layout section.
- Depending on the selected menu layout some options may not appear in the pop-up menu.
- If a valid overlay is loaded then the Overlay button toggles the visibility of the overlay, otherwise it invokes the Load Overlay function. The shortcut is **O**.

Cursor Menu (FFT and MAT)

This menu is located right in the lower menu bar.



-  **Range** open the range sub menu where you can select the displayed frequency range. See page 64 for details.
-  **Cursor on Peak** move the cursor to the current peak of amplitude response. The shortcut is **Shift-P**.
-  **Lock on Peak** perform the **Cursor on Peak** function every time a new trace is drawn. In order to reset this option click again on the button or perform an other cursor related operation (Cursor on Peak, mouse click on the trace to set the cursor, movement of the cursor using arrow keys on your keyboard). The function's shortcut is **P**.

Hint:

- You can use the shortcut **C** to hide/show the cursor.

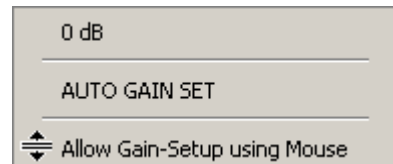
Gain / Offset Setting

This setting is located at right window. It is available in the MAT module and in the FFT module. Changing this value moves the selected trace up or down in the display window. You can use this setting to center the selected trace or to shift it in order to compare it to another trace. You can use the mouse to move the selected trace up or down, if the option *Allow Gain-Setup using Mouse* option is activated in the pop-up menu of the value display or in the *Tools* menu.



Hints:

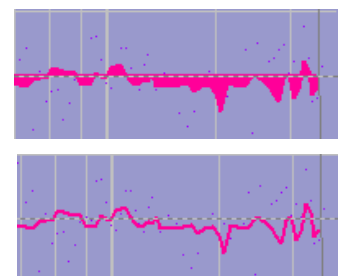
- Use shortcut **Z** or a double-click with the mouse to the gain display to set the gain to zero.
- Use *Auto-Center* or the shortcut **M** for the quick adjustment of the live trace.
- The gain settings affects the amplitude read out. Therefore SATlive shows the current gain setting behind the amplitudes value, if the gain is differs from zero.
- The colors of the display are swapped to indicate an offset value different from zero.
- You can use the shortcuts **Page Up** and **Page Down** to change the offset. The label and the color of the selected trace are shown on top and left to the gain setting.
- The value-display area contains a pop-up menu where you can enable the movement of the selected trace by moving the mouse vertically with the left mouse-button hold down.
- When working with the *Live-Add Trace* or the *Perfect-Addition Trace* you can use the entries in the pop-up menu of the cursor-info area in the right-menu bar to determine whether the offset should affect the calculated trace(s) or not.



Flood trace to center

The option **Flood trace to center** fills the area between the live trace and the zero dB line with the trace's color.

- Flood trace to center **selected**:
- Flood trace to center **not selected**:



Display range selection

The **Range** selection is located in the lower menu bar.

Use it to select the visible frequency range for the display.

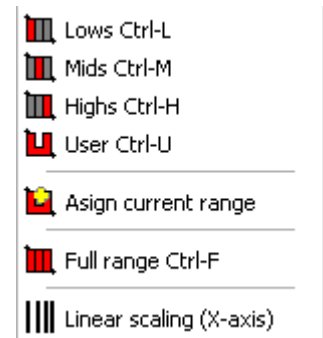
Beside the three ranges **Low**, **Mid** and **High** you can select a fourth setting, which is called **User**.

You can change the border of the user setting either (like the borders of the three other settings) at **Setup** -> **Post**

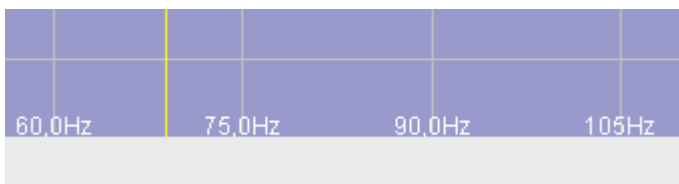
Process or by assigning the currently used borders using the **Assign current range** option.

The **Full range** function restores the full frequency range.

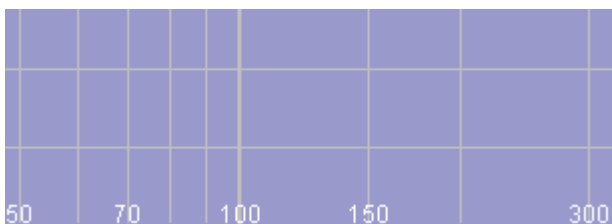
If a transfer measurement is performed in the MAT module then this menu contains the Linear Scaling (X-Axis) option, which activates a linear scaling of the frequency axis, opposite to the common logarithmic scaling. The linear scaling might be helpful when you work with the phase trace.



- Linear X-axis setting



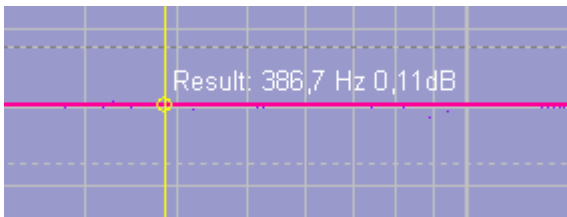
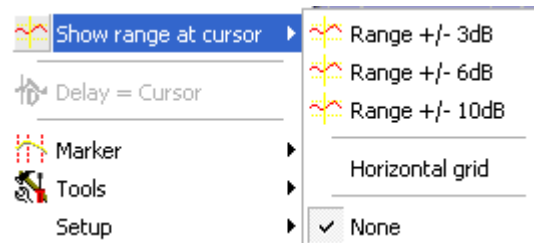
- Logarithmic (default) X-axis setting.



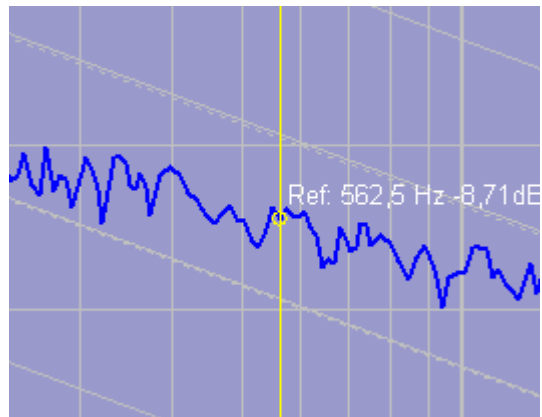
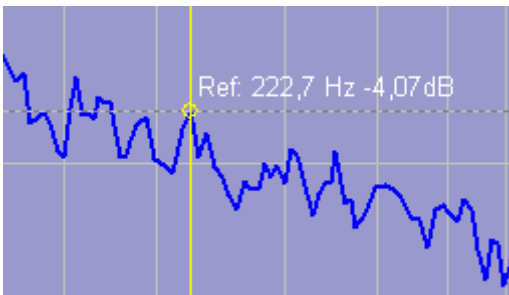
Show Range at Cursor

In the FFT module and in the MAT module you can find this setting in the pop-up menu of the trace display.

This option shows two lines with the selected distance related to the amplitude value at the current cursor position.



If the option **Pink spectrum lines** is activated in the current display settings, then the lines also use a slope of -3dB/octave.










The horizontal grid option shows a horizontal line at the cursor's intersection with the selected trace.

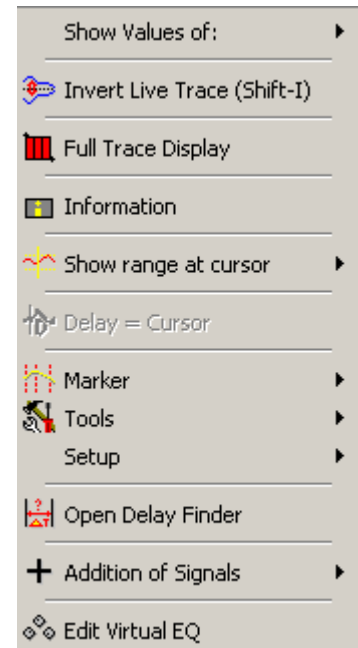
Hint:

- The cursor always shows the values of the currently **selected trace**.
- You can select the trace to analyze in the pop-up menu of the trace display using the **Show Values of** option.

Trace display's pop-up menu

You can open this menu by clicking on the trace display window with the right mouse button. The content of this menu varies dependent on the current status and the measurement selected.

- **Show values of** select the trace whose values are shown.
- **Group-delay related to** select the reference time used for the calculation of the group-delay. This option is available only in the impulse response's FFT module.
-  **Invert live trace** flip the live trace on the zero dB line. The shortcut is **Shift – I**.
-  **Information** show information about the currently selected trace.
-  **Full range** show the whole valid frequency range. The shortcut is **F**. See the range section for details.
-  **Show Range at Cursor** draws horizontal guide lines related to the value at the cursor's current position.
- **Delay = Cursor** applies the delay value at the cursor's current position to the current delay. This option is enabled only in the impulse-response measurement. You can also use the shortcut **F3** to invoke this function.
-  **Markers** assign, show or hide frequency markers. See page 67 for details.
-  **Tools** invoke the  **Tools** menu.
- **Setup** shows the layout options for the trace display.
- **Open Delay Finder** open the delay-finder window. Available in the MAT module only. See the delay-finder section on page 102 for details.
- **Addition of Signals** open the menu for the addition of signals tool.
- **Edit Virtual EQ** opens the editor window for the virtual EQ. For details about the virtual EQ see the virtual EQ section of this document.



Frequency Markers

In FFT and MAT module you can set frequency markers to mark frequencies of interest like crossover frequencies.

- The markers are shown in the trace display and labeled with their frequency.
- To assign the current cursor position to a marker use the shortcut **Ctrl** and a number from **1** to **5**. The number becomes the number of the marker.
- To overwrite an assigned marker use the shortcut combination **Alt** and the number of the trace (**1..5**).
- To toggle the visibility of an assigned marker use the shortcut combination **Ctrl** and the number of the trace (**1..5**).
- In the Marker pop-up menu in trace display's pop-up menu you can toggle the visibility and you can clear all markers there.

Smoothing

This selection is located on left side in the lower menu bar.

Select the amount of smoothing applied to the live trace.

The value of a point for the display is calculated as the mean value of the selected range. If, for example a range of one octave is selected, then the mean value is calculated from the frequency of the current point minus half an octave to the frequency of the current point plus half an octave.

Using the unit octave is closer to human hearing as a fixed frequency range or a fixed amount of points.

The option Similar to Ear varies the width of the smoothing depending on the frequency.

The higher the frequency, the smaller the window (in octaves).

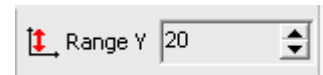
Hint:

- Human hearing is very sensitive to peaks in frequency response so you should not apply too much smoothing.

Show Values of

- This selection is located at trace display's pop-up menu.
- Select the trace to read values from. You can select any trace which is visible.
- Just choose the trace you want from the sub-menu.
- The selected trace is indicated in front of the values.
- You can use the shortcut **T** to toggle the cursor readout.

Value Editor Field



This edit field is located right of the layout - parameter selection below the trace display in FFT and MAT module.

This field shows the current value of the selected layout parameter.

You can change this value by:

- The selection of a **preset value** from the field's pop-up menu.
- Clicking on the **arrows** on the right side of the field.

SATlive shows the name of the selected parameter left of the value edit field.

Cursor range tool

In the MAT module and in the FFT module there is the possibility to get more information using the cursor.

The cursor range tool uses the latched cursor, which can be set using the shortcut **D** on the keyboard and the current cursor's position to calculate the bandwidth and the center frequency of the range between both cursors.



An other way to set the latched cursor is to click the right mouse-button while you're holding down the left mouse-button. This will set the latched cursor to the position of the click, or in case there is still a cursor latched, it will remove the latched cursor.

In the trace display a solid line is shown at the latched cursor's position, and the center frequency is marked with a dotted line, also in the color of the latched cursor.

The cursor range tool supports two ways to select the desired area in the graph display.

- **Latched Cursor is Center Frequency** the latched cursor's position is treated as the center of the area. The area is expanded on both sides of the latched cursor, depending on the current cursor's position. In this case the latched cursor is drawn as a dashed line, and in the second line the frequencies related to both borders of the selected area are shown.
- **Latched Cursor is Border** the latched cursor's position is treated as one border of the area. The current cursor's position is the other border. The latched cursor is drawn as a solid line, and the calculated center frequency is shown in the second line.

```
Latched cursor: 240Hz
CF: 480Hz
BW: 1,50 , Q: 0,67, Octaves: 2,00
```

The information shown above the trace display may consists of the following components depending on the settings for Advanced Cursor Information at the  **setup** ->  **post process** window. The information of the cursor range tool are shown on the left of the information area above the trace display.

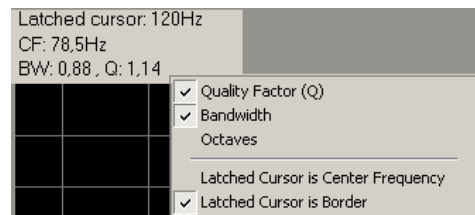
- **Latched Cursor** the position of the latched cursor.
- **CF** center frequency of the range between the position of the latched cursor and the position of the current cursor. The position is shown as a dashed line in the trace display. This is shown only if the **Latched Cursor is Border** setting is selected. Otherwise in the FFT module FQ2 is shown followed by the calculated frequency of

the second border. In the MAT module the frequencies related to both borders are shown.

- **BW** the bandwidth of the range between both positions, related to the center-frequency¹.
- **Q** Quality, calculated by $1/BW$.
- **Octaves** bandwidth in octaves.

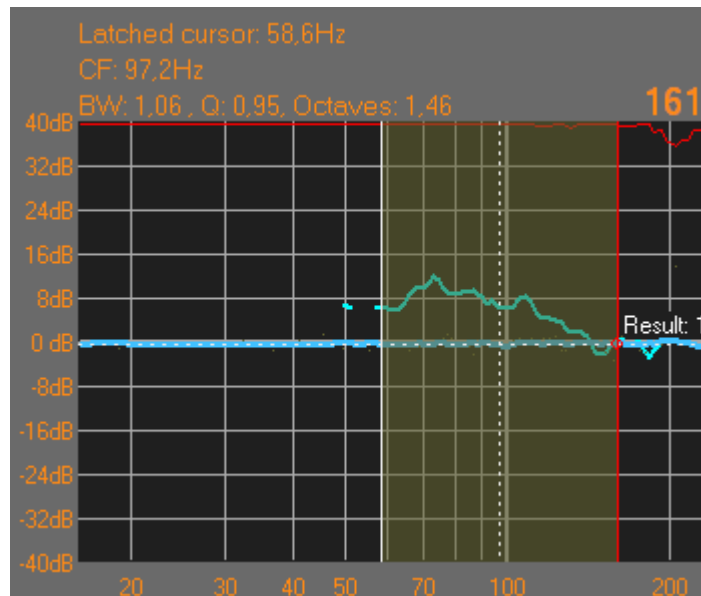
The cursor details window in the right menu area, which is available in the MAT module only, shows more information related to the position of the current cursor.

To open the **setup menu** for the cursor range tool, just click in the left area of the info area in the MAT module, or in the text display above the trace in the FFT module.



Just select the values you want to see and the mode of the cursor range tool by clicking on the related entry.

The selected range is marked by a transparent overlay. The overlay shares the color with the color used for the amplitude-threshold display in the FFT measurement.



¹ This is not the correct definition of the Bandwidth, but it's the Bandwidth definition used in many digital equipment.

Full Range

This function is located in the trace display's pop-up menu and in the range pop-up menu in the lower menu bar.

This function sets the upper and lower frequency of the display so that the whole range of valid frequency data is visible.

The lowest frequency is given by the lowest valid frequency of the current trace and the highest frequency is given by the Nyquist's frequency (= half the samplingrate). The function's shortcut is **F** or **Ctrl-F**.

Lowest valid frequency

Due to the windowing of the impulse response only a part of the impulse response is used for the calculation of the FFT. Therefore it is not possible to show frequencies below a certain frequency.

On the lowest frequency one whole cycle can be completed. This means that the period of the lowest valid frequency is equal to the length of the window applied prior to the calculation of the FFT.

For example let the length of the time window be 20 milliseconds. The lowest frequency is defined by $f = 1/\text{period}$, which yields $1/0.02\text{s}$, resulting in 50 [1/s = Hz].

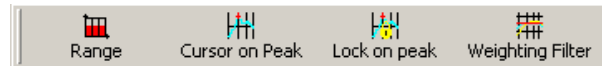
Nyquist Criteria

The Nyquist's criteria postulates that an analog signal which is used as an input into an analog-digital converter, must not contain signals with a frequency higher than half of the sampling frequency (samplingrate). Otherwise the digital signal is spoiled with artificial signals.

This is the reason why a steep low pass filter is applied prior to any analog digital conversation.

Therefore the signal feed into the FFT does not contain any information about frequencies above half the samplerate. This is why SATlive does not display any frequencies above that value.

Weighting Filters



In the MAT Module you can apply a weighting filter to the mic signal input. The selection of the weighting filter can be found in the lower menu bar.

The frequency response of the human ears is not linear and changes, especial at lower frequencies, related to the sound-pressure level. The frequency response will become more flat when the level is increased. At lower frequency the sensitivity of the human ear is reduced at the low and at the high frequency area.

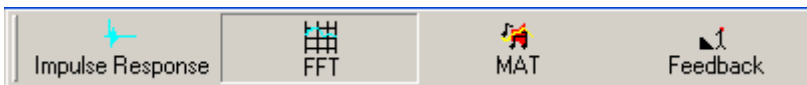
To match this behavior of the human hearing there are some so called weighting filters. This filters include a low-pass filter, which is the same for all three filters described below, and a high-pass filter whose parameter vary.

- **A Weighting dB(A):** A weighing performs the strongest cut at lower frequencies. Intended to be used for lower levels, this has become the most commonly used weighting filter. This filter correlates with the 'frequency response' of hearing damage and therefore it is used in the German DIN 15905-5 to weight the energetic averaging of sound pressure levels.
- **B Weighting dB(B)** this weighting, whose low cut is in the middle between A and C weighting was intended to be used ad medium levels. Nowadays this weighting is not used often, so it is not present in SATlive.
- **C Weighting dB(C)** this weighting is intended for high levels and applies only a small amount of low cut filtering to the signal. It is mainly used to weight short signals (Peaks).

Hint:

- You can set the weighting filter used for the level display independent from the filter used in the MAT Module. Select the filter to be used for the level display in the related setup window.

FFT Module



This module displays the FFT of the impulse response and allows you to post process the trace in different ways.

In the normal operation this module is invoked directly from the impulse - response module when you perform a FFT or a smooth FFT, but it can also be accessed directly using the FFT button in the top menu-bar.

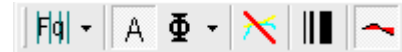
FFT

The FFT is an algorithm (= description of a calculation) used to transform a signal in the time domain, like an impulse response into a signal in the frequency domain.

The new signal contains the same information as the original signal, but in another kind of values. The values of the frequency domain are amplitude and phase related to the frequency. We call this kind of display Frequency response.

In the frequency response it is easy to the system's (in this case, system refers to the whole measured way of signal) peaks and dips.

Display functions







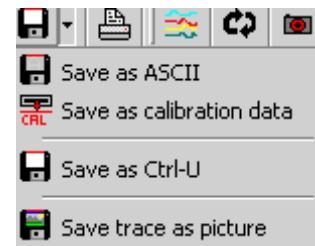
In the complex menu-layout this functions are located at the upper menu bar.



- **Fd** **Toggle Display mode** this button and it's pop-up menu toggle the display mode. For details see page 64.
- **A** **Show Amplitude** toggle the display of the amplitude response. If the amplitude display is not active, then the phase display is activated in order to prevent an empty screen.
- **Φ** **Show Phase** toggles the display of the phase response. If the phase display is not active, then the amplitude display is enabled in order to prevent an empty screen. In the button's pop-up menu you can select different display modes for the phase (-180° to 180° or 0° to 360°), different ranges of the group-delay display and furthermore the reference used for the group-delay.
- **X** **Hide Amplitude and Phase** hide both the amplitude and the phase trace of the live trace. The shortcut is **^** (left of the number 1 key).
- **|||** **Trace width** toggle the width of the live trace. The shortcut is **Ctrl-W**.
- **→** **Flood trace to center** toggles the flood trace to center display mode. Only available if the current trace was created using the smooth FFT. The shortcut is **Shift-F**. See page 67 for details.

FFT File functions






Use these functions to open, save or print the live trace.

-  **Save** saves the live trace. Set the file name and edit, if the info window shows up the trace's description. The function's pop-up menu contains more options, like the  **Save Trace as Picture** (Save directly picture),  **Save as ASCII** (Saves trace's data into a text file) and  **Save as calibration data**.








-  **Load** Open a stored trace. If you open a new trace, then the current trace will be lost. The function's pop-up menu contains a list of the most recently used files.
-  **Print** Prints the trace window.

Hints:

- You can set the quality used for the  **Save Graph as Picture** function in  **Setup** ->  **Features**.
- You can add a fixed offset to the amplitude for the ASCII output. You can configure this option at  **Setup** ->  **Features**

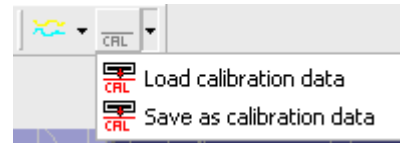
Additional Functions



-  **Use Mic-correction** activate the mic correction. If no mic correction is currently loaded, the function calls the **Load Mic Correction** function, which is also located in the button's pop-up menu. The shortcut for this function is **M**. See page 80 for details.
-  **Tracemanager** open or close the tracemanager. This function can also be accessed using shortcut **Ctrl-T**. See page 177 for details.
-  **Stop/Again** stops a macro measurement when it runs in a loop, or repeats the last macro. You can use the shortcut **R** to invoke this function.
-  **Assign snapshot** to macro copy the current settings into a user macro.
-  **Info** opens the information window for the current trace. The trace's description can be edited in information window as well. The shortcut for the information window is **I** (Uppercase 'i').

Mic correction

In addition to the **Calibration** and the **Complex Compensation** which are available in the Impulse-Response Module and the FFT Module only, SATlive features the possibility to correct the measurement microphone's frequency response.



This feature is called Mic Correction and can be applied to the measurement (MIC) Signal in the FFT and the MAT module.

You can use any Smooth FFT trace, as long it has the same samplerate as the current trace, as the Mic correction data.

Furthermore you can create your own Mic correction file using the SATlive's mic-correction editor (available for download at: <http://www.take-sat.de/download/miccaledit.zip>).

The shortcut **M** is used to load and to enable the Mic Correction.






Group-delay related to

You can find this menu in the trace display's pop-up menu and in the phase-display type pop-up menu.

The group-delay is a value calculated by the derivation of the phase over the frequency. It can be interpreted as a frequency dependent delay, related to the begin of the current time window. Because the begin of the time window is known by SATlive, it can provide group-delay values related to different reference times.

- **Time Zero** the group-delay 0 is at time zero of the impulse response.
- **Window** the group-delay 0 is at the beginning of the current time window (no correction performed).
- **Peak** The group-delay 0 is at the impulse response's peak.

Overlay and Calibration


-  **Overlay** show the current overlay trace. If no overlay trace is assigned, the **Load overlay** function is executed. The function's shortcut is **O**. The pop-up menu contains the  **Load Overlay** function and other functions. If you want to use the overlay functionality you need to enable it in the **setup -> post process** section. See page 65 for details about the overlay-trace.
-  **Calibration** activate the use of the current calibration file. If no valid calibration file is assigned, it executes the **Load CAL** function. The function's shortcut is **C**. The pop-up menu contains the  **load calibration data** and the  **save as calibration data** functions.


Calibration

In the FFT module you can create a calibration file, which is taken as the reference for the measured trace. By doing so, the non linearity of the measurement setup is compensated and all dB values are related to calibration file.

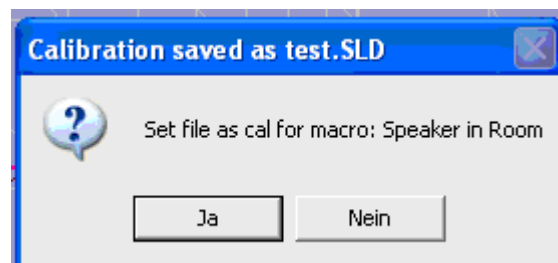
Create a calibration file

To create a calibration file, just connect the output direct to the input. Start a measurement, and save result (in FFT module) using **Save as calibration data**. In the complex menu layout this option is located in the pop-up menu of the **Cal** button, in the

simple mode it can be found at  **Tools** ->

Calibration as well. In both layouts this function is also present in the  **Save** button's pop-up menu.

If measurement was executed using a macro (which is recommended), you'll see a window likes this after saving calibration file.



If you click Yes then calibration file is automatically assigned to the macro.

This assignment can also be performed in  **Setup** -> **M User Macros**.

Using the calibration file

If you assigned a calibration file to a macro, then the calibration is automatic applied every time you run the macro.

To load a calibration file use the function  **Load Cal** from the Cal button's pop-up menu.



If a calibration file is loaded, toggle it on and off using the **Cal** button or the shortcut **C**.

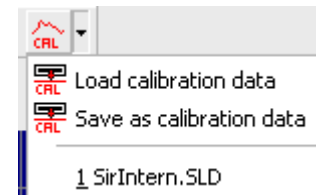
Hints:

- If a calibration file is applied, then its name is displayed on left side of trace window.
- To calibrate the display of the impulse response in the impulse - response module use the **Complex Compensation** feature. See page 46 for details.
- A calibration file can only be used for measurements performed with the same settings (FFT size and type, samplerate).
- To check the calibration file just repeat the measurement. If your systems works

fine and calibration is correct, you shall see a flat line at zero dB.




Calibration menu

In the FFT module this menu opens up, if you perform a right mouse click on the CAL button  which in the simple menu-mode is located in the upper menu-bar and in the complex menu-mode in the  Tools pop-up menu.

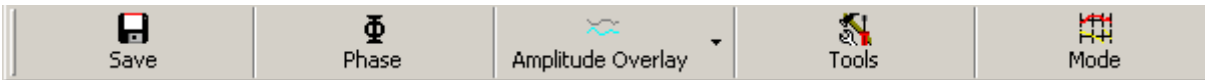



- **Load Calibration Data** open a calibration file.
- **Save as Calibration Data** store the current trace as a calibration file.
- **List of files** the list of the most recently used files. To load a file from the list, just click on the file's name.








Hints:

- You need different calibration files for FFT and Smooth FFT.
- If you want to compensate the display of the impulse response then use the complex compensation feature in the IR Module.
- To compare different results, you can use any file as calibration file, as long as the settings used to create it are the same as for the current trace. To activate or deactivate a calibration file, just click with the left mouse-button on the button CAL  or toggle the state using the key **C** on your keyboard.
- If a calibration file is activated, then the label "Cal:" and the name of the cal-file is displayed at the left side of the trace display. You can change the way the file name is displayed at  **Setup** ->  **Features** -> **Fileinfo**.


FFT Menu bar (simple menu layout)













In the simple menu layout there are only a few buttons in the FFT module's menu bar. You can access the other functions via the  **Tools** menu.

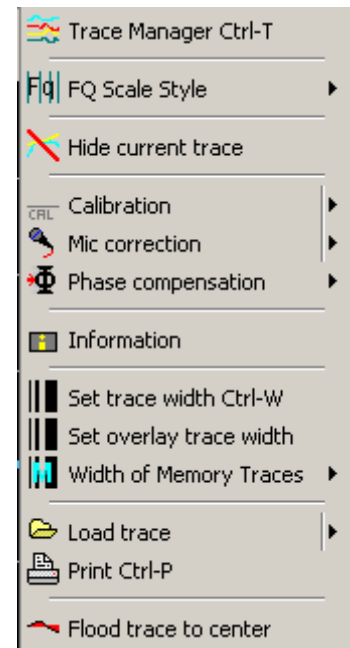
-  **Save** saves the live trace. Set the file name and edit, if the info window shows up, the trace's description. The button's pop-up menu contains also the functions . **Save Graph as Picture** (Save the display directly as picture) and  **Save as ASCII** (Saves the live trace's data into a text file). The function  **Save as Calibration Data**, allowing you to save the live trace as a **calibration file**, is also in this menu.
-  **Show Phase** toggle the display of the phase response trace. If the phase response is not shown, the amplitude display is enabled to prevent an empty screen. In the button's pop-up menu you can select different display-modes for the phase (-180° to 180° or 0° to 360°), different ranges of the group-delay display and furthermore the selection of the reference for the group-delay.
-  **Show Overlay** toggle the visibility of the current overlay trace. If no overlay trace is currently loaded then the **Load overlay** function is executed. The function's shortcut is the key **O**. The pop-up menu contains more functions and settings related to the overlay trace. If you want to use the overlay functionality you need to enable it in the **setup -> post process** section. See page 65 for details about the overlay trace.
-  **Stop/Again** stop the execution of a macro measurement when it runs in a loop or repeat the last macro. You can use the shortcut **R** to invoke this function, too.
-  **Tools** contains a lot more functions and settings. For details see page 86.

FFT menu Tools

There is a lot of functions and settings in the menu tools. In the simple menu layout the menu tools can be accessed directly using the **Tools**  button in the menu bar.

In both menu layouts the menu  **Tools** can also be accessed via the trace display's pop-up menu.

-  **Tracemanager** open or close the tracemanager. This function can also be accessed using the shortcut **Ctrl-T**. See the tracemanager section starting at page 177 for details.
-  **FQ Scale Style** set the style of the frequency scale. See page 64 for details.
-  **Hide current Trace** hide both the amplitude and the phase display.
-  **Calibration** activate the current calibration file. If no valid calibration file is loaded then the **Load CAL** function is executed. The function's shortcut is **C**. More functions can be found in the function's sub menu. See page 82 for details.
-  **Mic Correction** activate the use of the mic correction. If no valid mic - correction data is loaded then the function **Load Miccorrection** is invoked. This function can also be accessed using the function's sub menu. The shortcut for the mic correction is the key **M**. See page 80 for details about mic-correction.
-  **Phase compensation** select the phase - compensation mode. Visible only if the live trace was created using smooth FFT. For details see page 198.
-  **Information** show the information window for current trace. The trace's description can be edited in the information window as well.
-  **Set Trace Width** sets the width of live trace display. The function's shortcut is **Ctrl – W**.
-  **Set Overlay Trace Width** set the width of the overlay trace display. This item is visible only if you've activated the overlay functionality it in the **setup -> post-process** section. See page 65 for details about the overlay trace.



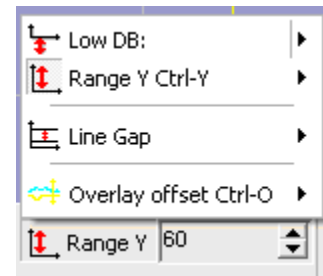
- **||| Width of memory traces** select the width of the pen used to draw the memory traces. This setting does not affect the display of traces using the tracemanager. The tracemanager sets the trace width according to the trace's weighting.
- **📁 Load Trace** open a file. In the function's sub menu you find a list of the most recent used files, from which you can pick a file with a double click.
- **🖨 Print** prints the current trace display. The shortcut is **Ctrl-P**.
- **🚧 Flood trace to center** Toggles the flood trace to center display mode. Only available if the live trace was created using the smooth FFT. The shortcut is **Shift-F**. See page 67 for details.

Trace Layout FFT Module, simple menu layout

In the FFT module you find this settings below the trace display window in simple menu layout.

Select the layout parameter you want to change:

- **📏 Low DB** move the trace display's lower border. The visible area ranges from Low DB to Low DB + Range Y.
- **↕ Range Y** set the trace display's vertical range.
- **📏 Line Gap** set the distance between two vertical grids.
- **👉 Overlay Gain** move the overlay trace up and down. This option is active only if a valid overlay trace is displayed and if you've activated the overlay functionality in the **Setup -> Post Process** section. See page 65 for details about the overlay trace.



Hints:





- To select a parameter simply click on the parameter field left of the value editor field. This will show a pop-up menu, where you can choose the parameter to edit.
- After a parameter is selected the value editor field shows the parameter's current value. The current parameter's name is displayed left of the value editor field.
- The parameter's value can be changed using the value editor field.
- The value editor field contains a pop-up menu with some presets for the currently selected parameter.

Trace Layout FFT module, complex menu layout

In the FFT module you'll find this settings below the trace display window, when the complex menu layout is selected.



Select a parameter of the trace display's layout, either by clicking on a field or by selecting it from the current parameter display's pop-up menu.

-  **Low DB** move the trace display's lower border. The visible area ranges from Low DB to Low DB + Range Y.
-  **Range Y** set the trace display's vertical range.
-  **Lines Gap** set distance between two vertical grids.
-  **Overlay Gain** move the overlay trace up and down. This option is active only if a valid overlay trace is displayed and if you've activated the overlay functionality in the Setup -> Post Process section. See page 65 for details about the overlay-trace.

Hints:

- After the selection of a parameter, the value editor field shows the parameter's current value. The current parameter's name is displayed left of the value editor field.
- The parameter's value can be changed using the value editor field.
- Every parameter's field features a pop-up menu with some preset values.

Feedbackfinder





The Feedbackfinder is a FFT display optimized for the quick location of feedbacks. It is useful for ringing out a monitor system.

- It looks for the frequency with the highest amplitude value and displays it.
- That frequency can be displayed either as a frequency value or as the corresponding band of an equalizer.
- The search algorithm has three states:
 - **Wait** for the level to meet the threshold set for starting detection. The feedbackfinder's state display (bottom left) shows: **Looking for feedback**.
 - **Sampling and scanning** for the frequency with the highest amplitude. The feedbackfinder's state display (bottom left) shows: **Calculating Frequency**. This step is performed very quick so you might not see this label.
 - Depending on the current settings the feedbackfinder either waits for the level to drop below a given threshold, or for a manual restart. The feedbackfinder's state display (bottom left) shows: **Waiting for Restart**.

Upper menu bar



Select how the frequency with the highest amplitude is displayed:

-  **Eq 10 Band** displays the corresponding band of an 10 band eq.
-  **Eq 15 Band** displays the corresponding band of an 15 band eq.
-  **Eq 32 Band** displays the corresponding band of an 30 band eq.
-  **Frequency** displays the frequency value as number.

If an EQ band based display is selected, the center bar






shows the offset of the frequency to the center of the corresponding EQ band. This helps you to decide if you should attenuate an EQ band beside the band displayed or not.


When the frequency meets the nominal frequency of the corresponding band very close, the dot is shown in the middle. The more the point moves to side, the more the frequency is below (point near left side) or above (point near right side) the nominal frequency of the corresponding EQ slider.

Controls for feedbackfinder:





-  **Auto Restart** (Default) if the input level drops below the assigned threshold, the feedbackfinder switches into search mode. The display will remain unchanged until the next frequency is found.
-  **Sample** samples and analyzes the current input signal even if it's level is below the threshold set for sampling. The shortcut is the **space bar**.
-  Search restart the scanning for feedback even if the input signal's level is above the threshold set for Auto Restart. The function's shortcut is **R**.

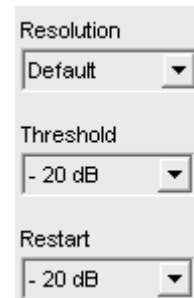
Hints:

- You can set the threshold values for Restart and Sampling at the feedbackfinder's right menu bar.
- Do not worry about the icon used for  Auto Restart. It's just because the German word for car is Auto.

Feedbackfinder's right menubar

Here you can set the feedbackfinder's parameter.

- **Resolution** the precision used for the calculation of the feedback's frequency. Higher settings, which yield more precise results need more time. In normal applications the **Default** setting should be best choice. If you need speed choose Low. High should be used if you need a precise frequency detection especial at low frequencies.
- **Threshold** the threshold level for the start of the sampling and the calculation. If the input signal exceeds this level, then the feedbackfinder performs a sampling and calculation sequence, resulting in an updated display. You can force the start of a sampling and calculation sequence using the button **Sample**  in the feedbackfinder's upper menu bar.
- **Restart** the threshold level for the restart of scanning, if Auto Restart is enabled. The threshold value is related to the sampling threshold. You can force the feedbackfinder to start scanning using the **Search**  button in the feedbackfinder's upper menu bar.



Hints:

- The value for the restart threshold shown in the right menu is related to the sampling threshold.
- The values shown in the statusbar on the bottom are related to the maximum input level (0 dB dfs).

