Vallen VisualTR™ Overview

What is VisualTR™?

VisualTR is a program for analysis and presentation of AE TR-data files.

What is "Visual" Family of programs?

The visual family of programs is designed to analyze and present data under Windows operating system.

Members

VisualTR™ is the second program in the new "Visual" family of AE Windows software products, **VisualClass™** being the first and **VisualAE™** being the third.

Family Characteristics

The motif that ties the "Visual" family of software programs together is the ability to see (visualize), both the data and analysis being performed on the data.

How the VisualTR™ Display is organized

VisualTR presents the user with three levels of data organizations: Diagrams/Pages/Windows.

TR-Diagrams (single TR-data set objects)

TR-Diagrams are presentations of single TR-data sets. TR-Diagrams are functional building blocks (objects) used in the "Visual family" and are controlled in a similar fashion in all "Visual" programs. Among the TR-Diagram options is the option to display more than one graphic (master and client displays). Both of these individual graphics are always displaying data from the same TR-data set.

Pages (organization of TR-diagrams for analysis/printing)

Pages are groups of TR-Diagrams. These pages simplify data analysis and printing. Many separate pages can be set up and independent analysis can be carried out on each.

Windows (interfaces to individual data file)

Windows are the complete displays (all pages) for individual data files. Several windows can be opened simultaneously and manipulated with the familiar Windows controls.

What Happens when Analysis is resumed

Automatic State Recall

VisualTR stores the state of data analysis when a window is closed or the program is exited. This state is restored the next time the data file is started. This setup includes the diagram/page/window layout and the display options for each.

File Types used with VisualTR™

.TRADB

VisualTR can analyze all AMS3, AMSY4 and AMSY-6/-5 data sets (data file extension .TRADB). Under Windows 9.x/NT/2000, data files can be opened under **VisualTR** with the properties context menu. **VisualTR** treats TRADB files as read-only; **VisualTR** will never alter the contents of the data itself.

.VTR

The program state information is stored in a file with the extension ".VTR". **VisualTR** will rewrite the contents of the VTR file with each use.

Title: Intro-1: VisualTR Overview
Link: AESuite/VisualTR/Introduction/VisualTR_Overview.htm

VisualTR™ Program Tips

Since many of the uses of **VisualTR** may be self-evident, it is worthwhile to review a number of unique features that can be beneficial and one might not immediately notice. They can be found in the **Edit** menu:

Sequential and Channel Assigned Modes

VisualTR provides two modes are provided for updating diagrams on a TR-page:

- Sequential mode - each command to display a new TR data set will display it in sequence from top to bottom on the page. This mode is useful for seeing data in the order it was acquired.
- Channel assigned mode - each command to display a new TR data set will display it in a specific position on the page. This mode is primarily useful in viewing hits from a single event where each event will always occupy the same position on each page. A second use of this mode is to establish different settings (digital filters, for example) and assign all pages to the same channel. Each new page will now display the same signal under different circumstances.

Run Mode

VisualTR allows the user to step through data sets automatically. By specifying "Run mode", the **VisualTR** display will continually advance through a TR-file, according to sequential or channel assigned mode.

Fixed and Auto scaling the y-axis

Two scaling methods help to optimize the visualization of signals:

- Auto scale will maximize the y-axis of the signal while still displaying the peak in the window.
- Manually adjusting the y-axis is useful for looking at signal noise and threshold effects of signals.
- Fixing all y-axis scales to a specific value will make amplitude comparisons between signals easier.

Page Usage

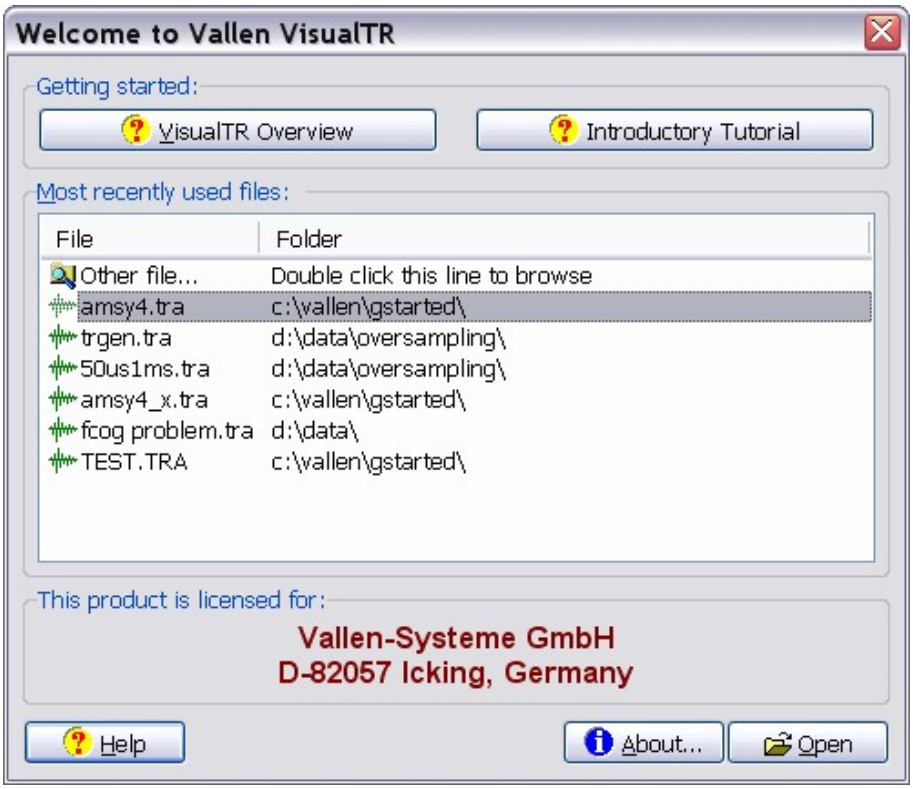
Grouping a set of diagrams on a single page makes it easy to reference previous analysis.

Title: Intro-2: Tips on VisualTR
Link: AESuite/VisualTR/Introduction/VisualTR_ProgramTips.htm

A first look at VisualTR

Welcome to **VisualTR™** is a Dialog which requires a TR-file name. For this purpose, it presents a file selector

list. Analysis proceeds when an analysis file is opened. An item from the most recently used files should be selected to continue. If you choose to close this dialog with the "X", you should select the "Open" item from the "File" menu.



Most Recently Used Files

Other file...

Selecting "Other File" will open a file selection dialog. Select a TRA-file for analysis. The file AMSY4.TRA is provided for testing for practice in analysis. It is found under the c:\vallen\gstarted directory.

List of files

Choosing a file listed here will open the selected file.

Title: Intro-3: Welcome to VisualTR
Link: AESuite/VisualTR/Introduction/VisualTR_dlgWelcome.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > Introductory Exercise into VisualTR

VisualTR™ Introductory Exercise

Purpose

To become familiar with VisualTR commands: This step by step procedure is intended to quickly survey **VisualTR™**'s features on actual data. It will take at least 10 minutes, however exploring variations on the presented options may take longer.

Hint: Printing this exercise will make it easier to follow.

Data File

This exercise uses the 36 TRA hits found in c:\vallen\gstarted\AMSY4.TRA. A description of the data can be found in the section about Example Data.

Steps

The following 10 steps are designed for execution in sequence. A short description of what is happening proceeds the actual steps followed by actions marked by bullets "•" which must be followed to maintain the sequence. **VisualTR** will remember your last place, so you may halt the exercise at any point and continue later.

1. Select file AMSY4.TRA

The file to be selected for this exercise is c:\vallen\gstarted\AMSY4.TRA. A file selection dialog can be called up:

- Select "Other file" from the **Welcome to VisualTR™** window when the program is started,
- *(or)* select "Open" item out of the **File** menu when the program is running,

Steps 2-6: TR-Set Examination

2. Setup a page with 4 diagrams (sets 1-4)

The program begins with 2 diagrams on one page. We would like to see all 4 hits belonging to the same event, so 2 additional diagrams are needed. We would also like to see set 1 as the top diagram followed by set 2, 3 and 4.

- Select "Add diagram" out of the **Edit** menu. Repeat. There should be four diagrams on the page.
- Look at the information line above each diagram to see which set it is displaying. For each diagram which does not match the desired diagram: clicking on it with the left mouse. The tool bar will appear, use the blue forward/backward arrows to reach the set number.

Hint: The sets can also be accessed with **Next/Previous Set** or **Goto Set** from each diagram's context menu.

3. Duplicate page, setup tab names

Next, we would like to set up a second page and give each page a distinctive name.

- Select "Add Page" from the **Pages** menu. There should now be 2 tabs at the bottom of the screen labeled Page 1 and Page 2.
- Select Tabs out of the **Pages** menu (or click right mouse on the page tab). The **Tab Settings Dialog** will appear. Select Page 1 in the list. In the edit box on top, change Page 1 to Event 1. Select "Page 2" in the list. Change it to "Other Events". Hit return or select OK. The tabs at the bottom of the screen should now have the labels "Event 1" and "Other Events".

4. Enable channel assignment, 1-2-3-4

Now we should step through the file.

- Select page "Other Events". Select the item Channel Assignment out of the **Edit** menu. The **Channel Assignment Dialog** will appear.
- Click in the channel assignment enable box. The four diagrams should read 1,2,3,4 from top to bottom. If not, adjust these. Select OK.

5. Step through events

We will step through the data sets by two means: first 5a and then 5b.

1.
   a. Navigating through the data automatically

1.
   b.
      - The simplest way to see the entire data set is to select the item Run out of the **Edit** menu. The data set will begin to increment the data sets automatically, one after another. This continues until either the end of the file is reached or "run" is deactivated with the run command. When finished, deactivate "run."

   c. Navigating through the data manually

1.
   a.
      - Select the top diagram. Click the right mouse button to get the context menu. Select GoTo Set with the left mouse button. The GoTo Set Dialog will appear. Select Set number 1.

