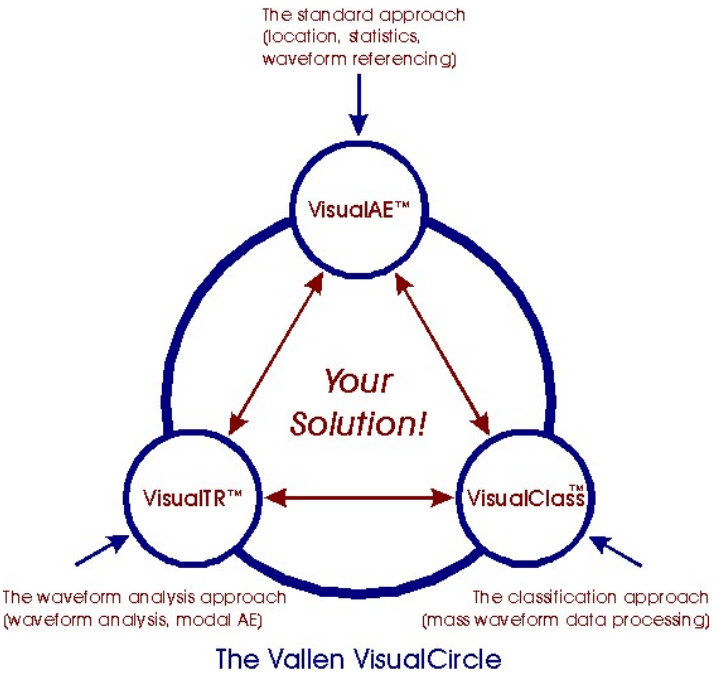
Vallen VisualAE™: Introduction

VisualAE is the part of the Vallen **VisualCircle** which represents the standard approach to Acoustic Emission: Evaluation of the AE data by statistical means (see the section distribution plots for more information), investigating the AE parameters (see the section Result Description) like e.g. amplitude, duration and counts and performing location calculations.

Additionally the seamless integration of the waveform analysis is realized!



The Vallen VisualCircle

VisualTR™ and **VisualClass™**, the other members of the Vallen **VisualCircle** represent the two alternate approaches to AE data: Single waveform analysis and pattern recognition/classification for large numbers of waveforms.

Please visit our QuickShow to get more information about them.

For a first introduction into using **VisualAE™** look at the Introductory Exercise.

Title: Intro-1: Introduction into VisualAE
Link: AESuite/VisualAE/Introduction/VisualAE_Overview.htm

VisualAE™: Online Capabilities

VisualAE™ offers advanced and superior online capabilities:

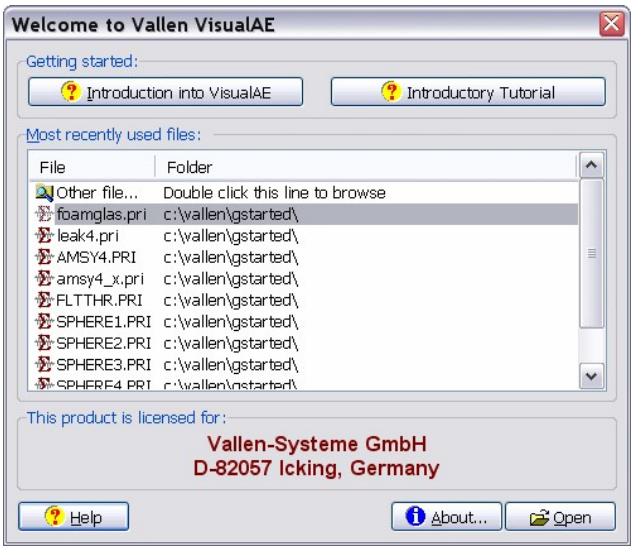
- **VisualAE™** can be operated simultaneous with a running data acquisition and analyze the data online. You can add, modify, and remove Visuals and processors during data acquisition without any negative effect. Select the PRI-file which is currently used for acquisition to be analyzed.
- **VisualAE™** can analyze data while recording data on a different file.
- **VisualAE™** can display AE graphs, listings, and waveforms on one screen. Waveforms are updated online as well as AE graphs and listings. Just insert a TR-Diagram. You will need transient recorder (TR) memory modules to acquire AE and TR data simultaneously.
- **VisualAE™** can display the results of the Feature Extractor online. You will need transient recorder (TR) memory modules and the software **VisualTR™** (option VTR). Then run the **Feature Extractor** (tool coming with **VisualTR™**) parallel to data acquisition and enable the "Use Feature File" box in Edit/project settings of **VisualAE™.** Now you can select the "TR-Feature Results" from the attribute menu of any Visual and get the online results of the feature extraction.
- **VisualAE™** is able to display online the data of a classifier built with **VisualClass™**. You will need a classifier and transient recorder (TR) memory modules. Then enable the "Use Feature File" box in Edit/project settings of **VisualAE™.** Now you can select the "TR-Feature Results" from the attribute menu of any Visual and get the online results of the feature extraction.