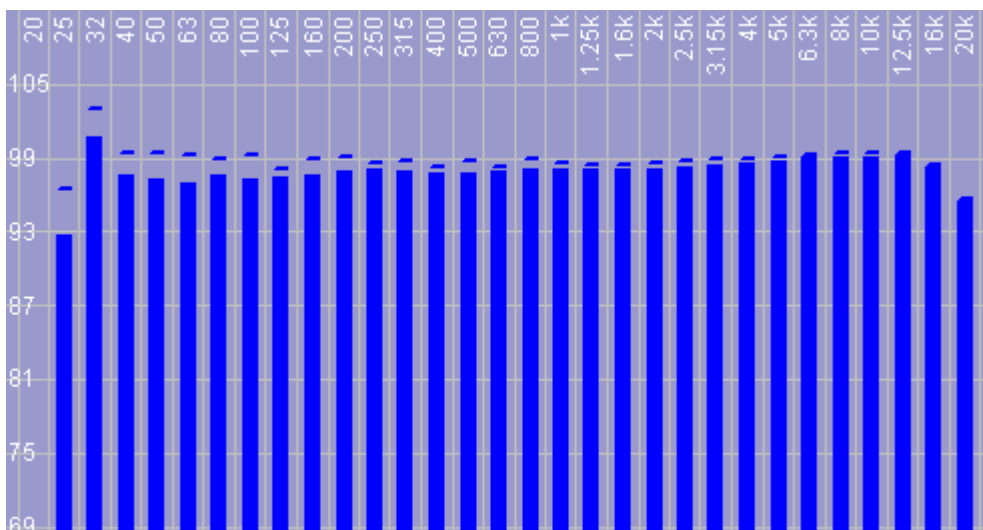
The MAT module



MAT is the powerful Dual Channel FFT measurement part of SATlive measurement system.

The measurements in the MAT module

RTA Measurement



A RTA (Real Time Analyzer) displays the input's energy content, averaged in frequency bands. A RTA shows a flat response on a flat system when feed the system with pink noise. In **SATlive** the RTA measurements are located in the MAT module.

There are, according to graphic equalizers, three different resolutions of the RTA display:

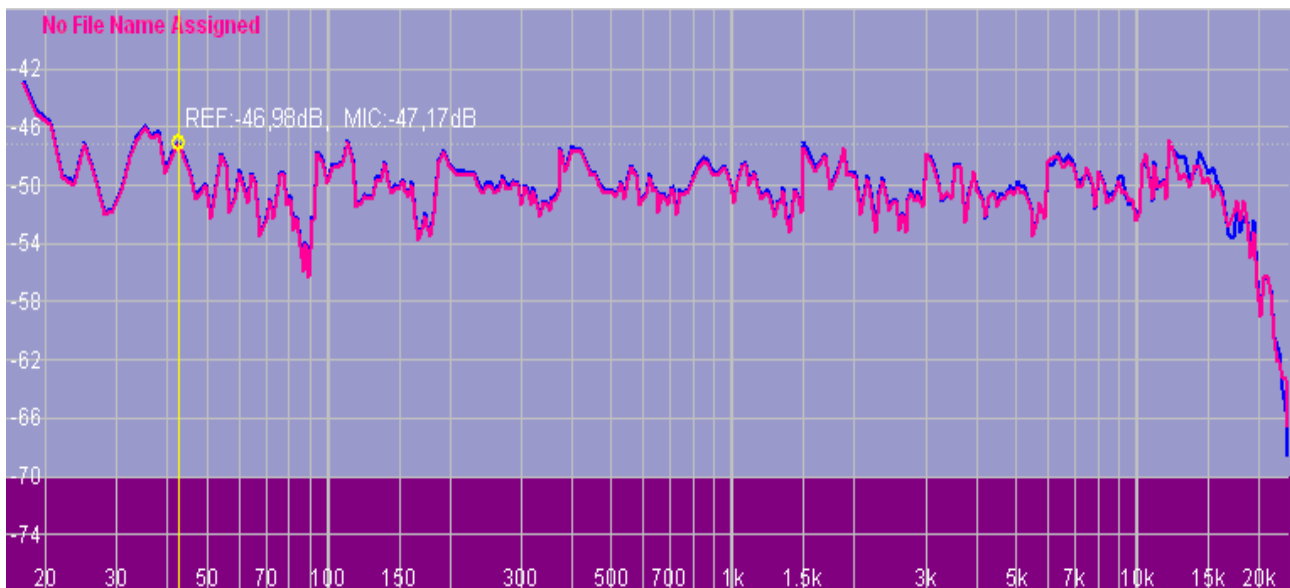
- $\frac{10}{\text{---}}$ **10 band RTA**, frequency bandwidth is one octave.
- $\frac{15}{\text{---}}$ **15 band RTA**, frequency bandwidth is two third of an octave.
- $\frac{32}{\text{---}}$ **30 band RTA**, frequency bandwidth is one third of an octave.

The display shows the average level of the selected amount of averages measurements as a solid bar, and the highest level in the measurements averaged as a line above.



You can select the input(s) to display using the labels below the VU meter. A selected delay is applied to the REF input. See page 104 for details about setting the delay.

Use the cursor to read out values.



FFT measurement



The MAT module's FFT the display shows the spectral contents of the selected input signal(s). On a flat system it shows a horizontal line if the system is feed with white noise.

- Select the input(s) to display using the labels below the VU meter.
- If pink noise is used as signal, then the result falls with a slope of -3dB per octave. To check the linearity you can use the Pink Spectrum Lines feature in the **Setup -> Display** window.
- You can also use the Compensate FFT feature in  **Setup ->**  **Measurement** to remove the influence of the pink filter.
- A selected delay is applied to the REF input. See page 104 for details about how to set the delay.
- Use the cursor to read out values.
- The measurement is performed as a Smooth FFT.
- The FFT measurement is intended to show the energy content of signals.
- The values shown are absolute levels only if you performed and activated the level calibration.
- You can set the amount of averages in the trace - layout menu in the bottom area.
- The amplitude threshold set for the transfer function is indicated using a different background color. See page 116 for information how to set the amplitude-threshold value.

Compensate FFT (MAT)

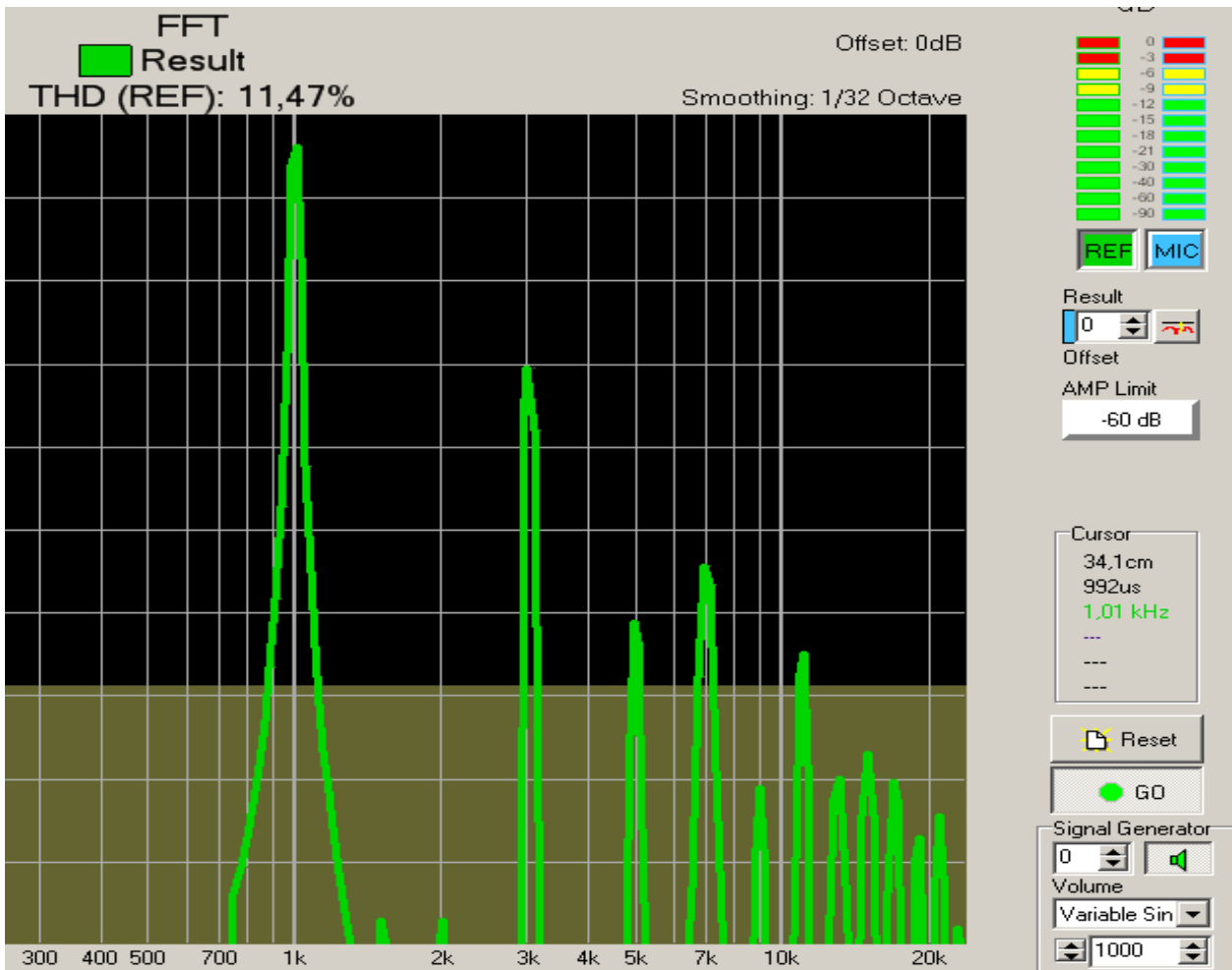
You can select a compensation for the FFT measurement in the MAT module at  **Setup**
->  **Measurement.**

The selection is used for the display in the FFT measurement and in the FFT + Spectrograph measurement, but has no effect to the calculation and the display of the transfer function.

You can select one of the three compensation patterns available:

- **Flat on white noise** this is the default display of a FFT measurement. You'll get a flat line, if you feed the FFT measurement with white noise.
- **Flat on pink noise** filter the result of the FFT measurement using a +3dB/octave filter. This compensates the influence of the filter used to create the pink noise. With this setting you'll get a flat line, if you feed the FFT measurement with pink noise. With this setting the FFT measurement acts like a RTA measurement with small frequency bands.
- **Sawtooth with pink noise** with this setting you can see the nine different bands used for the calculation of the result. This setting is mainly intended for compatibility to other software.

THD (Total Harmonic Distortion)




Basics

Beside the wanted amplification any active device changes the shape of the signal a little bit. When we send a sine wave signal through an electronic (or an electro-acoustic) device we can easily detect the changes when we look at the frequency response of the output of the device. There we can see peaks on integer multiples of the basic frequency. If we add the levels of this so called harmonics and relate this sum to the basic frequency's level, we get the THD.

In the early days of electronics THD was the main criteria for the quality of amplifiers, and a low THD was the goal of mostly all developments in audio electronics.

When the industry managed to gain real low THD values, the people realized that, even with very low THD values, amplifier may not sound good. Today we know that THD is not always bad, and that speakers have a much more higher THD than it's driving electronics. Another interesting fact is that tube amps have a real high THD compared to solid state amps, and that we use exciter to create additional harmonics, which means we're rising the THD value.



THD measurement in SATlive

The THD measurement is performed in the MAT module as an option for the FFT measurement. You can start it in the menu  **Tools**.

SATlive assumes that the frequency set for the Sin Var signal is the basic frequency.

Therefore you have to set the frequency value to the sine wave signal's frequency even if you're using an external sine wave generator. The THD value is displayed on top of the trace display for both inputs separately.

Settings

You can set the order of the highest harmonic which is to be examined in the  **Setup** ->  **post process** window. You can also select the input(s) to be examined using the buttons below the VU-meter in the right menu-bar.

Transfer function measurement



You find the  **transfer function** measurement in the MAT module.


The transfer function means how the system, which means all influences between input and output of the measurement, transfers a signal from the input to the output.

This covers influence in the frequency response, how good each frequency is transferred, and the signal's timing like delays.

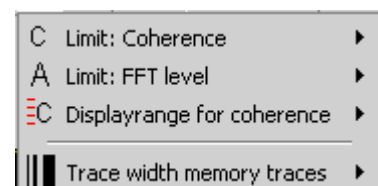
In live PA situations the system to measure consists of an addition of different transfer functions. Any part in the signal chain has it's own transfer function, but the most problematic part is the speaker to listener transfer function.

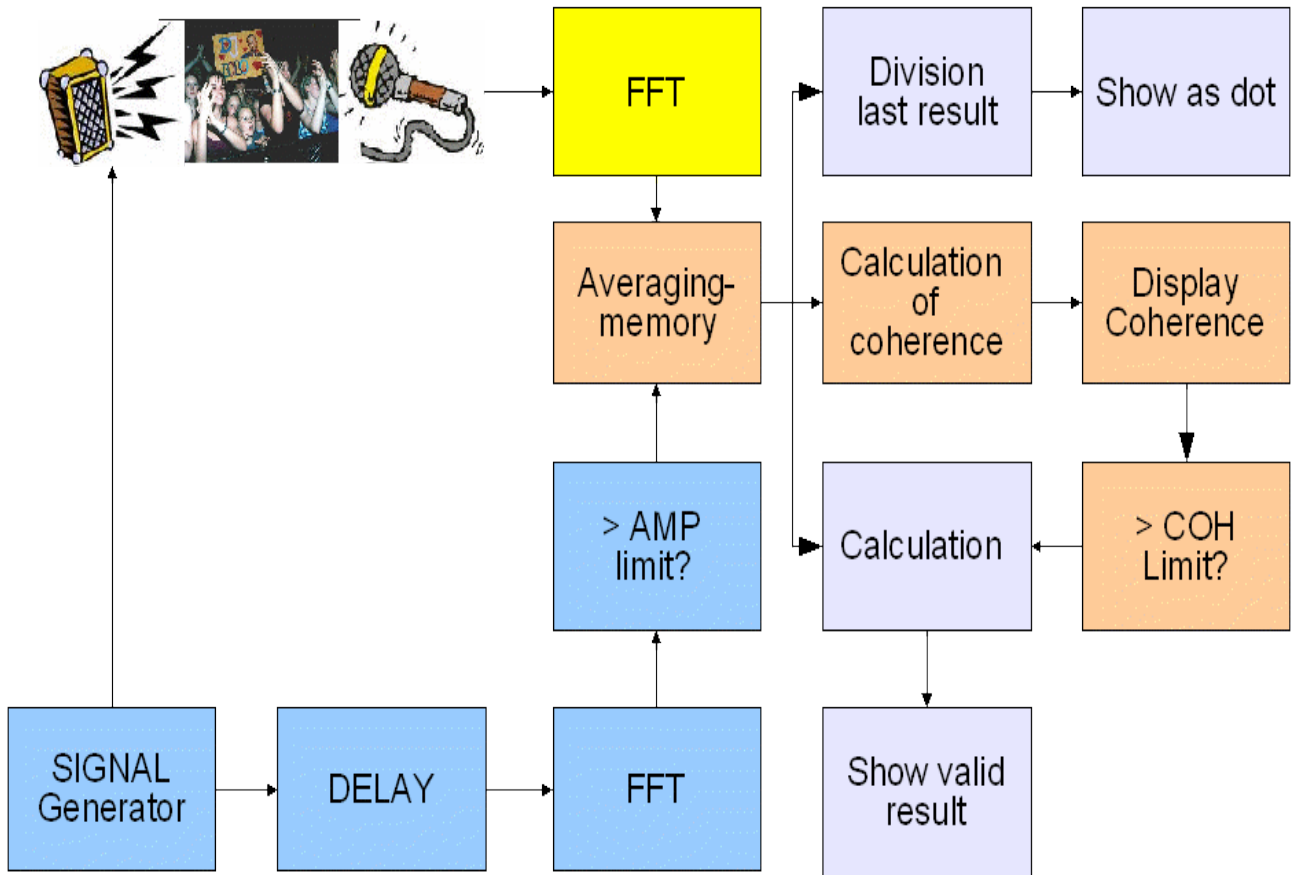
The transfer function is calculated by comparing the measured output-signal of the system with the input signal feed into it. In PA measurement, the signal is feed into the console and measured by a measurement microphone located in the room. Both signals are transformed into their frequency responses, and then transfer function is calculated by a simple division of the frequency spectra.

In order to minimize the external interference to the measurement, there are some options to improve the quality of the result

This division makes only sense on frequencies where the source signal contains enough energy. The amplitude threshold value, which can be set at the  **Tools** menu, acts as a threshold for the execution of the calculation. See page 116 for details about how to set the amplitude-threshold value.

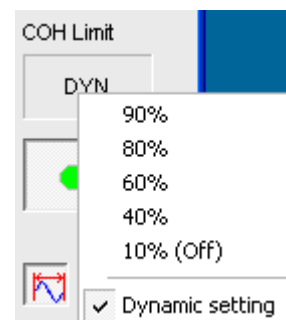
If the value is below the threshold, there is no update of the display.





To avoid influence of external signals a coherence threshold can also be set. The coherence is a value that indicates how good the measured signal relates to the input signal.

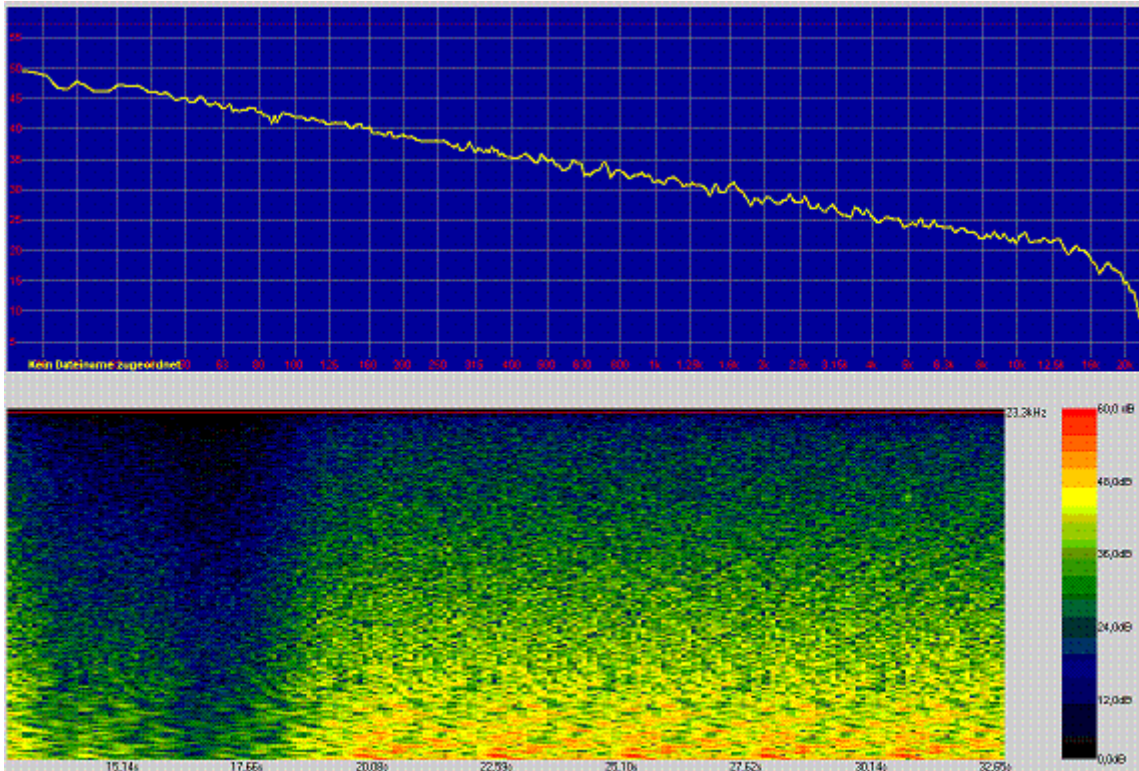
If a dynamic coherence threshold is selected, then the coherence threshold depends on the count of valid measurements take for a frequency value, otherwise the coherence threshold is set to the selected value. The coherence is calculated using all values in the current average memory. If the value is above the threshold, then the value is shown as trace. This is done for every single frequency, so the value might be shown as part of the trace or as dot.



Hints:

- The current values for both thresholds are shown in the right menu area.
- A click on the threshold display opens the setup menu for the selected threshold.
- You can set the colors used for trace, dots and coherence in the **Setup -> Display** window.

FFT + Spectrograph







In the FFT + Spectrograph measurement in the MAT module the measurement (MIC) signal is displayed in two ways at the same time.


The upper window shows the FFT of the measurement (MIC) signal and the lower window shows the spectral distribution of the energy over time.

In the lower window the level at each frequency is displayed using different colors. The scale used is shown right of the display.

The vertical axis is the frequency and the horizontal axis is the time.

The settings for the  Y-Range and for the  Top level are the same in both displays, the  Averages setting and the  Range setting is used only for the FFT display in the upper window.

Hints:



- You can select the display range in time of the spectrograph display in the menu .

Tools.

- The cursor movement is synchronized in both windows. In the upper window the cursor is a vertical line, in the lower window a horizontal line.

Impedance measurement

The impedance measurement in the MAT module could be used for speaker development or to check speakers. The impedance is the frequency dependent resistance.

To measure the impedance you need an external reference resistor capable of enough power. You must set the value of the resistor used at  **Setup** -> 

Measurement.

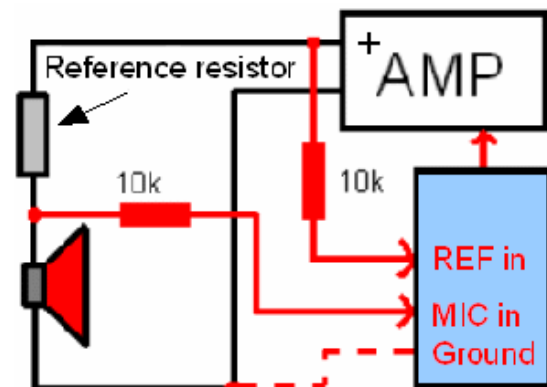
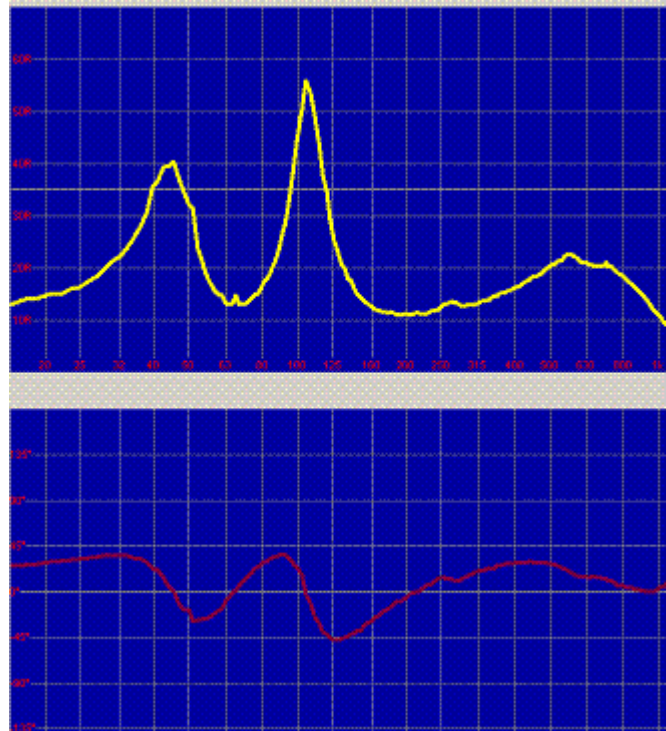
Measurement.

In order to measure impedance you need another wiring than for all other measurements.

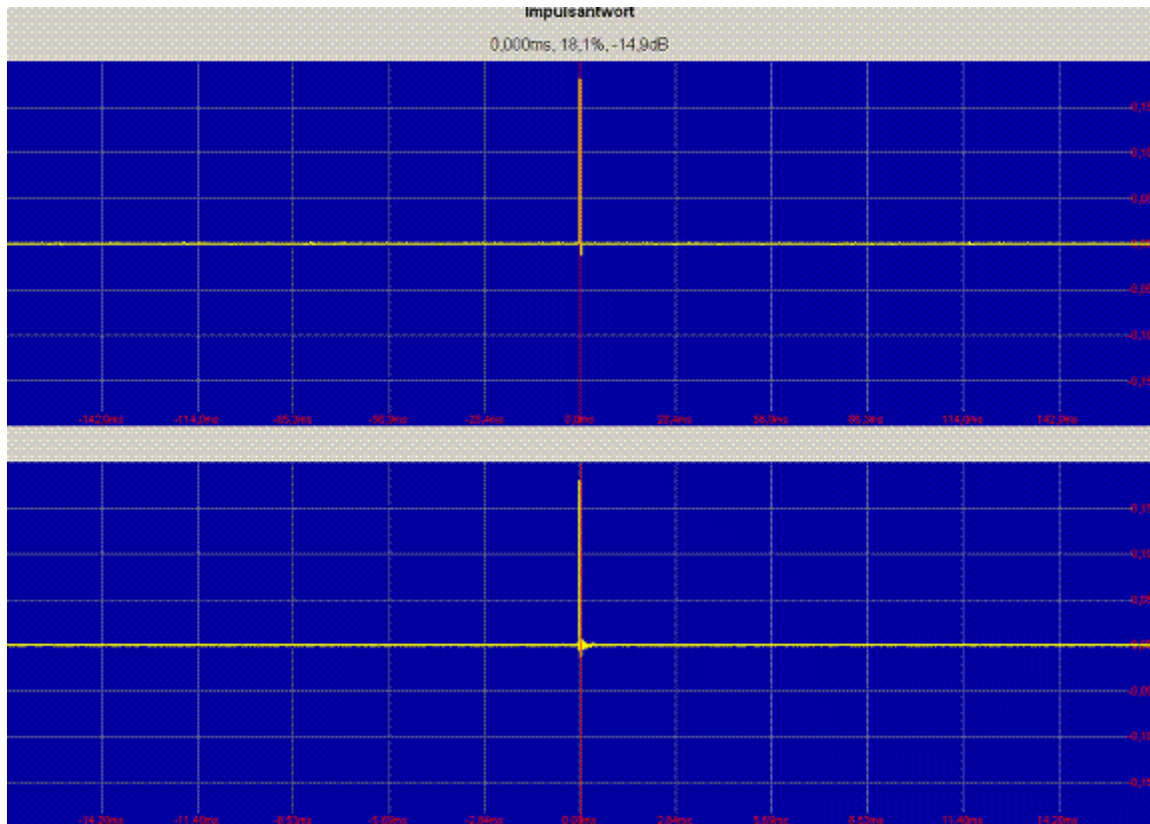
Because the measurement is done using an external power amp, you must take care to wiring and measurement. Wrong usage or wiring could destroy your audio interface, your computer and/or your power amp. Read and obey the following hints.

Hints:


- For the sake of safety you must use the two resistors (10k/0.5W) marked red.
- Start measurement with no ground connection on the power side. Use this connection only if necessary.
- Use only power amps with the negative speaker output connected to ground.
- Never use power amps in bridge mode!
- Make sure you're using the right connections before you switch the poweramp on.
- There is no liability for any damage!
- The reference resistor's value should be about twice the value of the nominal impedance of the speaker. A 15 ohms resistor is a good choice for common 8 ohm/4ohm speakers.



Impulse response measurement (MAT)




The measurement of the impulse response in the MAT module is done using the DualFFT algorithm.

The upper window shows the whole range selected in the right menu bar or at the menu Tools , the lower window shows the range around the time zero with a time scale zoomed by the factor of ten.

Use the shortcut **P** to move the cursor to the peak.

The reference (REF) signal is delayed prior to the calculation of the impulse response. Therefore the time scale does not show the absolute value of the display, but the offset from the current delay.

You can use the button **D = C**  or the shortcut **F3** to assign the cursor's current position to the current delay, so making the current cursor's position the new time zero of the display.

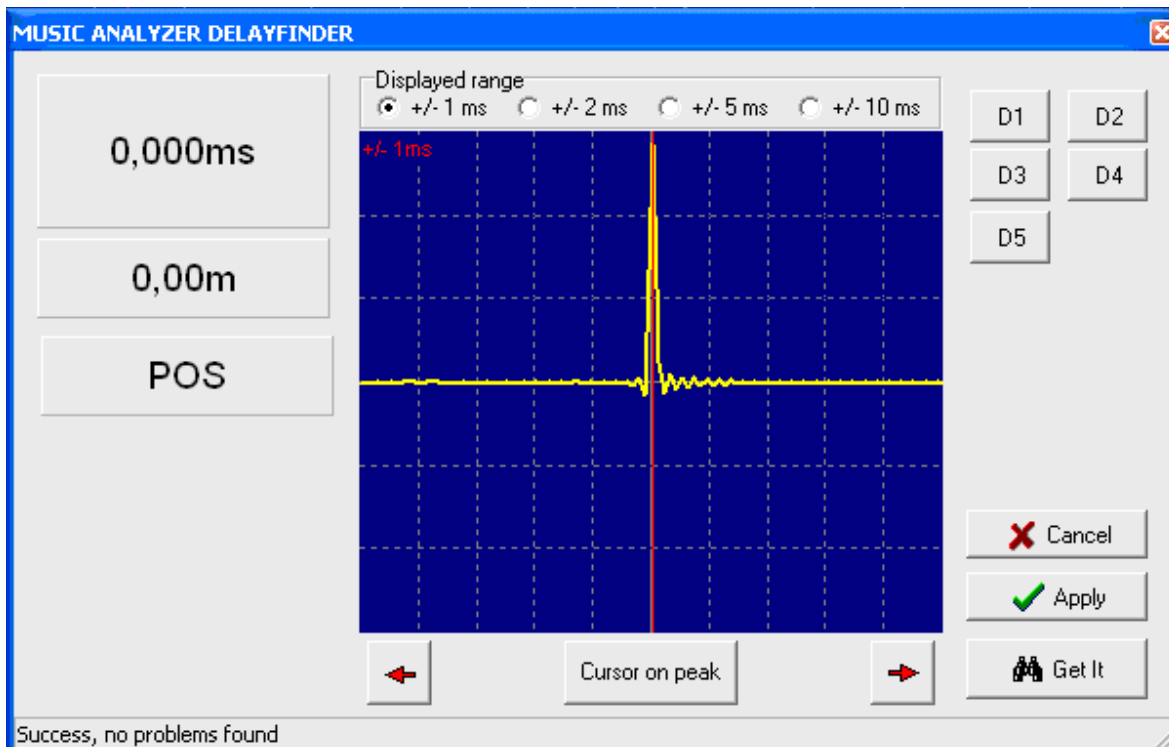
Use the right menu bar or the menu Tools  to change the display's properties.

You can apply markers and use the delay matrix in this display.

Use the shortcut **F5** to make a copy of the current impulse response trace. The shortcut **F6** toggles the visibility of this memory trace.

Delay Finder (MAT)

You can use the delay finder in the MAT module to measure the time delay between the both input channels.









This setting is very important to get reliable results in the transfer function measurement.

- To start the delayfinder just click on the label showing the current delay-time in the lower menu bar or use the shortcut **F7**.
- Use **Get It** to start a delay measurement. If the previous measurement is not saved to one of the delay presets, the measured delay will be lost.
- Use **Cancel** to return to MAT main window without applying the measured delay.
- Use **Apply** to return to MAT main window and apply measured delay as current MAT delay. The prior MAT delay is replaced by measured delay. You can also use the **F3** key to apply the delay.
- Use the buttons **D1** to **D5** to save the measured delay to one of the five delay presets.
- After measurement the delay finder shows the impulse response around the peak to allow an optical check.





- The delay-time can be changed by moving the cursor using either the arrow buttons below the display area or using the cursor right/cursor left keys on your keyboard.
- You can reset the delay to the peak's position using the **Set on peak** button.
- The delay can also be selected using a left mouse click to the display area.

Hints:

- If the option **Delayfinder before Transfermode** is selected in  **Setup** ->  **Measurement**, then delay finder shows up every time you activate the transfer-mode measurement.
- Distance is calculated from the measured time delay. Temperature value used for that calculation is set at  **Setup** ->  **Features**.
- At  **Setup** ->  **Features** you can toggle the units used for temperature and distance between meters and degree centigrade or feet and degree Fahrenheit.
- In the transfer-function measurement you can use the *Auto-Delay* functionality, described on the next page.

Setting the Delay for MAT measurements

When you perform a transfer - function measurement in the MAT module it is important to adjust the delay properly. There are different possibilities for setting the delay:

- Measure it using the **Delay-finder**. See page 102 for description of the delay-finder.
- Locate it in the impulse - response module and save it for **MAT** using the **Save Cursor as MAT Delay**  function in the trace window's pop-up menu.
- For manual tuning of the delay you can use the arrows left and right to the delay-display. Left arrows add or subtract one millisecond of delay, right arrows add or subtract one sample of delay.
- Recall a saved setting using one of the buttons D1 to D5 .
- Use **Direct**  to set the current delay to zero.
- Perform an impulse - response measurement in MAT module, set the cursor on peak, and use the **Cursor -> Delay**  function at trace window's pop-up menu or in the delay menu in the lower menu area.
- In the MAT module the current delay is applied to the reference channel even in the RTA and the FFT measurement.
- If you changed the current delay, then you can save it to a delay preset using **Save Delay**  in the lower menu area.
- In the measurement of the transfer-function, you can also use the *Auto-Delay* functionality described below.

Auto-Delay Functionality

During the measurement of the transfer-function, **SATlive** calculates and monitors an impulse-impulse in the background. This enables the software to keep track with changing values of the delay, which for instance occur when you move the measurement mic to an other location.

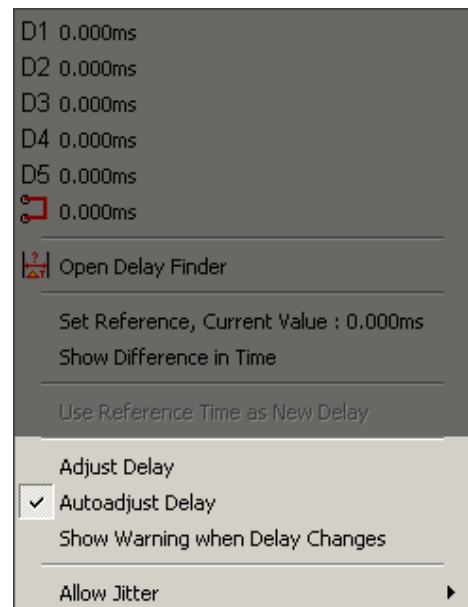
If you're performing a measurement in order to check relation in time, you must disable the automatic change of the delay, because the automatic change of the delay value would spoil your measurement.

Therefore you should use the automatic change only if you're interested in amplitude information only.

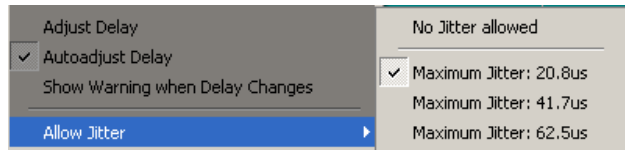
Settings

The settings are located in the pop-up menu of the delay-display in the lower menu bar.

- Adjust Delay:** This function changes the current delay to the last delay measured. You can use the shortcut **Ctrl-D** to invoke this function without the need to pop-up this menu.
- Autoadjust Delay:** If you activate this option, the current delay is changed any time the delay measured changes. This is helpful when you're measuring amplitude-response traces, but must be unselected when you want to measure information about relations in time, as needed for time-align or for creating a certain coverage pattern.
- Show Warning when Delay changes:** If you activate this option, **SATlive** compares the currently used delay to the measured delay. If the values differ, then it swaps the colors in the display to indicate the difference.



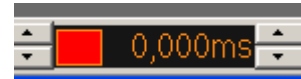
- **Allow Jitter:** The calculated delay might slightly vary due to the movement of the air, change of



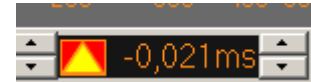
temperature or other reasons, even if the position of the mic does not change. The entries in the *Allow Jitter* sub-menu will add some tolerance to the *Autoadjust Delay* function, so that small changes will not change the delay and not reset the current measurement. Select the tolerance from the entries in the sub-menu.