      - Select Next Set from the Edit menu. Repeat this until sets 5 through 8 are displayed on the diagrams (6,5,7,8). You should see that channel 2 (set 5) was hit first, followed by 3, 2 and 4.

      - Switch to page 1 ("Event 1") with the tab at the bottom of the screen. You should see that channel 1 (set 1) was first hit in this event, followed by channels 4,2,3. You can also observe that the time delays for second, third and fourth hit channels are similar for both events (events 1, 2, 3 and 4 are from autocalibrations beginning at sensors 1,2,3 and 4 respectively).

6. Axis Scaling

There are three scaling options for vertical axis in **VisualTR**: Auto scale, manual scale and fixed scale. By default, each graph is auto scaled, which means **VisualTR** shows all of the signal that fits the peak inside the window. Start on Page 1 ("Event 1"). Try both alternative scaling options: 6a and 6b.

1.
   a. All channels can be fixed to the same scale with "Fix Scale All."

1.
   b.
      - Select the item "Fix scale all..." out of the Edit menu. The Fix vertical scale dialog will appear.

      - A suggested maximum is already given for maximum time amplitudes. Enter a value of 30 mV in the time diagram section of the diagram,

      - Click on the Fix scale button next to the time axis scale, and then "Okay." You should observe that, except for the pulsed channel which has not been amplified, the amplitude decreases in this event with later arrival times.

   c. Each channel can be manually scaled by selecting manual scale out of its diagram context menu.

1.
   a.
      - The tool bar must be visible for auto-scaling, so click on diagram 3 with the left mouse button.

      - From the diagram's context menu, select "Auto Scale" which is presently checked. A scroll bar to the right of the screen will appear.

- For better viewing, select "Zoom" out of the diagram's context menu. By moving the scroll bar to the bottom, you can see the electrical noise in the signal. By moving the scroll bar to the top, you will see only the largest part of the signal, if any.

When finished with step 6, delete page "other events." This is done by first making it the currently active page (click on its tab) and then selecting the item "delete page" out of the "pages" menu.

Steps 7-10 TR-Client Examination and Advanced Options

7. Set up 4 hits with TR-clients on a new page

- Make a new page by duplicating the first page (sets 1-4).
- Name this page "Event 9" and select sets 33 to 36 for the hits on this page.
- Select the option Add TR-client from one of the diagram's context menu. The diagram splits into two showing a frequency spectrum for the second diagram. Repeat this for each diagram.

8. Settings for TR-Client

We would like to look at a specific portion of each diagram corresponding to its arrival.

- Select settings from the context menu of the diagram. The diagram's settings dialog will appear.
- In this dialog, set the following values for each diagram: range=1024 samples, minimum FFT range=4096 samples. Also, select a separate window for each channel:

Channel 1 (set 33): Offset = -100

Channel 2 (set 34): Offset = 300

Channel 3 (set 35): Offset = 500

Channel 4 (set 36): Offset = 200

9. Digital filters

Note that the 150 kHz resonance dominates the sensor's response. There are some higher order resonances above 150 kHz which are difficult to see in the presence of the 150 kHz resonance, we can observe these with digital filters.

- Duplicate this page and name the new page "Filtered event 9."
- Select Digital Filters from the diagram's context menu. The digital filters dialog will appear. Choose high pass for the filter type, enter 200 for the high frequency cut-off and 160 dB/octave for the filter slope. Repeat this for each diagram. You should now see there are two frequency peaks left in each of the TR-clients frequency spectrums: one between 200 and 210 kHz and another near 250 kHz.

10. Gaussian correlation

The filtered data from step 9 tends to have two time peaks and two frequency peaks in the selected time windows. Does one frequency dominate for one time peak? We will look to see what the Gaussian correlation says.

- Select Gaussian correlation from diagram's context menu. The Gaussian correlation dialog will appear.
- Select "Add" and enter 210 kHz in the diagram.
- Add a second Gaussian, this time at 250 kHz and exit the Gaussian filter.

- Repeat the last two steps for each diagram. You should see, especially at with sets 34 and 35 that the 210 kHz Gaussian appears with the first wave packet and that the 240 kHz Gaussian appears with the second.

This is the end of the interactive tutorial exercise, however you are invited to try the other functions on this file.

Title: Intro-4: Introductory Exercise into VisualTR
Link: AESuite/VisualTR/Introduction/VisualTR_InteractiveExercise.htm

VisualTR™: Sample Data

Overview

There are 36 data sets stored in AMSY4.TRA, 4 channels hit in each of 9 events.

Test Object, Sensors, and Channel Positions

The channels are arrayed at the four corners of a 21 x 32 cm plastic plate. Channel positions, relative to (0,0) at the center of the plate, are:

- channel 1= -15, 10 cm
- channel 2= 15, 10 cm
- channel 3= 15,-10 cm
- channel 4= -15,-10 cm

Each sensor is an SE150M (150 kHz sensor). The signals pass through 95-850 kHz filters.

Data Stored in File

The sources for the nine events are:

- 1-4 (hits 1-16): Autocalibration signals at the four sensors (1,2,3,4)
- 5-8 (hits 17-32): Pencil Lead Breaks at (-8,8), (8,8), (8,-8), (-8,-8).
- 9 (hits 33-36): A pulser placed at (-4,4).

There are 4096 samples per set, sampled at 10 MHz. The samples are pool triggered, meaning the actual delays are measured in each case.

Note: The 36 hits in this TRA file were selected from a larger TRA file. You can see that hit 36 has index 248, an indication that this set is only 15% of the original set. This data reduction was performed with TR-Combi.

Where

AMSY4.TRA is found in the c:\vallen\gstarted directory. It corresponds to the AMSY4.PRI file also in this directory.

Title: Intro-5: VisualTR Sample Data
Link: AESuite/VisualTR/Introduction/VisualTR_ExFileDescript.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > Menu > Main Menu

VisualTR: Main Menu

The main menu provides access to many of the functions of VisualTR™.

Menu File

Standard file operation commands. See chapter **Menu File** for details.

Menu Edit

General setup functions. See chapter **Menu Edit** for details.

Menu Page

Functions to change page settings. See chapter **Menu Pages** for details.

Menu Window

Standard Windows functions to arrange several open project windows inside the main window. See chapter **Menu Window** for details.

Menu Help

Calls the online help system and tutorials. See chapter **Menu Help** for details.

Hint: For a first introduction into using **VisualTR™** see chapter Introductory Exercise.

Title: Menu-1: Main Main
Link: AESuite/VisualTR/Menu/VisualTR_MainMenu.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > Menu > Menu File

VisualTR: Menu File

The File menu offers well known Windows functionality for opening and closing projects, as well as printing. This menu can be found by **File** out of the main menu.

Open

Opens a new TRA-file. The TRA-file contains the waveform data. When exiting VisualTR™ the current setup is automatically saved to setup file with extension .VTR.

Close

Closes the currently open TRA-file.

Print (shortcut <F2>)

Opens the **Print Preview** dialog for printing.

Most recently used file list (MRU-list)

The MRU-list is a history list that allows one to quickly access the most recently used files.

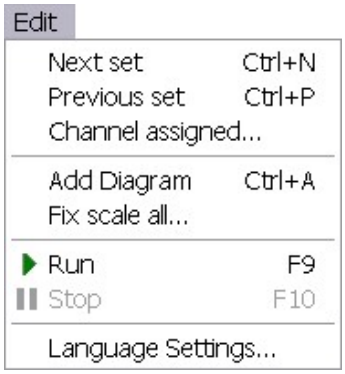
Exit

Exit quits VisualTR™.

Title: Menu-2: Menu File
Link: AESuite/VisualTR/Menu/VisualTR_MenuFile.htm

VisualTR: Menu Edit

The Edit menu provides functions that affect all diagrams on the current page at once. This menu can be found by **Edit** out of the main menu.



Next Set (shortcut <Ctrl+N>), Previous Set (shortcut <Ctrl+P>)

Displays the next/previous data set of the TRA-file depending on the mode currently selected:

- If in sequential mode (the default mode), the next/previous data set will be inserted in the next/previous diagram. The next/previous diagram is the diagram immediately below/above the current diagram. When the diagram is the last/first diagram on the page, the next/previous data set will be inserted in the diagram on top/at bottom of the page.
- If channel assigned mode has been selected, the next/previous data set having a channel number which is assigned to a diagram will be inserted into all diagrams to which this channel number is assigned.

Note: Next Set will do nothing if the current set is at the end of the data file.

Channel assigned

Calls a dialog to assign a fix channel number to each diagram. See chapter **Channel assignment** for details.

Add Diagram

Adds one diagram to the page below the bottom diagram. Re-scales all diagrams on the page.

Fix Scale All

Allows one to fix scale all diagrams on the current page to the same scale. See chapter Fix scale all diagrams for details.

Run (shortcut <F9>)

Automatically increments the data sets continuously until all data sets in the file has been stepped through. Behaves as a continuous series of "Next Set" commands.

Stop (shortcut <F10>)

Stops the Run mode.

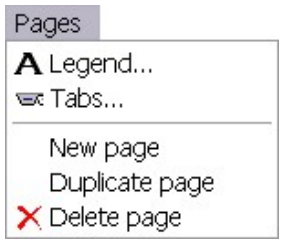
Language Settings

Calls a dialog to change the current language shown.

Title: Menu-3: Menu Edit
Link: AESuite/VisualTR/Menu/VisualTR_MenuEdit.htm

VisualTR: Menu Pages

The Pages menu offers everything required to modify the pages. This menu can be found by **Pages** out of the main menu.



Legend

Calls the Page Legend dialog. See chapter **Page Legend** for details.

Tabs

Opens the Page Tab Settings that allows one to rename and rearrange pages.

New page

Creates a new page.

Duplicate page

Duplicate page creates a new page. The new page becomes the last page (furthest right) and becomes the currently active page. The new page has the same number of diagrams and the same settings for each diagram as the page that was currently active when selecting the command.

Delete page

Delete page eliminates, after a confirm dialog, the currently active page.