Hint: In order to create a graph with attributes that are results from an feature file (*.TRFDB), this file has to contain at least one data set. If you have not yet started acquisition, the TR-Feature Results are still disabled. Then start acquisition, record at least one TR-data set, and then create the desired graph(s).

Title: Intro-2: Online Capabilities
Link: AESuite/VisualAE/Introduction/VisualAE_Online.htm

VisualAE™: First Look

On starting **VisualAE™** the window shown below appears:



Welcome to **VisualAE™** is a dialog which requires a PRI-file name. For this purpose, it presents a file selector list. Either one of the most recently used projects can be opened or any other PRI-file can be chosen. The project can be located anywhere on your local HDD or your network.

It offers several possibilities to enter the online help system as well.

For a first introduction about using **VisualAE™** look at the Introductory Exercise.

Title: Intro-3: First Look
Link: AESuite/VisualAE/Introduction/VisualAE_dlgWelcome.htm

VisualAE: Introductory Exercise, Getting Started

Purpose

This step by step procedure is intended to quickly survey **VisualAE**'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 AE data AMSY4.PRI and the 36 TRA hits found in c:\vallen\gstarted\.

Steps

The following 11 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. **VisualAE?** can save the current status (File/Save or confirm the request to save the last changes), so the exercise may be halted at any point and continued later.

1. **Select file AMSY4.PRI**

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

- Select **Other File** from the **Welcome to VisualAE** dialog when the program is first started,
- (or) select **Open** out of the **File** menu when the program is running,
- choose c:\vallen\gstarted\AMSY4.PRI by either mouse or keyboard.

VisualAE will display some diagrams prepared by Vallen Systeme.

Steps 2-6: Setting up VisualAE Graphs

Before performing the next steps, please create a new, empty page (menu: **Pages/New Page**).

2. Setup a diagram containing a correlation

- Select **AE-Diagram** out of the **Insert** menu. The Diagram Wizard will be started.
- Choose "AMSY4: amsy4.pri" as Data Source. Click on "Next".
- Click on the "Left vertical axis attribute" button, select **Hit results** and then **A Peak Amplitude in dB**. Click on **Next**.
- Click on **Correlation**, then on **Next**. The upcoming dialog shows **Page 2** which is fine, click on **Finish**.

Now an empty graph is displayed. To see the data the two steps **Reset** and **Run** (click on icons and) are necessary.

3. Add a plane and apply a filter

A second plane shall be added and a filter used to display the data.

- Next click the right mouse button on the graph and select **Properties**.
- Click on the tab **Correlation** tab, click on **Add** and select the **Plane Filter** tab. Choose **And**, click on the **Attribute** button (left), select **Hit Results** and there **Duration**.
- The **Relation** shall be **>=** and the **Compare Value** set to **100 ?s**. Click 3 times on **OK** and **Reset** and **Run**.

Now all signals having a duration >= 100?s are displayed in red.

4. Add second (right) y-axis

Now an additional attribute shall be assigned to the right y-axis.

- Click the right mouse button on the graph and select **Properties**.
- Check the box **Enable right vertical axis attribute** in the lower area of the Diagram properties window, click on the button and select **Hit Results/HITS Hits**.