Visual indication in the delay-time display

If the *Autoadjust Delay* option is selected, a red square is shown at the left in the delay-time display.

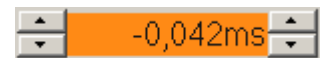


When you've activated the *Show Difference in Time* option at the same time, the yellow triangle, which indicates that the display



shows a difference in time, is drawn on top of the square. More details about using a reference in time for the delay-time display can be found on page 118 of this document.

A difference in time between the currently set delay and the delay measured is indicated by an inversion of the colors in the delay-time display, if the *Show Warning when Delay changes* option is selected.

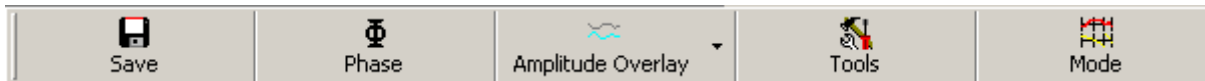


Hints:

- The calculation of the delay is not as precise as done for the delay-finder or for the impulse-response display.
- The calculated delay is updated in intervals of 750ms, so some delay may occur between the change of the delay and the reaction of the software.

Menus in complex menu mode

Trace display (MAT)



- **Phase** opens a pop-up menu where you can select different display modes for the phase (-180° to 180° or 0° to 360°) and different ranges of the group-delay display. You can shift the phase display using the shortcuts **Ctrl - PAGE UP** and **Ctrl - PAGE DOWN** in steps of 45° .
- **Invert live trace** mirrors the live trace on the zero dB line. The shortcut is **Shift-I**.
- **Hide current trace** hides both the amplitude and phase display. The shortcut is **^** (Top left of number 1).
- **Trace width** toggle the width of the live trace. The shortcut is **Ctrl-W**.
- **Flood trace to center** toggles the flood trace to center display mode. The shortcut is **Shift-F**. See page 67 for details.

Hint:

- The options displayed depend on the measurement selected.

Mic-correction, Tools and Info (MAT)

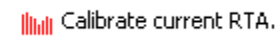



- **Mic Correction** activate the mic correction for the live trace. If no valid mic correction is loaded, then the **Load Mic-correction** function, which can be accessed via the button's pop-up menu also, is invoked. The shortcut is **M**. On page 80 you can find more information related to the mic-correction.
- **Tools** open a sub menu containing more settings and functions.
- **Info** show information about the selected trace. You can also use this function to edit the trace's description.

Menu Tools



The options displayed depend on the measurement selected.

RTA Modes



-  Calibrate current RTA calibrate the RTA display. To calibrate, use a loop-back from the output to the REF input, select 64 averages and start pink noise. The function is enabled only if the REF input is selected and at least 64 averages are performed.

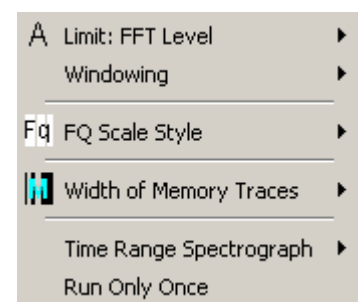
FFT

- **A Limit: FFT Level** a point is only added to the averaging latch, if the ref signal's level exceeds this threshold value. Therefore the transfer function is calculated only on frequencies with enough power in the reference signal. The values shown are absolute levels only if a level adjustment has been performed.
- **Window** select the window applied prior to the calculation of the FFT.
-  **FQ Scale Style** set the style of the frequency scale. See page 64 for details.
-  **THD+N** start the total-harmonic distortion measurement. See page 95 for more details.



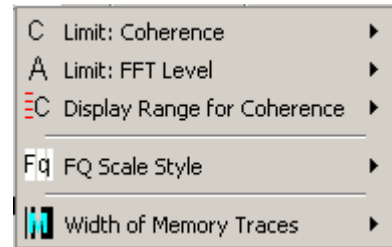
FFT and Spectrograph

- For the description for the four upper settings see the FFT section of this page.
- **Time Range Spectrograph** select the desired time for the spectrograph display from the sub menu. The time selected is needed to fill the spectrograph.
- **Run only once** if this option is selected, the spectrograph (not the FFT) stops after it is filled completely.



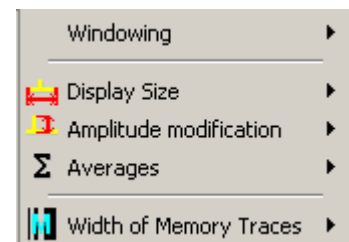
Transfer Function

- Limit: Coherence** a point is only displayed if its coherence exceeds this threshold value. The coherence indicates how good the mic signal is related to the ref signal. The coherence is, especial at high frequencies, affected by the delay setting.
- Limit: Amplitude** a point is only added to the averaging latch, if the ref signal's level exceeds this threshold value. Therefore the transfer function is calculated only on frequencies with enough power in the reference signal. The values shown are absolute levels only if a level adjustment has been performed.
- Display range for Coherence** select the vertical range for the coherence display. The coherence is show at the top of the upper window. The labels for the coherence range are on the left side.
- FQ Scale Style** set the style of the frequency scale. See page 64 for details.
- Width of Memory Traces** select the line's size for drawing the latched traces, like the quick traces or the memory trace. This setting does not affect traces displayed using the trace manager. The trace manager sets the trace width according to the trace's weighting.





Impulse Response

- Window** select the window applied prior to the calculation.
- Display size** set the size of the calculated impulse response. Higher size has higher precision but takes more time to calculate.
- Amplitude modification** set the gain of impulse response, given as a linear factor, not as a dB value.
- Averages** set the number of averages performed. The impulse response is calculated using FiFo memory, except for the **ADD** option, which averages all measurement since the last reset.
- Width of Memory Traces** select the width used for drawing the memory trace.





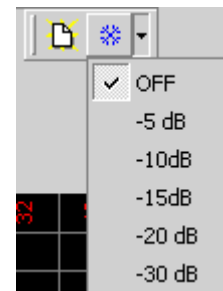
MAT Kind of Measurement, Overlay and Tracemanager



- **Select kind of measurement** open a pop-up menu from which you can select the measurement. Information about the kinds of measurement available could be found at the MAT overview.
-  **Overlay** toggle the visibility of the current overlay trace. If no valid overlay trace is loaded, then the **Load overlay function** is invoked. The pop-up menu contains more functions and settings related to the overlay trace. This item is visible only if you've activated the overlay functionality in the **setup -> post process** section. See page 65 for details about the overlay-trace.
-  **Tracemanager** hide or show the tracemanager. The shortcut is **Ctrl-T**. See page 177 for details about the tracemanager.

Additional functions MAT

-  **Reset Averages** clear all data in memory and start again with new samples. The shortcut is **R**.
-  **Freeze Display** disables the update of the live trace. You can also freeze the display depending on the signal's level, when you choose a level limit in the function's pop-up menu. You can also use the **GO** button right of the display to start/stop the recording and display of data. The shortcut is the **space-bar**.



Right Menu-bar MAT

The right menu-bar contains different functions and information, depending on the kind of measurement selected.

Right menu bar RTA and Impedance

- **Gain** move the live trace up or down. See page 67 for details.
- **GO** button start/stop the update of the live trace's display. The shortcut is the **space-bar**.
- **Cursor details:** this function is not available in RTA measurement. For more details see the *Cursor details (MAT)* section of this document.

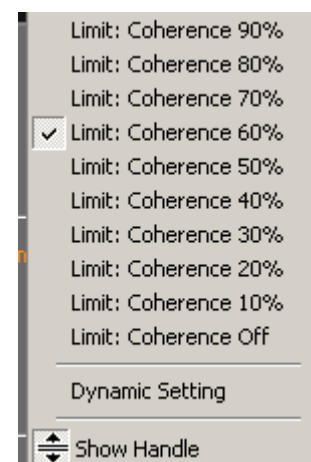
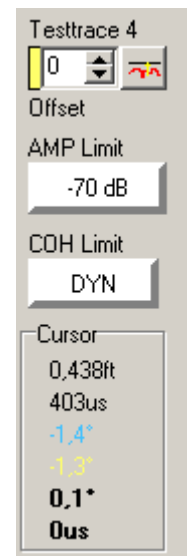
Hint:

- Most of the settings are available in the  **tools** menu as well.




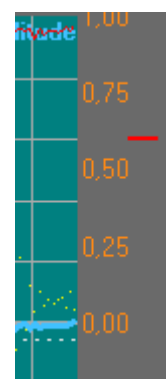
Right menu bar transfer function

- **Offset** move the selected trace up or down. You'll find more details on page 67.
- **AMP Limit** a point is only added to the averages latch, if the ref signal's level exceeds this value. Therefore the transfer function is calculated only on frequencies with enough power in the reference signal. The values shown are only absolute levels, if a level adjustment has been performed.
See page 116 for details about the setup of the amplitude-threshold value.
- **COH Limit** a point is displayed in the transfer function only if its coherence exceeds the coherence limit. The coherence indicates how good the mic signal is related to the ref signal. The coherence is, especial at high frequencies, affected by the delay setting. If the dynamic setting is selected, then the coherence limit is calculated depending on the amount of valid points in the averaging memory for each frequency. On the bottom of the pop-up menu you find the *Show Handle option*, which enables a handle to set the coherence value using the mouse.
- **GO** button start/stop the update of the live trace's display. The shortcut is the **space-bar**.
- **Cursor details:** See the *Cursor details (MAT)* section for details.



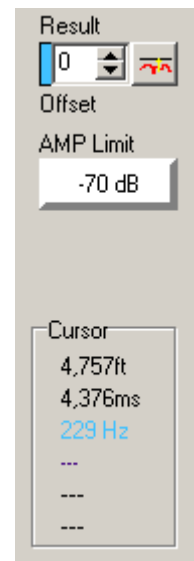
Hints:

- Most of the settings are located in the  **Tools** menu as well.
- The handle for the coherence setup is shown only if a fixed coherence value is selected and the *Show Handle* option is selected in the menu.



Right menu bar MAT-FFT and MAT-FFT and Spectrograph

- **Offset** move the selected trace up or down. More details can be found on page 67.
- **AMP Limit** in the Transfer function a point is only added to the averages latch only if the ref signal's level exceeds this value. Therefore the transfer function is calculated only on frequencies with enough power in the reference signal. The values shown are only absolute levels, if a level adjustment has been performed. You can use the FFT to check if the signal is above the limit. A setup window shows up when you click on the value display. See page 116 for details about setting the amplitude-threshold value.
- **GO** button start/stop the update of the live trace's display. The shortcut is the **space-bar**.
- **Cursor details** is shown only in MAT-FFT. You'll find more details in the *Cursor details (MAT)* section of this document.

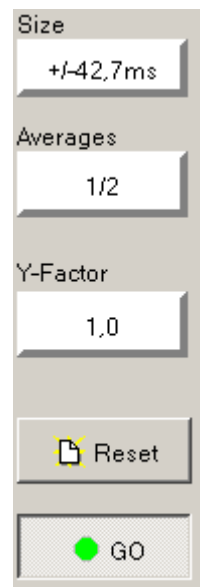


Hint:

- Most of the settings can be found in the  **Tools** menu as well.

Right menu bar impulse response (MAT)

- **Size** size of the impulse response to be calculated. A higher size has higher precision, but takes more time.
- **Averages** number of measurements to averages for the result.
- **Y-Factor** gain of the impulse response, given as a linear factor, not as a dB value.
- **Reset** clears all averages and starts a new measurement. Shortcut is the key **R**.
- **GO** button start/stop the update of the live trace's display. The shortcut is the **space-bar**.

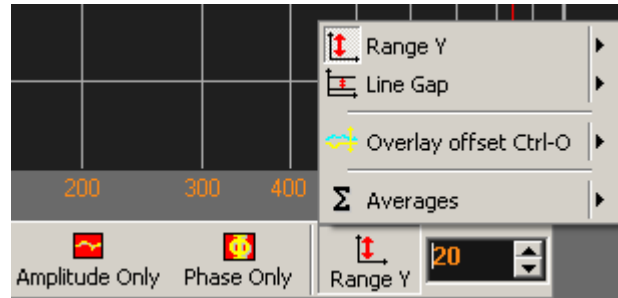


Hint:

- Most of the settings can be found in the  **Tools** menu as well.

Trace Layout (MAT complex menu layout)

Select a parameter of the trace display's layout. Not all parameters are available for every measurement.




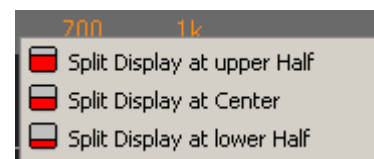
- **Amplitude only** this option is visible in the transfer function measurement only. It hides the phase display window and shows the amplitude window in full size. The shortcut is **A**.
- **Phase only** this option is visible in the transfer function measurement only. It shows the phase display window in full size, hiding the amplitude display area.
- **Upper limit** move the trace display's top border. The visible dB range ranges from the **upper limit** minus the **Y-range** to the **upper limit**. This setting is not enabled in the transfer function measurement.
- **Range Y** set the trace display's vertical range.
- **Line Gap** set the scale's vertical distribution.
- **Offset Overlay** move the overlay trace up and down. This option is enabled only if an overlay trace is displayed and if you've activated the overlay functionality in the **setup -> post process** section. See page 65 for details of the overlay-trace.
- **Averages** set the number of averages to perform.
 - In the transfer function measurement you can select the averaging mode from the pop-up menu of the **Averages** menu.

The image shows a pop-up menu for the 'Averages' function. It contains three items: 'Average all values' (with a sigma symbol icon), 'Complex Averaging' (with a checkmark icon), and 'RMS Averaging default' (with a sigma symbol icon).

 - **Complex averaging** both parts of the complex transfer function are summed before the calculation of transfer function. This is the default setting and allows the display of the phase trace.
 - **RMS averaging default** in this case the averaging is done after the calculation of the amplitude. The averaging is done based on the energy content (RMS), and there is no phase display. You can use this kind of averaging to improve the quality of the amplitude trace under difficult conditions.

Hints:

- After a parameter is selected the value editor field shows the parameter's current value. The current parameter's name is displayed left to the value editor field.
- In the transfer-function measurement you can change to the full views by double-clicking on the related area in the display. A double-click on the full-view changes back to the split view.
- The parameter's value can be changed at the value editor field.
- Each parameter features a pop-up menu containing some preset values.
- The values for the parameters **Upper limit**, **Range Y** and **Averages** can be different for each kind of measurement.
- In the RTA and the FFT measurement you can **select the input** to display below the VU-meter.
- The trace layout section is not enabled in the impulse - response measurement. You can use the settings in the right menu-bar and in the  **Tools** menu instead.
- In measurements which use a split screen, it is possible to change the position of the split. There are two ways to do this:
 - Use the pop-up menu of the split area to select one of the three predefined positions.
 - Put the mouse onto the split area, click and hold down the left mouse-button and move the split area up or down by moving the mouse. If the desired split position is reached, just release the mouse-button.



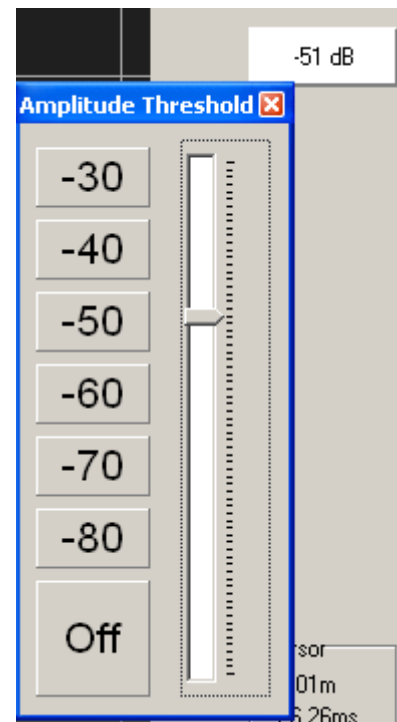
The Amplitude-Threshold setup window

The amplitude – threshold setup window shows up when you click on the value of the current amplitude – threshold in the right menu area. The setup of the amplitude – threshold value is supported in the FFT measurement and the measurement of the transfer – function in the MAT module. On the right of the setup window there is a slider which allows a fine adjustment of the amplitude – threshold value in steps of 1 dB.

On the left there are some preset buttons for a quick and coarse setup of the amplitude – threshold value.

The button **OFF** disables the use of the amplitude – threshold feature in the transfer – function calculation. To enable the amplitude – threshold feature just click again on the **OFF** button, move the slider or select one of the preset values using the buttons on the left.

The currently selected amplitude – threshold value is shown in the right menu area.

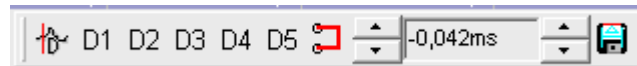




Set the Amplitude – Threshold value in the FFT measurement

Beside of using the amplitude – setup window as described above, you can set the amplitude – threshold value by moving the small handle on right to the trace – display area in the FFT measurement in the MAT module. To do so, just move the mouse to the handle, hold down the left mouse button and move the mouse up or down. If you move the handle below -100dB, then the amplitude – threshold value will change to OFF. To enable the amplitude – threshold feature again, just move the handle up until it is over the -100dB border.

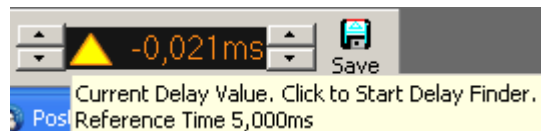


Menu Delay in the MAT module




-  **Cursor to delay** use the current position of the cursor as the new delay time. This option is available only in the impulse - response measurement. The shortcut is **F3**.
- D1 - D5 **Delay presets** allow the direct access to one of the five saved delay-time presets.
-  **Direct (Zero Delay)** reset the current delay to **0** ms.
- **Custom delay setting (coarse)** use the two arrows at the left of the delay display to increment and to decrement the current delay in steps of one millisecond.
- **Delay display** shows the current delay. To start the delay finder just click on this area. This area contains a pop-up menu, which is described in the *pop-up menu of the delay display* section on the page 118.

If the delay display shows the time difference between the reference-time and the current delay setting, a yellow triangle is



shown left of the value. The value of the reference-time is shown in the hint. To display the hint, just move the cursor onto the delay-display area.

If the *Autoadjust-Delay* option is activated in the pop-up menu, a red square is drawn in the left area. See page 105 for details about the auto-delay functionality.



- **Custom delay setting (fine)** use the two arrows at the right of the delay display to increment and to decrement the current delay in steps of one sample (approx 0.021 ms).
-  **Save Delay in Preset** assign the current delay to one of the five delay-time presets. This function is visible only if the current delay has been changed.

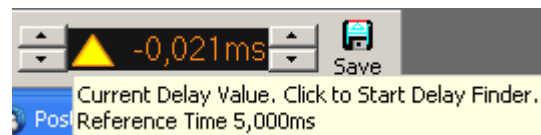
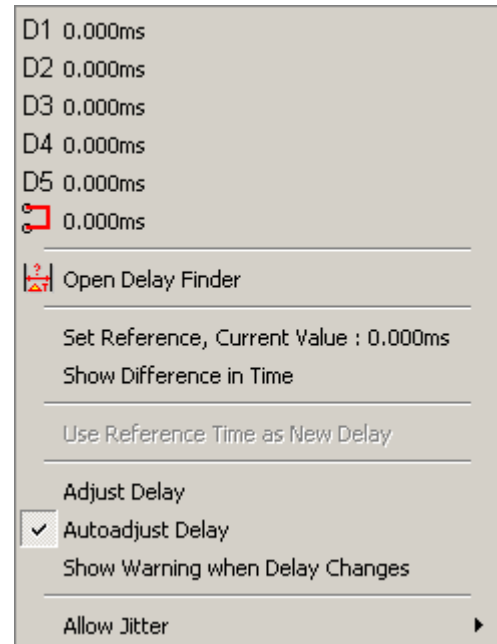
Hints:

- Any change of the current delay voids all data and restarts the measurement.
- The delay's resolution is given by the current samplerate. It is $1/\text{samplerate}$, which yields approx 21 usek (= 0.000021 sec) at 48k samples sampling rate.
- The delay is used for the REF input in all measurements taken in MAT module.

The pop-up menu of the delay display area


This pop-up menu is assigned to the delay-display area. It contains some settings, which are also contained in the delay menu, and two additional entries at the bottom of the menu.




- D1 - D5 **Delay presets** allow the direct the access to the five saved delay-time presets.
-  **Direct (Zero Delay)** reset the current delay to 0 ms.
-  **Open Delay Finder** Invoke the delay finder. See the delay-finder section of this document for further details.
- **Set Reference, current value:** assigns the currently set delay time to the reference -time memory, which is used to calculate the difference in time when the **Show Difference in Time** option is activated in this menu.
- **Show Difference in Time** when this option is activated, the delay-time display shows the difference in time of the value assigned to the reference-time memory using the **Set Reference** entry of this menu. In this case a yellow triangle is shown left to the time value, and the hint of the delay-display shows the value of the reference-time memory. To show the hint, just move the mouse onto the delay-display area. Otherwise, the delay-time display shows the absolute value of the currently set delay.
- **Use Reference Time as new Delay:** this function applies the reference-delay setting as current delay. This function is enabled only when the reference-time setting differs from the current delay value.
- **Adjust Delay, Autoadjust Delay, Show Warning when Delay changes, Allow Jitter:** This entries refer to the auto-delay functionality and are described in the Auto-Delay section of this document, starting on page 105.



Menus in the simple menu layout

The menu Delay in the MAT module


 Delay open a pop-up menu that contains the following functions:

- D1 - D5 **Delay presets** allow the direct the access to the five saved delay-time presets.
-  **Direct (Zero Delay)** reset the current delay to 0 ms.
-  **Delayfinder** Invoke the delay finder. See page 102 for details.
-  **D = C** set the cursor's current position as the current delay. Available only in the impulse - response measurement. The shortcut is **F3**.
- **Custom delay setting (coarse)** use the two arrows at the left of the delay display to increment and to decrement the current delay in steps of one millisecond.
- **Delay display** shows the current delay. A click on this area starts the delay-finder. See page 102 for details about the delay-finder. This area contains a pop-up menu, which is described in the *pop-up menu of the delay display* section on page 118 of this document.

If the delay display shows the time difference

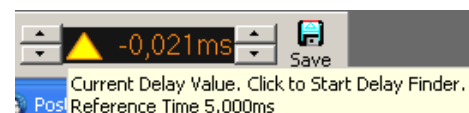
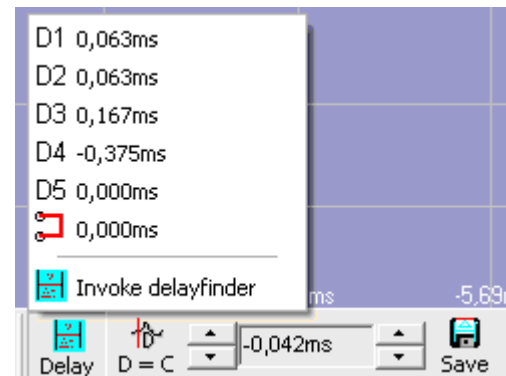
between the reference-time and the current delay

setting, a yellow triangle is shown left of the value. The value of the reference-time is shown in the hint. To display the hint, just move the cursor onto the delay-display area.

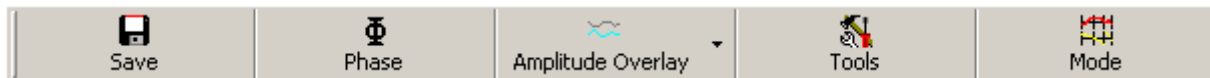
- **Custom delay setting (fine)** use the two arrows at the right of the delay display to increment and to decrement the current delay in steps of one sample.
-  **Save Delay** assign the current delay to one of the five delay-time presets. This function is visible only if the current delay has been changed.





Hints:

- Any change of the current delay voids all the data and restarts the measurement.
- The delay is applied to the reference (REF) input in all the measurements taken in MAT module. See page 104 for details about how to set the delay.
- You can use the shortcut **F7** to invoke the delay-finder. See page 102 for details.




Upper Menu (MAT simple menu layout)

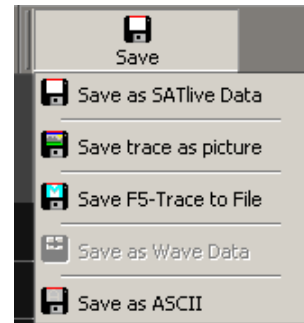







-  **Save** store the live trace into a file. The button contains a pop-up menu where you can select the type of file you want to save the trace to.
-  **Phase** open a pop-up menu which contains the selection of different display modes for the phase (-180° to 180° or 0° to 360°) and different ranges of the group-delay display. Use the shortcuts **Ctrl - Page Up** and **Ctrl - Page Down** to shift the phase display in steps of 45° .
-  **Overlay** toggles the visibility of the current overlay trace. If no valid overlay trace is loaded then the . Load overlay function is executed. The function's shortcut is O. The pop-up menu contains more settings and functions related to the overlay trace. This item is visible only if you've activated the overlay functionality in the **setup -> post process** section. See page 65 for details about the overlay-trace.
-  **Tools** additional functions and settings. See page 108 for details.
- **Mode** opens a pop-up menu from which the measurement can be selected. The button shows the current measurement's symbol.

The pop-up menu of the SAVE button (MAT Module)

This pop-up menu is assigned to the button  **SAVE** in the MAT Module.










You can save the trace into different types of file. Depending on the measurement selected, some type of file will be not available.

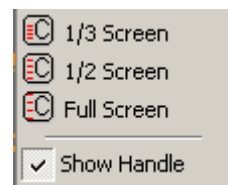
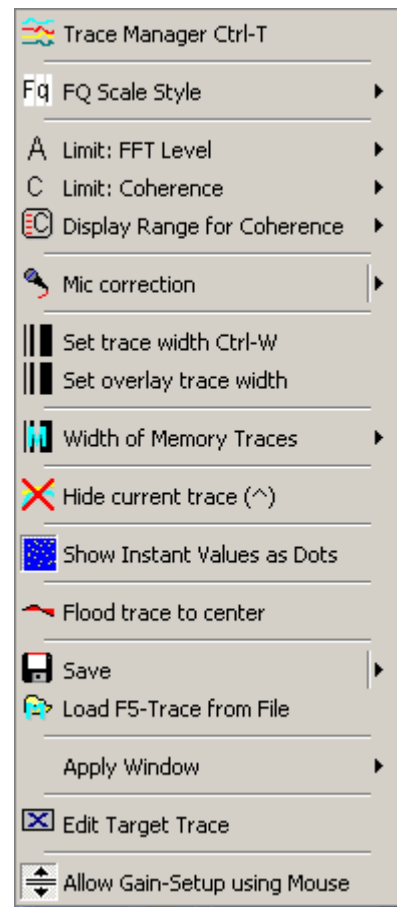


-  **Save as SATlive Data** save the live trace using the default SATlive file type. This type contains many additional information, so you should use it, if you want to load the file into SATlive.
-  **Save Trace as Picuture** save the current display as a picture. You can select the kind of picture you want to save to, in the file type selection in the save file name selection dialog. The quality of the picture (and it's file size) can be changed using the Quality of JPEG conversion setting at setup -> features window.
-  **Save F5-Trace** to file save the trace which is assigned to the internal memory using the F5 key into a default SATlive file type file.
-  **Save as Wave Data** save the trace of the impulse - response measurement into a default windows® audio file. This file can be accessed by many audio related software.
-  **Save as ASCII** export the data of the transfer function into a text file. This enables you to import the data into other software.

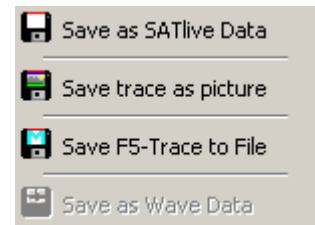
Menu Tools in MAT (simple menu layout)

This menu features many functions and options. Please note that it's content varies with the measurement selected.


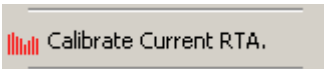
-  **Tracemanager** open or close the tracemanager. This function can also be accessed using the shortcut **Ctrl-T**. See page 177 for details.
-  **FQ Scale Style** set the style of the frequency scale. See page 64 for details.
-  **Limit: FFT Level** in the transfer function measurement a point is only added to the averaging latch, if the level of its reference signal exceeds this value. Therefore the transfer function is calculated only for frequencies with enough power contained in the reference signal. See page 116 for details about how to set the amplitude-threshold value.
-  **Limit: Coherence** a point is only displayed in the transfer function if it's coherence exceeds this threshold value. The coherence indicates how good the mic signal is related to the reference signal. The coherence is affected by proper delay setting. You can edit this value in the right menu-bar as well.
-  **Display range for Coherence** select the vertical range for the coherence display. The coherence is shown at the top of the upper window. The labels for the coherence range are on the right side. The sub-menu contains the *Show Handle* option, which allows you to change the coherence-threshold value using the mouse.
-  **Mic correction** activate the mic correction for the live trace. If no valid mic correction is loaded, the  **Load Mic correction** function is executed. The function  **Load Mic correction** is located in the pop-up menu of this function. See page 80 for details about the mic-correction
-  **Set Trace width** set the width of the live trace. The shortcut is **Ctrl-W**.




- **||| Set Overlay Trace width** sets the width of the overlay trace. This item is visible only if you've activated the overlay functionality in the **setup -> post process** section. See the page 65 for details about the overlay-trace.
- **|| Width of Memory Traces** select the line size for drawing the latched traces, like the quick traces or the F5 trace. This setting does not affect the display of traces using the trace manager. The trace manager sets the trace width according to the trace's weighting.
- **✗ Hide current trace** hides both the amplitude and phase display. The shortcut is ^ (Left to the number 1 key on your keyboard).
- **■ Show Instant Values as Dots** show the non averaged result of the current FFT calculation as dots. In the transfer-function measurement the result of the last calculation is shown as a dot. **SATlive** supports different settings for FFT and transfer-function calculation. You can change the color of the dots in the *Setup-> Color* section.
- **↔ Flood trace to center** toggles the flood trace to center display mode. See page 67 for details of the Flood to center option.
- **Save** this entry contains a pop-up menu where you can save different traces.
 - **Save as SATlive data** saves the live trace into a file.
 - **Save Trace as Picture** saves the current display as a picture.
 - The **Save F5-Trace to File**, which is enabled only if a memory trace is assigned, saves the memory trace to a file.
 - **Save as Wave Data** saves the impulse response as default windows® wave format. You can import this format in various other audio related software.
- **📂 Load F5-Trace from File** open a saved trace as the F5 memory trace.
- **Apply Window** add a window to the signal prior to the calculation of the transfer-function. A window excludes later reverb and longer delays from the measurement.
- **✂ Edit Target Trace** opens the editor for the Target Trace. See page 193 for details about the Target-Trace functionality.
- **Allow Gain-Setup using Mouse** allows you to move the currently selected trace by moving the mouse vertically while you hold the left mouse button down.



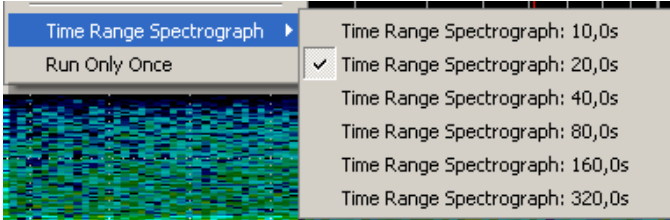
Additional for RTA measurements

-  **Calibrate current EQ** calibrates the RTA display of the currently selected RTA. Use a loop-back from output to the reference (REF) input, select 64 averages and start pink noise. The function is enabled only if the REF input is selected and at least 64 averages have been performed.
 

Additional settings for the FFT measurements

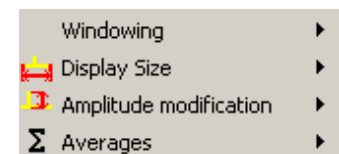
- Window** select the window applied prior to the calculation of the FFT from the sub menu.
-  **THD+N** Start a total harmonic distortion measurement. See page 95 for details.

Additional settings for the FFT + Spectrograph measurement

- Time Range Spectrograph** select the desired time for the spectrograph display from the sub menu. The time selected is needed to fill the spectrograph.
 
- Run only once** if this option is selected, the spectrograph (not the FFT) stops after it is filled completely.

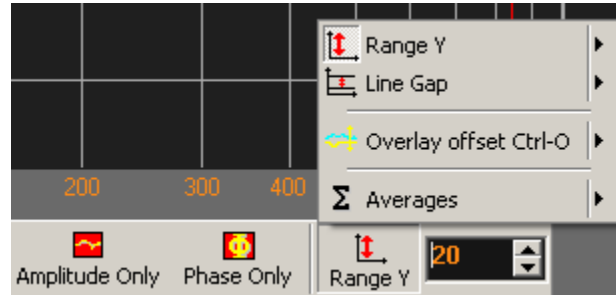
Additional for Impulse Response measurement










- Window** select the window applied prior to the calculation.
- Display size** set the size of the impulse response calculated. Higher size has a higher precision, but takes more time. You can edit this value in the right menu-bar as well.
- Amplitude modification** set the gain of the impulse response display, given as a factor, not as a dB value. You can edit this value in the right menu-bar also.
- Averages** set the number of measurements averaged for the result. You can edit this values in the right menu-bar as well.



Trace layout MAT (simple menu layout)

To select the parameter to edit, click on the symbol left to the value edit field with the left mouse button and select the parameter from the pop-up menu showing up.



-  **Amplitude only** this option is visible in the transfer function measurement only. It hides the phase display window and shows the amplitude window in full size. The shortcut is **A**.
-  **Phase only** this option is visible in the transfer function measurement only. It hides the amplitude - display window and shows the phase - display window in full size.
-  **Upper limit** move the trace display's top border. The visible dB range ranges from  **upper limit** minus  **Y-range** to **upper limit**. This setting is not active in the transfer function measurement.
-  **Range Y** set the trace display's vertical range.
-  **Line Gap** set the scale's vertical distribution.
-  **Offset Overlay** move the overlay trace up and down. This option is active only if a valid overlay trace is displayed and if you've activated the overlay functionality in the **setup -> post process** window. See page 65 for details about the overlay-trace.
-  **Averages** set the number of averages to perform.

Hints:

- After the parameter is selected the value editor field shows the parameter's current value. The current parameter's name is displayed left of the value editor field.
- The parameter's value can be changed at the value editor field.
- Every parameter features a pop-up menu containing some preset values.
- The values for the parameters Low DB, **Range Y** and **Averages** can be different for each kind of measurement.
- You can select the input(s) to display below the VU meter when you perform a RTA or a FFT measurement.
- The layout parameter used in the impulse - response measurement can be set either in the tools menu or in the right menu area.
- In measurements which use a split screen, it is possible to change the position of the split. There are two ways to do this:

- Use the pop-up menu of the split area to select one of the three predefined positions.
- Put the mouse onto the split area, click and hold down the left mouse-button and move the split area up or down by moving the mouse. If the desired split position is reached, just release the mouse-button.





Select the Input used for RTA and FFT measurement

You can select the input(s) for SATlive to display in the FFT or the RTA measurement.



To select you can either perform a mouse click on the labels below the VU meter or you can use the shortcuts **F8** (REF) and **F9** (MIC).

Hints:

- You can display the **REF** input, the **MIC** input or **both** inputs.
- The delay is applied to the **REF** input.
- A mic correction is applied to the **MIC** input.
- You can change the assign of the physical input to the functions reference (**REF**) and measurement (**MIC**) in  **Setup**->  **I/O Devices**.

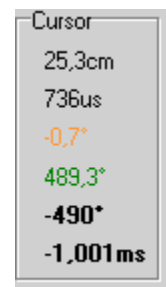
Cursor details (MAT)

The cursor details display is located in the right menu bar.

It is visible only if a **transfer function** measurement or a **FFT** measurement is currently selected.



It shows details about the values at the current position of the cursor.

The following values are shown (top down):

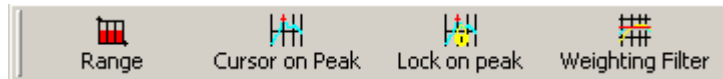


- **Wave length** at the cursor's position.
- **Period** at the cursor's position.
- **Phase angle** of the **live trace** at the cursor's position (Displayed only if a transfer function measurement is performed).
- **Phase angle** of the **selected trace** at the cursor's position (Displayed only if a transfer function measurement is performed and the live trace is not selected as the selected trace).
- The **difference** between the **phase angles** of the live trace and the selected trace. (Displayed only if a transfer function measurement is performed and the live trace is not selected as the selected trace).
- The **delay between the selected trace and the live trace** calculated using the difference of the phase angles and the frequency of the cursors current position. (Displayed only if a transfer function measurement is performed and the live trace is not selected as the selected trace).
- The pop-up menu of the cursor details area contains the settings of the live add trace and of the perfect addition trace.