Title: Menu-4: Menu Pages
Link: AESuite/VisualTR/Menu/VisualTR_MenuPages.htm

VisualTR: Menu Window

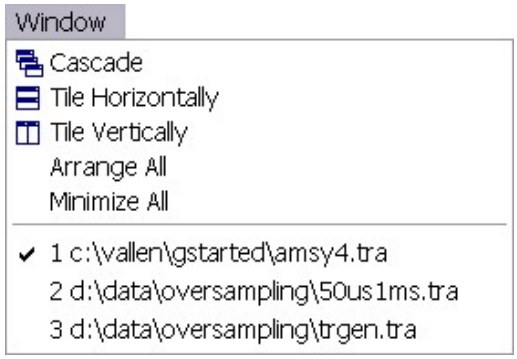
The Window menu offers the standard Windows function for managing separate open windows inside the application window. This menu can be found by **Window** out of the main menu.

Cascade, Tile Horizontally, Tile Vertically, Arrange and Minimize

These are the well known window commands for size and position of several project windows.

List of currently opened windows

The lower area shows the opened **VisualTR™** projects, the currently active (the one having the keyboard input focus) is checked.



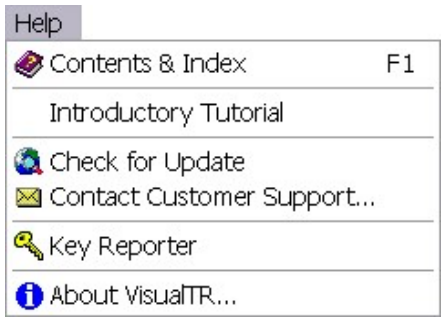
Title: Menu-5: Menu Window
Link: AESuite/VisualTR/Menu/VisualTR_MenuWindow.htm

VisualTR: Menu Help

The Help menu calls the online help system and tutorials. This menu can be found by **Help** out of the main menu or pressing the **<F1>-key**.

Contents & Index

Link to Contents and Index.



Tutorial

See chapter Introductory Exercise. When using VisualAE™ for the first time it is highly recommended to go through this tutorial first.

Key Reporter

Creates a report about currently installed keys.

See chapter Software Protection for details.

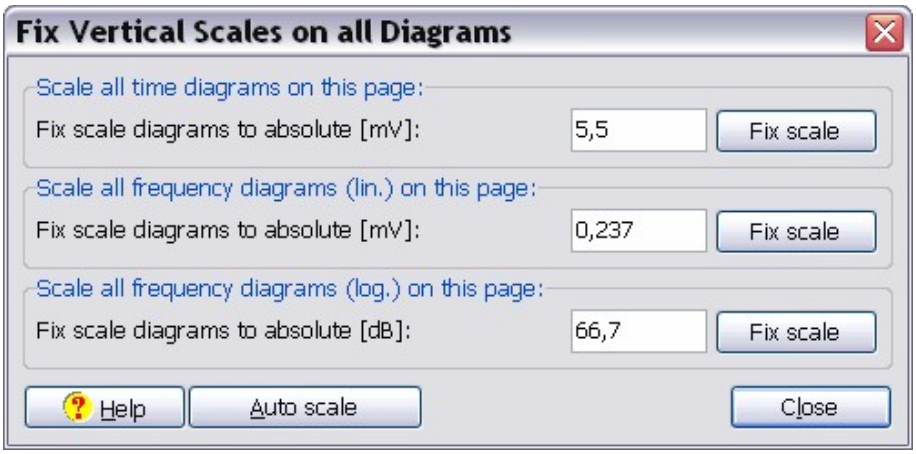
About

Shows general information about the program, its release version, the operating system and available memory.

Title: Menu-6: Menu Help
Link: AESuite/VisualTR/Menu/VisualTR_MenuHelp.htm

Fix vertical scale on all diagrams

Fix scale sets the maximum value for the vertical axis (y-axis) on all graphs of similar type. This is useful for direct comparison of several similar data sets.



Scale all time diagrams on page

Specifies the maximum value for the amplitude in sampled data graphs.

Scale all frequency diagrams (lin) on page

Specifies the maximum value for frequency magnitude in linear frequency graphs.

Scale all frequency diagrams (log) on page

Specifies the maximum value for frequency magnitude in logarithm data graphs.

Auto scale

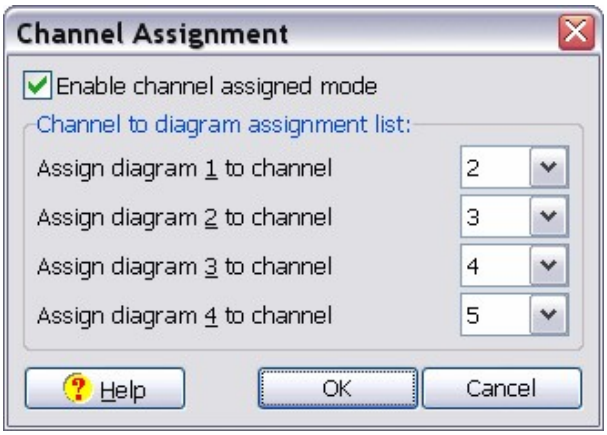
Returns all graphs to auto scale mode. The y-axis for each graph is determined so that all data can be represented on the graph.

Title: Use-1: Fix scale all diagrams
Link: AESuite/VisualTR/Use/VisualTR_dlgFixScaleAll.htm

Fix Assignment of AE channel to diagram

Channel assignment is used together with "Next Set" and "Previous Set" commands:

- When channel assignment is enabled, Next set will insert the next set into all diagrams with the corresponding channel assignment.
- When the channel of the next set has not been assigned, the following sets are automatically checked until there is match between channels or the end of the file is reached.



Enable channel assigned mode

When this box is active (checked with an √), the commands "**Next set**" and **Previous set** will place the next TRADB set in the diagrams according to the assigned channel.

Assign diagram x to channel

Designates which channel will be accepted into each diagram when the commands "Next Set" and "Previous Set" are executed.

Title: Use-2: Channel assignment
Link: AESuite/VisualTR/Use/VisualTR_dlgChannelAssignment.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > TR-Utilities > TR-Utilities Overview

TR Utility Programs (Option VTR required)

The **VisualTR Package** contains a number of utility programs. Those are quite useful tools completing the software's functionality. They are located on the tabs "TR" of the Vallen Control Panel.

TR-Utilities

TR-Combi	To select TR-data sets (waveforms) out of one or more source files and to assign them in any combination to one or more target files.
TR-Copy	To copy selected data sets from of a transient file (TRA-file) into one or more new files using a script file.
Feature Extractor	To extract features from a TRA-file out of frequency domain to be used like results from a PRI-file.
New Feature Extractor	The new Feature Extractor is an extended version of the conventional Feature Extractor.
TR-Indexer	To rewrite and update the indices in a TRA-File.
TR-Unifier	Change different TRA-file formats (sample rate and page length) to a common format so that they can e.g. be combined to a common file (using the utility **TR-Combi**) or used with **VisualClass**.
TR-Filter	To limit the frequency range of already acquired TR-data by means of a digital filter.
TR-FFT-Averager	Calculates the average of all spectra on a TRA-file

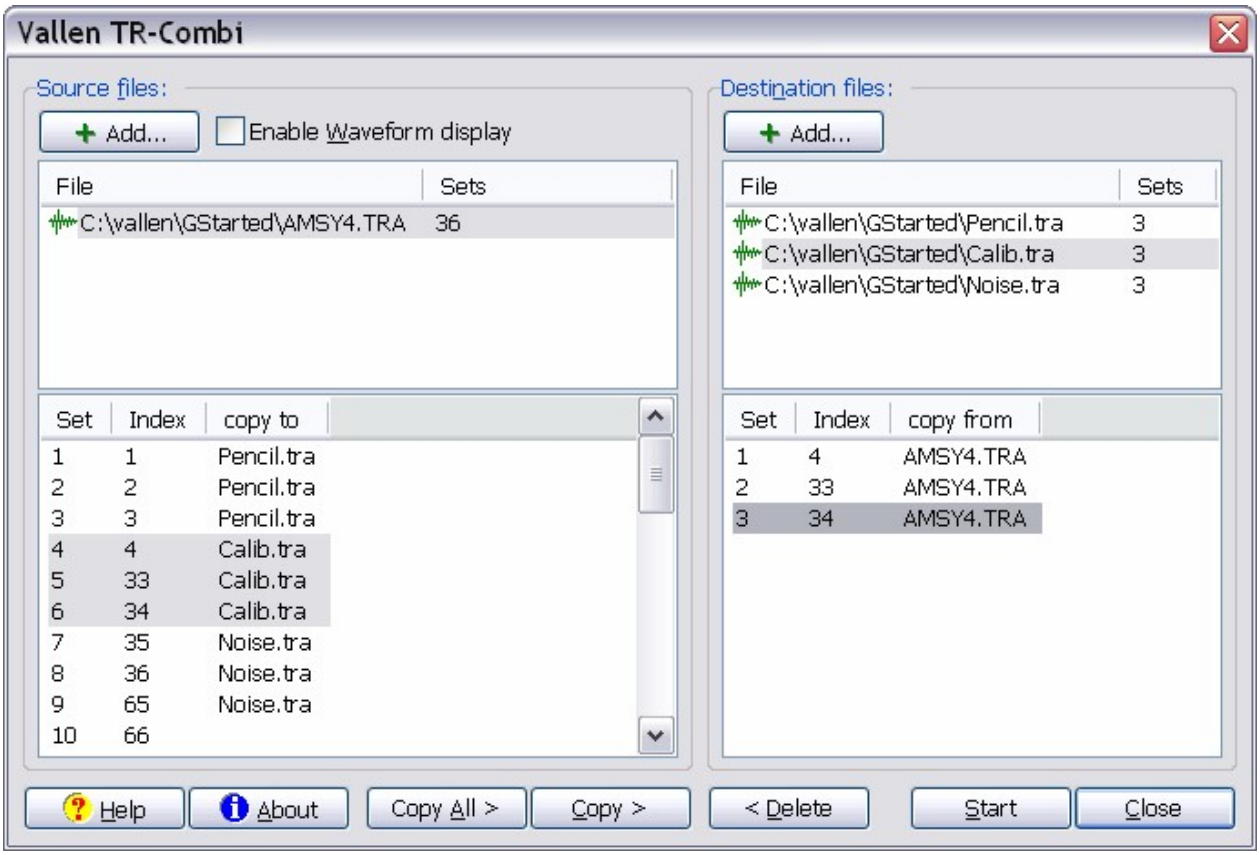
See also: AE Utilities

Title: Utility-0: Utilities Overview
Link: AESuite/VisualTR/Utilities/Utilities_Overview.htm

TR-Combi

Purpose

To select TR-data sets (waveforms) out of one or more source files and to assign them in any combination to one or more target files. TR-Combi can also be used to combine several transient data (TRA-) files.