The second axis is now enabled and the attribute selected. In order to display data associated with the right y-axis planes have to be added to this axis:

5. Add two distributions to the right y-axis

In order to make data visible, add two distributions to the right vertical axis:

- Select the **Distribution** tab from the **Diagram properties** window, select **Right vertical axis** and click on **Add**.
- Choose **Stairs cum. up** and a color which is not yet used in the graph from the **Style** tab.
- Do not filter the data but enter a plane legend on the **Legend** tab (e.g. by using the macro =[YR-AttrUnitLong]).
- Select **Right vertical axis** and click on **Add** again.
- Choose **Stairs cum. up** and a color which is not yet used in the graph from the **Style** tab.
- Do not enter a plane legend but add the same filter condition as in step 3 (D >=100?s) on the **Filter** tab.
- It is not necessary to change the "Calculation settings:"
- Click 3 times on **OK** and **Reset** and **Run**.

If you go to the distribution or correlation tab and select a plane (mind the appropriate y-axis!), clicking **Edit** allows one to modify the selected plane and make any changes. Please try a right mouse click on any plane and discover the plane context menu.

6. Delete one distribution from the right y-axis

- Select the **Distribution** tab from the **Diagram properties** window, and select a plane by clicking on it.
- Click on **Delete** *OR* right mouse click on the plane and select **Delete plane**.
- Click on **Ok** and **Reset** and **Run.**
- Now the AE-Diagram contains 2 vertical axis with different attributes, three planes (2 correlations and 1 distribution), a filter is applied and the legends have been modified.

Hint: Feel free to play around with the features used up to now: planes, distributions, correlations, different filters consisting of several conditions (AND sequence), different colors, symbols, legends.... This helps getting familiar with the possibilities offered by the software.

If no software option providing location algorithms has been purchased skip step 7 and continue with step 8.

7. Setting up a location set (needs option VAELP, any other option VAEL* will work, but of course with little differences)

- Select the **Insert** menu, click on **Location Processor**, select AMSY4.pri, and the **Location settings** dialog gets displayed.

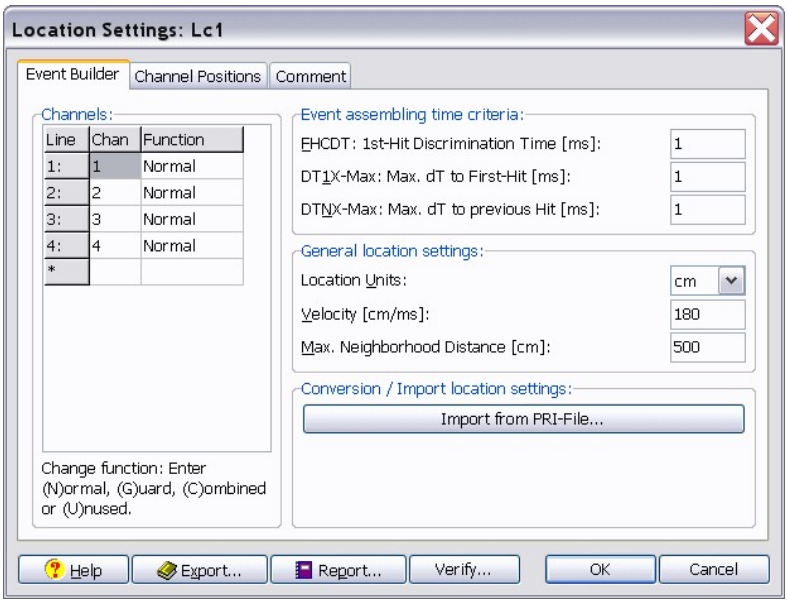
In order to perform location calculation the software needs to know how events have to be assembled:

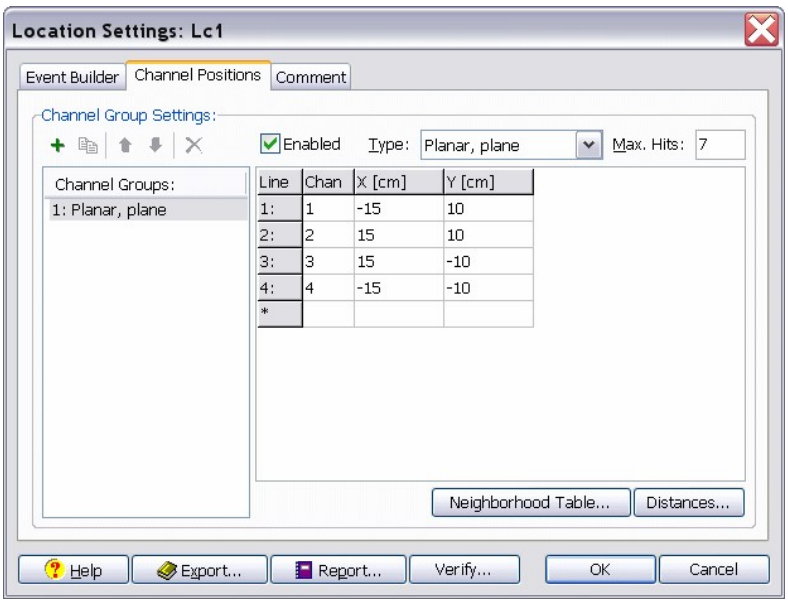
- For this example enter the channel numbers ("CHAN") 1 to 4 in lines 1 to 4, the default function "Normal" as well as the default FHCDT values work fine. Velocity shall be set to 180 cm/ms.
- Go to the **Channel Positions** tab, add a **Channel Group** with the **Add** button, it has to be **Enabled**, type shall be **Planar (plane)**, and here **Max. Hits** shall be larger than 4.
- 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

Hint: By pressing <Enter> the next field to enter a value can be addressed.

- Next go to the **Comment** tab and enter a descriptive title for the location set.
- In order to get location results displayed it is necessary to place a Visual (e.g. a 2D diagram y-location vs. x-location, or Events vs. x-location) behind the location processor!

Now it should look like:





- Click on **Ok**.

Hint: The location set can now be found in the Data Processing Structure, which is accessible by **Edit/Data Processing Structure**.

Steps 8-11 Using the Library and Data Processing Structure Menu

8. Export the created diagram to the Library

Any diagram and location can be exported to the **Library** to be saved for later reuse.

- Click the right mouse button on the graph and select "Properties..."
- Click the **Export** button just beside the **Help** button. Enter a meaningful name for the diagram, your name as author and **Save** the diagram to the Library.

9. Import diagrams from the Library

- Go to **Insert/Library Import...** and the **Library** window is displayed. Choose the "2D-Diagrams" tab, select the diagram named "erase" and click on "Import".
- The "Diagram properties" dialog window appears (allowing to modify the graph if necessary), click on "Ok" and the diagram will be added to the current page of your **VisualAE** window.

10. Delete a diagram from the Library

- Go to Insert/Library Import... and the Library window gets displayed. Select the diagram named "erase" and click on "Delete".
- Confirm, then close the Library.

11. Data Processing Structure Menu

- Select the menu "Edit/Data Processing Structure" to get the projects structure displayed.
- Click with the right mouse button on one of the structure's elements (or select the element and click on "Properties...") to get the "diagram properties" dialog. Change any of the properties if desired and then close this dialog window again.
- Move any of the elements around (e.g. from a location to the root or vice versa) by drag-and-drop.
- Select the diagram named "erase" and then press the "Delete" button. The diagram will be deleted from the current project.

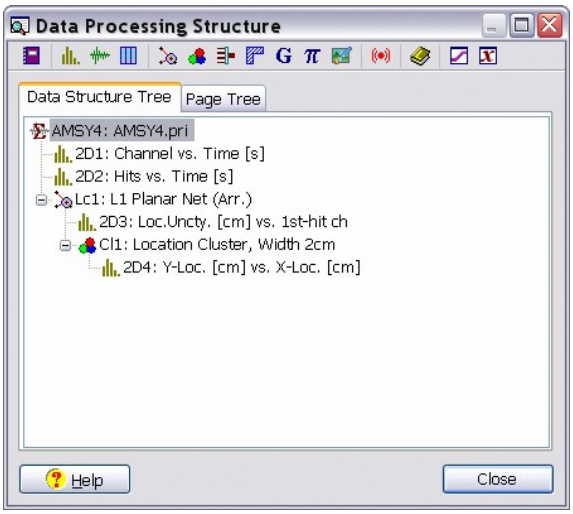
The structure window shows all active diagrams. If a diagram is used several times within your analysis, it is shown several times in the structure.