Hints:

- The phase values could be displayed either in the $-180^\circ / +180^\circ$ range or as calculated unwrapped values.
- Select the kind of phase display in  **Setup** ->  **Post process**.
- The unwrapped phase value is calculated assuming that the phase is in the first cycle at the lowest displayed frequency.

Bottom Menu Bar MAT



The bottom menu bar is located at the lower right area. It is available in the MAT Module. Not all options are available for all kind of measurements.



- **Range** open the sub menu Range. See page 68 for details.



- **Cursor on Peak** moves the cursor to the peak of the live trace. This action unlocks the Lock on Peak setting.



- **Lock on Peak** if this option is activated then the cursor is moved to the live trace's peak each time the live trace is drawn. To unlock the cursor you can either click on this button again or you can perform another cursor related action like:
 - Click on the trace's display to set the cursor.
 - Move the cursor using your keyboard.
 - Invoke the cursor on peak action.



- **Weighting Filter** open a sub menu, where you can choose a weighting filter for the mic input. See the *weighting filter section* on page 76 of this document for further details.

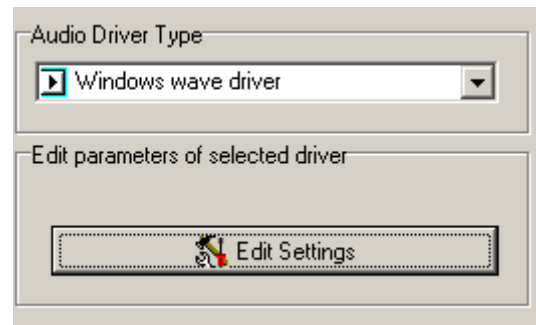
Setup



Setup -> I/O devices

The setup I/O devices contains different areas.



Audio-mode selection

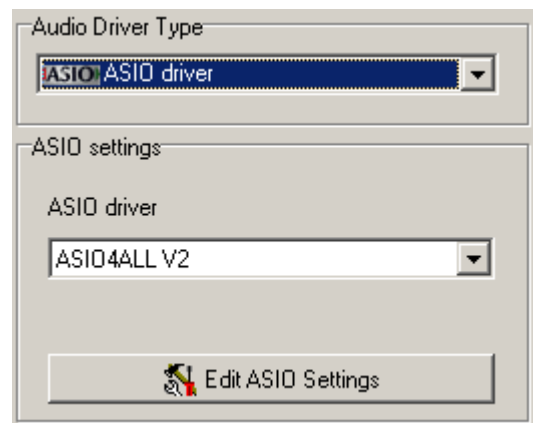
Select the kind of audio driver you want to use from the selection in the upper area.



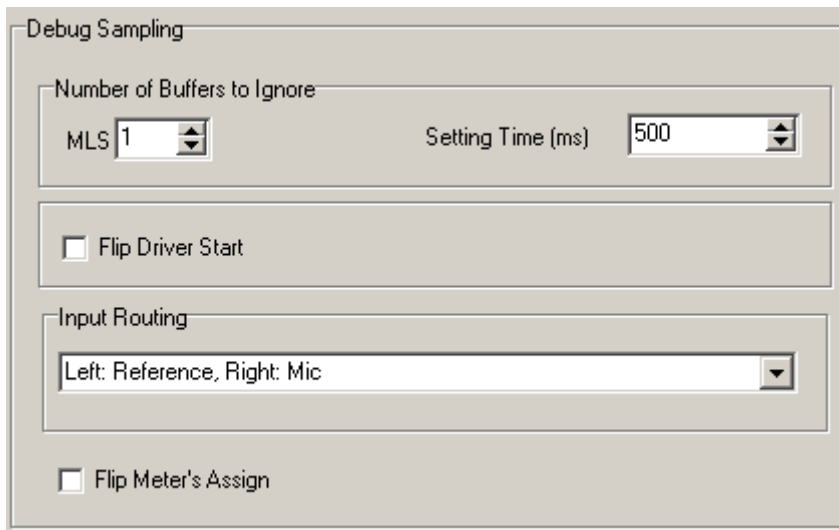
-  **Windows wave driver** these are the generic drivers supplied by windows® OS for the access to the audio hardware.
-  **Directsound driver** these are windows directsound® drivers for the audio I/O. Directsound® is part of DirectX®. SATlive needs a directsound® installation of version of 8.0 or higher.
- **ASIO driver:** Use the ASIO interface to access audio device. If you select the ASIO driver you have to select the device you want to use before entering the setup.

Hints:

- To edit the audio I/O parameters click on the button  **Edit Settings**.
- Use the  **SAVE** button in top menu bar to store your selection.
- **ASIO is a trademark and software of Steinberg Media Technologies GmbH.**
- The ASIO setup is available only if at least one ASIO driver is available on your system.
- Because SATlive can only check drivers and not the device itself, an ASIO device can be shown in the list even if it is currently not present on the system. Selection of a device that is not present will result in empty fields in the ASIO setup or an error message.
- Outside of the setup you can use the shortcut **Ctrl - Alt - D** to show information about the current audio driver.



Audio debug section



Debug Sampling

Number of Buffers to Ignore

MLS 1 Setting Time (ms) 500

Flip Driver Start

Input Routing

Left: Reference, Right: Mic

Flip Meter's Assign

- **Number of Buffers to ignore** the MIs measurement used in the impulse - response measurement needs some time to get stable. Therefore at least one sequence needs to be played prior to the measurement. In some cases one sequence might be not enough, in this case you can increase this value if needed.
- **Settling time** when SATlive starts pink noise or white noise a fade-in of 500ms is performed. This time must also be excluded from the measurement to get stable results. Some soundcard - driver combinations might need more time to establish a stable audio performance. On some USB audio interfaces the settling time might be longer then one second.
- **Flip Driver Start** flip the start sequence of the audio I/O drivers. This might be helpful on some soundcard - driver combinations to shorten the settling time.
- **Input routing** assign the physical inputs to the reference (REF) and measurement (MIC) function. This setting is not shown if an ASIO driver is selected and it does not affect the position of the VU meter bars, because they are linked to the input's function but not to the input channels.
- **Flip Meter's Assign** flips the position of the VU-meter's bars, so that the left meter shows the measurement (MIC) level and the right meter shows the reference (REF) level. This is independent from the physical routing which is set using the input routing selection.

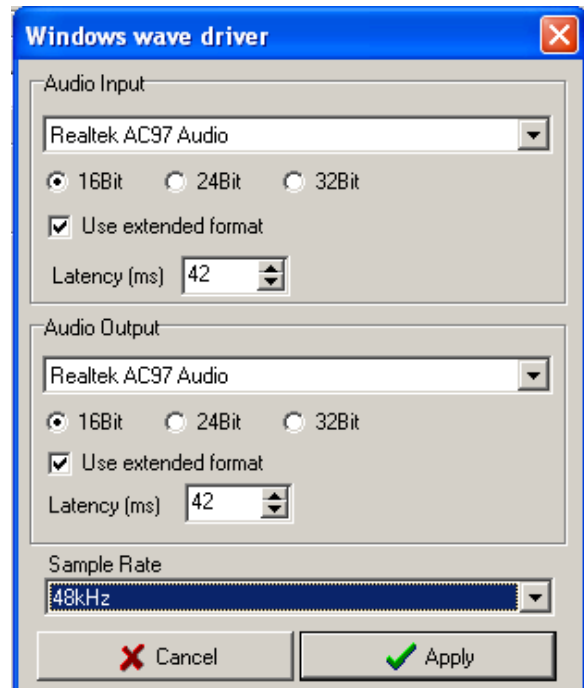
Wave I/O setup

The setup is divided into two sections, which contain the same settings, the upper one for the audio input and the lower one for the audio output.


At the bottom there is the samplerate selection.

This is a global setting.

- **Soundcard** selection select the soundcard you want to use for this function. It is possible to use different soundcards for input and for output.
- **16Bit - 24Bit - 32 Bit** resolution of one sample, indicates how exact the analog signal is converted into digital signal.
- Use extended format use the new type of microsofts®'s wave format description for the access to the input driver.
- Latency (ms) specify the size of the data blocks used for transferring the audio data from and to the soundcard. Lower values mean faster response but the data are more likely to be affected by performance issues. You should not change the default values unless you're facing a problem related to the audio I/O.



Hints:

- After every change of the settings SATlive rebuilds the list of supported samplerates. This may take some seconds.
- To get the best quality use the highest samplerate available.
- Different settings may produce different output levels. So please be very careful with the volume setting when changing any settings.
- In the extended format windows expands audio data to the selected resolution, even if the hardware does not support that resolution. A selection of a resolution not supported by the hardware creates more data and processor load than necessary.
- The Apply button saves the current settings of the wave I/O and closes the window, but does not select Wave I/O as the current audio driver. The input driver selection must be confirmed using the  **Save** button in the top menu bar.

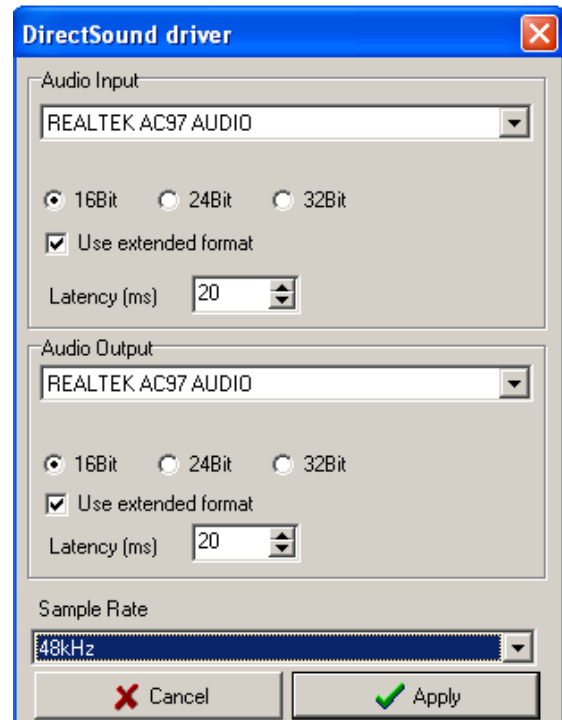
Directsound(R) I/O setup

This setup is divided into two sections, which contain the same settings, the upper one for the audio input and the lower one for the audio output.


At the bottom there is the samplerate selection.

This is a global setting.

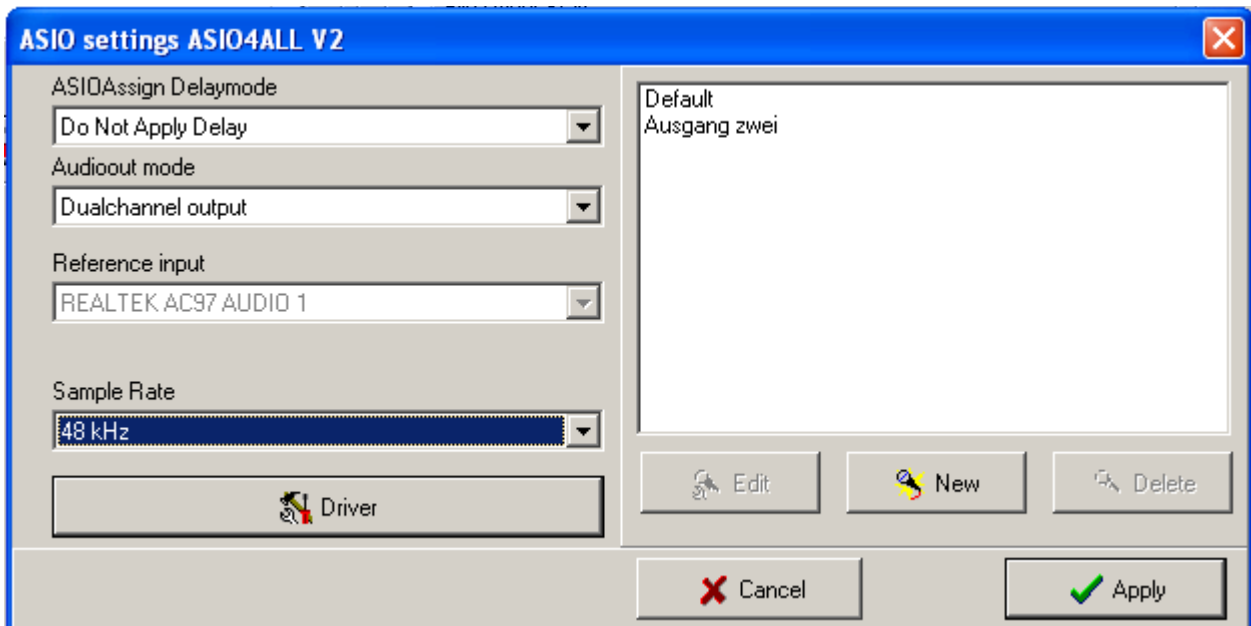
- **Soundcard** selection select the soundcard you want to use for this function. It is possible to use different soundcards for input and for output.
- **16Bit / 24Bit / 32 Bit** resolution of one sample, describes how precise the analog signal is converted.
- Use extended format use new type of the wave-format description.
- Latency (ms) specify the size of the data blocks used for transferring audio data from and to the soundcard. Lower values mean faster response but the data is more likely affected by performance issues. You should not change the default value of unless you're facing audio I/O related problems.



Hints:

- After every change of the settings SATlive rebuilds the list of supported samplerates. This may take some seconds.
- To get the best quality you should use the highest samplerate available.
- Different settings may produce different output levels. So please be very careful with volume setting when changing any settings.
- If the extended format is used, then windows expands the audio data to the selected resolution. Therefore selection of a resolution not supported by the hardware just creates more data and processor load as necessary.
- The Apply button saves the current settings of the directSound I/O and closes the window, but does not select the directsound driver as the current audio driver. The audio-driver selection must be confirmed using the  **Save** button in top menu bar.

Asio I/O setup



ASIO is a trademark and software of Steinberg Media Technologies GmbH.

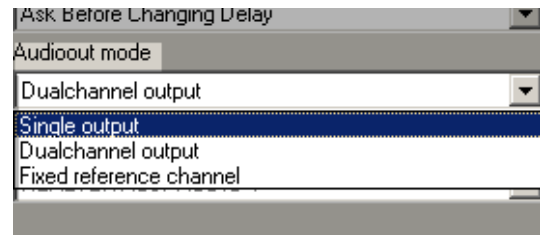
To open the ASIO setup window, in the  **Setup->**  **I/O Devices** section select **ASIO** in the driver-selection area and then click on the **Edit ASIO Settings** button.


The header shows the name of the currently selected ASIO device.

The common parameters for all ASIO Assign routing are located on the left side of the window.


- **ASIO Assign Delay Mode** select how ASIO Assign modifies the current delay when you select another ASIO Assign routing.

- **Audio Out Mode** select how ASIO Assign routes the output channel(s). Audio Out Mode. The selection contains the following items:





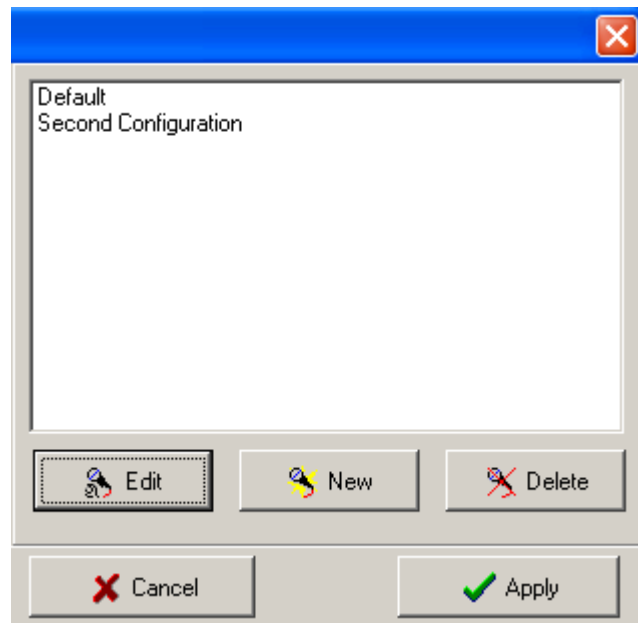
- **Single Output** the output signal is routed to only one output of the I/O interface. You can select the output channel for every routing in the ASIOAssign. You can access any output of the I/O interface using this setting.
- **Dual Channel Output** the output signal is routed to a stereo pair of output channels, like AnalogOut1 and AnalogOut2. As suggested in the ASIO specification, you can only select the first pair of outputs of an output group, so not all outputs will be listed in the ASIOAssign's routing setup. The list contains the name of the first output of the stereo pair, in the example above this would be AnalogOut1.
- **Fixed Reference Channel** this option combines the global selection of one output with the individual selection of another output. This enables you to use your I/O device as an output switcher to select different speakers using ASIOAssign without the need to think about how to route the reference signal. You can select the fixed reference output in the global ASIO I/O setting on the lower left.
- **Reference Output** select the output channel which SATlive uses if fixed reference channel is selected for the current Audio-Out Mode.
- **Samplerate** amount of samples per second taken from the audio input signal. For best results use the highest possible value. This setting might interact with samplerate setting in the device's ASIO setup.
-  **Driver** open a driver specific setup menu, which is supplied by the manufacturer of the ASIO device. This might give you access to latency and buffer settings.
- On the right area of the ASIO setup window you can edit the ASIO Assign routing. The routing **Default** is selected after each start of SATlive.

Hints:




- To get the best quality use the highest samplerate available.
- ASIO does not support the use of different audio devices for the input and the output.
- Different settings may produce different levels. So please be very careful with volume setting when changing any settings.
- In order to show only ASIO devices which are currently available, SATlive tries to open the ASIO drivers before it puts it on the list. Therefore it might take a few seconds until the driver list is completed.
- The Apply button saves the current settings of the ASIO I/O and closes the setup window, but does not select the ASIO driver as the current audio driver. The input driver selection must be confirmed using the  **Save** button in the top menu bar.
- And never forget: **ASIO is a trademark and software of Steinberg Media Technologies GmbH.**

ASIOAssign

- ASIOAssign enables you to define different input/output routings for the selected ASIO device. You can create, edit and delete the routings in the ASIOAssign window.
- To show this window, go to the ASIO section of the  **Setup** ->  **I/O Devices section**.
- ASIOAssign is able to manage the current delay in the MAT module as well.
- You can recall a routing in several ways.



Add, delete and modify the routing.

-  **New** open a window to set the routing and name for this routing preset.
-  **Edit** modify a existing routing preset. Select the routing preset to edit from the list before you click on the edit button.
-  **Delete** removes the selected routing preset.
- The routing **Default** is recalled every time SATlive starts, or when you leave the **Setup -> I/O Devices** window, therefore you cannot delete it.

Edit a routing

- **Name** edit the name of the routing preset.
- **Audio Input REF** select the input used for the reference (REF) signal.
- **Audio Input MIC** select the input used for the measurement (MIC) signal.
- **Audio Output** select the output used for the signal generator. The contents of this selection varies according to the selected mode of the audio output.
- If you performed all settings, you can save it using the **OK** button. Use the button **Cancel** to discard your changes.




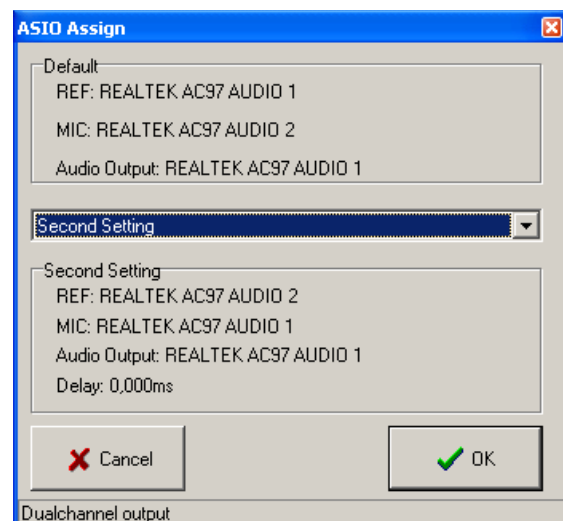
Select an ASIO-Assign Routing

You can select an ASIO-Assign routing, which enables you to use an ASIO device as an Input selector and an Output selector.

So you can quickly change the audio inputs and outputs that SATlive will use.

There are two ways to select an ASIO-Assign Routing:

- Use one of the buttons in the signal-generator window. This buttons recall the ASIO-Assign routing assigned to them using the **Assign buttons for ASIOAssign** function located in the pop-up menu of the signal-generator area.
- Use the  **ASIO Assign** entry in the pop-up menu of the signal-generator area to open the ASIO Assign selection window.
- In the upper half of the window contains details of the currently selected routing.
- Use the selection box in the middle of the window to select the routing to activate.
- The details of the selected routing are shown in the lower half. The delay time assigned to the selected routing is shown on the bottom of this information area.
- Use the button **OK** to activate the selected routing and to close the window.
- The button **Cancel** closes the window and discards the changes.

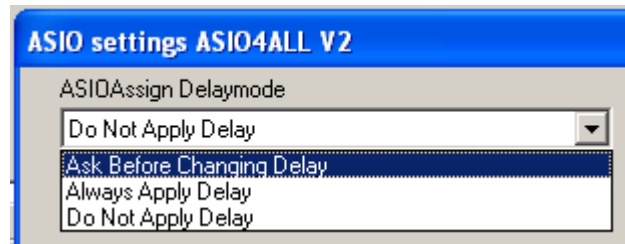


Hints

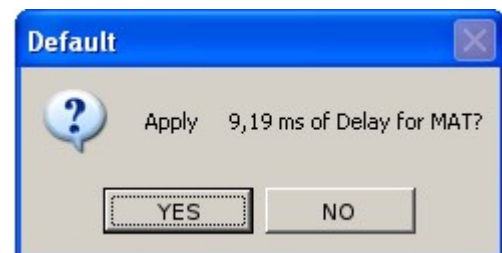
- SATlive changes the routing to **Default** when the software starts and when you leave the **setup -> I/O devices** section.
- The ASIO Assign selection window is available only if more than one ASIO-Assign routing is defined for the current I/O device.

Manage delay-time in ASIO-Assign

- ASIO-Assign manages not only the routing of inputs and outputs, but it is also capable of managing the delay used in the MAT module.

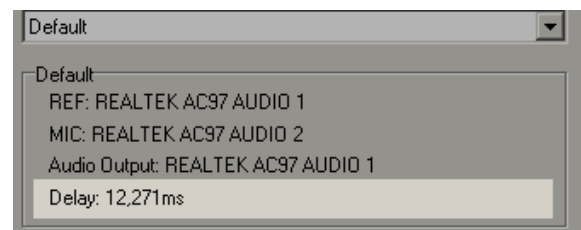


- At the top left half of the **ASIO Setup** area you can select how ASIO - Assign will manage the delay when you select a different routing.
- The selection contains three items:
- Ask Before Changing Delay** when you change the routing, a message box shows up where you can select if you want to change the delay (**YES**) or not (**NO**). The header of the message box contains the name of the routing whose delay will be recalled.
- Always Apply Delay** the delay assigned to the selected routing is set as the current delay.
- Do Not Apply Delay** the current delay is not affected when you select another routing.



Hints:

- The current delay is assigned to the current routing when you close the program or when you change the ASIO - Assign routing.
- The delay assigned to a routing is shown in the selection of the routing to use.
- If you intend to manage only delays and no I/O routing, you should prefer using the delay presets in the lower menu area.
- ASIO - Assign works only if you use an ASIO driver for the I/O device. If another kind of driver is selected, then you can use the delay presets in the bottom menu area in order to manage up to five delay time settings.






Setup -> User Macros

Name of Macro		Short name (button)	
Chirping Bird		Chirping Bird	
Impulse Response			
Measurement Mode		Edit	
Sweep Measurement			
Sweep Measurement, Size: 64kSamples, From: 40,0Hz to 20,0kHz, Use short signal (Chirp), No Averaging			
Windowing		FFT	
Related to peak		FFT Size	
		Smooth Full (Automatic Windowing)	
Pre: 400		Smoothing	
		1/12 Octave	
Post: 682267		Phase compensation	
		No phase compensation	
Calibration		Mic Data	
test.SLD		ecm8000.SMC	
<input type="checkbox"/> Use		<input type="checkbox"/> Use	
<input type="checkbox"/> Repeating Measurement		<input type="checkbox"/> Lock window	
<input checked="" type="checkbox"/> Function Window		Blackmann	



In the impulse-response module SATlive features a powerful macro system, which enables you to perform a measurement with just one click. There are twelve macros available, which are fully editable.

In order to edit a macro, you first need to select the macro to edit from the list on the right. Now the selected macro shows up, and you can edit it's properties.

- **Name of Macro** edit the macro's name.
- **Short Name (Button)** this name is shown on the User Macro button in the impulse - response measurement. The last executed macro is assigned to the User Macro button.
- **Impulse response** select the measurement to create the impulse response. Click on **Edit** to edit the measurement properties. The current settings are shown below the selection box.
- **Window** set the parameter for the window applied prior to the calculation of the FFT. Because a Smooth Full FFT extends the window to fit the FFT size, those settings are disabled if a Smooth Full FFT is selected. If the current window settings are larger than the current size of the FFT or of the impulse response, then the background color will change to red.
- **FFT** set the size and the type for the FFT (or Smooth FFT) to be applied to the windowed impulse response.
- **Phase compensation** Select the kind of phase compensation applied to the phase trace. See page 198 for details about phase compensation.
- **Calibration** click on the button  to assign a calibration file to the macro. Check the USE option to apply it to the frequency response.
- **Mic Data** click on the button  to assign a mic correction file. Check the USE option to apply the correction to the frequency response. The Mic Data setting is enabled if a Smooth FFT or a Smooth Full FFT is selected.
- **Repeating Measurement** repeat the measurement until it is stopped by the user using the  **Stop/Again** function in the FFT module. This setting is useful for setting up electronic gear, where the frequency response can be watched in 'realtime' using this setting.
- **Keep Window** the macro will not change the absolute position of the time window.
- **Roundedge** apply the window selected in window selection box to the impulse response prior to the calculation of the FFT or of the smooth FFT. The window is always applied as a half window, i. e. it is only applied to the right half of the upper trace display. This is necessary to avoid spoiling of main peak, which should be on the left. The window selection is enabled only if the roundedge setting is activated. See page 32 for details.

Setup → User Windows

User defined windows, that means discrete ranges extracted from the measured impulse response for further treatment, are used in the impulse - response module.

You can edit this windows in  **Setup** ->  **User Windows**.



In the impulse - response module you can apply a window to the current impulse response.

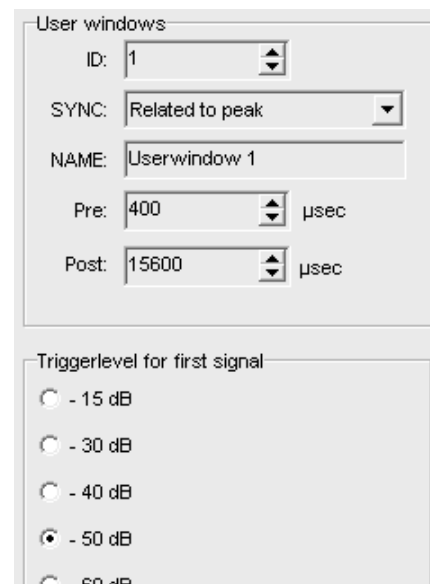
Each User Macro contains information about the window's parameter.

You can choose one of three modes for synchronizing the window with the impulse response:

- **Absolute** the window starts on a fixed time position (Parameter L), and has a given size (Length).
- **Related to Peak** the impulse response's peak is used as the time reference of the window to apply. This is a good choice for measurements with varying time delays. You can edit the window's left distance to the position of the peak (Pre) and the window's right distance from the position of the peak (Post). The total size of window is the sum of the values for Pre and Post. It is possible to use negative values for the Pre parameter in order to exclude the main impulse.
- **Related to first signal** the position where the impulse response first meets the set threshold level is taken as reference for the window. You can edit the position of the window related to the reference time (Dist) and the size of the window (Length).

Hints:

- You can perform manual windowing using the cursor and the trace display's pop-up menu.
- Because the peak contains the most energy and information, it is necessary for normal measurements that the peak is located inside the window.
- SATlive supplies two default windows. You can access this windows with 10ms and 20ms size, related to the peak, either using the shortcuts **Ctrl-1** and **Ctrl-2** or click on the  button or the  button.




Setup -> Display

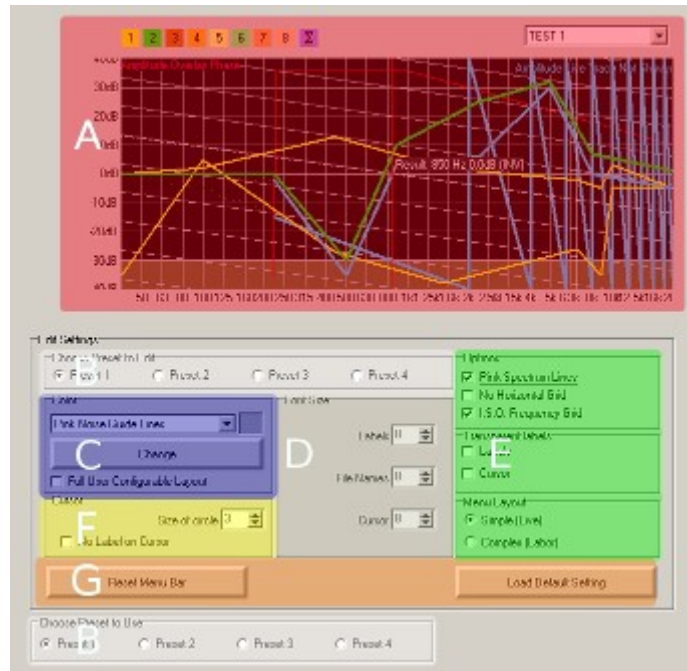
This setup allows you to customize the look of SATlive according to your preferences.

The description of the setup's parameters is divided into some topics.


- **A Preview** area this area displays all changes immediately. Keep in mind that you still need to save your changes.
- **B Preset** Select area you can select the preset you want to edit in the upper selection area. In the lower area you can select the preset that SATlive will show after you leave this setup.
- **C Color Assignment** area use this area to set the colors used to draw certain items.
- **D Font Size** area in this area you can select the font size for different labels.
- **E Option** area you find some options to customize the display in this area.
- **F Cursor** area customize the layout of the intersection between the cursor and the selected trace.
- **G Reset** area use Reset Menu Bar to rearrange the position of all menu bars. You can use this option to find lost menu bars. The Load Default Setting function resets the preset, which is currently selected for editing, to the default values.

Hint:

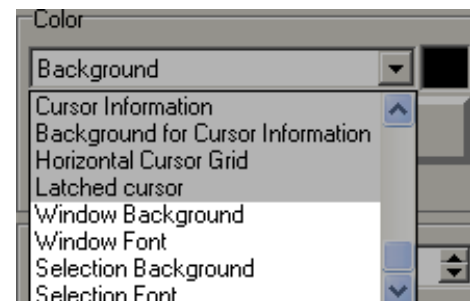
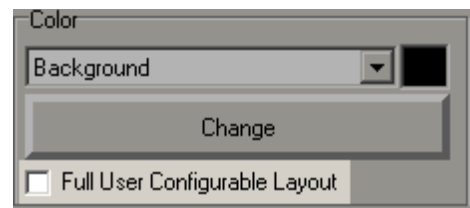
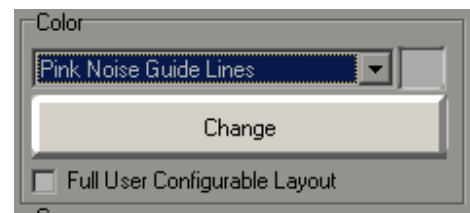
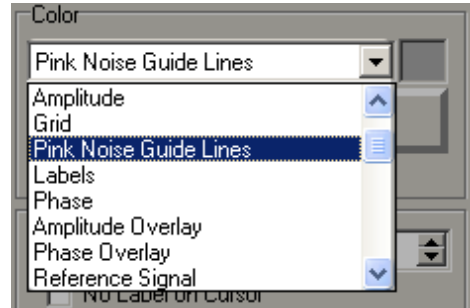
- The changes displayed in the preview window will get lost if you do not exit using the SAVE  button in the top menu bar.



Assign Colors

The Color Assignment are can be found in  **Setup -> Display**.

- In order to change the color of an item, first select the item from the list.
- After the selection of the item it's current color is shown in a small color area right to the selection box. You can invoke the color dialog by either by clicking on this color area, or by clicking on the button Change.
- Now you can set the new color for the selected item. To apply the new color, close the color selection dialog with the OK button. The new color is immediately shown in the preview area at the top of the setup window.
- At the bottom of the color selection area there is the Full User Configurable Layout. The activation of this option enables you to edit the color of the items listed below. Otherwise the color of the items is set according to the current settings in the windows and the items are not listed in the item selection box.
 - Window Background color used for the areas outside of the trace display.
 - Windows Font color used for strings and labels on the area outside of the trace display.
 - Selection Background color used for the background of selections and of the edit fields.
 - Selection Font color used for the strings shown in the selections and in the edit fields.



Items with configurable colors

- **Background** color of the background of the trace display area.
- **Zone below AMP-Threshold (MAT-FFT)** in the MAT Module the current Amplitude threshold is marked by this color in the background. See page 116 for details.
- **Amplitude** the result of the current measurement. In the MAT- FFT this color is used to draw the trace related to the MIC input. This is used for the transparent overlay in the cursor-range tool (page 73) as well.
- **Grid**
- **Pink Noise Guide Lines** used to draw the grid which falls with -3dB/octave. This grid is shown when the option Pink Spectrum Lines (located on the right in the Setup -> Display section) is selected.
- **Labels** used for labeling the grid.
- **Phase** used for drawing the phase trace of the current measurement.
- **Amplitude Overlay** used to draw the current overlay file's amplitude trace. This item is visible only if you've activated the overlay functionality in the **setup -> post process** section. See page 65 for details of the overlay-trace.
- **Phase Overlay** used to draw the current overlay file's. This item is visible only if you've activated the overlay functionality in the **setup -> post process** section. See page 65 for details of the overlay-trace.
- **Reference Signal** used to draw the reference's input signal in the MAT-FFT.
- **F5 Trace Amplitude** used to draw the amplitude of the memory trace, which is assigned using the key **F5**. In the IR Module this color is used to draw the second impulse response's trace.
- **F5 Trace Phase** used to draw the phase of the memory trace, which is assigned using the key **F5**.
- **Coherence** used to draw the coherence values in the transfer function display in the MAT Module.
- **Quick Trace 1..8** used to draw the Quick Traces 1 to 8. See page 219 for details.
- **Sum Trace** used to draw the Sum Trace
- **Live - Add Trace** used to draw the Live - Add Trace in the MAT transfer - function measurement.

- **Perfect Addition Trace** used to draw the Perfect - Addition Trace in the MAT transfer - function measurement.
- **FFT Peak Trace** used to draw the FFT Peak Trace.
- **Virtual EQ Trace** this color is used to draw the response of the virtual Equalizer.
- **Dots for invalid Amplitude Values** used to show the amplitude values of the result of the last single measurement in the transfer function measurement.
- **Dots for invalid Phase Values** used to show the phase values of the result of the last single measurement in the transfer function measurement.
- **Cursor** used to draw the cursor.
- **Cursor Information** used to show the information text next to the cursor's intersection with the selected trace.
- **Background for Cursor Information** color used to fill the background area of the cursor-information text. Used only if the **Transparent Label setting** is not enabled for the cursor.
- **Horizontal Cursor Grid** used for the horizontal line(s) used to mark the range selected by the **Show Range at Cursor** setting.
- **Latched Cursor** used to draw the latched cursor.
- **Target Trace** used to draw the Target Trace.
- **Range of Tolerance** used to draw the range of tolerance assigned to the current Target Trace. Currently the range of tolerance is supported only for the X-Curve.