Source files

This group represents the data source. Source files can be added by use of the "Add" button and are listed in the list window below. Only one source file can be selected at a time. For each selected source file the content of it is displayed in the list window below.

Waveforms of any data set can be displayed. Check "Enable Waveform Display" and click on any data set to see its waveform.

Hint: The open dialog for the source files allows one to pick a text file containing several TRADB files, one for each line. This is a special extension in case a lot of files needs to be handled.

Destination files

This group represents the destination for the source. A single file or many files can be defined as destination. Destination files can be added via the "Add" button. The two list windows have same function is in case of the source file group.

Copying data sets from source to destination

To copy data sets from a source file to a destination file, select the source file in the top left list view and the destination file in the top right list view. Afterwards select by all those data sets that need to be copied. Use <Shift> and <Ctrl> to select more than one data set at a time. The shortcut <Ctrl+A> selects all sets in the list view.

Hint: The lower list views showing the TR sets do have context menus for faster access of the Copy function. Right mouse button inside the list view opens the context menu.

Assigning data sets to destination files

Click on "Copy" to assign the chosen sets to the selected destination file. You can also use Drag-And-Drop to copy data sets from the lower left to the lower right list box. Repeat the selection and copy steps until all data sets of all source files you want to copy are assigned to their target file(s).

Note: This is just a data set assignment. No data is copied or modified unless you press the Start button.

Quick assign all data sets

In the simple case when all the source files need to be combined in a destination file, the "Copy All" button is a useful shortcut to combine all data sets in all input files into the current output data file.

Initiating the data copy operation

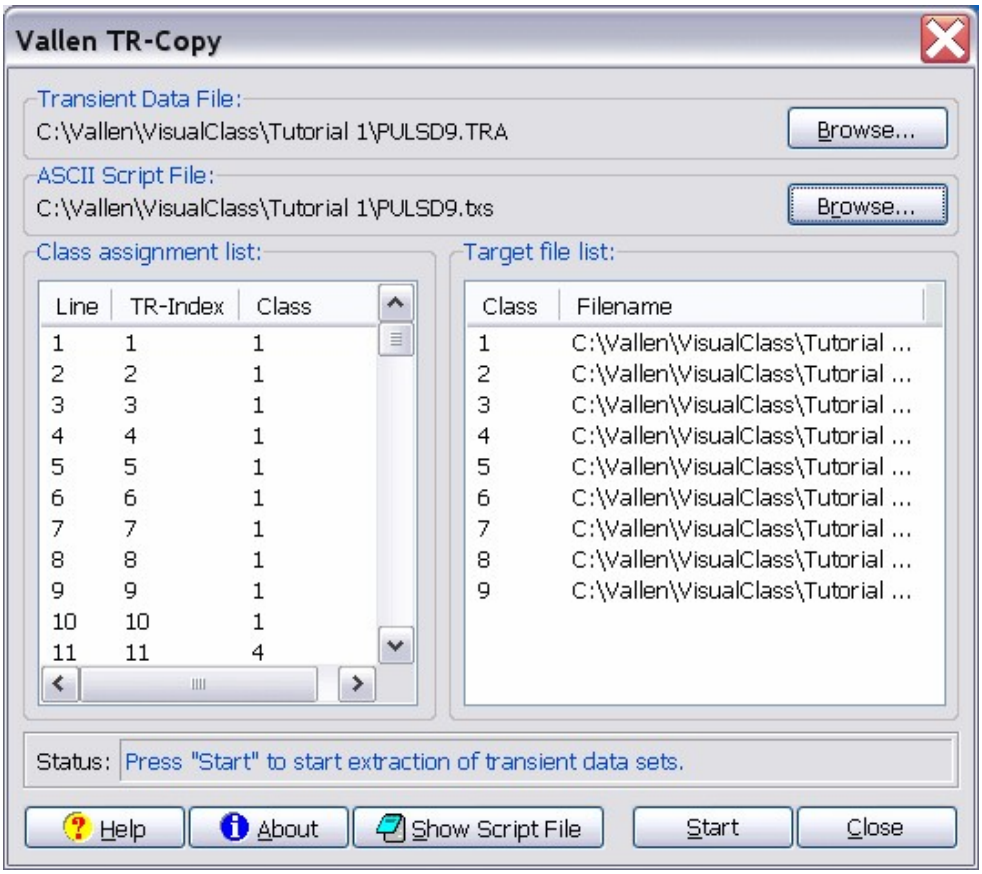
To start the copy process click on "Start".

Title: Utility-1: TR-Combi
Link: AESuite/VisualTR/Utilities/Program_TRCombi.htm

TR-Copy

Purpose

The purpose of **TR-Copy** is to copy selected data sets of a transient record data file into one or more new files using a script file.



Transient Data File

TR-Copy needs a source transient record data file. Waveforms are copied from the source file to one or a number of destination files.

ASCII Script File

The ASCII script file defines the data sets which are copied. It also defines the destination file to which a data set is copied to.

File format of the script file

Each line in the script file defines a TR-data set that is copied and a destination file id. The format of such a line is as follows:

<file ID> ; <TR-Index>

<file ID>

Must be a number. Can be used to split one source file into several destination files. If you want only one destination file then set this value to "1" for all sets. If you want to have more than one destination file then use a number for each target file, starting with "1" for the first file, "2" for the second and so on.

<TR-Index>

Specifies the TR-Index of the data set to be extracted. Each TR-Index can occur only once per script file. This means that each data set can only be assigned to one destination file.

Note: Lines in the script file with ambiguous format are ignored.

Creating a valid ASCII script file automatically by use of diagrams in VisualAE

This can be done in several ways. Common to all ways of creating a script file is that a correlation plot of TRAI vs another argument has to be created. The full range of filter possibilities can be applied to display only the desired TRAI-indices. Afterwards by the use of the copy option (right mouse click on the graph, then selecting copy option "copy/text to file") the result can be copied into a text/ASCII file. Here is a list of meaningful correlation plots:

- TRAI versus CLAS
- TRAI versus ClusterID
- TRAI versus ECP result, wherby ECP result delivers a file index

How to use TR-Copy

Step-by-step instructions to use TR-Copy:

- Click on the upper "Browse" button to select a source Transient Data File.
- Click on the lower "Browse" button to select an ASCII script file (can be e.g. the output of the separation file of classification; file extension .txs)
- If the script file format is valid, TR-Copy searches for the specified TR-indices in the Transient Data File and shows the selected set numbers in the list box on the left hand side. Sets shown in red color do not exist in the file.
- In the list box on the right hand side, the target file names are displayed which are to be created. You can change the name of the target file by a double click on the filename. Files shown in red color already exist. Be sure that you want to overwrite them.
- Click on "Start" to start the copy process.
- Click on "Close" to quit TR-Copy.
- Use the Windows Explorer to rename the new files to an expressive name before using them with another program.

Note: TR-Copy writes the file "Split.TRADB" or the series of files "Split1.TRADB," Split2.TRADB," ... so the user must observe that these files are renamed between several runs of **TR-Copy**.

Title: Utility-2: TR-Copy
Link: AESuite/VisualTR/Utilities/Program_TRCopy.htm

VisualTR: TR-Feature Extractor

Overview

The TR-Feature Extractor includes the following plugins: FFT-Feature Extractor, Classifier out of VisualClass and a the Spectral Ratio Extractor.

Purpose

Use this program to extract features beyond the conventional AE features from waveform data. This features are stored within a separate feature file (transient feature file, TRFDB) that can be read by VisualAE in combination with hit data, parametric data, location results, etc.

Use

VisualAE automatically uses the feature file if detected in the same folder and the same name (but extension TRFDB) as the PRIDB file and offers its results like other AE results out of the PRIDB-file. Please also verify that in VisualAE in the Project Settings (Edit/Project Settings/Other) the checkbox "use feature file" is checked.

Function

The Feature Extractor needs a source waveform file (*.TRADB), extracts certain features and exports those into the output feature file.