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
Link: AESuite/VisualAE/Introduction/VisualAE_InteractiveExercise.htm

Data Processing Structure: Organizing the Data Flow

The Data Processing Structure represents an overview how data analysis is conducted in the current project. This dialog is the most important control tool of a project: Each processor and diagram can be assessed from this dialog. Properties and attributes of processors can be modified. Additional elements (processors and Visuals) can be added by (clicking one of the menu icons or duplicated by a context menu). Additionally the sequence of processors and Visuals can be rearranged by drag and drop.



In the example shown (see picture above) "amsy4.pri" is the primary data source, the primary file containing the measured data. Attached to this data source are two Visuals with identifier 2D1 and 2D2 as well as a location processor (ID: LC1). The location processor represents a new data source. It modified the root data source by adding results from event assembly and location calculation. Attached to the location processor is a Visual (ID: 2D3) and a Cluster Processor (ID: CL1). Again, the Cluster processor represents a new data source since it adds the result of the cluster process to the location data source. Finally a Visual (ID 2D4) is attached to the Cluster processor displaying the results of the location processor (X- and Y-location) as well as the results of the Cluster processor (these results are displayed automatically in the diagram).

Processor

Processor (e.g. filter processor, location processor, cluster processor) perform defined manipulations on data. However, processors never display anything. Processors are used to alter the data flow. While the Filter processor is the only processor that filters out data, all other processors add results to the previous data source. Therefore the output of a processor can be interpreted as secondary data source. Several processors can form a sequence.

Available processors are: location, clustering, filtering, user, ECP, polygon, grading processors.

Deactivate Processor

Any processor can be deactivated for performance reasons using the context menu. If a processor is deactivated, it does not pass any data to its children. This decreases total processing time and is useful when having a complex setup which requires significant time for processing.

Deactivated processors are displayed crossed out in the Structure Tree. All its children are crossed out, too. In addition, Visuals are shown with a red cross.

Visual

A Visual displays data on the screen. The following Visuals exist: 2D-Diagram, 3D-Diagram, TR-Diagram (waveform diagram), Listing. A Visual can never be a data source, i.e. it is always the end of a data processing branch.

Data Structure Tree

Shows the diagrams at their proper place in the data processing structure. Each diagram and each processor has a unique ID-number. This helps keeping track how data is processed and displayed. Visuals can only display data that is available in their data processing path.

For further details please refer to the Getting Started Manual and the AMSY-6/-5 System Description. For information how to create or modify Visuals and processors, see the introductory exercise.

Diagrams from anywhere in the structure can be moved by drag and drop. Doing this attaches them to a new "data source", affecting what is being displayed.

Right click on a Processor or Visual opens a context sensitive menu. "Delete" removes the selected diagram/processor from the current project. "Properties" calls the corresponding dialog window either for the processor or the diagram.

Hint: It is not possible to put 2 or more location processors behind each other, but of course you can place them in parallel analysis branches. The same is valid for polygon processors.

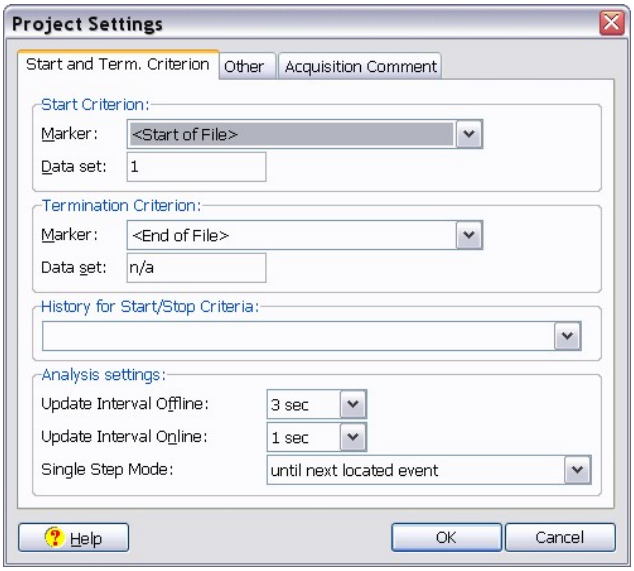
Page Tree

In the Page Tree tab, the diagrams are shown sorted by the pages on which they appear. If a diagram is selected in one of the tabs (Data Structure Tree or Page Tree) this diagram will remain selected when switching from tab to tab. On which pages a diagram is shown can easily be altered by drag and drop.