The items below are available only if the option **Full User Configurable Layout** is checked. Otherwise the computer's default settings are used for these items:

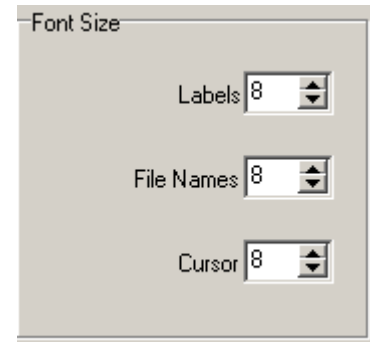
- **Window Background** used to draw the background of the areas outside of the trace display.
- **Window Font** used for labels outside of the trace display.
- **Selection Background** used to draw the background of selection fields and edit fields.
- **Selection Font** used to draw the strings in selection fields and edit fields.

Font Size

The Font Size area is located in the display setup window.

You can edit the size of some fonts here.

- **Labels** set the size of the labels used for the trace display.
- **File Names** set the size of the font used to show information inside the trace display, like the name of the overlay file.
- **Cursor** set the size of the font used to show information at the Cursor's intersection with the selected trace.

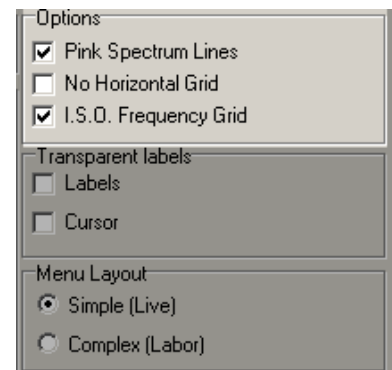


Setup Display Options

This area, which is located in the display setup window, contains three areas where you can set different options related to the display.

Options

- **Pink Spectrum Lines** shows grid lines falling with 3dB per octave in the FFT measurement. This is the same slope as the slope of pink noise. This lines might be helpful when you use the FFT as an RTA with pink noise signals.
- **No horizontal Grid** this setting is available only if the option Pink Spectrum lines is selected. It hides the horizontal lines, so that there are only the pink grid lines.
- **I. S. O. Frequency Grid** draw the vertical lines at the center frequencies of the **RTA** bands. Otherwise the lines are drawn at the borders between the RTA bands.



Transparent Labels

select transparency of the label's background.

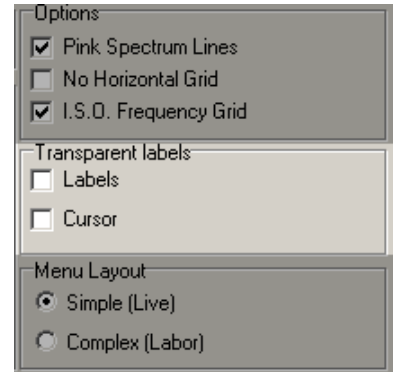


A transparent label does not cover the grid and the traces.



A solid label improves the readability.

- **Labels** activate the transparent background for the labels and file names in the trace display.
- **Cursor** activate the transparent background for the label at the cursor's intersection with the selected trace.

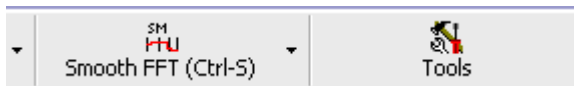


Menu Layout

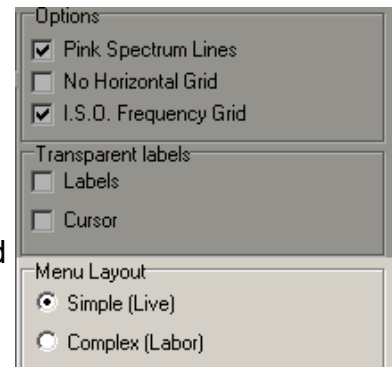
SATlive offers two different layouts for the menu bars.

You can select the layout you want to use here.

- Simple (live) is designed for the fast work on the road. Buttons are large, but there are not many functions directly assigned to them. A lot of functions can be found in the Tools menu.

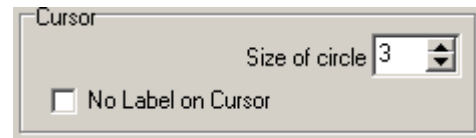


- Complex (lab) is designed for 'relaxed' working. A lot of functions can be accessed directly using smaller buttons.



Layout of the cursor's intersection with the selected trace

In this section you can configure the layout of the cursor.

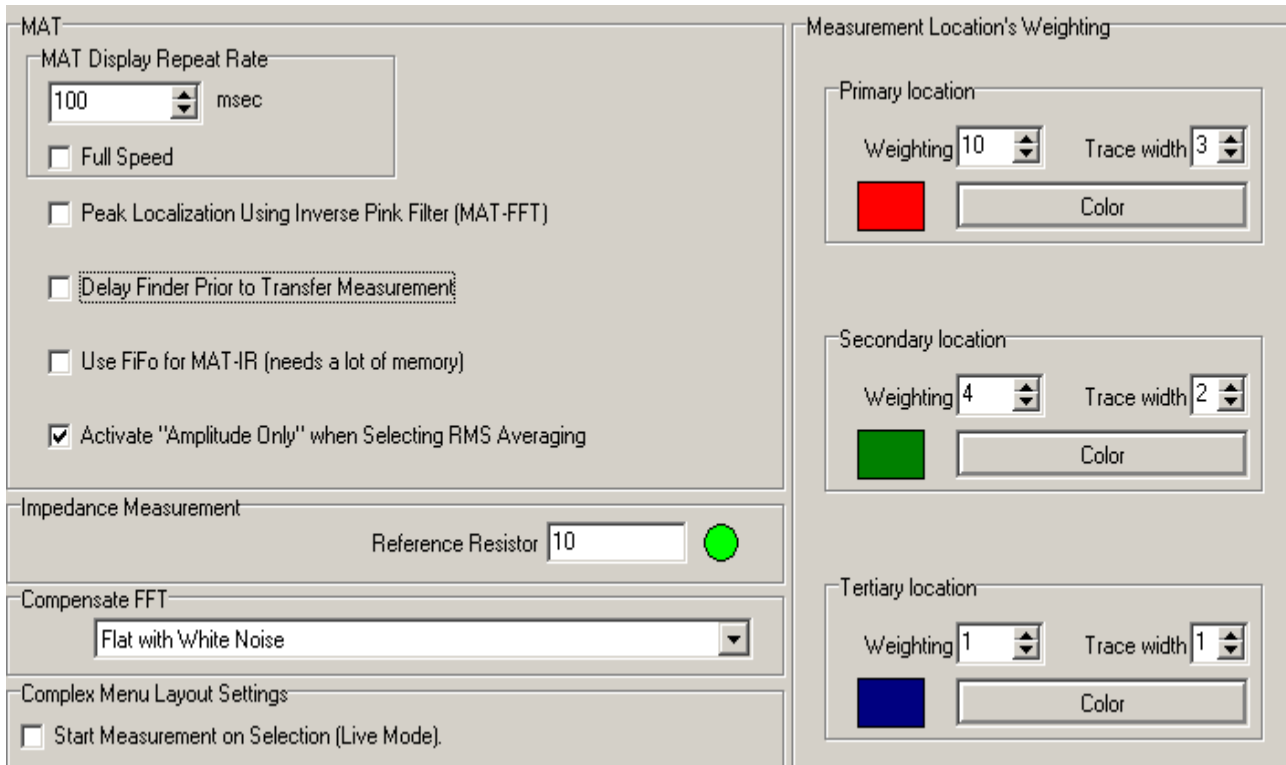


- **Size of Circle** set the diameter of the circle drawn at the intersection of the cursor with the selected trace. Use a setting of zero to hide the circle.
- **No label on cursor** no information is shown on the intersection of the cursor and the selected trace.

Hints:

- You can set the color of the cursor in the color area in the Display Setup.
- You can change the font size of the label shown at the cursor's intersection with the selected trace, which is also located in the Display Setup.
- Set the transparency of the background of the label at the cursor's intersection with the selected trace in the area options in the Display Setup.

Setup -> Measurement



MAT

MAT Display Repeat Rate: 100 msec

Full Speed

Peak Localization Using Inverse Pink Filter (MAT-FFT)

Delay Finder Prior to Transfer Measurement

Use FIFO for MAT-IR (needs a lot of memory)

Activate "Amplitude Only" when Selecting RMS Averaging

Impedance Measurement

Reference Resistor: 10

Compensate FFT

Flat with White Noise


Complex Menu Layout Settings

Start Measurement on Selection (Live Mode).

Measurement Location's Weighting


Primary location

Weighting: 10 Trace width: 3

 Color


Secondary location

Weighting: 4 Trace width: 2

 Color

Tertiary location

Weighting: 1 Trace width: 1

 Color

- **MAT display repeat rate** set the minimum time for updating the display in MAT module. A lower value means faster refresh of the display and higher processor load. This option affects only the FFT and the RTA measurement.
- **Full speed** perform the calculation and the display as fast as possible. This option will take all of the processor's power it could get. The influence of the averaging decreases because the same input data is used for more than one calculation. This setting affects the RTA, the FFT and the impulse response measurements in the MAT module.
- **Peak localization using inverse pink filter** the live trace is filtered by a 3dB/octave high pass filter prior to the **set cursor on peak function**, thus removing the influence of pink noise.
- **Delay Finder prior to Transfer Measurement** the delay-finder starts every time you invoke the transfer function measurement. See page 102 for details about the delay-finder.

- **Activate 'Amplitude only' when Selecting RMS Averaging** this option defines how SATlive reacts when you select the averaging mode RMS Averaging in the MAT module's transfer function measurement. If this option is active, then the display switches to the full amplitude display when you select the RMS Averaging in the layout area.
- **Reference resistor** edit the value of the reference resistor used for the impedance measurement.
- **Compensate FFT** select a correction applied to the FFT display. Flat on white noise shows the unchanged result, Flat on pink noise adds a 3dB/octave high-pass filter, so that the live trace acts like a narrow band RTA. The third option Sawtooth on pink noise is for compatibility with another measurement software.
- **Start Measurement on Selection (Live Mode)** in the simple menu layout a measurement in the impulse - response module starts immediately after the measurement is selected. Otherwise you have to start the measurement after the selection.
- **Measurement location's weighting** Set the weighting used for the traces for the averaging in the tracemanager. See the *tracemanager* section at the page 177 of this document for further details.

Setup -> Features

<p>Warnings</p> <input checked="" type="checkbox"/> Cal file misfit <input checked="" type="checkbox"/> Overwrite prompt <input checked="" type="checkbox"/> Calfile differences	<p>Global settings</p> <input type="checkbox"/> Quick delayfinder <input type="checkbox"/> Automatic averages reset <input checked="" type="checkbox"/> Auto linegap <input checked="" type="checkbox"/> Show system menubar <input type="checkbox"/> Fit FFT scale to trace <input checked="" type="checkbox"/> Display graph during averaging <input checked="" type="checkbox"/> Always show 0 dB line <input checked="" type="checkbox"/> Show MLS info	<p>Fileinfo</p> <input type="radio"/> Path and filename <input checked="" type="radio"/> Filename only <input type="radio"/> Remarks <input type="checkbox"/> Show name in tracedisplay <input checked="" type="checkbox"/> Show fileinfo when saving
<p>Display</p> <input checked="" type="checkbox"/> Static gap		
<p>Units</p> <input checked="" type="radio"/> ISO (m,°C) <input type="radio"/> USA (ft,°F)		
<p>Temperature</p> <input type="text" value="20"/> °C	<p>ASCII Save settings</p> <input type="text" value="80"/> Gain <input type="checkbox"/> Apply user offset	<p>Quality of JPEG conversion</p> <input type="text" value="100"/> %
<p>Languagefile</p> <input type="text" value="D:\Delphirun\Satlive\english.slf"/> <input type="button" value="Change"/>		<p>Start of program</p> <input type="text" value="Start using DualFFT (MAT)"/> <input checked="" type="checkbox"/> Enable other measurements

You can set a lot of options in this area. To cover all the options, this setting is explained in four sections on the following pages.

Setup -> Features, Section Warnings and Units

Use the warnings section to define SATlive's reaction when problems occur.

- **Cal File Misfit** inform me, if the calibration file cannot be applied to the current data (not the same samplerate or fft size).
- **Overwrite Prompt** prompts for confirmation if I try to overwrite an existing file.
- **Calfile differences** inform me if the parameters for the calibration data are not the same as for the current trace, but the main parameters fit, so the calibration could be used but might give wrong results.



The screenshot shows a settings dialog box with three sections:

- Warnings:** Contains three checked checkboxes: "Cal file misfit", "Overwrite prompt", and "Calfile differences".
- Display:** Contains one unchecked checkbox: "Static gap".
- Units:** Contains two radio buttons: "ISO (m,°C)" (selected) and "USA (ft,°F)".



The **Display** section contains only one option.

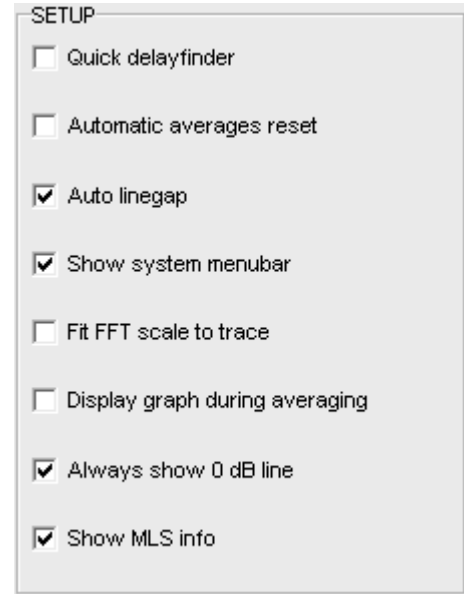
- **Static gap** disables the automatic setting of the gap between two vertical grids.

In the **Units** section select the display units for distance and temperature.

- **ISO** ISO units will be used (Meter and degree centigrade).
- **USA** US units will be used (feet and degree Fahrenheit).

Setup->Features Section Setup

- **Quick delay finder** link the impulse - response module **Set Cursor On Peak** function with the **Latch Cursor** function at the first execution and with the **Show difference** function on all the following executions of the **Set Cursor On Peak** function.
- **Automatic averages reset** reset the amount of averages to perform in the impulse - response module to one after a measurement has been performed.
- **Auto Linegap** readjust the grid line's gap in the FFT and MAT module's display when other parameters change. This option is also located at the Line Gap setting's pop-up menu.
- **Show System Menu bar** show the window header, allowing you to move and re-size the main window of SATlive. Otherwise the main window of SATlive runs in full screen mode and might cover the task bar.
- **Fit FFT scale to trace** execute the Full Trace Display function every time new data is displayed in the FFT display.
- **Display Graph during averaging** updates the trace display of the impulse - response module after every measurement, when more than one average is performed. Otherwise the display is updated only after all averages have been performed. This option is only available if the **Enable Time Sync-check** option is enabled at  **Setup** ->  **Advanced Sampling**.
- **Always show 0dB line** always display the zero dB line if it is in the displayed range.
- **Show impulse response Info** display information about the peak's position in the current impulse response in the FFT display.





Setup -> Features Section Fileinfo

Select the kind of information that SATlive displays about the active overlay, calibration or mic - correction data.

- **Path and Filename** the whole path including filename is shown. For example:
C:\SATMessung\Musikvereinsaal\Front of stage left.sld.
- **Filename only** the filename is shown without its path. For example: *Front of stage left.sld*
- **Remarks** the file's description is shown. For example: *Nine feet left of sidefill, on ear level.*
- **Show Name in Tracedisplay** if a filename is assigned to the live trace, then it will be displayed in the trace display window.
- **Show Fileinfo when saving** open the file's description window prior to saving the trace. This allows you to edit trace's description before saving it to a file.




Hint:

- You can edit the font size of the information's display in the  **Setup** ->  **Display** window.

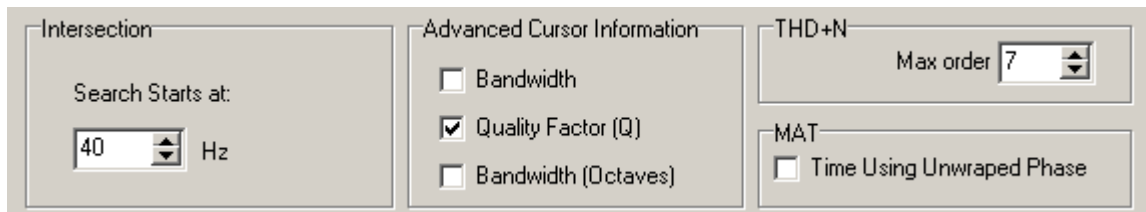
Setup -> Features ASCII, Jpeg Quality, Temperature, Language

Temperature <input type="text" value="20"/> °C	ASCII Save settings <input type="text" value="80"/> Gain <input type="checkbox"/> Apply user offset	Quality of JPEG conversion <input type="text" value="100"/> %
Languagefile D:\Delphirun\Satlive\english.sllf <input type="button" value="Change"/>		Start of program <input type="text" value="Start using DualFFT (MAT)"/> <input checked="" type="checkbox"/> Enable other measurements

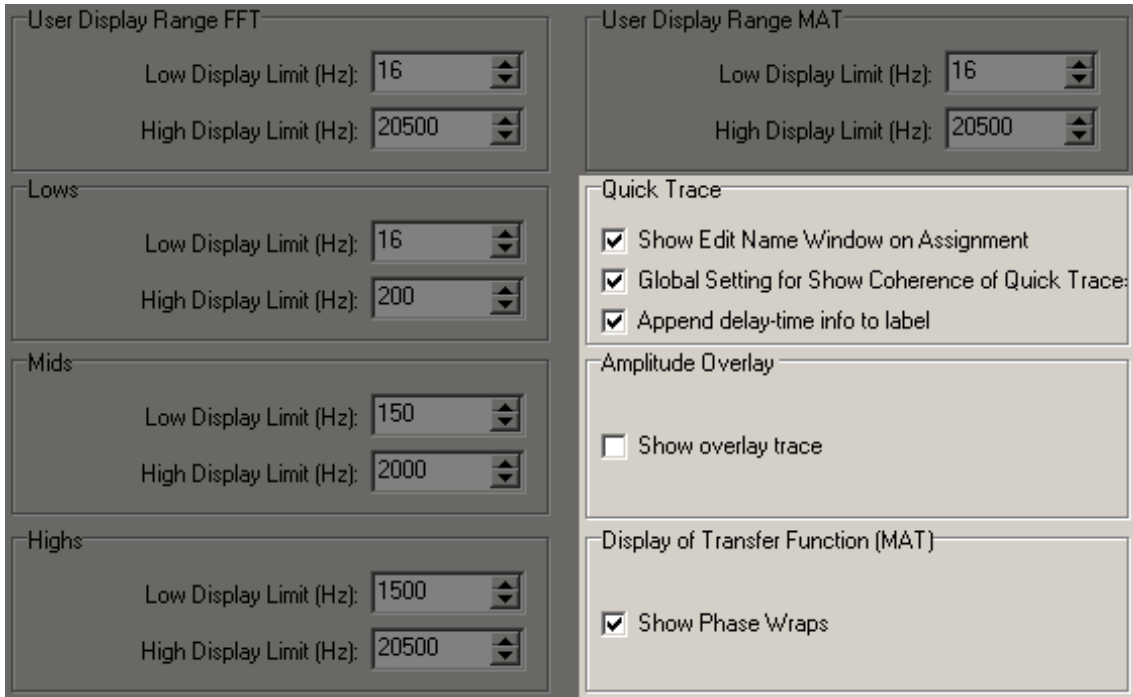
- **Temperature** set the temperature value used to convert the delay time into distance and for the wavelength calculation.
- **ASCII Save settings** add an offset if a trace is saved as an ASCII file. You can edit the amount of offset to add. Activate the offset by checking the **Apply User Offset option**.
- Quality of JPEG conversation set the quality of the conversation used for the  **Save trace as picture option**.
- **Language file** select a language file for SATlive. See page 16 for details.
- **Start of program** select the module which is invoked at the start of SATlive and every time you leave the setup section.
- **Enable other measurements** if a module is selected at Start of program, then you can disable the other modules by disabling this option.

Setup -> Post Process

The description of this setup window is divided in three parts.



- **Advanced Cursor Information** select the value(s) to show for the result of the Advanced Cursor Information.
- **THD+N max Order** set the highest order of harmonics used for the calculation of THD+N in MAT module's FFT measurement. The THD-N can only use frequencies below the Nyquist's frequency. See page 95 for details about THD measurement.
- **Time Using Unwrapped phase** show the calculated unwrapped phase values in the cursor detail window in the right menu bar. Otherwise the phase value will range from -180° to $+180^\circ$.

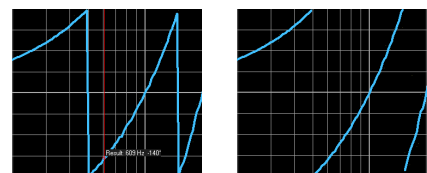


- If the **Show Edit Name Window** on Assignment entry is selected, then the Rename function is called each time you assign the live trace to a Quick Trace, otherwise a default name is assigned to the quick trace, which can be edited in the pop-up menu of the quick trace.
- **Global Setting for Show Coherence of Quick Traces.** If this option is selected then you can control the visibility of the coherence traces of the Quick Traces using the entry **Show single Trace's coherence** in the Settings and Tools sub-menu of the pop-up menu of the Σ sum-trace. Otherwise you can activate the visibility of the coherence for each particular Quick Trace in its pop-up menu.




- **Append delay-info to label** if this option is selected then the delay used to create the particular quick trace is shown after its name. See page 219 for details about quick traces.



- Use the **Show overlay trace** setting to enable the overlay functionality. See page 65 for information about the overlay-trace display.
- Select the **Show Phase Wraps** setting if you want SATlive to draw a connection when the phase wraps in the display.



<p>User Display Range FFT</p> <p>Low Display Limit (Hz): 16</p> <p>High Display Limit (Hz): 20500</p>	<p>User Display Range MAT</p> <p>Low Display Limit (Hz): 16</p> <p>High Display Limit (Hz): 20500</p>
<p>Lows</p> <p>Low Display Limit (Hz): 16</p> <p>High Display Limit (Hz): 200</p>	<p>Quick Trace</p> <p><input type="checkbox"/> Show Edit Name Window on Assignment</p> <p><input type="checkbox"/> Global Setting for Show Coherence of Quick Trace:</p>
<p>Mids</p> <p>Low Display Limit (Hz): 150</p> <p>High Display Limit (Hz): 2000</p>	<p>Amplitude Overlay</p> <p><input type="checkbox"/> Show overlay trace</p>
<p>Highs</p> <p>Low Display Limit (Hz): 1500</p> <p>High Display Limit (Hz): 20500</p>	<p>Display of Transfer Function (MAT)</p> <p><input checked="" type="checkbox"/> Show Phase Wraps</p>

- Set the display ranges for the different range menu options.
- The  user display range can have different values for the use in the MAT module and for the use in the FFT module.
- You can assign the current display range to user display range using the  **Assign current Range** function in the  display-range menu in the FFT module or in the MAT module. See page 68 for details about the display-range menu.

Setup → Advanced Sampling

Time Synchronization

If you want to average some impulse response measurements for a better result, then it is very important that the measurements are exactly aligned in time. Even a very small difference in the peak's position will destruct the result, creating comb-filter like results.

The Time Synchronization feature helps you to keep your measured impulse responses in perfectly synchronized.

SATlive remembers the peak's position of the previous measurement, and compares it to the current measurement peak's location.

If the positions match, then the averaging is performed.

Otherwise the procedure depends on the settings in the **Advanced Sampling** window.

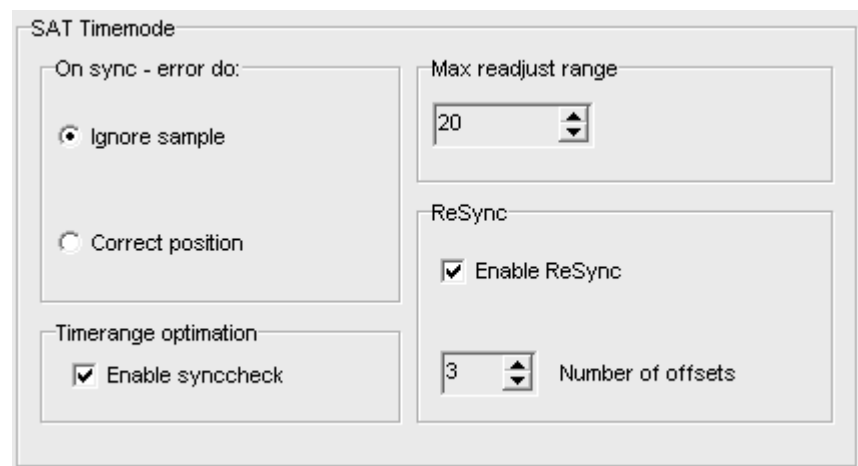
- If the **Ignore sample** option is selected, then the current measurement is discarded.
- If the **correct position** option is selected, then the current measurement is shifted in time to align the peak's positions. This is done only if the offset between both peaks is smaller than the **max readjust range** value. If the offset is larger than the max readjust range then the current measurement is discarded.
- This function assumes that the first measurement is perfectly time aligned. To deal with that problem, you can enable the **ReSync** option.

If **ReSync** is enabled, then SATlive discards the first measurement if the same offset occurs for given times, set by the Number of Offsets setting.

The settings affect the impulse-response module only.

This setup can be accessed via the extended setup window only.

Use the shortcut **Ctrl - Alt - S** to open the extended setup window.



- **On Sync Error do** select how SATlive reacts, if the current measurement's peak position is not the same as prior measurement's peak position.
 - **Ignore Sample** discards the current measurement.
 - **Correct Position** shifts the current measurement in time, if the distance of the two peak positions is less or equal to value of the Max Readjust Range. Otherwise the current measurement is discarded.
- **Time Range Optimization** enable the checking of the peak's position during averaged measurements in the impulse - response module.
- **Max Readjust Range** set the maximum offset accepted for the **Correct Position** option of the **On Sync Error Do** setting.
- **ReSync** the Time Range Optimization checks for the synchronization of the peak in the measurements averaged. It compares the peak's position in the current trace to the peak's position in prior trace(s). Therefore it assumes that the first measurement has a correct timing. If the **Resync** option is enabled and the same offset is detected for the selected times, then the new peak's position is taken as new reference and all the prior measurements are discarded.
- **Offset in time** correct a time offset between the left and right input channel. Use this setting, if the peak of an impulse - response measurement is not at zero time when the output is linked to the input directly (cable measurement).
- **No Overlapping Samples** wait for all new data after completing a calculation. Otherwise a new calculation is started immediately.

Setup -> Internal Configuration

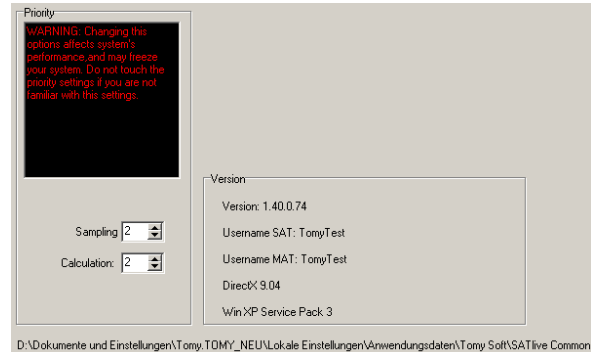
This setup can be accessed via the extended setup window only.

Use the shortcut **Ctrl - Alt - S** to open the extended setup window.

- **Priority** changes the priority of the different tasks in SATlive. Windows assigns processor calculation power and time depending on priority. Changing these settings influences performance of your computer system. Be careful when changing these settings. You must restart SATlive to activate the changed priority settings.
- **Version** Information about current versions on your PC.
 - **Version** detailed file version of SATlive.
 - **Username SAT** the name of the registered user of MLS module. Dongle indicates that a valid dongle was found.
 - **Username MAT** the name of the registered user of MAT module. Dongle indicates that a valid dongle was found.
- **DirectX** shows the current version of DirectX® installed on your computer.
- **Win** operating system's description.
- **Folder** on the bottom you can see the path to the folder where the current settings will be stored. To explore the folder, just click on the path.

Hints:

- You can use the shortcut **Ctrl - Alt - F** browse the folder containing the current settings without the need to open this setup window.
- You can use the shortcut **Ctrl - Alt - U** to show the user information window without the need to enter this setup window.
- You can use the shortcut **Ctrl - Alt - V** to show a version information window without the need to enter this setup window.



Clock Settings

Clock Mode:

16:48

- **System time only** shows only the system's time (PC's clock)

16:40 00:59:48
Down to: 17:40

- **Count Down** start a countdown to the time set at Countdown Time. If the target time is reached, the mode is changed to count up from now with the target time as reference time.


16:40 00:00:03
Up from: 16:40

- **Count up from now** set the time display to zero when you close the window, and starts counting up.
- **No clock display hides** the whole clock.

Countdown Time

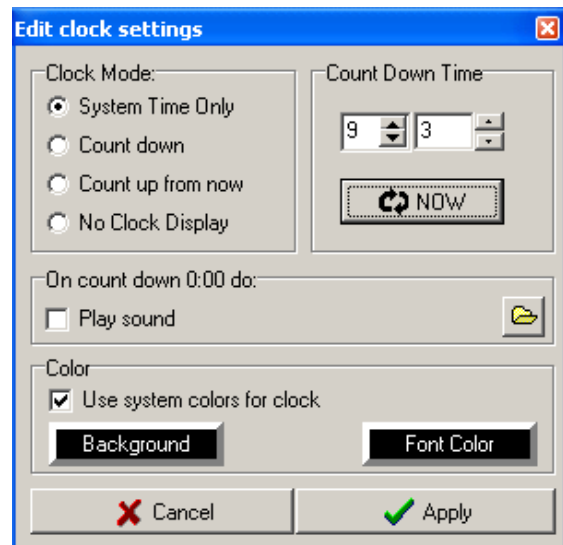
- **Time** set the countdown target time (count down mode) or the count up reference time (count up mode).
- **Now** assign the current time to the target time display.

On count down 0:00 do

- **Play Sound** if the target time is reached in the count down mode then a sound file is played. Use the function  to select the sound file to play. Please note that larger files may take some time to load and therefore a slight delay might occur until the playback starts after the count down reaches 0:00.

Hint:

- The background of the counter starts flashing during an interval of 120 seconds around the target time. The flash frequency is as higher as closer the current time is to the target time.



Color

- **Use system colors for clock** use the menu colors defined by windows. In this case the clock display uses the same colors as the other menu bars.
- **Background** allow the user to select the background color for the system clock display, which might be different from system's background setting. This setting is applied only if the Use system colors for clock option is not selected. The current selection of background and font color is applied to the Background and the Font Color button, independent of the **Use system colors for clock** setting.
- **Font Color** allow you to select the color of the font used by the system clock display, which is might be different from system's font color setting. This setting is applied only if the Use system colors for clock option is not selected. The current selection of the background and the font color is applied to the Background and Font Color buttons, independent of the **Use system colors for clock** setting.

Hint:

- These settings affect the system clock area only. The count up/down area uses fixed colors, which are green for the count down mode and yellow for the count up mode.

Global

- **Cancel** close the setup window and discard all changes.
- **OK** close the setup window and apply changes.

Hints:

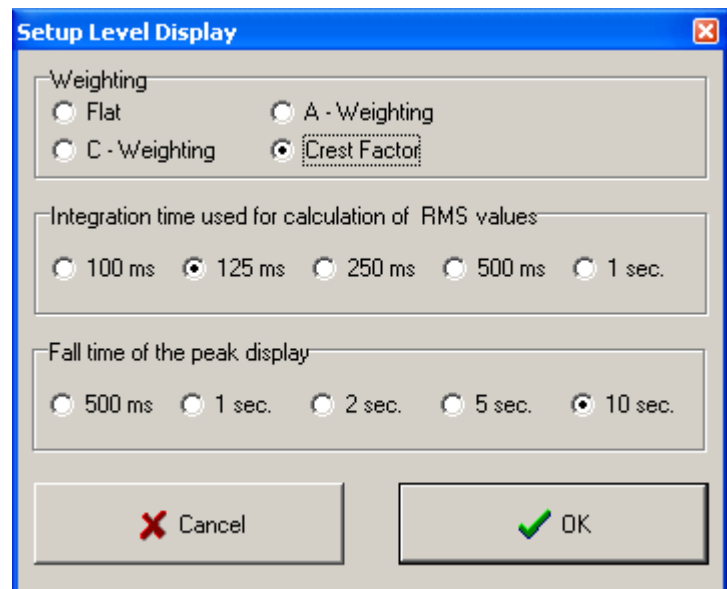
- The settings for the **Countdown Time** and for the **on countdown 0:00 do** option are used only if the **Count down mode** is selected in the Clock Mode setting.
- You cannot set the system time using SATlive. Please use the windows(R) functions to set the system time.

Setup Level Display

You can set the parameters of the level display, which is located at the top of the VU meter in this setup.

To open the setup window simply click on the level display area above the VU Meter.

- The top area contains the selection of the weighting filter to be used for the level display. You can select an **A** or **C** weighting or disable the



weighting using the **Flat** setting. Furthermore you can set the mode of the level display to **Crest Factor**. In this case the level display shows the crest factor, which is the difference between the peak level and the rms level. The crest factor is an indicator of the dynamic of the signal.

- The middle area contains the selection of the averaging time used for the display. A higher value results in a smoother display.
- The lower area contains the setting of the VU meter's fall time for the peak value.
- Use the button **OK** to close the window and to apply the changes.
- The button **CANCEL** closes the window and discards the changes.






Hints:

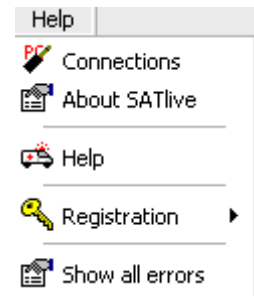
- You need to perform a level calibration to get correct values in the display.
- The settings for the weighting filter and for the averaging time are used for the level display only. You can apply a weighting filter on the mic input in the MAT module using the weighting setting in the bottom menu bar. the weighting filter section for more details on weighting filters.

Menu Help


The menu  **Help** is located in the upper menu bar.

It contains the following options:

-  **Connections** show information about the connections needed for the measurement.
-  **About SATlive** show some information about the current version and the current user.
-  **Help** show the help file.
-  **Registration** open the registration menu. This topic is not shown if a valid dongle is detected.
-  **Show all Errors** shows the error-report window.

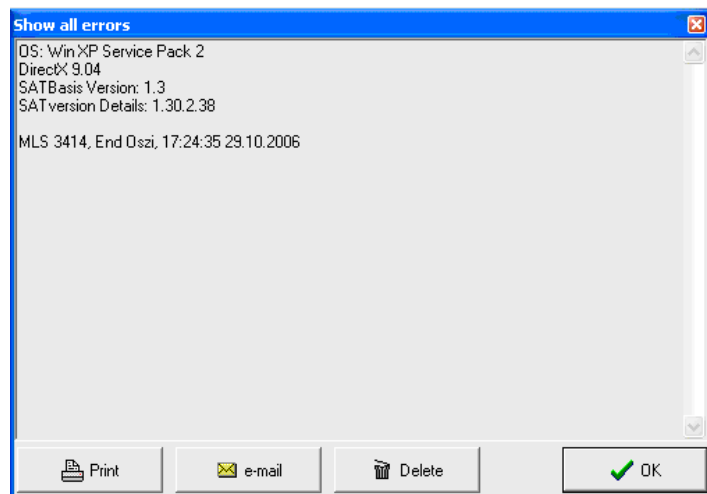






Error-report window

You can open the error-report window using the **Show all Errors** function in the  **Help** menu.

At the top to the error-report window you find some information about your system.

Below of this information you can find the error message(s), which contain a short description and the date and time the error occurred.



-  **Print** send the error report to your printer.
-  **E-mail** create an e-mail containing the error-report. Send this e-mail to SATinfo@take-sat.de.
-  **Delete** removes all entries from the error list.
-  **OK** close the error-report window.



Hints:

- If there is a new entry in the error log then SATlive shows a remainder on next start of SATlive.
- Any error report sent to us may improve the next version of SATlive. So please support us by mailing the error report to us.
- **SATlive** features a second error reporting tool, which looks a little like the windows error report tool. The error information is sent to us and helps us to improve SATlive.