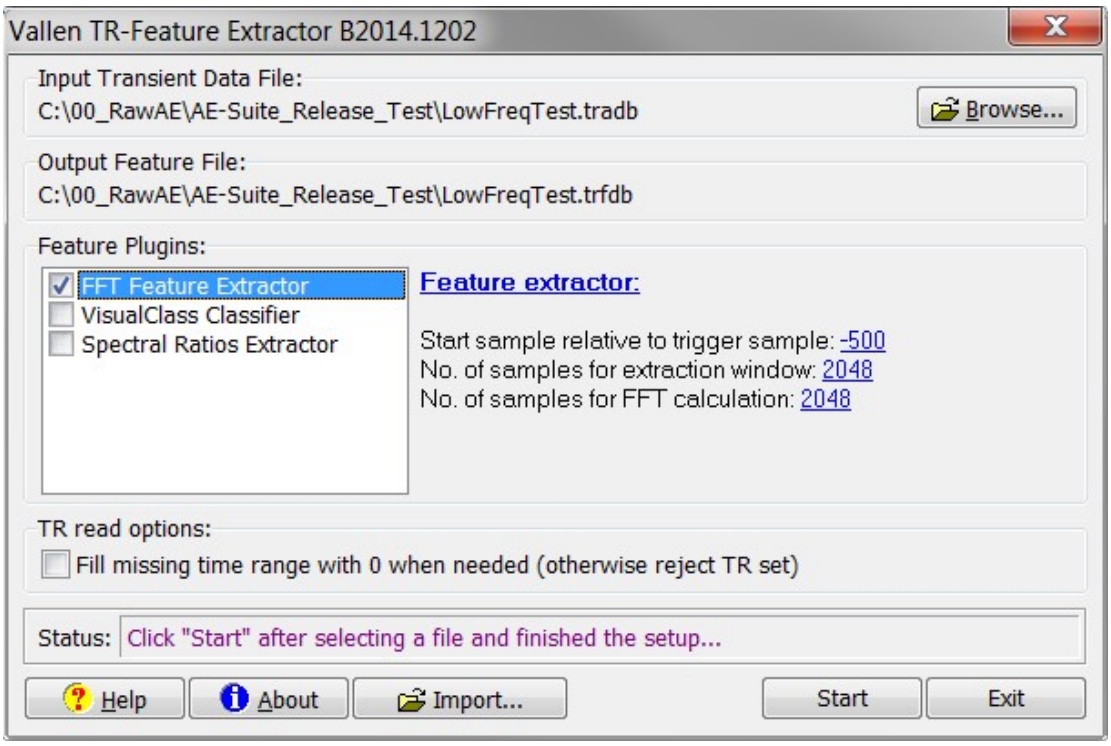
The features are calculated by feature plug-ins which are shown in the form within a box. Currently three "feature plug-ins" are built in:

- FFT Feature Extractor (compatible to old Feature Extractor)
- VisualClass Classifier (compatible with old Classifier program)
- Spectral Ratios Extractor

Each of the three plug-in modules can be individually enabled with checkboxes. On the right hand side a short description for the currently selected plug-in is shown. Click on any plug-in to show its property description. The description contains links which can be clicked on to open the property dialog for each plug-in. The property dialog also shows up if a plug-in is checked to be enabled.

Each plug-in defines its own features; all new features are written in the Output Feature File and can be used in VisualAE.

One essential advantage of this program is that it can generate features coming from different plug-ins. Using the former programs (Feature Extractor or Classifier) it was only possible to generate one Output Feature File containing a limited feature set.



Input Transient Data File

Select (via Browse button) the transient data file to which transients the individual plugins are applied

Output Feature File

File name for the feature file. This file name and location is set automatically based on the file name and location of the input transient data file

Feature plugins

check the plugins which shall be applied to transient data.

in the area on the right, click on links to open setup menu for the different plugins.

TR read options

TR pages recorded in duration adapted mode can have different length and number of pretrigger samples. Plugins of the TR Feature Extractor require that a user specifies the start sample of an extraction window, which can be before the trigger and the number of samples for extraction window. Variable TR-pages may not necessarily provide the number of pre trigger samples and total length as it is specified in the settings of the according plugins. In cases where a mismatch is detected the user can choose two ways of handling these exceptions:

1: discard pages that do not have the required number of samples. As a result no features are extracted for such pages. Uncheck the box in this case

2: fill missing samples with 0s. Check the box in this case.

Note: if the box is unchecked a page is discarded and therefore not available for ALL plugins even if only one plugin reports a mismatch in settings.

Title: TRFeatEx-1: New Feature Extractor
Link: AESuite/VisualTR/Utilities/TRFeatEx/TRFeatEx_Overview.htm

FFT Feature Extractor

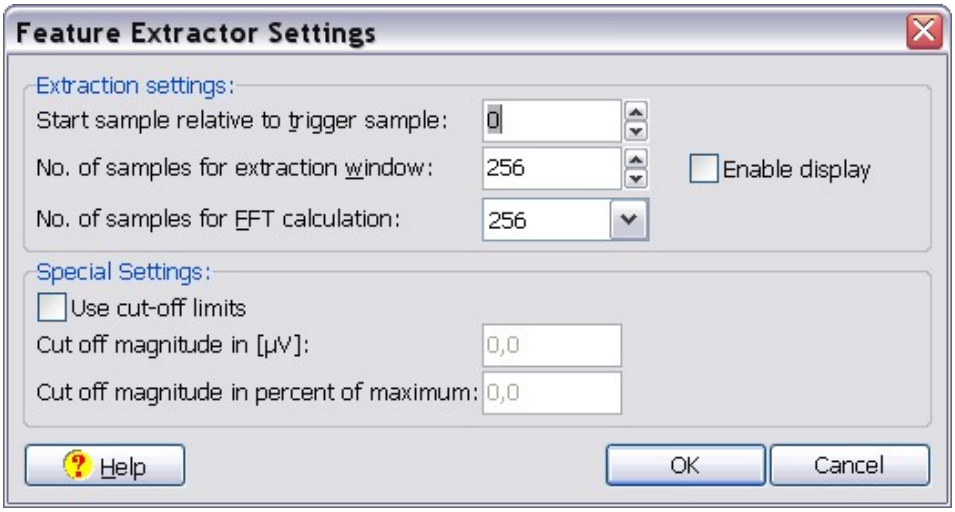
Purpose

To extract features from a TRA-file to be used like results from a PRI-file. Features are essentially out of the frequency domain.

Function

The Feature Extractor runs through all waveforms to extract the features. Currently, two features are extracted:

- FCOG: The frequency center of gravity (FCOG) is the frequency where the areas of the frequency spectrum below and above the FCOG are the same.
- FMXA: Frequency where the frequency spectrum has maximum amplitude



Extraction settings

Features are extracted only from the window specified by a start position in samples relative to the trigger sample (time of threshold crossing). The Feature Extractor takes the data out of the extraction window and applies a Hamming window to it (compatible to VisualClass). Afterwards the FFT is calculated.

Start sample relative to trigger sample

Specifies the starting point for the feature extraction (beginning of FFT-window). Start point is defined with respect to the trigger sample. Positive values shift the start point into the positive time position (later). Negative values shift the start point into the negative time direction (before the trigger sample).

No. of samples for extraction window

This setting specifies the number of samples that are considered for FFT calculation. It is recommended that the number of samples is a power of 2. Click the checkbox "Enable display" to show the current extraction window graphically (see section Waveform diagram: context menu and controls for more information).

No. of samples for FFT calculation

This specifies the number of samples used for the FFT calculation. This value is selected from a drop down list and is a power of two (always equal or larger than the number of samples for extraction window). The number of samples of the extraction window is expanded (padded with 0) to fit the number of samples for FFT calculation.

For extraction windows with less than 4096 samples, the maximum number of samples for FFT calculation is 4096. If the extraction window is larger than 4096 samples the maximum number of samples for FFT calculation is always the next larger power of 2.

If the display is enabled the result of the FFT is displayed in the right hand diagram. This diagram exactly shows the FFT as it is calculated by the Feature Extractor to determine the features mentioned above.

Special Settings

Use cut-off limits

If checked cut-off limits are used to calculate the features of the signal in frequency domain. The cut offs can be specified as an absolute value or relative to the maximum FFT result. By default this checkbox is unchecked.

The cut-off is applied in the frequency domain and shall avoid the influence of digitization noise on FFT Results of small signals. If the cut-off is set too high, it may happen that all bins of a signal are cut-off. The calculation of FCOG is not possible then. This is indicated by a result of 0,001 kHz (instead of 0, to avoid

division by 0 errors if an user processor would be used to calculate other results based on this value).
The FMXA result is defined even if the value is below the cut-off value.

Note: The number of samples used for FFT must be a value 2^N and must be greater equal to the number of samples used for the width of the extraction window. As the result of the FFT in frequency domain gives only half of the number of samples specified in time domain, it might be useful sometimes to use a higher number of samples for the FFT calculation than used for the width of the extraction window in order to increase the frequency resolution. In this case the time signal is zero padded for the length used for FFT calculation. As a result the absolute FFT magnitudes will decrease in the final result.

Step-by-step instructions to use Feature Extractor

- Click on the proper checkbox to enable the plug-in.
- Change any settings of the window parameters used for feature calculation. The Enable display button may be selected to see the window defined. You can specify more samples for the FFT calculation than defined by the width of the time window. The window is then filled up with zeros to increase the frequency calculation.
- Click OK to validate the settings.
- Click on Start in the main program to start the feature extraction process.
- When analyzing the corresponding .PRIDB file, the extracted features are available from the attribute menu.

Title: TRFeatEx-2: Feature Extractor plug-in
Link: AESuite/VisualTR/Utilities/TRFeatEx/TRFeatEx_Featex.htm

Classifier plug-in

Once a classifier has been built (".VCF" file) using VisualClass, it can be applied to classify independent transient recorder files (".TRADB" files). This can be done with this plug-in or with the standalone program.

Details about classification process can be found in VisualClass help.

Settings

The AE Classification plug-in has, as user interface, just an open dialog to select the classifier file to use.

Results

The results written in the feature file are: Class number; Dst-Ratio; Hit-Ratio; Off-Ratio; Result ID. These can be displayed in VisualAE and used e.g. for filtering (read VisualClass help for details).

The Classifier Program functions naturally in the following sequence

- Click on the proper checkbox to enable the plug-in.
- Select the classifier file.
- Optionally, view either script or text splitting file that show the classification results by clicking on the

links when the plug-in is selected.

Example Results

The results of a classification can be viewed by the use of a text editor. The files with extension .txt and .txs display script and output splitting information, respectively. An example is shown below.

No. of classes: 6

Class # 1: Pcl1st

Class # 2: Cal1st

Class # 3: matrix

Class # 4: Fixtr1st

Class # 5: Dela1st

Class # 6: Ifric1st

Table Format:

SetNo	TR-Index	Result Class	Dst-Ratio	Hit-Ratio	Off-Ratio	Result ID
1	1	101	1.07	0.000028	0.000012	Pcl1st
2	5	4	3811.97	0.324297	0.170534	Fixtr1st
3	9	6	9969.38	0.846214	0.293160	Ifric1st
4	13	3	11572.54	0.662611	0.503498	matrix
5	17	6	337.95	0.059827	0.014688	Ifric1st

and so forth...