Title: Step-1: Data Processing Structure
Link: AESuite/VisualAE/Step/VisualAE_dlgStructure.htm

Tab Start and Termination Criterion

The Project Settings define which part of the data is to be analyzed. The window below can be directly addressed by clicking on in the toolbar or out of the **Edit** menu.



Start and Termination Criterion

Data is analyzed between start and termination criterion. Either marker or data set number can be used as criteria.

Marker

are intended to give the stream of data a structure to select data easily. Marker can be used e.g. to separate pulsing-run data from the measurement, to indicate any point of interest (for instance start of load application)...

Two types of marker exist:

a. "Labels" which can be entered during the acquisition of AE data.

b. "Marker" which can be entered during analysis (in development).

History for Start/Stop Criteria

This is a history list of the most recent Start and Stop Criteria combinations. The history is empty on start but updated each time analysis is performed. The list is limited to 25 entries.

Analysis Settings

determine at which intervals the screen is updated. Values range from 0.1s to 60s. This interval can be defined for online and offline analysis independently.

Single Step Mode

This mode allows one to analyze data step by step. The step width is defined by the drop-down box:

a. until next Label

b. until next located event

c. until next event

d. until next single or 10 or 100 or 1'000 or 10'000 or 100'000 or 1'000'000 hits.

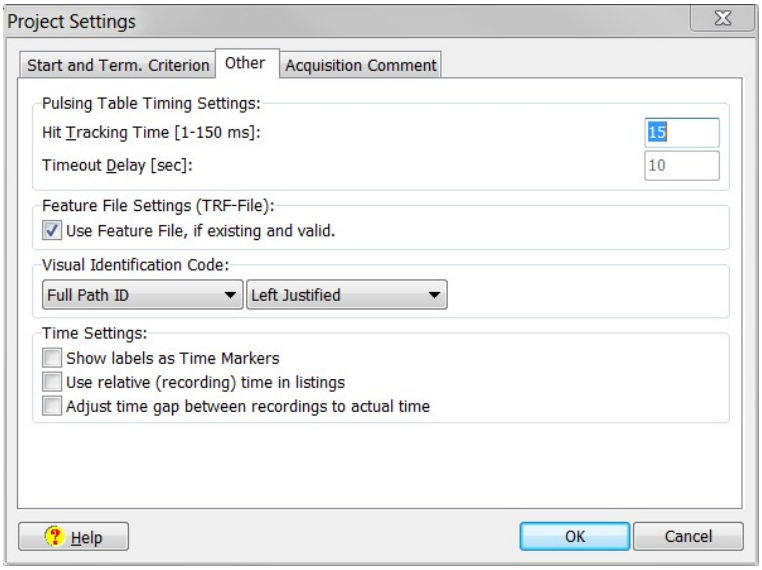
Use the combo box to define any of these Single Step Mode criteria. When clicking on or pressing F8 the analysis runs until the condition defined occurs. This function is useful to analyze the data file in smaller portions without the need to specify Start and Termination criteria of each portion.

The step size can be changed during analysis using the small 'arrow down' button just right of .

Title: Project-1: Project Settings
Link: AESuite/VisualAE/Project/visualae_projectsettings.htm

Tab Other

On the Other Tab are some general settings that define basic properties of the current analysis.



Pulsing Table Timing Settings

Hit Tracking Time

When performing a pulsing-run the system knows when a pulse is sent. But the other, receiving channels have to decide whether a received hit is coming from this pulse or from any other source. This decision is made by the Hit Tracking Time. All hits received during the Hit Tracking Time are considered to come from the pulse.

Hint: The "Hit Tracking Time" should be the minimum of
a) approx. 1.2 times the maximum sensor distance divided by the velocity of sound
or
b) approx. 1.2 times the event lifetime.

Timeout Delay

For the Pulsing Table calculation it is important to know when no more signals from pulsing-run will arrive. This time starts after each pulse. When the Timeout Delay has expired without pulse the Calibration Table is finished.

Feature File Settings (TRF-file)

Use Feature File, if existing and valid

A feature file is only used if the box is checked. A Feature File can be created by use of the **Feature Extractor** (a tool coming with **VisualTR**). If in the directory of the currently analyzed PRI-file is a TRF-file with the same name exists its results can be displayed within **VisualAE™**.