Registration menu



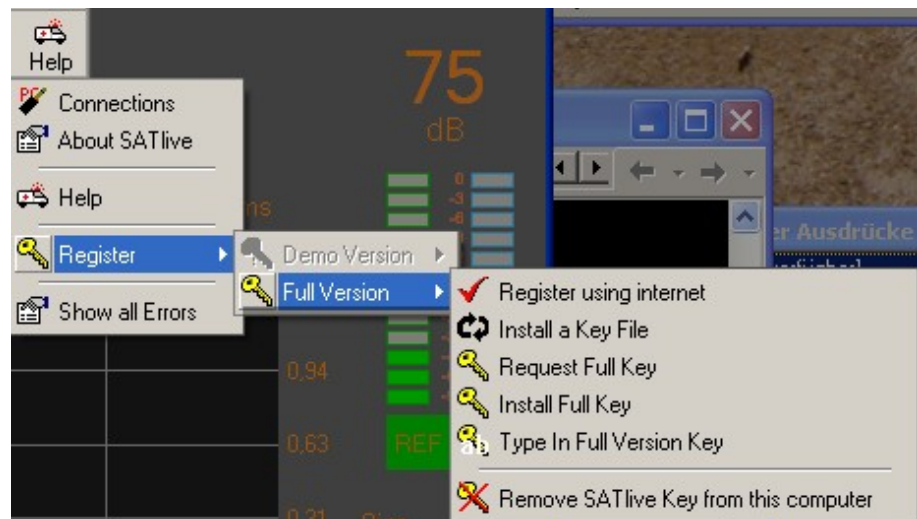
The registration menu is a sub-menu of the menu  **Help** menu.



-  **Demo version** invoke a sub menu which contains the **Request Demokey** and the **Enable Demo** entry.
-  **Full version** opens the Full Version sub menu.

Hints:

- The different options are enabled according to the current state of your registration.
- This menu is not shown if SATlive detects a valid dongle.

Full version menu



This menu is a sub-menu of the  registration menu. The registration menu is a sub menu of the  help menu. It contains the steps needed to complete a registration of the full version

Register using internet

Takes you to the order page of *shareIt* where you can order your SATlive license.

Hints:

- ShareIt supports ordering via a fax and money transfer if you don't trust the internet.
- There are two types of license available. For details please check the SATlive website. [Http://www.take-sat.de/english/order.php](http://www.take-sat.de/english/order.php)

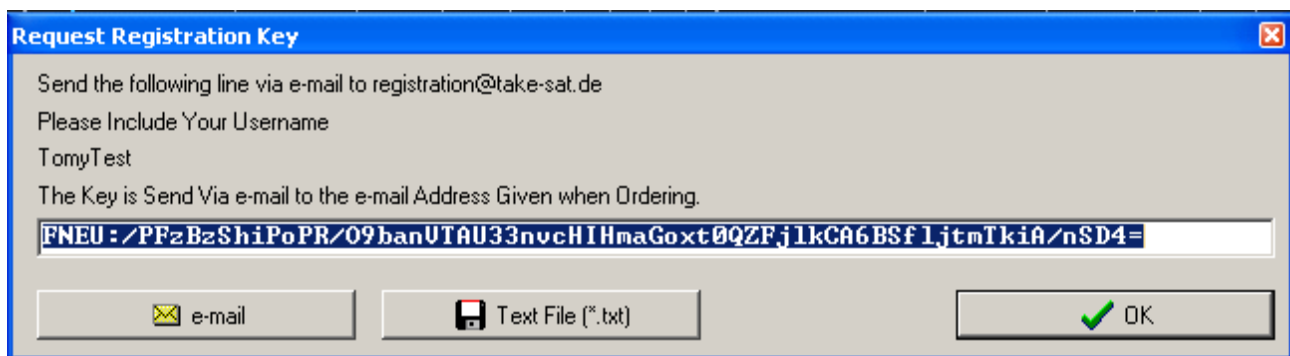
Install a keyfile


After purchasing a PC related licence you'll get four key files. Save them to your computer and use the *Install Keyfile* function to activate them. Keep the key files in a safe place. They give you 10 days of unlimited access to **SATlive** even if you totally rebuild your system. Use the install a key-file function to install a *.DKF file. The other files are needed for older versions of SATlive only.

Request Full Key

This option opens the request registration key window.

After installing the key files you get ten days to complete your registration.



This will personalize the software to your computer. To do so, you need to request a full key by sending the full-version basic-key displayed in this window via e-mail to Registration@take-sat.de. You can either copy and paste the full - version basic - key in an e-mail or just click on the  **e-mail** button and let SATlive create the e-mail for you. You can also use the **Text File** button to save the information into a text file, which could be easily transferred to another computer, if the current PC does not have the possibility to sent e-mails.

Hint:

- If you choose the e-mail option, SATlive will invoke the e-mail client on your computer and create the e-mail there. You need to send the creates e-mail by yourself.

Install full key

In return to your full key request you'll get a small key file. To complete the registration, just save that file to your hard disk and select it using this function.

Type in full version key


Use this function if you're facing a problem during the activation of the full version key. If you need to perform the installation by hand, you need to perform the following steps:

- Change the extension of the key file to .TXT instead of RXR.
- Open the file using a text-editor software.
- Copy the string into the clipboard.
- Open the **Type in Full Version Key** window.
- Paste it into the input area in this window.
- Click on **OK**.

Remove SATlive Key from this computer

Use this option if you want to move your PC related license to another computer. After performing this function SATlive will not longer run on this computer! This function creates a code, which is needed for the license for the new computer. The code is saved to a file called SATLiz.txt in the folder My Documents. Keep this file in a safe place.

Hints:

- The full version key is valid only on the computer where the full version basic key was created.
- Please use the  **e-mail** option or at least copy & paste to avoid typos.
- Please allow some time for handling your key requests and orders, especial if you're using wire transfer from abroad.
- You do not need to perform any of these functions if you're using a dongle type license.

Signal generator

the signal generator is located at the lower right of the SATlive window. It features different types of signals and access to the windows mixers and level control.

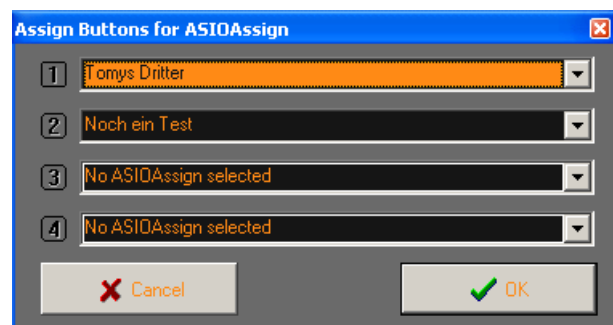
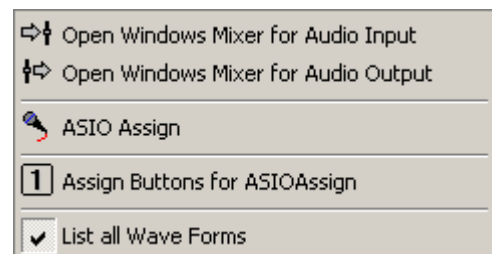
Furthermore it contains four buttons, which can be assigned to different ASIO-Assign routings, to allow quick recall of predefined routing when a ASIO I/O device driver is used. The buttons are visible only if an ASIO - device driver is selected in the **Setup** → **I/O Devices** window.



The pop-up menu of the signal-generator area

This pop-up menu is assigned to the signal-generator window at the lower right of the SATlive window.

- ⇌ **Open Windows Mixer for Audio Input** invokes the windows mixer assigned to the selected audio - in driver. This function is not enabled during a MLS measurement in the impulse - response module.
- ⇌ **Open Windows Mixer for Audio Output** invokes the windows audio output mixer assigned to the selected audio - out driver.
- 🔍 **ASIO Assign** open the ASIO Assign selection window. For details see the *Select ASIO Assign routing* section of this document. This function is available only if more than one ASIO Assign is defined for the currently used ASIO I/O device.
- Assign Buttons for ASIO Assign** opens an editor window where you can assign an ASIO - Assign routing to the buttons in the signal-generator area. Select the desired routing from the selection right of the button.
- List all Wave Forms** enables the selection of all available wave forms for the output signal. Otherwise only the most common signals (pink noise, white noise, sweep and 1kHz sine wave) are selectable.



Set the output level


This setting is located in the signal generator area.

It controls the of the output signal.

The values shown are attenuation values, i.e. the hottest output is reached at a setting of 0 and -80 mutes the output. The level settings pop-up menu contains some preset level values.



Hints:

- Any change in the device I/O setup can cause large differences in the output level. Therefore reduce the output level when you change any audio related setting.
- The output's value can be affected by the settings in the windows output mixer. You can access the windows output mixer using the  **Invoke windows output mixer** function in the pop-up of the signal generator area.
- The attenuation is shown in dB values.
- On the first start the level is reduced to -60dB.

Frequency

This setting is located in the signal generator area and shown only if the current output signal supports different frequencies. This is true for the wave forms **Sin var**, **Rectangle**, **Triangle**, **Sawtooth +** and **Sawtooth -**. Set the frequency of the output signal. The arrows on the right increase/decrease the frequency in steps of 1 Hz, the left arrows in larger steps, depending on currently selected frequency.



Hint:

- Some frequency presets are available in the pop-up menu of the setting.

Output signal

This selection is located in the signal generator area.

Select the output signal from the list.

- **White:** MLS noise with a white spectrum.
- **Pink:** MLS noise with a pink spectrum.
- **Pink Noise < 200 Hz:** Pink noise with a low pass filter at 200 Hz.
This wave form is listed only if the option **list all output signals** is enabled in the pop-up menu of the signal-generator area.
- **Sin 1khz:** Sine wave with a fixed frequency of 1 kHz.
- **Sin var:** Sine wave with a variable frequency. This wave form is listed only if the option **list all output signals** is enabled in the pop-up menu of the signal-generator area.
- **Sweep:** Swept sine with variable parameters.
- **Rectangle:** a rectangle shaped wave form with variable frequency.
This wave form is listed only if the option **list all output signals** is enabled.
- **Triangle:** a triangle shaped wave form with variable frequency. This wave form is listed only if the option **list all output signals** is enabled in the pop-up menu of the signal-generator area.
- **Sawtooth +:** an increasing sawtooth shaped wave form with variable frequency. This wave form is listed only if the option **list all output signals** is enabled in the pop-up menu of the signal-generator area.
- **Sawtooth -:** a decreasing sawtooth shaped wave form with variable frequency. This wave form is listed only if the option **list all output signals** is enabled in the pop-up menu of the signal-generator area.




Hints:

- You could not change the type of output signal during a MLS measurement in the impulse - response module.
- Different wave forms contain a different amount of energy. Therefore reduce the volume setting before you select another wave form.

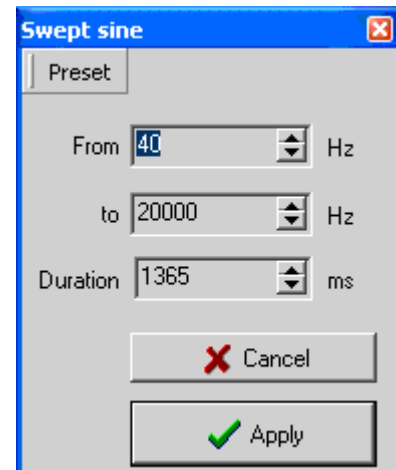
Swept sine (Sweep)

The swept sine is an output signal whose frequency increases continuously covering a given frequency range.

Select the swept sine signal in the signal generator's window from the output signal selection. To change the settings open the setup window by clicking on the  **Sweep** button.



- **Presets** assigns the current settings to a preset or recall settings from a preset
- **Start** the frequency at the start of swept sine
- **Stop** the frequency at the end of swept sine
- **Duration** the time in milliseconds used for one complete sequence
- **Apply** saves the changes and close the window
- **Cancel** discards the changes and close the window




Hint:

These settings do not affect the swept sine used for the sweep measurements in the impulse - response module.

Sweep Presets

In the swept sine setup window of the signal generator you can assign the current settings of the sweep signal to one of the four presets, or you can recall one of the presets. This enables you to change the settings quickly.

To invoke a preset just select it from the pop-up menu available when you click on the Preset button at the top of the sweep setup window.

To save the current settings into a preset, select the preset in which you want to store the settings in the sub menu of the  **Save as preset** menu entry in the pop-up menu of the Preset button at the top of the sweep setup window.

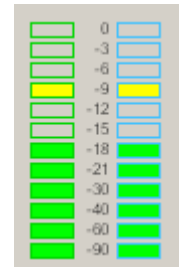
VU Meter

The VU Meter is located in upper right area of the SATlive window.

It shows the levels of both inputs.

The bargraph display shows the input levels related to digital full-scale.

The peak level is indicated by a single line, and the RMS value is shown as a solid bar.



Hints:

- You can use any signal, either external or from the internal signal generator to adjust the input level.
- The input level is adjusted in the windows recording mixer, which can be accessed using the **Open Windows Mixer for Input** function in the pop-up menu of the signal-generator area.
- In the MAT module you can select the input for display by clicking on the labels below the bargraph display.
- You can set the fall back time of the peak display in the **Setup Level Display** window.
- Avoid clipping the input to assure good quality of the results.



Start the output signal

This function is located in the signal generator area.

It is located right of the output level setting.

It's label shows the current state of the signal generator.



-  The output is muted. Click on the label to start the output signal.
-  The signal generator puts the selected signal out. Click on the label to mute the output signal.

Hints:

- You could not mute the output during a MLS measurement.
- You can also use the shortcut **G** to mute/unmute the output.
- All measurements in the impulse - response module mute/unmute the output. You can disable this behavior for the MIR measurement in the measurement's setup.

Level Display

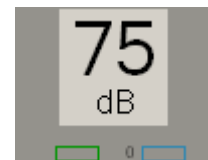
The level display is located at the top of the VU Meter.

It shows the average level (RMS) of the mic input. You can set the time used for averaging in the Level Display's setup window.

You can use a Weighting Filter for this display. The selection of the weighting filter is in the Level Display's setup window. The currently selected Weighting Filter is indicated by a letter in the label shown below the number.

Furthermore the display can show the crest factor of the signal applied to the mic input.

- **dB(A)** the Weighting Filter A is currently selected.
- **dB(C)** the Weighting Filter C is currently selected.
- **dB(Crest)** the result shows the crest factor, which is the difference between peak and rms level.
- **dB** no Weighting Filter is currently used.




You can open the Level Display setup window by clicking on the Level Display.

In order to get correct values, you need to calibrate the level.

The Tracemanager

You can use the tracemanager to display and average saved Smooth FFT traces.





Invoke the Tracemanager either by clicking on the **Tracemanager**  button or use the shortcut **Ctrl-T**.

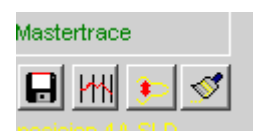
Single traces

The upper part contains eight similar windows. Every window handles one saved trace.







Functions for any of the eight loaded traces:

-  **Load Trace** open a saved smooth FFT file. Only frequency response traces are supported by the tracemanager. The trace name display's pop-up menu contains a list of the most recent used files, where you can pick a file with a double click.
-  **Show Trace** displays the loaded trace. This option is enabled only if a valid trace is loaded.
- **+** **Average Trace to master trace** average the loaded trace to the master trace using the selected weighting. This function is enabled only if a trace is loaded and the loaded trace has the same samplerate as the master trace.
-  **Offset, Smoothing, Color** open a window containing additional settings.
-  **Info** show information about the trace including the possibility to edit the trace's description.
- Weighting the colored field right of file name display shows the currently selected weighting of the trace. Toggle the three different weightings with a mouse-click on this field. The trace width used for the display of the trace is changed according to the selected weighting and the trace width assigned to this setting.





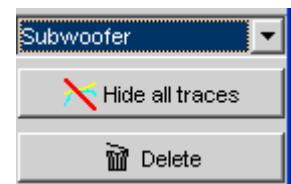
Mastertrace

The master trace is the result of the averaged traces.

-  **Save** the master trace as save the master trace to a file.
-  **Show** the mastertrace display the master trace.
-  **Color** of the master trace.
-  **Invert** the master trace mirror the mastertrace's display on the 0 dB line to ease the adjustment of equalizers.



Lower area of the tracemanager

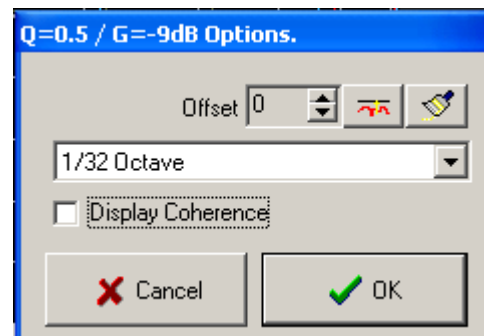
- Select a speaker from the current project. If a valid speaker is selected, then the eight traces of this speaker are assigned to the trace manager's traces.
- The function  **Hide all Traces** sets the visibility of all traces related to the tracemanager, to false.
- The function  **Delete** removes all traces from the tracemanager.



Offset, Color and Smoothing

This window contains more settings for the traces displayed using the tracemanager.

- **Offset** move the current trace up or down.
-  **Relate to master trace** center the current trace around the mastertrace. This eases the comparison of traces measured with different signal levels.
-  **Color** change the color used to display this trace.
- **Smoothing** select the smoothing of the current trace.
- **Display Coherence** this setting is enabled only if the trace contains coherence information. This is true only for traces saved in the Transfer Function measurement in the MAT module. This option determines if the coherence trace related to this trace is shown or not.





Hints:

- The changes are displayed in real-time if the trace is displayed in the tracemanager.
- If you exit this window using the **Cancel** button then all **changes will be lost**, and the display switches back to the old settings. To keep the changes, exit this window using the **OK** button.

Weighting and averaging

The tracemanager enables you to average up to eight traces using different weightings.

There are three levels of weighting available. You can edit the parameter for the weighting at  Setup ->  Measurement.

If different traces are averaged in the tracemanager they are weighted according to assigned levels of weighting.

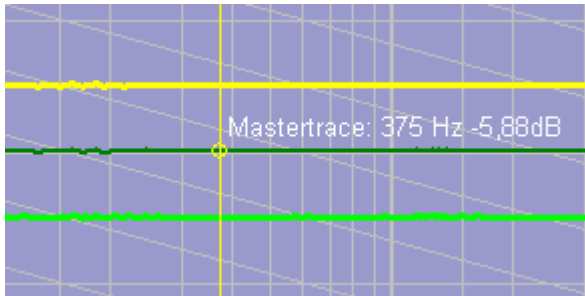
Example

Averaging of two traces using the following levels of weighting:

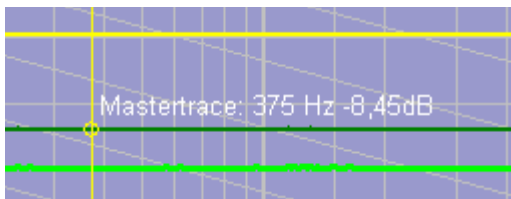
Primary location: 10

Secondary location: 4

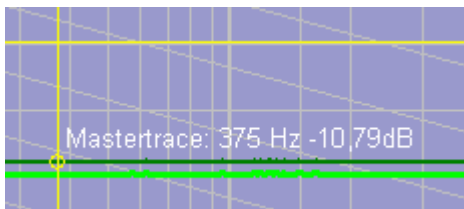
Tertiary location: 1



Both traces with the same level (primary).



One trace primary, other secondary.



One trace primary, other tertiary.

Using Averaging

The proper selection of the mic's locations for measurement has a great influence on the measurement's result.

You can take the following as a rule of thumb:

- One primary location for every speaker, located on axis in speaker's direct sound range.
- Additionally one or more secondary locations in direct sound range, but off axis.
- Tertiary locations are used to check for coverage or interaction with other speakers.
- The creation of the master trace for setting the EQ should be based mainly on the primary location. Secondary locations are used to check if a peak or dip is a result of the mic's location, or a common problem in the whole coverage area.
- Tertiary location are mainly used for special tasks like delay alignment or level adjustment, but normally not as a base for the adjustment of the equalizer.

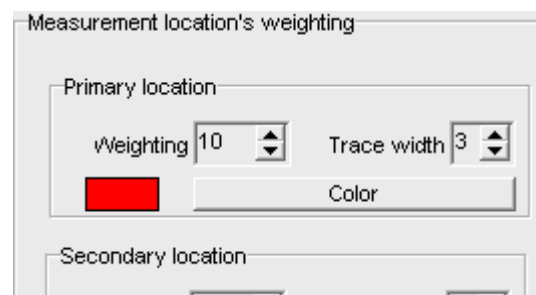
Setup Weighting

These settings are located in the  **Setup** -> 

Measurement window.

Set the parameters for three levels of weighting for traces averaged in the tracemanager.

- **The Names** of the three levels are given by the software. Levels are labeled primary location, secondary location and tertiary location.
- **Weighting** set how much the trace influences the result. As higher the value, as higher the influence.
- **Trace Width** select the width used to display a trace with this weighting.
- **Color** set the color used for the weighting indicator in the tracemanager. See the tracemanager section starting at the page 177 for further details.



Smooth FFT

The Smooth FFT is a special algorithm to calculate the frequency response from an impulse response whose result is closer to human hearing than the result of a default FFT.

Basic considerations

The human ear (or to be more exact, the human brain) analyzes the received sound using special criteria.

The part of sound received first is treated as utilizable and used to locate the sound's source. (Haas Effect, Rule of first wavefront).

The sound which is received later is treated as interference and masked.

A normal RTA based measurement treats all the energy reaching the measurement mic in the same way, therefore you can call it 'time blind'.

For the simple FFT calculation a certain range of the impulse response is selected (windowing) and analyzed, thus masking unwanted parts of the impulse response.

But in human hearing the border between 'good' and 'bad' sound is frequency depended and ranges from a few milliseconds at high frequencies up to more than half a second at low frequencies so that applying just one window for all frequencies will match ear's recognition of sound only in a small range of frequency.

Theory of the Smooth FFT

To be closer to the human hearing, the frequency range is divided into nine frequency bands. Each band features its own window size, FFT resolution and FFT. After performing those nine FFT - calculations, the results are combined to one single trace.

The windowing applied by the user sets the maximum window size used for the smooth FFT windows. This means that the shorter of both (user window and smooth FFT window) sizes is used for the windowing.

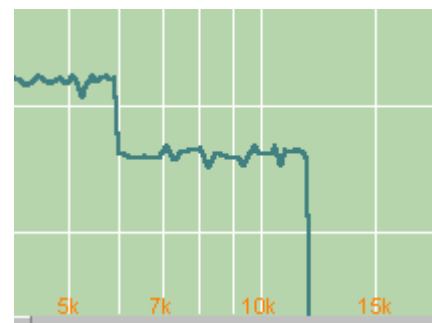
On a samplerate of 48 kSamples/sec the Smooth FFT uses the following parameters:

Start	End	Size of window	Resolution
16 Hz	93,75 Hz	684 ms	1,46 Hz
93,75 Hz	187,5 Hz	342 ms	2,93 Hz
187,5 Hz	375 Hz	171 ms	5,86 Hz
375 Hz	750 Hz	85,3 ms	11,7 Hz
750 Hz	1.5 kHz	42,7 ms	23,4 Hz
1.5 kHz	3 kHz	21,4 ms	46,9 Hz
3 kHz	6 kHz	10,7 ms	93,8 Hz
6 kHz	12 kHz	5,3 ms	188 Hz
12 kHz	24 kHz	2,7 ms	375 Hz

As you can see the Smooth FFT combines a high resolution at low frequencies with a sufficient resolution at high frequencies.

In the field the Smooth FFT shows a good correlation between what you hear and what you measure.

The **Smooth FFT** overlays the selected window with different windows during calculation. All windows are linked to the left border of the given window. Therefore a large setting left of the peak can exclude the peak from the internal window used at higher frequencies. This results in a spoiled frequency response trace at high frequencies.

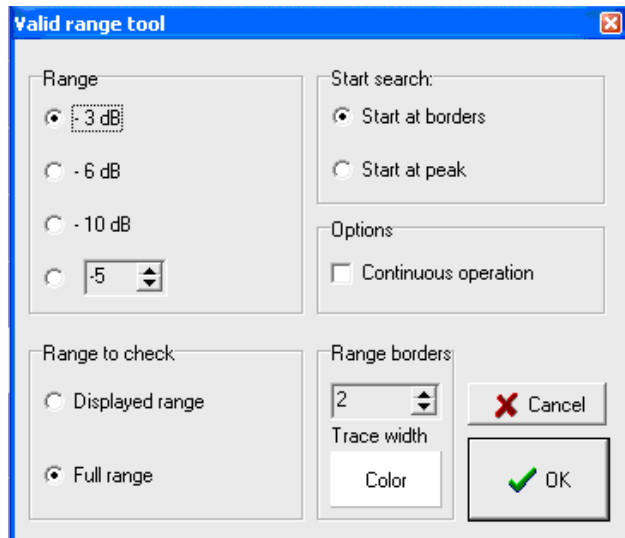


Valid range tool

In the FFT module you can invoke this tool in the pop-up menu of the trace display.

The valid range tool checks for the usable frequency range, shows border's frequencies and displays the border lines.

- **Range** set the maximum level difference related to the peak's level allowed for the usable frequency range.
- **Range to check** set the frequency range to check for the usable frequency range. If displayed Range is selected, then the valid range tool searches only the displayed part of the frequency display and the Range setting is related to highest level in the displayed range. If Full Range is selected then the whole frequency response is examined and the Range setting is related to the highest value found in the whole frequency response.
- **Start Search**
 - **Start at Peak** start searching for the borders at the frequency response's peak (or at the highest value in the displayed frequency range).
 - **Start at Borders** starts the search at the borders of the frequency response (or the borders of the visible range).
- **Options -> Continuous Operation** the borders of usable frequency range are displayed in the right menu area above the signal generator' area , and updated on every change of the selected trace.
- **Range Borders** customizes the display of the borderlines used for the display of the usable frequency response range.



Hints:

- You can select the trace to analyze in the pop-up menu of the trace display in the Show Values of selection.
- Use the hide range markers function from the pop-up menu of the trace display to hide the markers on the borders.

Absolute and relative Level

The unit dB is always used for a relation between two values.

If the level used as reference is an official defined reference SPL, then we talk about **Absolute Level**. To get an Absolute Level display, you have to adjust the internal reference SPL of SATlive.

We talk about **Relative Level** if the level is related to some not official defined reference value. As default SATlive uses only relative levels, with the following reference values:

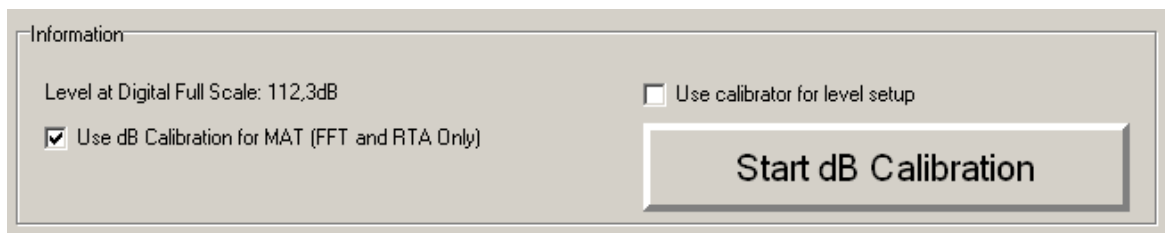
- **FFT uncalibrated, Smooth FFT uncalibrated**: the reference level is the mean level of the whole frequency response trace.
- **FFT calibrated, Smooth FFT calibrated**: the reference level is the level of the calibration frequency trace. This means that the difference in level to the calibration trace is shown.
- **MAT Transfer** the reference level is reference (REF) input signal's level.
- **VU Meter** the reference level is the digital full-scale.

Calibration of the absolute Level

To enable SATlive to display absolute level values you have to set it's internal reference level using either a calibrated SPL measurement unit or a calibrator device.

The calibration is performed in the  **Setup** →  **Set dB Ref** window.

- Please check if all internal levels are set properly before starting. Use the sin 1k signal for this purpose because it is used during the calibration process also.
- If you use an SPL meter, then you need to set the external SPL meter's parameter to **A weighting** and **Slow RMS** display.
- If you want to use a calibration device then select the **Use Calibrator for Level Setup** option.
- Use the option Use db Calibration for MAT (FFT and RTA only) to enable/disable the use of absolute levels in the trace display. If this option is not selected then the calibration values are used only for the Level Display.







- The **Level at digital Full Scale** shows the SPL at digital full scale. Click on **Start dB Calibration** to start the calibration process.
- SATlive will guide you through the calibration process. Use the button **NEXT** to go to the next step. The description of the current step is shown in the information area. The setup consist of the following steps:
 - Ask you if all preparations are done.
 - If an external SPL meter is used, then a 1kHz sine wave signal is played and you need read the meter's display after it gets stable. If the display does not get stable then check the settings of the meter again (**A weighting** and **Slow RMS** display).
 - If you're using an external SPL meter, then type in the meter's display in the edit field below the information area. If you're using an calibration device, type the RMS level of the calibration device in the edit field below the information area.

- If you use an external SPL meter then replace the external dB meter with SATlive's measurement microphone. If you're using a calibrator device, then apply the calibration device to the measurement microphone and activate it. Please read the instruction manual of the calibration device for further information.
- If you use an external SPL meter, then the 1kHz sine wave signal is played again and it's RMS level is measured, otherwise SATlive measures the signal level delivered by the calibration device.
- The internal level calibration values are calculated.
- Now check the **Level at digital Full Scale** if it fits to your needs. If the value does not fit, then change the settings of the input mixer and the level control of your I/O device accordingly and repeat the calibration.
- If you want to change an earlier setting, you can use the **BACK** button.

Project

You can use a project to manage different measurements taken in the MAT module and in the FFT module.

- A project contains information about the venue and at least one speaker.
- Up to eight different measurements can be assigned to each speaker.
- The selection of a speaker loads the traces assigned into the quick-trace memories.
- You can load all traces assigned to one speaker into the  **Tracemanager**. See the tracemanager section starting at the page 177 for further details.
- You can create or edit a project in the  **Setup** ->  **Project** section.
- You must assign at least one speaker to a project during creation.
- You can use the  **Project Manager** in the pop-up menu of the sum trace to add further speakers or to rename speakers or measurements. You can open project – manger using the key combination **Ctrl – P** as well. See page 191 for details about the project – manger.



Project setup

Basics

The **Project Management** is intended to ease the handling of larger amount of measurements and supports this features:

- Assignment of groups of measurements to speakers.
- Recall of all the measurement assigned to a speaker by a simple selection of the speaker they are assigned to.
- All measurements are saved when they are assigned to a **Quick Trace**. **SATlive** creates a unique file name which is used to save the measurement. See page 219 for details about quick traces.

Preparation

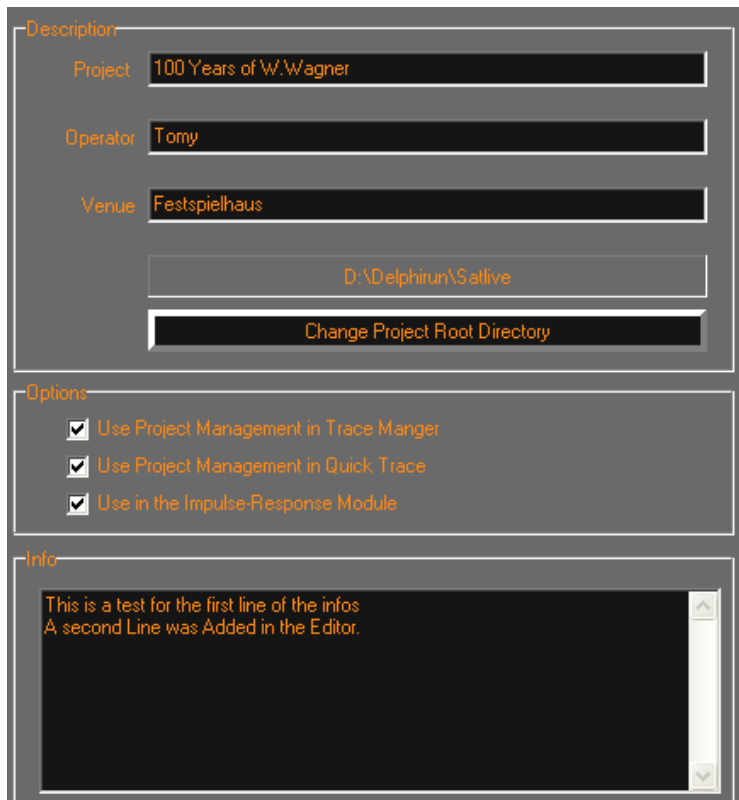
Start with creating a new project. This is done in the  **Setup** ->  **Project** section.

There is some information about the venue which you can edit. A text is needed in the project field, because this information is used to create the file-name of the current project.

The other fields are optional. The info filed can be used to store additional information about the project. You can edit the information in the Project-Manger as well.

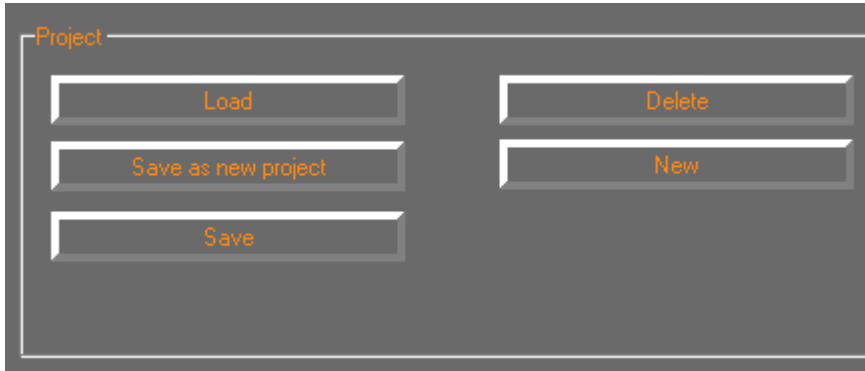
The information is shown in the file-selection window when you select a file to open.

- Use the button **Change Project's Root Directory** to select the directory where SATlive saves the trace files of the project.
- You can activate the project management separately for the use in FFT module and in the MAT module, where it is linked to the **quick traces** and/or in the **trace manager**. Furthermore, you can use the project management in the impulse-response module to organize the measured impulse response traces.
- See page 116 for details about quick traces.
- See page 177 for details about the trace manager.



The screenshot shows the Project configuration window with the following sections:

- Description:**
 - Project: 100 Years of W.Wagner
 - Operator: Tomy
 - Venue: Festspielhaus
 - Path: D:\Delphirum\Satlive
 - Change Project Root Directory button
- Options:**
 - Use Project Management in Trace Manger
 - Use Project Management in Quick Trace
 - Use in the Impulse-Response Module
- Info:**
 - This is a test for the first line of the infos
 - A second Line was Added in the Editor.



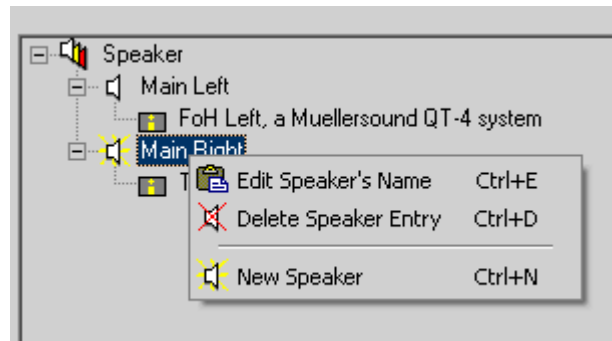
You have to **save** your settings before you can add a speaker.

- Use the **Load** function to select another project.
- **Save as new project** saves the current project to a new project. Only the settings are saved, the new project contains no measurements.
- **Delete** removes the project, all measurements assigned to it and the projects folder (if possible) from the disk.
- **New** resets the current values thus creating a new clean project.

Adding speakers to the project

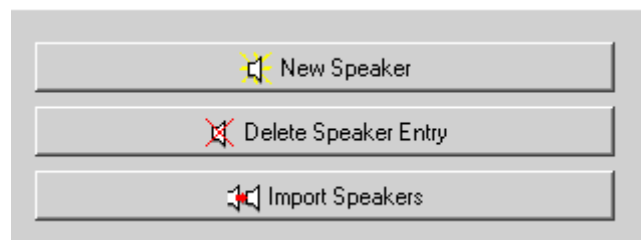
To be able to edit the speaker section, the current project must be saved using either the **save** or the **save as new project** function.

You can add or remove speakers or measurements using either the speaker area's pop-up menu or the buttons below the speaker area. First select the item to edit or to



delete with a mouse click, then select the option to perform either from the speaker area's pop-up menu or from the buttons below the speaker area.