Classifier result description of Dst-Ratio (DST1), Hit-Ratio(DST2) and Off-Ratio (DST3) can be found here.

Title: TRFeatEx-3: Classifier plug-in
Link: AESuite/VisualTR/Utilities/TRFeatEx/TRFeatEx_Classifier.htm

Spectral Ratios Extractor plug-in

Introduction

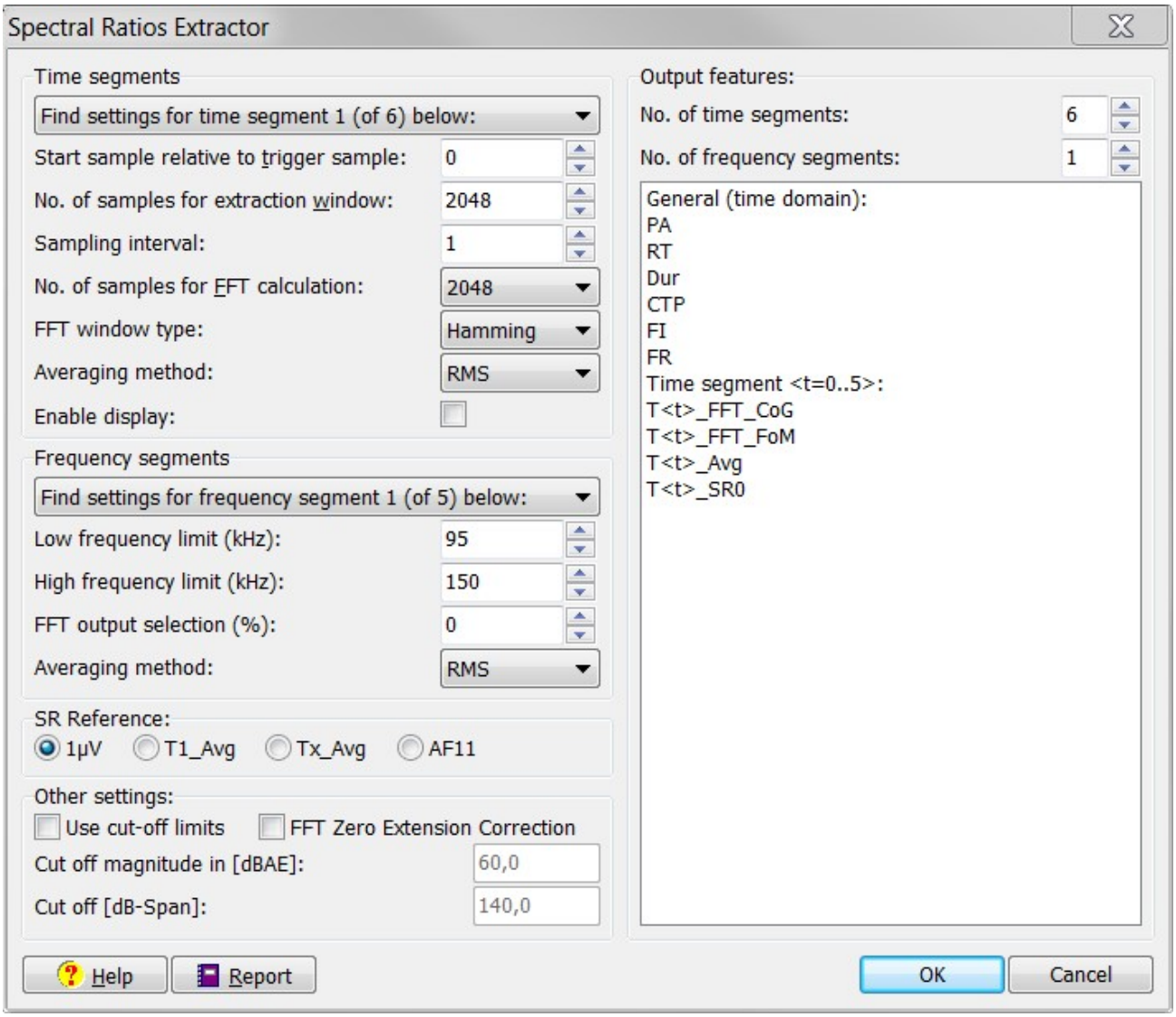
The Spectral Ratios Extractor calculates the ratio of an average frequency of a frequency segment to an average amplitude of a time segment.

Spectral Ratios are abbreviated Tx_SRy where x and y correspond to time segment x and frequency segment y, respectively. The average amplitude in time domain is abbreviated Tx_Avg where x corresponds to time segment x. The average amplitude in frequency domain is abbreviated AFxy where x and y correspond to time segment x and frequency segment y, respectively.

The user can freely select up to segments of interest. Each time segment is defined by an offset to the sample of the first threshold crossing (negative for time before), and by the length in samples. Each frequency segment is defined by the lower and upper frequency. Time segments and frequency segments may overlap.

A rectangle- or a Hamming window is applied to each time segment. Then the RMS or AVG (notation RMS/AVG) in dB re 1µV (refers to Tx_Avg), and the Fast Fourier Transformation (FFT) is calculated. RMS/AVG abbreviates the user-selected averaging method (RMS: root mean square; AVG: average of absolute values).

From the FFT result of each time segment and frequency segment, the RMS or AVG is calculated and converted into dB**AE**(refers to AFxy). By subtracting the RMS/AVG result of one time-frequency segment from that of another time-frequency segment, the spectral ratio is made available (refers to Tx_SRy).



Time segments

The first combo box selects one out of six time segments for which the settings apply. Check the "Enable display" option to visualize the selection. Up to six different time segments can be specified.

Start sample relative to trigger sample:

Defines the first sample of the time segment relative to the sample of the first threshold crossing (FTC). Use a negative value to define a start sample prior to the FTC.

No. of samples for extraction window:

Defines the length of the time segment.

Sampling interval:

Usually set to 1. Reduces the number of samples of a time window. A value (N) greater than 1 causes the selection of every N^{th} sample.

No. of samples for FFT calculation:

Can be larger than the number of samples of the extraction window.

FFT Window type:

The window function (Hamming or rectangle) is applied to the time segment. The number of samples exceeding the time segment are padded with zeros. This results in a smooth appearance of the FFT curve. The number of samples for FFT calculation defines the number of bins of the frequency axis in the FFT diagram. The number of bins is half the number of FFT samples (for application see FFT output selection).

In contrast, the Feature Extractor plug in applies a Hamming window only but not rectangular window.

Averaging method

Sets the type of averaging for the average amplitude of a time segment (Tx_Avg): RMS (Root Mean Square) or AVG (average of absolute values)

Frequency segments

Up to five different segments in the frequency domain can be selected

Low frequency limit (kHz):

Lower cut-off limit for frequency segment

High frequency Limit (kHz):

Upper cut-off limit for frequency segment

FFT Output selection (%:)

The frequency bins of the FFT diagram are sorted in descending order. Only x% of the number of largest frequency bins are considered to calculate the average FFT-amplitude in a frequency segment.

Averaging method

Specifies how the average FFT-amplitude is calculated.

SR Reference

The spectral ratio Tx_SRy is the ratio of average amplitude in frequency domain to average amplitude in time domain or frequency domain. It is derived by considering the average of all FFT bins converted to dB scale with respect to one of the following references (x and y refer to the time segment and frequency segment, respectively). In a mathematical sense, the references are denominator of the ratio calculation.

1µV

Denominator of the ratio is 1µV. The resulting spectral ratio will be the average of FFT-amplitude of time segement x and frequency segment y (AFxy)

T1_Avg

The reference for calculating the spectral ratios is the RMS/AVG amplitude of time segment 1.

Tx_Avg

The reference for calculating the spectral ratios is the RMS/AVG amplitude of time segment x.

AF11

The reference for calculating the spectral ratios is the RMS/AVG amplitude of frequency segment 1 in time segment 1 (Tx_SRy = AFxy - AF11).

Other settings

Use cut-off limits

check this box to use cut off limits in the frequency domain when calculating the AFxy.

Cut-Off magnitude in dB$_{AE}$

Specifies an absolute limit. FFT-results of lower magnitudes are set to zero before RMS/AVG is calculated. This is mainly thought to avoid that an AFxy result is influenced by electronic noise.

Cut-Off [dB-Span]

Specifies a relative limit (Max from FFT - dB-Span). This is mainly thought to avoid that side effects of the FFT, especially with rectangle window, or cross-modulation effects influence an AFxy result.

Which cut off applies depends on the evaluation of the cut-off criteria. The criteria yielding the maximum value is applied.

Example**:**

> Cut-Off magnitude in dB**AE**: x=20dB
>
> Cut-Off [dB-Span]: y=40dB
>
> Max FFT Amplitude: A=50dB
>
> Result: max(x,A-y)=max(20,10)=20. The 20dB setting of Cut-Off magnitude in dB**AE** is taken.

FFT zero extension correction

The algorithm always uses 2N samples for calculating the FFT, so zero extension reduces the FFT magnitudes (they become smaller). This option tries to compensate this influence.

Output features

No. of time segments

sets the number of time segments that are used for output. Value can be 1 to 4

No. of frequency segments

sets the number of frequency segments that are used for output. Value can be 1 to 5

PA

Peak amplitude of recorded transient in mV. The entire transient data page is taken into account. This value may differ from AE-feature ALIN, if the transient data page is shorter than the duration of the burst signal and the peak amplitude occured after transient data page has ended.

RT

Rise time in µs. Calculated as the time difference between start of hit to peak amplitude. This value may differ from AE-feature R, if the transient data page is shorter than the duration of the burst signal and the peak amplitude occured after transient data page has ended.

Dur

Duration in µs. Calculated as the time between start of hit to end of hit. This value may differ from AE-feature D, if the transient data page is shorter than the duration of the burst signal.

CTP

Counts to peak, the number of positive threshold crossings from start of hit to peak amplitude. This value may not be correct if the peak amplitude of the burst signal occurred after the transient data page has ended.