This can also be done online (see VisualAE online capabilities)

To achieve this the **Feature Extractor** has to be running simultaneously with the acquisition and **VisualAE™**.

Visual Identification Code

Each element in **VisualAE™** (diagrams, processors, listings) has an ID.

Three different styles of ID exist and can be selected from the left drop-down box

1. Full Path: Indicates through which data processors the displayed data have been passed (shows Server IDs and the Control ID).
2. Server ID: Displays only the processors (Data Server): Lc1\Fl1\Fl3\Cl2 (LcXX: Location processors, FlXX: Filter processors, ClXX: Cluster processors,

UsXX: User processors, GPx: Grading processors)

3. Control ID:Displays only the diagram ID-number: 2D5, 3D2, Li1, Tr1 (2DX: 2D-Diagram, 3DX: 3D-Diagram, LiX: Listing, Trx: TR-Diagram)

The IDs will be displayed

a. in the bottom line if a bottom header exists (and is "visible")

b. in the header line if no bottom header, but a caption exists (and is "visible")

c. not at all, if neither bottom header nor caption is visible for the diagram in question.

The right drop-down box defines whether the IDs will be left or right justified. When calling the properties menu the diagram ID is displayed in the title bar of the properties dialog window.

Hint: Even an empty line is considered as existing - the ID will be displayed properly without anything else showing up in that line.

Time Settings

Show labels as Time Markers

If enabled, labels are shown as vertical lines in all 2D diagrams.

This works if dataset number or time (relative time of any kind, seconds, hours...) is the attribute of the horizontal (X) axis.

Use relative (recording) time in listing

Listings usually display time in format HH:MM:SS and use absolute time of a day. Check this box to display the relative time of the recording (in same format) starting with 00:00:00 when recording started.

Adjust time gap between recordings to actual time

Default behavior is to add a time gap of 5s when Acquisition has been paused and restarted again in cases when attribute TS is used in a diagram. The time gap that is added in a visual can be adjusted to reflect the actual time gap.

Title: Project-2: Project Settings, other
Link: AESuite/VisualAE/Project/visualae_ProjectSettingsOther.htm

Tab Acquisition Comment

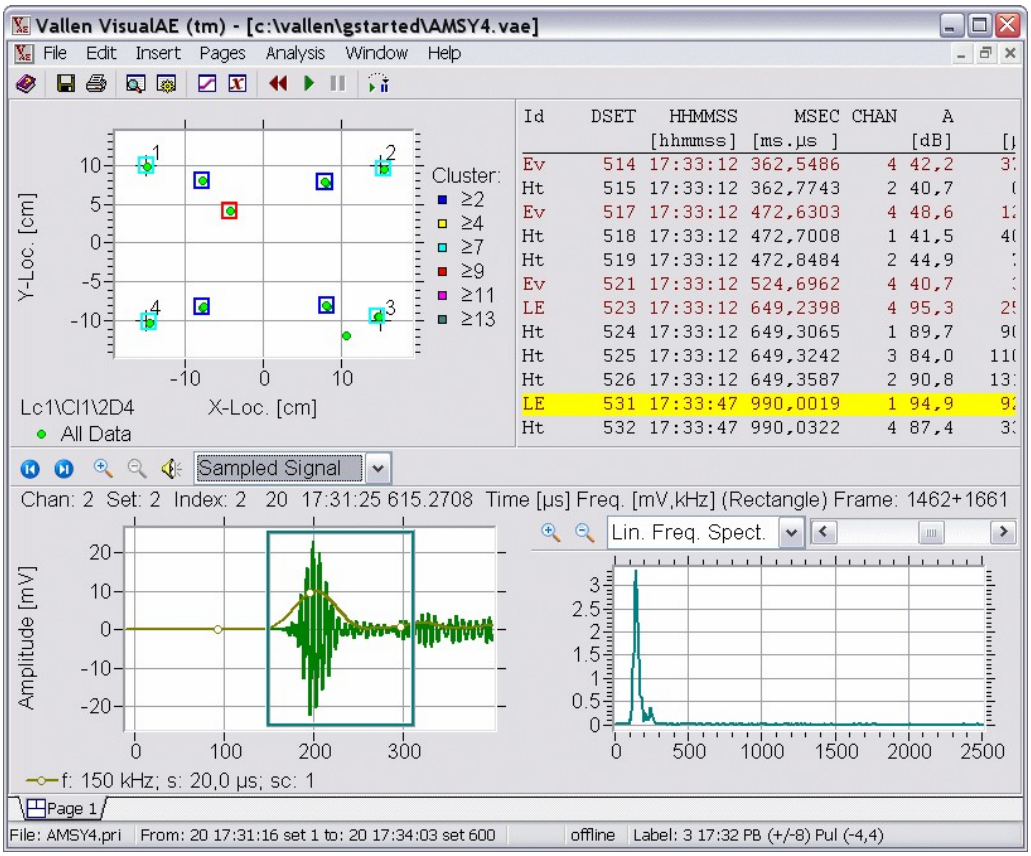
The Acquisition Comment tab shows the acquisition title and caption which have been entered during acquisition (**Acquisition Comment**). These comments are stored on the equivalent VAC-file and therefore can not be modified here and are shown for information purposes only. In the Project Settings Report these comments are also shown at the beginning of the report.