Use the Import Speakers function to import the speakers (not the measurements) of another project into the current project. **This will delete all speakers already assigned to the current project.**



The Project manager

Use the project manager to add a speaker to the current project or to change the label of a speaker or of a measurement directly in the MAT module.

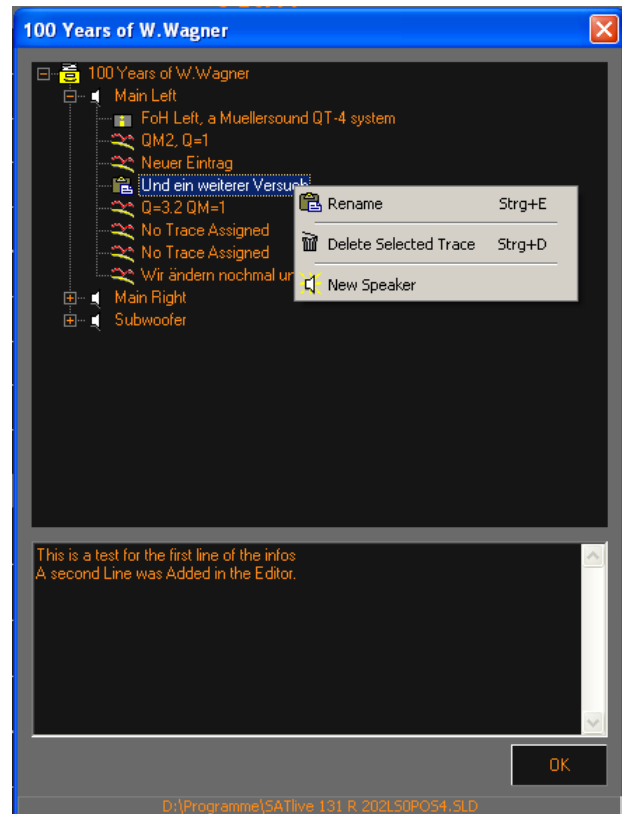
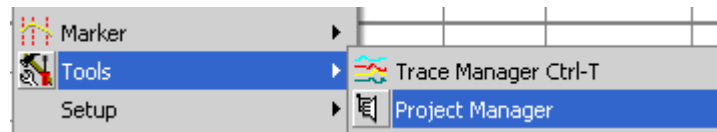
You can invoke the project manager only if a project is currently selected.

Use the function  Project manager in the sub menu  **Settings and tools** in the pop-up menu of the sum trace button or the button , which is available only in the complex menu display.

You can use the key combination **Ctrl – P** as well to invoke the project manager.

To add a speaker, to change a label or to delete a measurement just select the item and then select the action to perform from the pop-up menu.

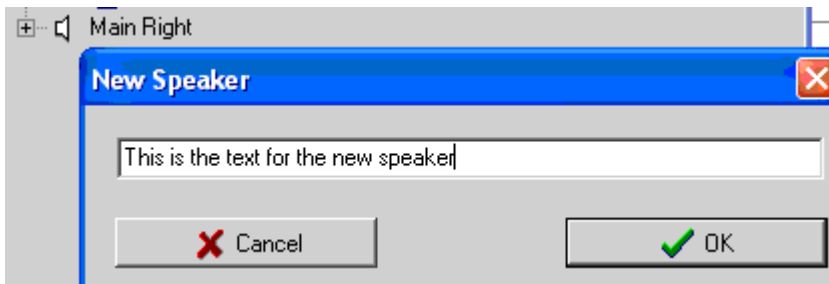
The lower window shows the global info text of the project.






Hints:

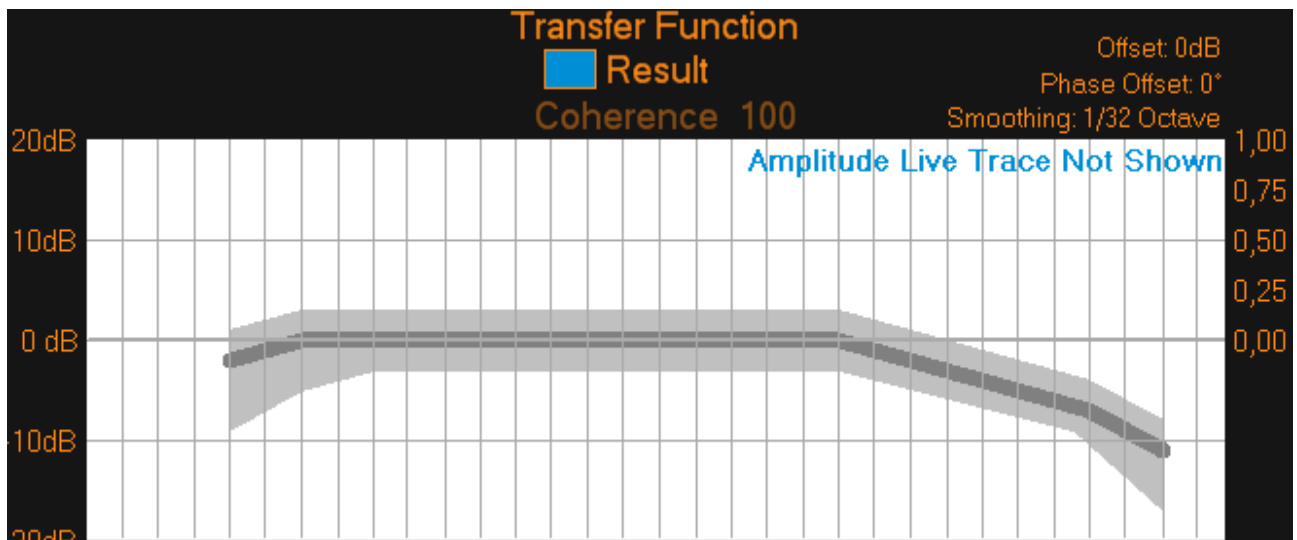
- Any changes performed here are applied directly and there is no possibility to undo them.
- You can delete speakers in the project setup-section only.
- Use the button **OK** to close the window and to return to **SATlive**.
- You must close the window before you could continue to work with **SATlive**.
- The info text is shown in the file-selection window and in the project-setup window.

New speaker



- This window shows up when you create a new speaker in the current project, which can be done at the project-setup section or at the  project manager using the  New speaker option of the pop-up menu of the speaker section.
- You can enter the label of the speaker in the edit field. The label can have a maximum length of 40 characters and must not be empty.
- Different speakers of the same project could share the same label, but you should avoid that in order not to mix up different speakers.
- You can edit the  memo assigned to the speaker in the project manager or in the project-setup section. During the creation of a new speaker the memo is filled with the speaker's label.
- Use the button **Cancel** to close the window and to return without adding the new speaker to the current project.
- Use the button **OK** to close the window and to add the new speaker to the current project.
- You can delete speakers only in the project-setup section.

Working with Target Traces



You can show a static trace in the background to have a guideline for the adjustment of the frequency response. Those traces are called Target Traces.

The picture shows the **X-Curve** including its range of tolerance.

Currently SATlive supports one user-definable target-trace and the **X-Curve** which is widely used for the optimization of sound systems in cinemas.

Hint:

- Currently only the amplitude of the target trace is shown.
- The target trace feature is available in the **FFT module** and in the **transfer-function, FFT, RTA** and in the **FFT + Spectrograph** measurements in the MAT module.

Create a user defined Target Trace

Currently you cannot build a user-defined target trace in SATlive.

You must use the Target Trace Builder, which is available for free download at <http://www.take-sat.de/download/TTB.zip>

In the Target Trace Builder you can define the amplitude response you want to be shown in the background of the amplitude display.

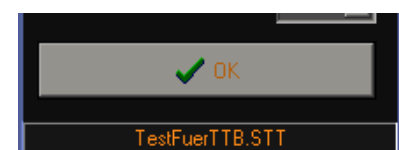
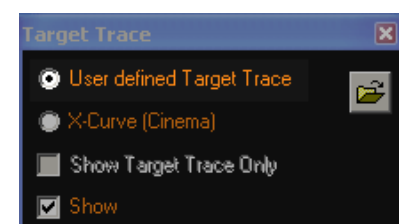
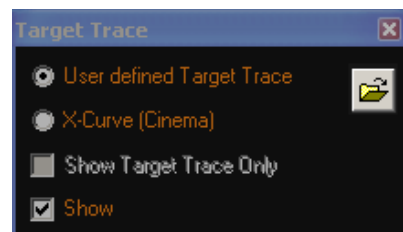
Once you've created and saved a Target Trace, you can use it in SATlive.

Hints:



- Do not try to load other traces then those created in the Target Trace Builder.
- If you want to use stored measurements, load them into a **quick trace** and use the quick trace functionality, described on page 219.

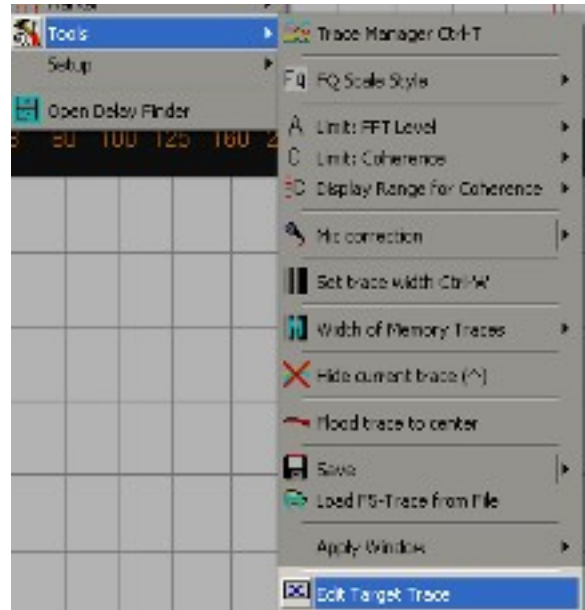
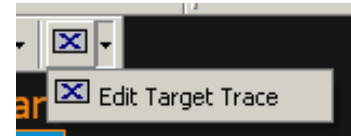
Load and select a user defined Target Trace

- Create the Target Trace you want to use using the Target Trace Builder.
- Invoke the Edit Target Trace window. Click on the open button in the upper right corner of the window.
- Select the Target Trace you want to use from the load Target Trace dialog.
- Choose User defined Target Trace at the top of the Edit Target Trace window.
- The statusbar at the bottom of the Edit Target Trace window shows the name of the selected user defined Target Trace.



Invoke the Editor for the Target Trace

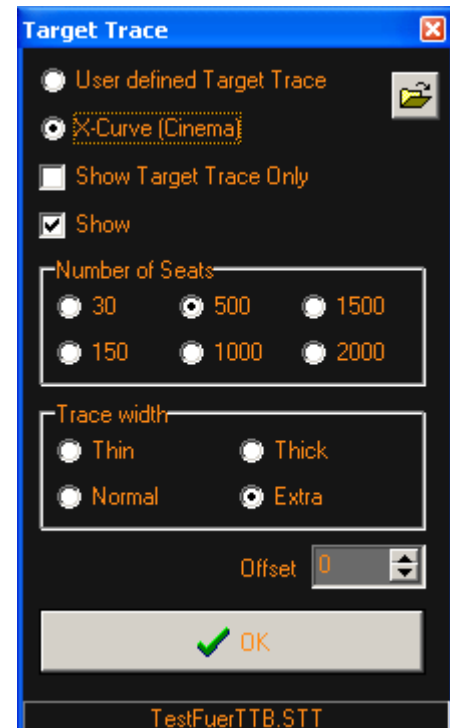
- Use the pop-up menu of the Target Trace Button  in the top menu and click on Edit Target Trace
- You can find the **Edit-Target Trace** function in the sub-menu  **Tools** of the pop-up menu of the trace display.
- You can also use the key-combination **shift + X** on your keyboard.



The Editor for the Target Trace

The window contains some settings to customize the display of the Target Trace.

- On the top you can select which trace you want to show.
 - The X-Curve is a predefined Target Trace to be used for sound systems in cinemas.
 - The user defined Target Trace shows a Target Trace created by the user. You must load a user defined Target Trace before you can select this option.
- The show Target Trace only option hides the display of the range of tolerance. This option is available only when the X-Curve is selected. Currently no range of tolerance is supported for the user defined Target Trace.
- The Show option shows or hides the Target Trace and the range of tolerance. The selection area Number of Seats is related to the X-Curve. Choose the size of the cinema here. The X-Curve and it's range of tolerance varies depending on this setting.
- The selection Trace Width contains different values for the width of the display of the Target Trace. This value does not affect the range of tolerance.
- Use the Offset setting to move the Target Trace (including the range of tolerance) vertically. Please note, that the offset settings used in the transfer function measurement may differ from the offset used in the other measurements.
- The button OK closes the editor window.
- The statusbar at the bottom of the window shows the name of the user defined Target Trace currently loaded.

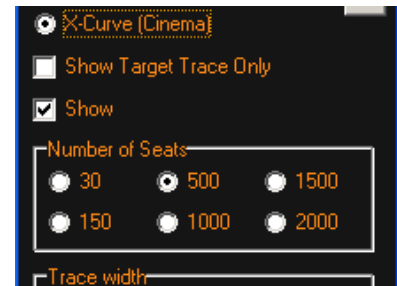


Hints:

- All changes are applied immediately
- The option User defined Target Trace is available only if a user defined Target Trace has been loaded.


The X-Curve

- The X-Curve is a Target Trace for the amplitude response, intended to be used for the adjustment of sound systems in cinemas.
- It's shape varies slightly with the amount of seats in the cinema, which can be selected in the editor for the Target Trace.
- In addition to the optimum trace, a range of tolerance is defined as well.
- By default the range of tolerance is shown, if you select the X-Curve.
- The display of the range of tolerance can be disabled using the Show Tolerance Trace only option in the editor for the Target Trace.




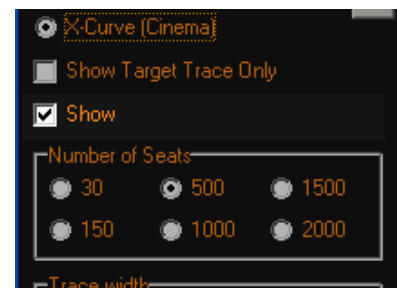
Show / hide the Target Trace

The Target Trace can be shown or hidden in different ways.

- Use the shortcut **X** on your keyboard.
- Use the menu entry  **Target Trace** in the top menu bar.
- Use the show option in the editor for the Target Trace.

Hints:

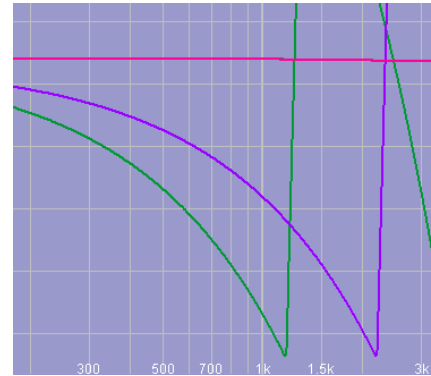
- The menu entry  is not available in the top menu bar in the RTA measurements.
- The width of the Target Trace can be selected in the editor for the Target Trace.
- You can change the **color** of the Target Trace and of the range of tolerance in the color setup section of the **display setup window**.



Phase compensation

The Phase compensation, which is available in the FFT module is intended to remove the phase-shift which is introduced by the delay.

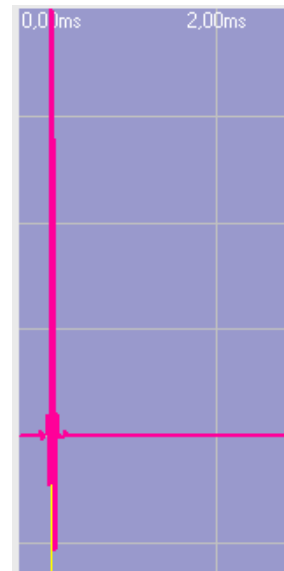
After running the speaker in room macro in the impulse - response module with just a link between the input and the output you hopefully get a near flat amplitude response graph. But when you activate the phase display, you might be surprised, because you will not a flat phase graph, but a falling one.



To explain what happens here, we first take a look at the left side of the impulse response's display in the upper window.

You that there is some space between the left border of the window and the impulse's peak, even if the peak is at 0.0ms.

This space is generated by the window selected in the macro setup. For the speaker in room macro a peak related window with a 'pre' setting of 400usec is used. This means that the part of the impulse response which is used for the calculation of the FFT starts 0.4 ms before the highest point of the impulse response.

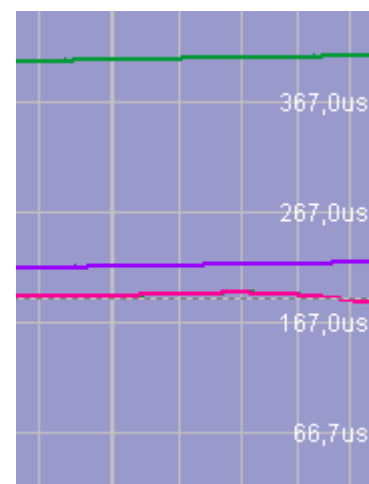


This **pre** time is used to 'catch' the setup time of the loudspeaker, because the highest point of an impulse response is not necessarily the first valid point of the impulse response.

To go back to our example, we can say that the peak has a delay of approx 0.4 ms related to the starting time of the FFT window (which is the left border's position).

This picture shows a comparison of two FFT traces created from the same impulse response, one using the default 0.4ms pre time (green phase trace), the other with a pre time shortened to approx 0.2 ms (violet phase trace).




As expected the amplitude traces match perfectly, but the phase traces are different, because delay information is present in the slope of the phase traces. The higher the delay as steeper the phase trace. The negative value of the slope is called group - delay and can be displayed in SATlive as well.



The group-delay traces are both flat, which means that the delay is constant over time, and as you might guess, the green trace is at approx 0.4ms and the violet one at approx 0.2 ms.

SATlive can try to remove this delay from the phase display when you look at the smooth FFT result. Because of the cyclic nature of phase this might fail in some situations.

There are two phase-compensation modes available, which you can use in macros, too. They differ in the detection of the delay.

- In the mode  (left button) the location of impulse response's peak is used as the time reference.
- In the mode  (middle button, marked with 1k) SATlive assumes that the phase value at 1kHz in the FFT is at zero degree phase.
- The third option  just disables the phase compensation feature.

The Virtual EQ

- The virtual EQ shows a calculated transfer function of an equalizer. You can apply the virtual EQ to the sum trace and to the live trace.
- The virtual EQ is available only in the Transfer - Function measurement in the MAT module and in the FFT of the impulse response.
- The virtual EQ consists of single EQ blocks, where each block simulates a fully parametric analogue EQ.
- In the free mode, the virtual EQ contains a high-shelving and a low-shelving EQ block.
- You can select two modes of operation for the virtual EQ.
 - **Free mode** supports an 'unlimited' amount of EQ blocks.
 - **Rope R1** mode, where the number of blocks available and the range of the parameters is defined by the limits of the hardware.
- The virtual X-over allows you to apply a high-cut and a low-cut filter

Hint:

- The virtual EQ simulates an analogue EQ using a mathematical model. Therefore the result might differ from the result you got from your real world EQ.

Change the mode of operation of the virtual EQ

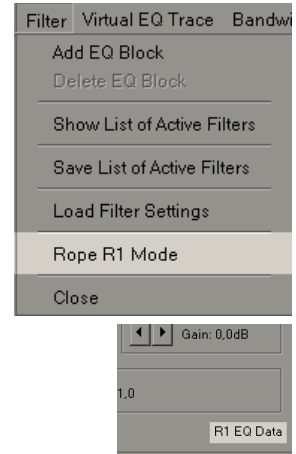
The virtual EQ can operate in two different modes:

- In the **free mode** you can add and remove EQ blocks and the range for the parameters covers a wide range. Furthermore you can select how you want to set the bandwidth of the virtual EQ. In this mode, the two shelving filters are available.
- The **Rope R1** mode limits the number of EQ blocks to four. The range for the gain (+ 6dB to - 18dB) and the range for the quality factor (0.5 - 25) is adapted to the possibility of the hardware. The bandwidth edit mode is set to Quality Factor (Q), and there are not shelving filters.

To change the mode of operation of the virtual EQ select or deselect the option Rope R1 in the Filter menu. All EQ settings will be lost if you change the mode of operation.

Hints:

- If the Rope R1 mode is selected, then the functions and buttons used to add or remove an EQ block are not shown.
- The Rope R1 mode is indicated in the lower right area of the virtual trace editor.

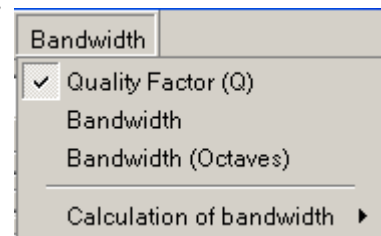


Select Bandwidth mode for the virtual EQ

If the free mode is selected as the mode of operation of the virtual EQ, then you can select which units you want to use to edit the bandwidth parameter of the virtual EQ.

Select the unit you want to use for the bandwidth display from the pop-up menu **Bandwidth** in the virtual EQ - editor.

- **Quality (Q)** shows the center frequency related to the EQ range. Higher values indicate a smaller range.
- **Bandwidth** shows the width of the EQ range related to the center frequency. Higher values stand for a wider range.
- **Bandwidth (Octaves)** shows the width of the EQ range related to the center frequency. The relation is shown in octaves. Higher values stand for a wider range.
- The shelving filters do not use a bandwidth setting, but a slope selection.



Add/remove an EQ block

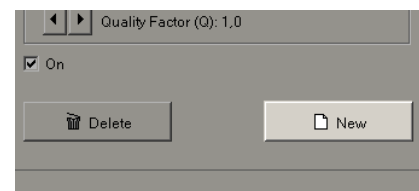
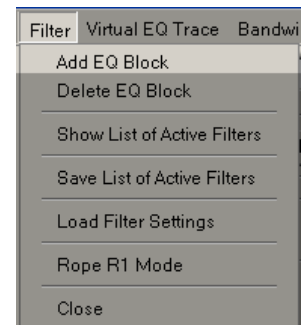
If the free mode is selected in the virtual EQ than you can add or remove EQ blocks to the virtual EQ.

Keep in mind that at least one EQ block must remain. Therefore the remove option is available only if the virtual EQ contains at least two EQ blocks.

Removing an EQ Block will discard all values assigned to this block. If you just want to mute an EQ block then you should use the **ON** of the EQ block to mute the EQ block without changing it's values.

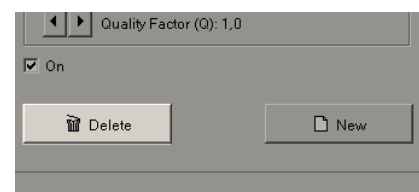
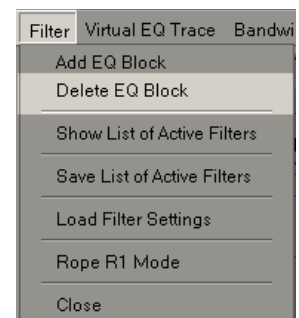
There are two ways to add an EQ block:

- Click on the Add EQ Block entry in the menu Filter in the editor of the virtual EQ.
- Click on the button New in the lower right area of the editor's window.



There are also two ways to remove an EQ block:



- Click on the Delete EQ Block entry in the menu Filter of the editor for the virtual EQ.
- Click on the button Delete in the lower left area of the editor's window.

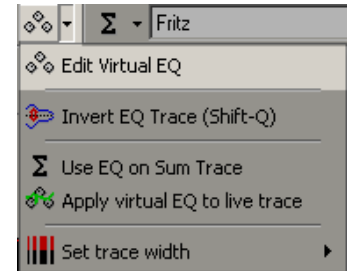



Hints:

- At least one parametric EQ block must remain.
- The shelving filters could not be removed.
- In Rope-R1 mode you cannot add or remove filter blocks.

Invoke the editor of the virtual EQ

You can invoke the editor of the virtual EQ either using the menu entry **Edit virtual EQ** in the pop-up menu of the button  assigned to the virtual EQ, or using the shortcut **Q**. The button  assigned to the virtual EQ is located in the menu bar Quick Trace and in the pop-up menu of the trace display (MAT Module).



You can invoke the editor by clicking with the right mouse-button directly on the  virtual EQ button, left of the arrow.

The editor for the virtual EQ will open on the position where it was closed before.

Edit an EQ Block

Use the selection in the upper area of the editor window to select the EQ block you want to edit.

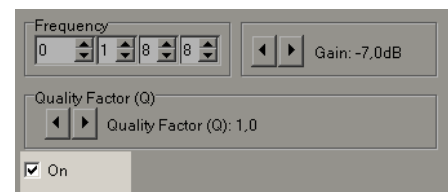
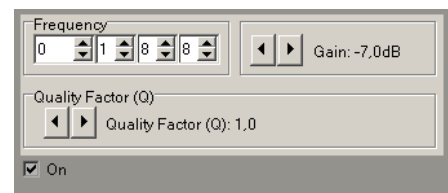
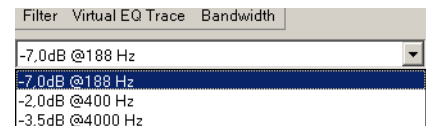
The list is ordered by frequency, and contains the two shelving filters as the top-most entries.

The selection is enabled only if there is more than one EQ block.

If the mode of operation of the virtual EQ is set to free mode then you can add and remove EQ blocks.

You can edit the values now. All changes are applied immediately.

In the lower area you can activate the EQ block using the **ON** setting. The other values are not influenced by this setting. The EQ block affects the frequency response only if it is activated.



Hints:

- You can change the bandwidth units, if the operation mode of the virtual EQ is set to free mode.
- Any of the three settings features a pop-up menu containing some preset values.
- You can edit the virtual EQ with the mouse as well.
- The shelving filters do not use a bandwidth setting, but a selectable slope.
- To disable a shelving-filter simply set its gain to zero.

Edit the virtual EQ using the mouse

You can edit the virtual EQ using the mouse. You can edit only EQ blocks which are still defined.

- In order to edit the virtual EQ the EQ trace must be visible.

- The frequency of each EQ block is marked by a square.

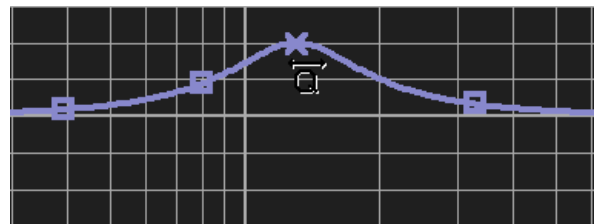


- Move the cursor to the square related to the EQ block you want

to edit. If the cursor is over one of the squares, then the square changes to a cross and the parameter of the EQ block assigned are shown above the trace display.

- If you press the left mouse button and keep it down, then you can change the frequency and gain setting of the EQ block.
- A horizontal movement changes the frequency and a vertical movement changes the gain.

- In order to change the Q or Bandwidth of the selected EQ block, use the right mouse button instead of the left one. Now you can set the Q or Bandwidth by a horizontal movement of the cursor.



The cursor changes to a Q.

- During the edit of the frequency and/or gain, you can change the Q/Bandwidth setting using the + and - keys on your keyboard.
- As soon as you release the mouse button you can use the mouse as usual.

The virtual X-Over

The virtual X-Over is located in the editor of the virtual EQ.

It affects the trace of the virtual EQ.

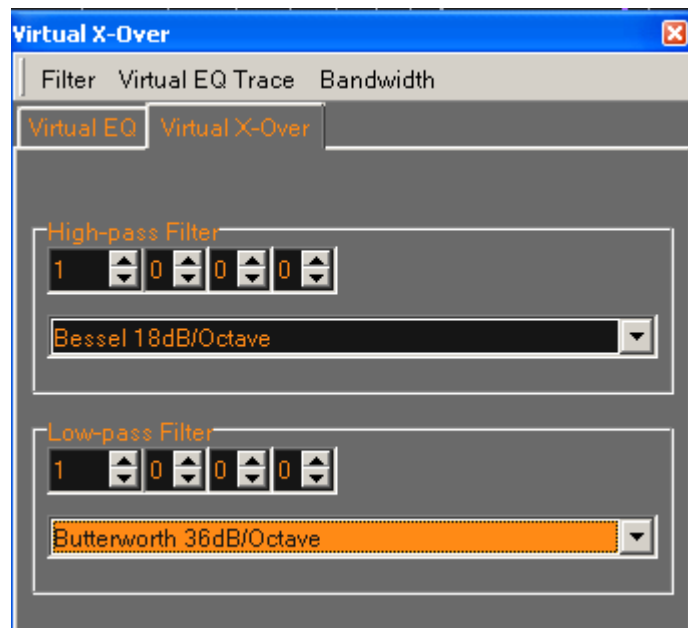
To edit the virtual X-Over you need to open the editor of the virtual EQ.

In the editor window click on the *Virtual X-Over* tag to open the editor for the virtual X-over.

You can apply on High-pass and one Low-pass filter. Both filters may have different kind or order of the filter and may also differ in their corner frequencies.

To apply a filter, simply select the type and order you want from the selection at the bottom of each filter-edit box. To disable a filter, select the **No X-Over selected** entry from the selection.

The corner-frequency of the filter can be set using the frequency editor at the top of each filter-edit box.



Hints


- The corner-frequency of the Bessel type filters is defined as the -3dB point of its frequency response.
- The settings of the virtual X-Over are **not** saved nor recalled.

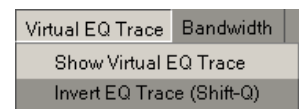
Show/flip the trace of the virtual EQ

You can show the frequency response trace of the virtual EQ in the graph display area.


The display of the trace does not depend on the current visibility of the editor's window.

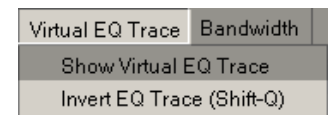
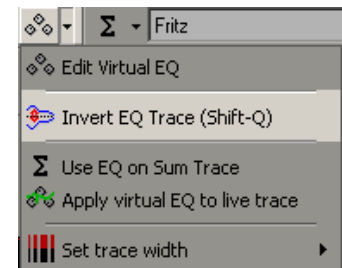
There are two ways to change the visibility of the trace:

- Use the button  assigned to the virtual EQ in the Quick - Trace menu bar of the main window.
- If the editor is invoked you can use the entry **Show virtual EQ Trace** in the menu **Virtual EQ Trace** in the editor.




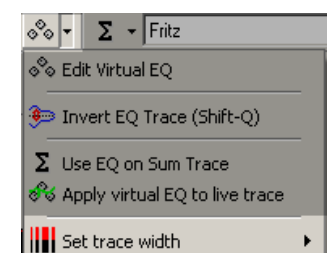
You can flip the display of the virtual EQ. If the display of the virtual EQ is flipped then the trace is mirrored at the zero dB line. This enables you to fit the virtual EQ to a given trace easily. There are three ways to flip the trace:

- Use the shortcut **Shift + Q**
- Use the entry **Invert EQ Trace** from the pop-up menu of the button  assigned to the virtual EQ.
- Use the entry **Invert EQ Trace** from the menu **Virtual EQ Trace** in the editor.




Hints:

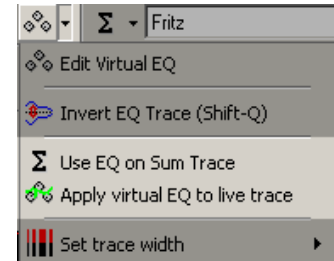
- You can select the color of the trace in the **Setup -> Display** window.
- You can change the width of the trace using the sub menu **Trace Width** of the pop-up menu of the button  assigned to the virtual EQ.
- The trace can be selected for the **selected trace**, adding some additional settings.



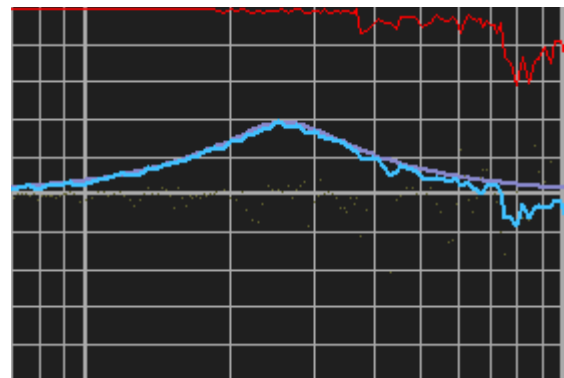
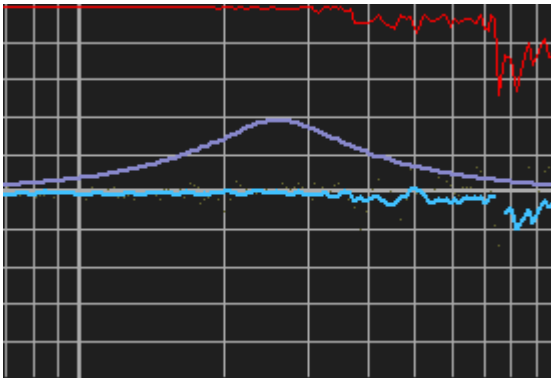
Apply the virtual EQ to the live trace or to the sum trace

You can apply the virtual EQ to the live trace or to the sum trace. This setting does not depend on the current visibility of the trace of the virtual EQ or of the editor window.

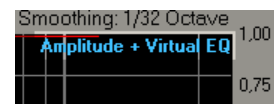
You can apply the virtual EQ using the entries **Apply virtual EQ to live trace** and **Use EQ on Sum Trace** in the pop-up menu of the button  assigned to the virtual EQ.



The two pictures below show the live trace and the trace of the virtual EQ. The right picture is taken with the option **Apply virtual EQ to live trace** selected.



If the virtual EQ is applied to the live trace then the label on the upper right in the graphic display changes.



Hints:

- In the FFT module you can apply the virtual EQ to the live trace only if the live trace was created using a Smooth FFT calculation.
- The virtual EQ is applied after the trace is smoothed.
- The virtual EQ is removed prior saving the trace.
- The virtual X-Over is also applied to the trace.

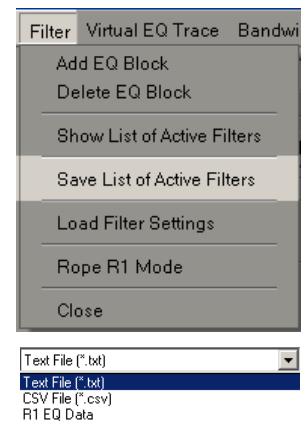
Save the settings of the virtual EQ

You can save the settings of the virtual EQ in the editor.

The entry Save List of active Filters opens the save dialog.

The save dialog contains the selection of the file type in its lower area.

- **Text File** save the settings in a standard text file. This is the type of file, which you can load into the virtual EQ if the mode of operation is set to free mode.
- **CSV File** save the settings separated by a comma. This is a file format designed for the import into spreadsheet software. **You cannot load CSV files into the virtual EQ.**
- **R1 EQ Data** save the settings in the rope R1 data format. This type of file can be used to import the settings into other software. This is the type of file, which you can load into the virtual EQ if the mode of operation is set to Rope R1.



Hint

- The settings of the virtual X-over are not saved nor recalled.

Load saved settings into the virtual EQ

You can load saved EQ settings into the virtual EQ.

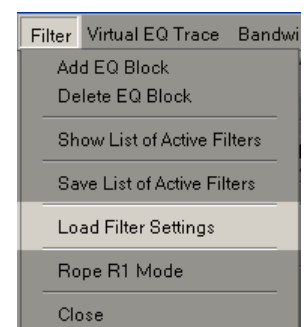
To load a saved EQ setting use the Load Filter Settings entry in the menu Filter in the editor of the virtual EQ.

When you click on the entry, a dialog window shows up, where you can select the file to load.

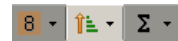
Please note, that, opposite to the save dialog, the type of file is fixed here.

The type of file depends on the mode of operation selected for the virtual EQ.


- If the free mode is selected, then you can load only text files.
- If the Mode Rope R1 is selected, then you can load only Rope R1 files. In this mode you can load Rope R1 files created with other software as well.






Peak Trace

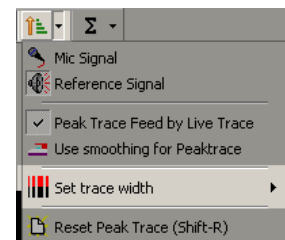


The Peak Trace is available in the FFT measurement of the MAT module.

The Peak Trace shows the highest values of the live trace. The button  is located in the Quick Trace menu bar and contains a pop-up menu.