FI

Initiation frequency, calculated by dividing CTP by RT

FR

Reverberation frequency, calculated by dividing (CNTS-CTP) by (Dur-RT)

Tx_Avg

average amplitude of time segment x; x=1,2,3,4.

Tx_FFT.CoG

Frequency of spectral gravity center for time segment x in kHz. In contrast, the Feature Extractor plug in extracts FCOG, for the whole TR page.

Tx_FFT.FoM

peak frequency of FFT for time segment x, i.e frequency of spectral maximum for time segment x. In contrast, the Feature Extractor plug in extracts FMXA, for the whole TR page.

Tx_SRy

Spectral ratio of time segment x and frequency segment y. The numerator of the division will be a time the average FFT amplitude of a time segment x and frequency segment y. The denominator is either set by the "SR Reference" selection and can be 1µV, T1_Avg, Tx_Avg or the average FFT amplitude of time segement 1 and frequency segment 1.

Title: TRFeatEx-4: Spectral Ratios Extractor plug-in
Link: AESuite/VisualTR/Utilities/TRFeatEx/TRFeatEx_SpectralRatios.htm

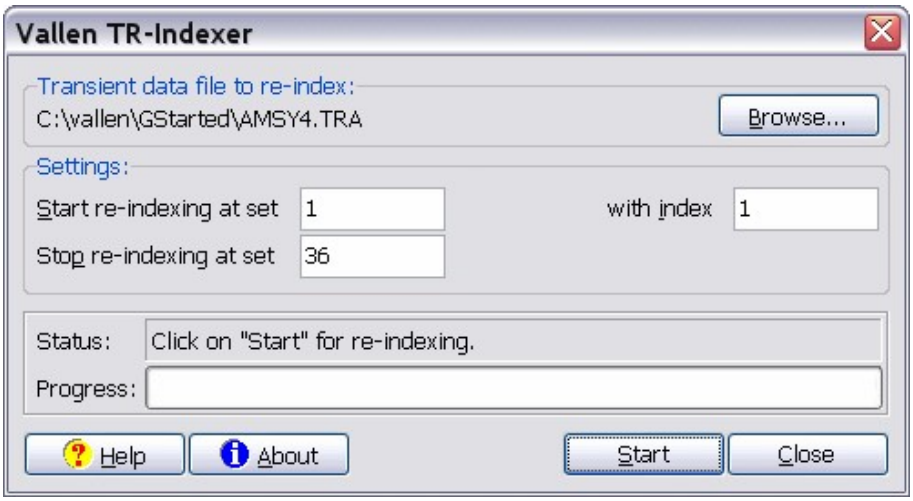
Home > The Vallen AE-Suite Software > Vallen VisualTR > TR-Utilities > TR-Indexer

TR-Indexer

Purpose

To rewrite and update the indices in a TRA-File. This is useful to uniquely identify TR data sets that have been combined out of several source files into a new file using **TR-Copy** or **TR-Combi**.

Note: this will prevent further use of the TRAI in primary file as a filtering parameter.



Transient data file to re-index

Via the "Browse" button a tra-file which has to be re-indexed can be selected.

Settings

Start re-indexing at set

Specifies where in the file to begin. Default is the beginning of the file.

with index

Specifies the first index to use.

Stop re-indexing at set

Specifies where to stop re-indexing the file. Default is at the end of the file.

About Sets and Indices

- "TR-Set" refers to the actual number and order of TR-signals stored in a file. When there are 36 sets, the last set is always 36.
- "TR-Index" refers to the number and order of TR-signals when originally acquired and stored. The index is also stored in the primary data file, and can be used as a means to extract data with **TR-Copy**. Many indices can be missing if the data file has been filtered, if sets have been deleted, or if a part of the file has been copied to another file.

Buttons

Start

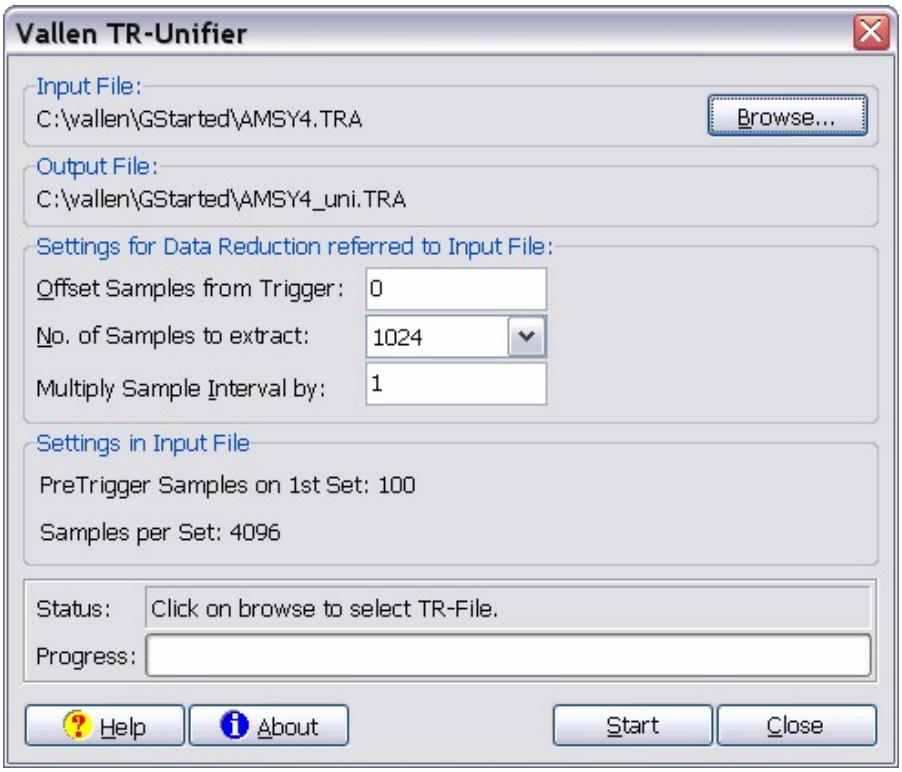
Click this button to rewrite the indices according to the above specifications.

Title: Utility-3: TR-Indexer
Link: AESuite/VisualTR/Utilities/VisualTR_TRIndexer.htm

TR-Unifier

Purpose

Change different TRA-file formats (sample rate and page length) to a common format so that they can e.g. be combined to a common file (using the utility **TR-Combi**) or used with **VisualClass**.



Input File / Output file

The Input file group specifies the source file. By clicking the "Browse..." button a source file can be selected from a folder. The output file name is automatically generated. A "_uni" is appended to the file name. The output file is stored to the same folder as the source file.

Settings for Data Reduction referred to Input File

Offset Samples from Trigger

Defines from where, relative to the trigger point, the waveform shall be considered. Negative numbers mean number of samples before the trigger point, positive refer to samples later than the trigger point. If "Offset Samples from Trigger" is larger than the pretrigger in the input file, the missing samples are filled with zeros.

No. of Samples to extract

Specifies how many of the samples (starting with the sample defined by "Offset Samples from Trigger") shall be processed.

Multiply Sample Interval by

Defines how many of the samples of the input file will be dropped and how many remain. Only integers (1, 2, 3,...) possible. Selecting e.g. "4" means: only every fourth sample will remain, all others will be dropped. This results in a sample interval which is 4 times longer than the sample interval in the input file (corresponding to a ¼ of the sample rate and data volume).

Settings in Input File

This group displays only information about the source file.

Example

Assume file A.TRADB has been acquired with 10 Msamples/s, 8192 samples per page, 1000 samples pretrigger, file B.TRADB with 2.5 Msample/s, 2048 samples page length, 500 samples pretrigger. Data of both files shall be combined on a new TRA-file with the format of B.TRADB.

The file A.TRADB has to be modified as follows:

a. Offset Samples from Trigger (referred to input file): -2000

b. No. of samples to extract: 8192

c. Multiply sample interval by: 4

Note:

a. 2000 samples in the input file divided by factor 4 (see line c) give 500 samples pretrigger on the output file.
Since the input file has only 1000 samples pretrigger, the program adds 1000 zero samples before it starts to modify the data.

b. 8192 divided by 4 (line c) gives 2048 as desired

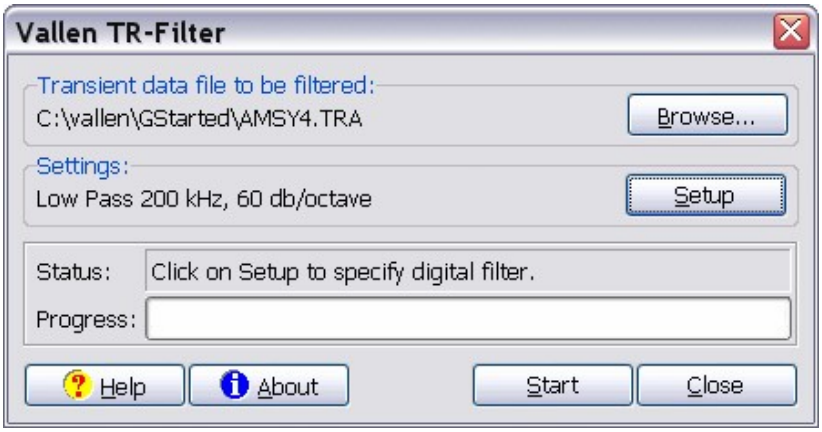
c. to reduce 10 Msample/s to 2.5Msample/s, the sample interval must be multiplied by 4.

Title: Utility-4: TR-Unifier
Link: AESuite/VisualTR/Utilities/VisualTR_TRUnifier.htm

TR-Filter

Purpose

To limit the frequency range of already acquired TR-data by means of a digital filter.



Assume a **VisualClass**-classifier has been built from data taken with narrow band filter (e.g. 20-44kHz). One of the features used for classification covers the frequency range at 55 kHz. Due to the frequency filter frequencies of 55 kHz are attenuated by approximately 13dB.

One wishes to apply the same classifier on data acquired with filters 20 to 850 kHz.

In that case, a low pass filter must be applied to that data (emulating the 44 kHz hardware low pass) before they can be successfully classified.

The **TR-Filter** is the utility that allows for such post test filtering of TRA-data.

The optimum settings for the simulation of the corresponding hardware filters are

Filter Module	Cut-off frequency	Filter slope
TP-044 (low pass 44 kHz)	42 kHz	40db/octave
TP-300 (low-pass 300 kHz)	300 kHz	47db/octave
HP-025 (high-pass 25 kHz)	23 kHz	44db/octave
HP-095 (high-pass 95 kHz)	100 kHz	40db/octave

Title: Utility-5: TR-Filter
Link: AESuite/VisualTR/Utilities/VisualTR_TRFilter.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > TR-Utilities > TR-FFT-Averager

TR-FFT-Averager

Purpose

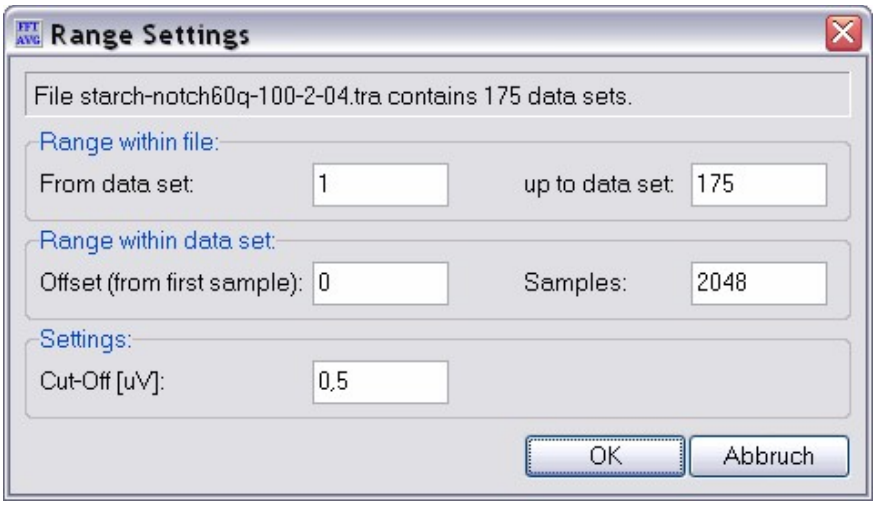
To present the averaged spectrum of all waveforms in a TRADB file. This application is useful for mainly two purposes:

1. Discover lowest level spectral compositions out of the white noise. Averaging the spectra reduces the white noise level shown and pronounces other spectral components, if any.

2. Discover changes in the averaged spectrum, e.g. when comparing files from different kind of sources, or after filtering a file by spectral criteria, e.g. using spectral ratios.

Range Settings

Open the Range Settings dialog by selecting a source file via the File/Open menu of the menu bar.



Range within file

Specifies the range of TR-data sets to be used for the calculation.

- From data set specifies the start
- up to data set specifies the end

Range within data set

Specifies the range within the TR data set that is used for the calculation.

- Offset (from first sample) specifies the first sample of the range
- Samples: specifies the number of samples to be used.

Settings

The cut-off is applied in the frequency domain and shall avoid the influence of digitization noise on FFT Results of small signals. If the cut-off is set too high, it may happen that all bins of a signal are cut-off.

Example

The demonstrated results are from the tra-file specified as source file in the image above.

The FFT-Averager uses a rectangular window function for the FFT. The minimum FFT range cannot be selected in the FFT-Averager.

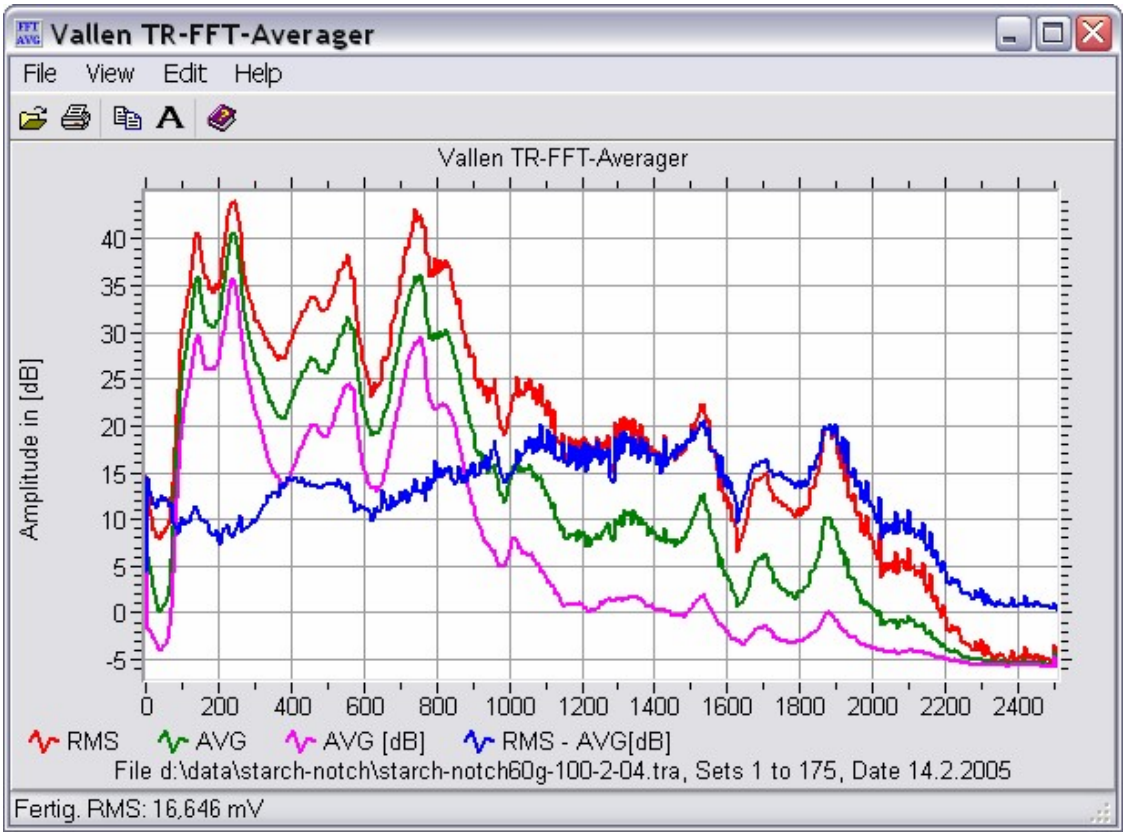
For each signal in From data set 1 up to data set 175 (in the example of Fig. 1), the time window specified by Offset 0 (from the 1st sample on) and Samples (the length of the time window) is fed into the FFT. From all FFTs, for each frequency bin, 3 averaging methods are calculated and shown in 3 curves:

a. RMS (red): Root mean square, result converted to dB above 1 µVRMS

b. AVG (green): Mean value of all bins, result converted to dB above 1µVAVG

c. AVG[dB] (purple) : Mean value of all bins, converted to dB above 1µV prior to averaging.

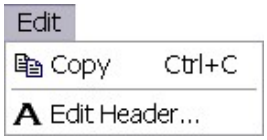
The blue curve shows the difference between the red and purple curve.



Notes

- Squaring the values, prior to averaging, pronounces high levels. Log-conversion of the values, prior to averaging, pronounces low levels. Therefore the larger the difference between RMS and AVG[dB] the larger is the variance of the averaged values.
- If all signals had the same amplitude and frequency distribution, all 3 average methods would produce exactly the same curve and the blue curve would be at zero.
- If signals have different amplitudes but same frequency distribution, the curves would show a parallel shift, the blue curve was a straight line somewhere above 0dB.
- Where the blue curve goes up, there is a larger variance of values in the FFT. This can help to optimize the frequency limits used for the Spectral Ratio determination with the Vallen Feature Extractor software.

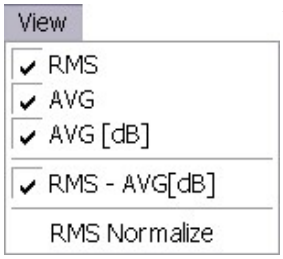
Menu Edit



By Edit/Edit header one can modify the header text.

By Edit/Copy the absolute average curve is stored to the clipboard and can be fed e.g. into an Excel sheet. The graphic can be stored to clipboard over right mouse button and then Copy to Bitmap.

Menu View



Using the View menu, one can switch on and off each of the 3 curves separately.

RMS Normalize normalizes all signals to 1mVRMS (all bins).

Title: Utility-6: TR-FFT-Averager

Link: AESuite/VisualTR/Utilities/VisualTR_TRFFTAvg.htm

XTR

Purpose

Provides an ActiveX interface that can be used by other Windows applications to access TR data.

XTR

ActiveX (COM) Interface to read TRA-files and write feature files (.TRFDB): lets one write programs in any 32-bit Windows supported programming language (e.g. C, Delphi, VisualBasic, EXCEL...) that read TR-data, extract special features and write those to a feature file that can be read and processed by VisualAE (a fully documented Excel sample is included as macro for quick start). The extracted features can be used in listings, graphs, and filters.

Vxaebas.ocx

The programming interface based on ActiveX for reading and writing to TRADB files.

Hint: You can find a documentation (pdf-file) and the Vxaebas.ocx in c:\vallen\api.

Title: XTR-1: XTR-Utility
Link: AESuite/Acq32/AcquisitionFiles/TR-XTR.htm

Home > The Vallen AE-Suite Software > Vallen VisualTR > TR-Utilities > Importing Waveforms using Waveimporter

Importing waveform data using Waveimporter

Waveform data in ASCII format can be imported by using the WaveImporter utility of AGU Vallen Wavelet freeware. For more information on importing the waveform see according help file of the AGU Vallen Wavelet freeware.

Title: Utility-8: Importing Waveforms using Waveimporter
Link: AESuite/VisualTR/Utilities/Importing_Waveforms_using_Waveimporter.htm