Display / Hide the Peak Trace

- Use the button  **Peak Trace** in the Quick Trace menu bar to show/hide the Peak Trace.
- You can select the trace width in the sub menu **Set Trace Width** which is located in the pop-up menu of the button  assigned to the Peak Trace.
- You can set the color of the Peak Trace in **Setup -> Display**.
- You can configure the display of the Peak Trace using the **Peak Trace feed by Live Trace** and the **Use smoothing for Peak Trace** entry in the pop-up menu of the button  assigned to the Peak Trace.

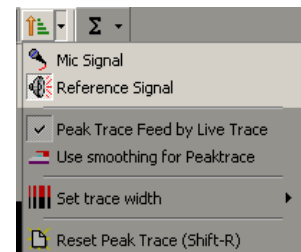


Select the trace to feed the Peak Trace

If only one signal is selected for the FFT measurement in the MAT module, then the Peak Trace is feed with the signal currently displayed.

If both inputs are selected, then you can select the trace which should feed the Peak Trace from the pop-up menu of the button  assigned to the Peak Trace.

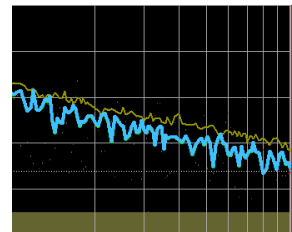
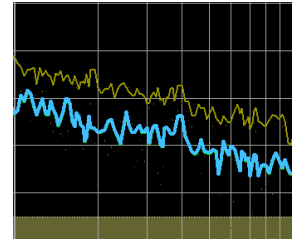
In this case you can also select both inputs. If both inputs are selected, then the Peak Trace will display the value with the highest amplitude value.




Use averaged Values for the Peak Trace

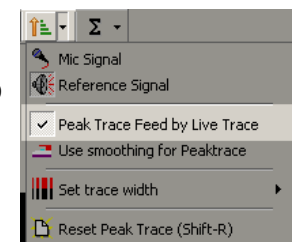
There are two ways how the Peak Trace can scan for the highest amplitude values:

- The Peak Trace scans the result of each calculation. Doing so, it will capture even short peaks. The trace will be higher than the live trace, because the live trace shows the averaged result of a number of measurements.
- The Peak Trace scans the live trace. Doing so, only averaged results are scanned and the peak trace will hold the maximum amplitude values of the live trace.




To use the averaged values of the live trace select the Peak Trace feed by Live Trace entry in the pop-up menu of the button  related to the Peak Trace.

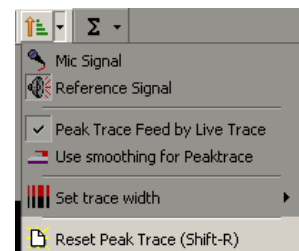
You can also select whether the Peak Trace scans the values prior to smoothing or after smoothing is performed.



Reset Peak Trace

The Peak Trace holds the maximum values of the input signal(s), therefore it must be reset to start a new measurement.


To Reset the Peak Trace you can either use the shortcut **Shift + R** or the **Reset Peak Trace** entry in the pop-up menu of the button  assigned to the Peak Trace.

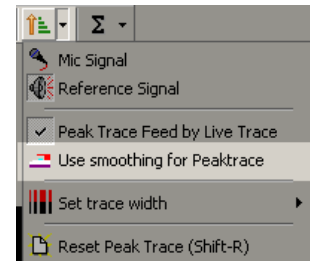


Use live trace's smoothing for the Peak Trace

You can select whether the peak trace scans the values of the live trace(s) prior to smoothing or after smoothing is performed.

Scanning prior to smoothing will record peaks which might get lost during the smoothing process.

You can use the **Use Smoothing for Peaktrace** entry in the pop-up menu of the button  assigned to the peak trace.



Selected Trace

The concept of the selected Trace selects a trace whose values are shown and can be edited.

You can select the trace using different ways:

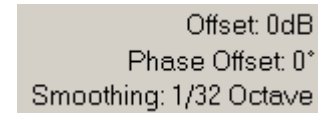
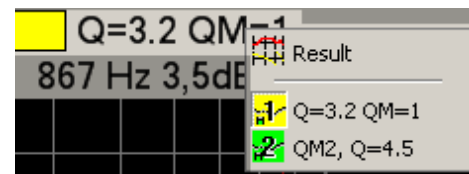
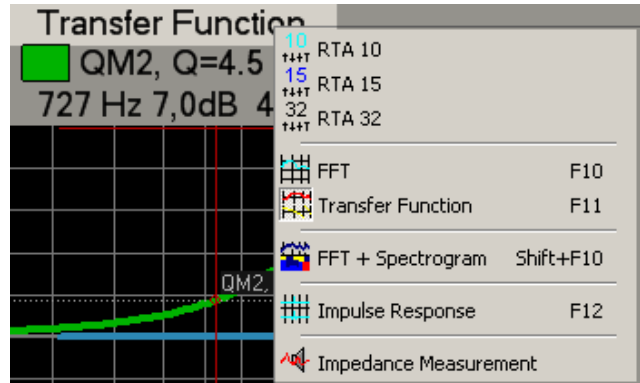
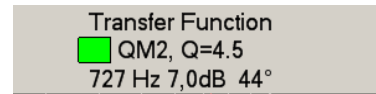
- Select it from the sub menu Show Values of in the pop-up menu of the trace display.
- In the info area above the trace display click on the name of the trace to open the show values of menu.
- The setup menu in the information area contains the sub menu show values of to select the trace from.
- Click on the name of the trace above the offset setting in the right menu bar, or on the color indicator left to the offset setting in the right menu bar, to open the show values of selection menu.
- The selected Trace can be used for the calculation of the Live Add Trace and for the calculation of the Perfect Addition Trace. This is possible only if you select a Quick Trace. See page 219 for details about quick traces.
- Use the shortcut **T** to toggle through the visible traces.
- The name of the selected Trace is shown in the info area and the settings related to the selected trace are assigned to it.

The Info Area

The Info Area is located at the top of the trace display.

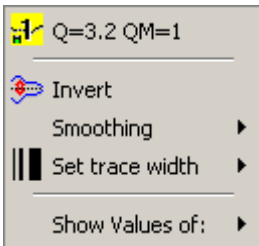
The following information and menus are available in the center of the Info Area:

- The top line shows the name of the measurement currently running. Click on the name with the left mouse button to open a menu to select the measurement from.
- The second line shows the name of the selected trace. Left of the name of the selected trace a color area indicates the color assigned to the selected trace. Click on the name or on the color area with the left mouse button to open the show values of selection to select the selected trace from.
- The lower line shows the values of the selected trace at the cursor's current position.
- SATlive shows the current settings of the selected trace in the right area of the Info Area. The global setting Phase Offset shows the currently applied shifting of the phase trace.



In the **left area** of the Info Area you can see the results of the cursor range tool if a latched cursor is present. If a latched cursor is present, you can open the setup menu of the cursor range tool with a mouse click on the left area.

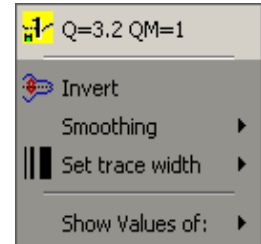
If you click on the Info Area using the right mouse button, then the setup menu assigned to the selected trace shows up.



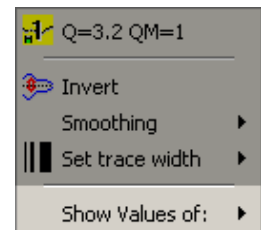
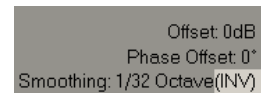
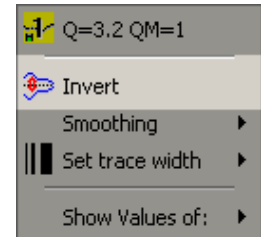
Settings related to the selected trace

This menu is the pop-up menu assigned to the info area and can be accessed with a click onto the info area using the right mouse button.

- The top entry in this menu is just the **name** of the selected trace.
- The next line contains the **Invert** option, which mirrors the selected trace related to the zero dB line. This might be helpful if you want to adapt an EQ to the selected trace.
- If the selected trace is inverted then (INV) is shown right of the smoothing value in the info area.



- The next entry is the **Smoothing sub menu**. You can select the smoothing you want to apply to the selected trace. The smoothing sub menu is not available if the virtual EQ has been chosen for the selected trace.
- The next menu entry is the Set Trace Width sub menu. You can select the width of the display of the selected trace. The sub menu contains four fixed settings and the entry Same as live Trace, which links the trace's width of the selected trace to the width of the live trace.
- On the bottom of the menu you find the sub menu Show values of where you can choose another trace as the selected trace.



Addition of the selected Trace and the live Trace

There are two possibilities to add the live trace and the selected trace. Both traces are available only if

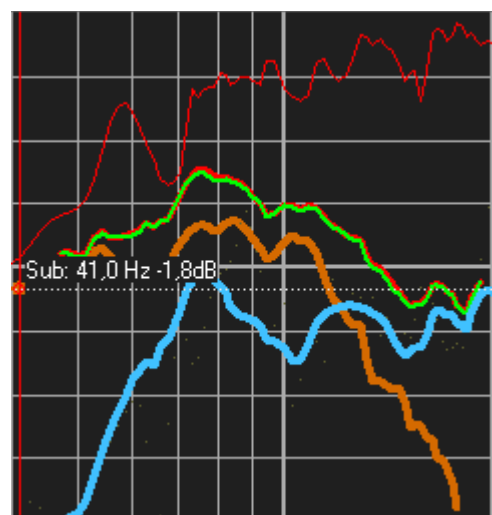
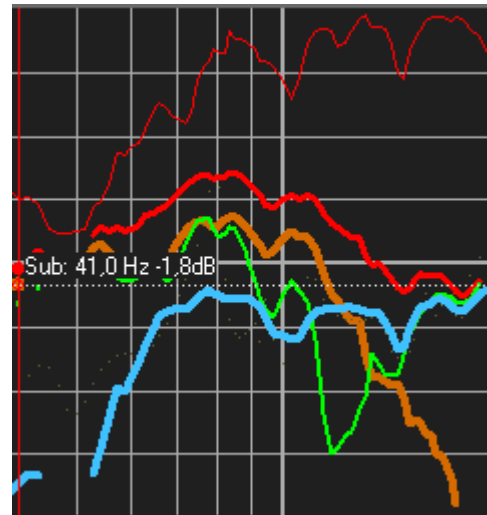
- The transfer-function measurement in the MAT module is selected.
- The selected trace is one of the eight quick traces. See page 219 for details.

The both traces are:

- **Live Addition Trace:** It shows the calculated complex sum trace of the selected trace and the live trace.
- **Perfect addition trace:** Calculate the sum of the amplitude values of both traces. This yields the amplitude-response which would be reached if both traces are perfectly aligned in time.

The upper picture shows the situation at the start of the time alignment.

The lower picture shows the same situation with adjusted delay settings.

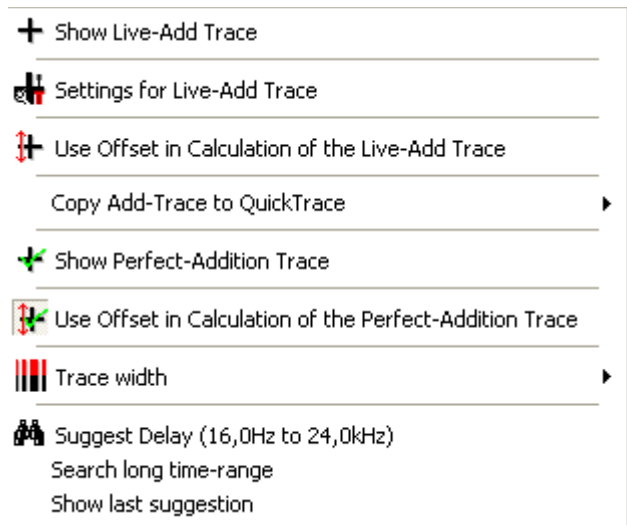


- Red: Perfect Add Trace
 - Green: Live Add Trace.
 - Blue: Mid/High
 - Brown: Subwoofer
- The perfect addition trace is calculated using the live trace and the selected trace. Therefore the selected trace must not be the live trace in order to enable the perfect addition trace.
 - To show or hide the addition traces or to set the width of the trace use the setting menu, which is the pop-up menu of the cursor details area in the right menu bar.
 - The color used to draw the perfect addition trace can be set at **Setup -> Display**.

Menu Addition of Signals

This menu is the pop-up menu of the cursor details area in the right menu bar, and it is located in the pop-up menu of the trace display.

It is available only in the MAT module when a transfer function measurement is performed and a Quick-Trace is the selected trace.



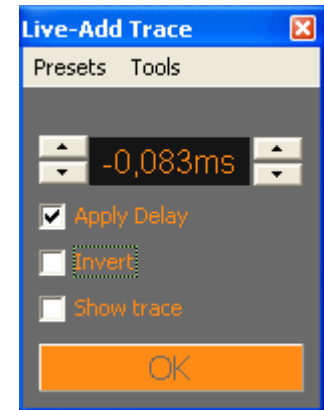
- **Show Live-Add Trace** display the addition of the live trace and the selected trace. You can also use the key *L* to toggle the visibility of the trace.
- **Settings for Live-Add Trace** opens the *editor window* of the *live-additon trace*. See page 216 for details.
- **Use Offset in Calculation of the Live-Add Trace** enables this option if the offset settings should affect the result of the addition of the live trace and the selected trace. Use this option only for special (educational) purpose.
- **Copy Add-Trace to Quick-Trace** stores the currently displayed Live-Add Trace into a Quick-Trace. Simply select the target Quick-Trace from the sub-menu.
- **Show Perfect-Addition Trace** display the amplitude response of the sum of the live trace and the selected trace, assuming their phase values will match perfectly at every frequency.
- **Use Offset in Calculation of the Perfect-Addition Trace** enables this option if the offset settings should affect the result of the addition. Use this option only for special (educational) purpose.
- **Trace width** select the thickness of the both addition traces. The Perfect-Addition Trace is drawn slightly thicker as the Live-Add Trace.
- The entries **Suggest Delay**, **Search long time-range** and **Show last suggestion** are related to the Delay Suggestion Tool, described on page 217.
- The color used to draw the perfect addition trace and the live add trace can be set at **Setup -> Display**.

Setting window for the Live-Add Trace

You can open the setup window for the Live-Add Trace either using the entry *Settings for Live-Add Trace* in the Menu Addition of Signals (see page 215) or using the shortcut *shift + L* on your keyboard.

The window contains virtual delay and polarity inversion, both settings are applied to the live trace prior to the calculation of the Live-Add Trace. The setting *Show Trace* shows or hides the Live-Add Trace. You can use the shortcut *L* for that, too.

You can change the virtual delay by clicking on the arrows on both sides of the delay-time display. The arrows on the right allow changing of the delay in steps of 0.021 ms, the arrows on the right in steps of one millisecond.

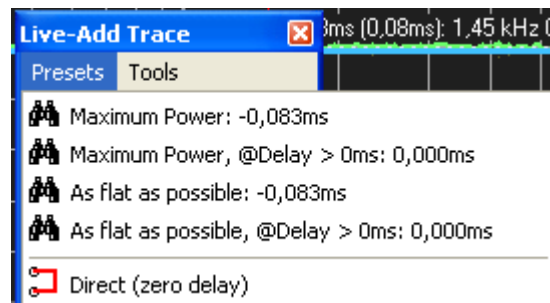


You need to check the *Apply Delay* setting to become the delay active.

Check the *Invert* setting if you want polarity inversion of the live trace to take place before calculation of the *Live-Add Trace*.

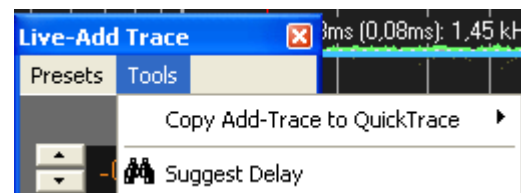
The menu Presets

The menu Presets shows the results of the *Delay-Suggestion Tool* (see page 217). If you click on a menu entry, the settings will be applied to the *virtual delay* and to the setting of the *polarity inversion*. This enables you to check the results of the Delay-Suggestion Tool without the need of a new measurement. Use the entry *Direct (zero delay)* to reset the virtual delay to zero.



The menu Tools

This menu allows you to save the Live-Add Trace (if currently shown) to one of the eight Quick-Traces with just a click on the target position wanted. It also contains the possibility to invoke the *Delay-Suggestion Tool*.



The Delay Suggestion Tool

Functionality of the Delay Suggestion Tool

The Delay Suggestion Tool calculates the addition of both the live trace and the currently selected quick-trace using the phase relation between both traces.

This calculation is done for a certain range of time. For each step in time the amount of energy and the 'flatness' of the resulting trace is calculated.

The delay values which yield the highest energy and the most flat trace are shown in the result window.

Parameter for the Delay Suggestion Tool

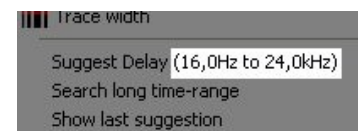
The Delay-Suggestion Tool needs the following parameter:

- *Which quick-trace to use.*

This selection is done by making the desired quick-trace the selected trace. See the page 211 for details about selecting a trace.

- *The frequency range to check:*

By default the frequency range is defined by the visible part of the display window. If a area is marked using the cursor-range tool (see page 73) the marked range will be used for the calculation. The current frequency range is shown right to the Delay-Suggestion Tool entry in the *Addition of Signals* menu (see page 215).



- *The time range in which the tool searches for the optimum values:*

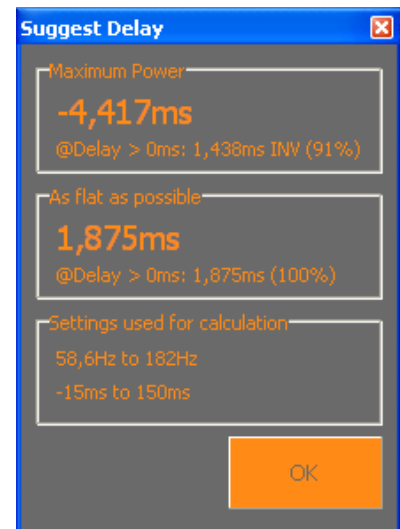
By default, the tools scans the range from -25ms to 25ms for the optimum values.

If you check the Search long time range option in the *Addition of Signals* menu (see page 215), the tools scans from -15ms up to 150ms. As longer the time as longer it will take to get the result.

The display of the results

The Delay-Suggestion Tool creates a window of its own to display the results. You can move the window or close it using the **OK** button. A previously closed window can be shown again using the Show last suggestion entry of the *Addition of Signals* menu (see page 215).

- The window shows the delay which creates the maximum of energy in the summed trace (upper area) or the most flat summed trace (middle area). The lower area shows the parameters used for this calculation.
- Below the delay value for the best result, a value labeled **@Delay > 0** is shown. This indicates the positive delay which gives the best result. The percentage shown right to the delay time can be used to estimate the quality of this alignment related to the best match. If the best result is archived using a positive delay, then both delay times are equal and the percentage is 100%.
- If **INV** is shown right to the delay, then you need to invert the polarity of on of the two signals used for the calculation.



Hints

- Take care if you use the result for maximum flatness. In this case there could be a strong loss of energy in order to flatten out the results.
- For alignment in time you should calculate the result only for the crossover area.
- The results of the *Delay-Suggestion Tool* are copied to the *Preset menu* of the setup window for the Live-Add Trace. See page 216 for details.
- The menu *Tools* of the setup window for the Live-Add Trace (see page 216) contains an entry to invoke the *Delay-Suggestion Tool*.




Quick Traces



You can use the Quick-Traces to save and recall amplitude and phase traces or impulse-impulse traces.

With the **project** management enabled, you can manage measurements taken on different locations. You can average the Quick-Traces into a so called **Sum Trace**.

Furthermore you can use a Quick-Trace to calculate the **Live Add Trace** or to calculate the **Perfect Addition Trace**.

Depending on the measurement currently selected, the  **virtual EQ**, the  **Peak Trace**, the **Target Trace** or the  **Sum Trace** is managed in this menu bar as well.

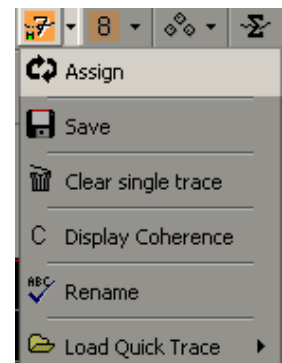
Hint:

- The trace-manager offers other features to work with saved traces. See page 177 for details.

Assign a trace to a Quick-Trace

The most common way to assign a trace to a Quick-Trace is to assign the live trace to a Quick-Trace.

- **Assign using a shortcut** press and hold the shift key and then press the number of the Quick-Trace to which you want to assign the live trace. This will overwrite any trace which was assigned to this Quick-Trace before.
- Click on the button assigned to the Quick-Trace using the left mouse button. If a Quick-Trace is assigned, then the click toggles the visibility of the Quick-Trace. Otherwise the live trace is assigned to the Quick-Trace. To overwrite a trace still assigned to the Quick-Trace press the shift key while you click with the left mouse button.
- Use the **Assign** entry in the pop-up menu of the button assigned to the Quick-Trace. This will assign the live trace to the Quick-Trace and a previously assigned trace will be overwritten.



You can also assign other traces to a Quick-Trace:

- The **Copy Sum Trace in a Quick-Trace** function in the pop-up menu of the button Σ assigned to the sum trace assigns the current sum trace to a Quick-Trace. A previously assigned trace will be overwritten.
- The *Copy Add-Trace to Quick-Trace* submenu can be found in the menu for the addition of signals (see page 215) and in the menu *Tools* in the setup window of the Live-Add Trace (see page 216).
- The next entries are located in the sub menu **Load Quick Trace** in the pop-up menu of the button assigned to the Quick-Trace.
 - **Load from File** load a trace from a file into the Quick-Trace.
 - **Load from current Project** opens a selection tree window, containing all speakers and traces of the current project. Select the trace you want to copy into the Quick-Trace and then press the OK button to assign the trace. Any trace previously assigned to this Quick-Trace will be deleted.
 - **Load from other Project** performs like the *Load from current Project* function,

but opens a select project window prior to showing the tree window. You have to select the project file first, after that the tree window is shown.

- **Import from CSV File:** allows you to import a frequency response from a CSV style text file.

Hints:

- Depending on the selection of the option **Show Edit Name Window on Assignment** in the **Setup -> Post Process** window the function **Rename** is activated after the trace is assigned to the Quick-Trace.
- The Quick-Trace is displayed after assignment.

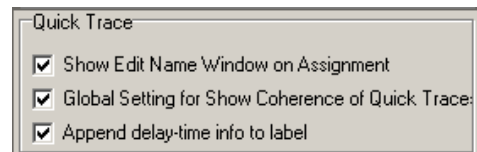
Show / hide a Quick-Trace

You can show or hide an assigned Quick-Trace either by clicking with the left mouse button on the button assigned to the Quick Trace or by using the number key (1..8) assigned to the Quick-Trace.



In the MAT Module you can enable the display of the coherence trace.

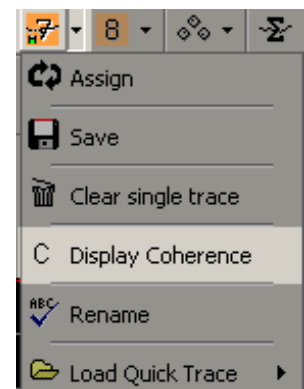
If the option **Global Setting of Show Coherence of Quick Traces** is selected in the **Setup -> Post Process** window then the display of the coherence is controlled globally for all Quick-Traces in the **settings**



& tools sub menu in the pop-up menu of the button Σ related to the sum trace.

Otherwise you can control the display of the coherence trace in the pop-up menu related to the Quick-Trace.

You can change the **color** used to display the Quick-Trace in the **Setup -> Display** section.

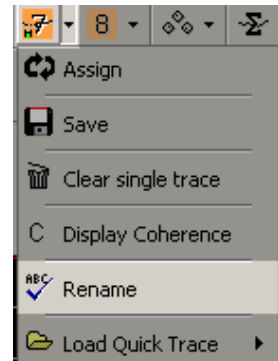


To change other settings, like **offset** or **smoothing**, choose the Quick-Trace as the **selected trace** and use the settings assigned to the selected trace.

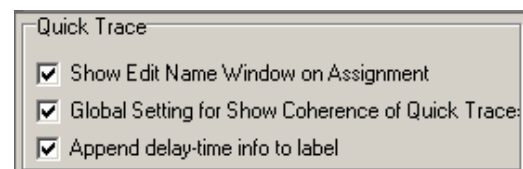
Rename a Quick-Trace

You can label a Quick Trace. The label is used as the hint assigned to the button and is used in the show value of selection menu and in the selection trees used in the project manager and for the load from current project and for the load from other project function.

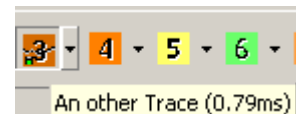
To change the label of a Quick Trace use the entry **Rename** which is located in the pop-up menu of the button related to the Quick-Trace. If you've selected the **Show Edit Name Window on Assignment** option in **Setup -> Post Process**, then the Rename function is executed after you've assigned the live trace to a Quick-Trace.



You can click on the icon of the particular Quick-Trace in the menu bar with the right mouse-button to invoke the rename function.



If the option **Append delay-time info to the label** is selected then the delay used when the trace was recorded is shown right to the trace text label, both in the Quick-Trace menu and in the upper right area of the trace – display window.

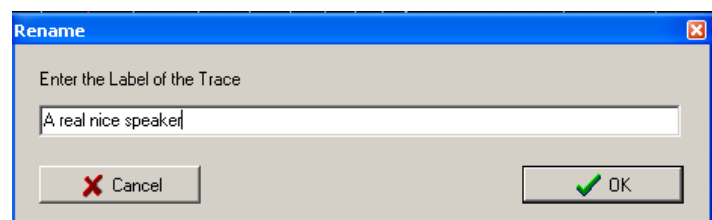


The Rename function shows a window, where you can edit the label.

After you've edited the label, you can apply the changes using the button **OK**.

Depending on the current status, the button **Cancel** works in different ways:

- If you executed Rename from the pop-up menu of the button related to the Quick Trace, then **Cancel** closes the rename window without changing the label.
- If Rename is executed by default during the assignment, then **Cancel** will close the window **and stop the assignment**. In this case the live trace is not assigned to the Quick Trace.



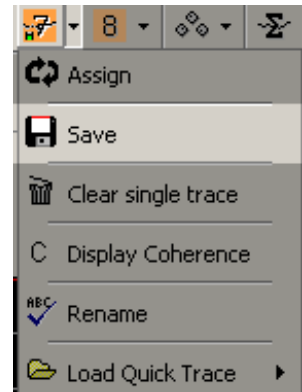
Save a Quick-Trace

All Quick-Traces are saved during the assignment.

If you want to save a Quick-Trace to a file with another filename, you can use the **Save** entry in the pop-up menu of the button related to the particular Quick-Trace.

The **Save** function opens a file name selection dialog. Just click on OK after setting the file name to save the trace.

You can use the file type selection in the save dialog to select another type of file.



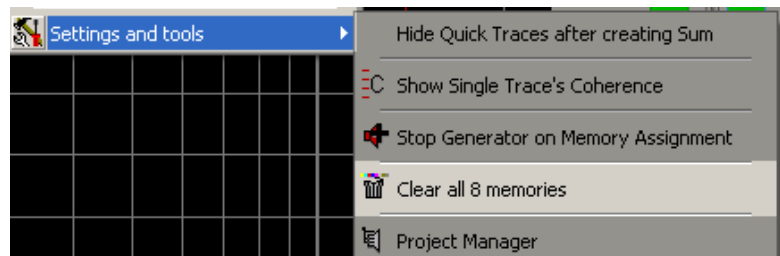
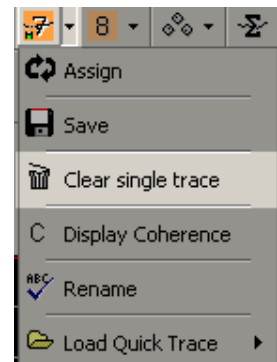
Clear a Quick-Trace

There are different ways to clear one or more Quick-Trace(s).

- Use the **Clear Single Trace** entry in the pop-up menu of the button related to the Quick-Trace.
- Use the **Clear all 8 Memories** entry in the **Settings and Tools** sub menu in the pop-up menu of the button Σ related to the Sum Trace to clear all Quick-Traces at once. If a project is

currently selected, all the Quick-Traces related to the speaker currently selected will be cleared.

- The measurement impulse response does not support a sum trace. Therefore the **Clear all 8 Memories** function is located directly in the menu bar in this measurement.



Sum Trace

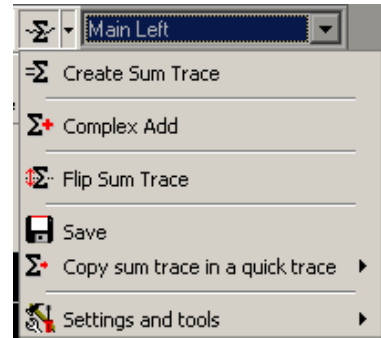


SATlive enables you to add some Quick-Traces into one trace.

This trace is called the **Sum Trace**.

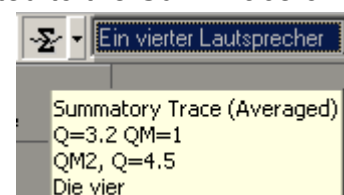
The Sum Trace is managed by the button Σ and its pop-up menu.

- The two topmost menu entries create a new Sum Trace. The Sum Trace is created using the Quick-Traces currently visible. Therefore those entries are enabled only if at least one Quick-Trace is displayed.
 - **Create Sum Trace** calculates the Sum Trace using only the amplitude values. The traces are normalized prior to the calculation, thus removing the absolute level information. Therefore this calculation is suitable for averaging traces taken on different locations.
 - **Complex Add** calculates the Sum Trace using both amplitude and phase information. Therefore all interferences are calculated, which makes this type of calculation the best choice when you need to add signals from different sources on one point.
- The next three entries define deal with the Sum Trace. Therefore they are available only if a valid Sum Trace exists.
 - **Flip Sum Trace** mirrors the Sum Trace on the zero dB line. This eases the adaption of an EQ to the Sum Trace.
 - **Save** save the Sum Trace into a file.
 - **Copy Sum Trace in a Quick-Trace** copy the current Sum Trace into one of the eight Quick-Traces. This enables you to compare different Sum Traces. Select the Quick-Trace in which the Sum Trace should be copied from the entry's sub menu.
 - The entry **Settings and Tools** shows a sub menu containing more functions and settings related to the Sum Trace.



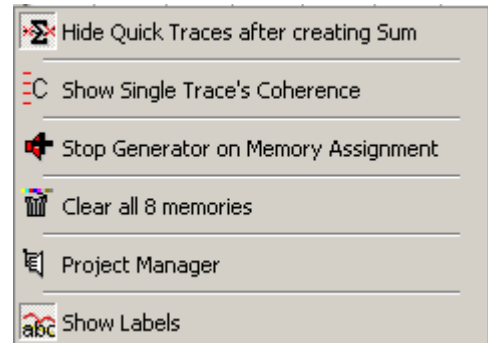
Hints:

- Depending on the measurement selected, not all entries might be available.
- You can select the Sum Trace as **selected Trace** and use the menu assigned to the selected trace to edit the Sum Trace.
- You can show/hide the Sum Trace using the button related to the Sum Trace or by using the shortcut 0 (Zero).
- The names of the Quick-Traces used to create the current Sum Trace are shown as the button's hint.

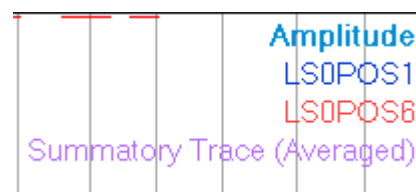
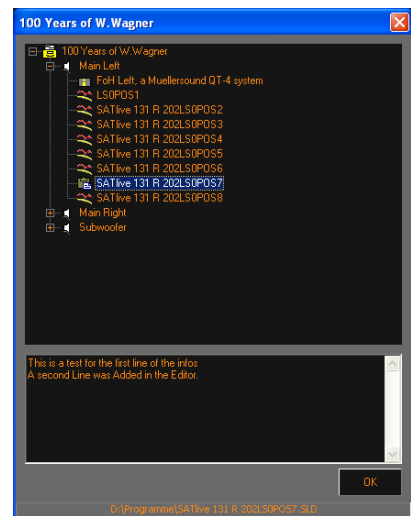


Settings and Tools menu (Sum Trace)

The Settings and Tools menu is a sub menu in the pop-up menu of the button Σ related to the sum trace.



- **Hide Quick-Traces after creating Sum** if you select this option then all Quick-Traces will be hidden when you create a sum trace, otherwise the visibility of the Quick-Traces is not affected.
- **Show single trace's coherence** select this option if you want the coherence of each visible Quick-Trace to be displayed in the graphic. This setting is available only if the option **Global Setting for Show Coherence of Quick Traces** in **Setup -> Post Process** is selected. Otherwise you can enable the display of the Quick-Trace's coherence of each individual Quick-Trace in its pop-up menu.
- **Stop Generator on Memory Assignment** if this option is selected, then the signal generator will stop after the live trace is assigned to a Quick-Trace.
- **Clear all 8 Memories** deletes all eight Quick-Traces. If a project is selected, then all the Quick-Traces assigned to the currently selected speaker will be deleted.
- **Project Manager** opens the project manager's window, where you can add and rename speakers and traces. The project manager is available only if a project is currently selected. Use the lower window to edit the description of the project. This description is displayed in the file-selection window and in the project setup window as well. You can use the key – combination **Ctrl – P** to invoke the project manager as well. Details about the project manager can be found on page 191.
- **Show Labels** show the names of the currently shown Quick Traces in the upper right of the trace display area. See page 219 for details about quick traces.



Thanks to

- Bill Waslow (www.libinst.com) for sharing his knowledge and experience.
- Uli Müller (www.audiotester.de).
- The beta testers Tamas Tako, Lukacs Sudar, Steffen Romeiß, Wolfgang Rathke, Marco Habeck and Maciej Blachnio.
- **Jan Goyvaerts** creates HelpScribble (<http://www.helpscribble.com>), the software which creates the help file.
- **Jordan Russel** (<http://www.jrsoftware.org>) for his Toolbar - Component and the Inno Setup installer software.
- **Martin Fay** (www.martinfay.com) creates the openASIO – DLL.
- **Frederic Vanmol** (www.axiworld.be) made a Delphi Interface to use the ASIO-DLL.
- **David Barton** (www.cityinthesky.co.uk) builds the cryptographic software used in **SATlive**.
- **SATlive** uses the **graphics32** (www.graphics32.org) library.
- All **SATlive** users who send suggestions, report errors and shared ideas.
- To my wife, allowing me to spent so much time on the pc.
- To the LIVING-WATER gospel choir (www.living-water.de) for all the challenges. I love those old church buildings here in Germany.
- Last but not least to my lord and savior Jesus Christ.

Release information

- 08-24-2011 (1-40-26) Added the setting window for the Live-Add Trace (Page 216), internal improvements.
- 07-23-2011 (1-40-24) Fixed two bugs and add the possibility to set a latched cursor using the mouse. See page 73 for details.
- 07-13-2011 (1-40-22) Added Delay Suggestion Tool (see page), added transparent overlay for indication of the range selected, added shortcut Ctrl – D for adjust delay function. You can select the different measurements from the menu bar in MAT-Module now. Some fixes.
- 04-29-2011 Some bug fixes
- 04-19-2011 Decimal Places in room-acoustic window added, stepping of trace-width setting changed, one bug-fix.
- 04-10-2011 Allow Jitter option, two bug fixes.
- 03-23-2011 Auto-Delay, Move trace using the mouse, coherence handle, double-click on trace-display and gain-display.
- 02-06-2011 Added memory trace to the room-acoustic calculation.
- 01-15-2011 Added information for **Use Reference Time as new Delay** in the Pop-up menu of the delay-time display section on page 118.
- 07-01-2011 Added information related to the version 1.40 and removed typos. Added/changed referring page numbers.
- 12-01-2010 Added information about the info section of the project management.
- 09-13-2010 Added changes related to the version 1.33.1.19 (virtual X-over, shelving-filters, signal-addition menu, pop-up signal-generator, pop-up delay-time display), fixed some typos and layout issues.