To modify these comments please use **VAC-Editor**.

Title: Project-3: Project Settings, Comment
Link: AESuite/VisualAE/Project/visualae_ProjectSettingsComment.htm

VisualAE™: Basic components

The **VisualAE™** window consists of several basic components:



Menu (very top), toolbar (below the menu), a plane to display AE-Diagrams, listings, TR-Diagrams and images, pages-tab and status line at the bottom. These are the fundamental parts displayed in **VisualAE™**.

Quick Start

For a first introduction into using **VisualAE™** see chapter **Introductory Exercise**.

For an overview about the menu commands see chapter **Menu and Toolbar**.

For an overview about the data processing structure see chapter **Data Processing Structure**.

Title: Intro-5: Basic components
Link: AESuite/VisualAE/Introduction/visualae_basiccomponents.htm

VisualAE: Menu and Toolbar

The menu and icons provide access to the functionality of **VisualAE™** which concerns the complete project or at least pages. Modifying the structure, changing the project settings, adjusting the display of several **VisualAE™** projects running parallel and many more give full control over the analysis of AE data.

VisualAE™ has a standard main menu as common for Windows programs.

Menu File

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

Menu Edit

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

Menu Insert

Functions to insert Data Processors and Visuals. See chapter **Menu Insert** for details.

Menu Pages

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

Menu Analysis

Different analysis functions. See chapter **Menu Analysis** 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

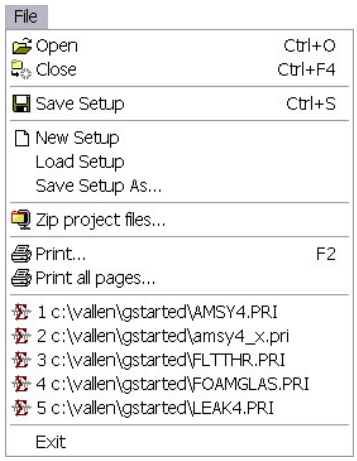
Calls the online help system and tutorials. See chapter **Menu Help** for details.

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

Title: Menu-1: Menu and Toolbar
Link: AESuite/VisualAE/Menu/visualae_menuicon.htm

File Menu

The File menu offers well known Windows functionality for opening, saving and closing projects as well as a list of the most recently used projects. This menu can be found by File out of the main menu.



Open

Opens a new VisualAE setup. Either a PRI-file or VAE-file can be selected. PRI-files contain the data acquired during acquisition. VAE-files contain the setup information used by VisualAE™. So VisualAE™ always uses a VAE-file in combination with a PRI-file. These files usually have the same file name but different extensions.

The PRI-file is never modified by VisualAE™. If you select a PRI-file to open, then VisualAE™ uses the VAE-file with the same name in the same directory as default. If there is no VAE-file it uses the default file located in c:\vallen\visualae\default.vae and copies it into the directory of the PRI-file selected and renames it to the PRI-file.

Close

Closes the currently open setup. If modified you are asked to save the setup before closing.

Save Setup

Saves the current analysis setup under the current file name. The function is also available in the toolbar.

New Setup

Overwrites the current VAE-file by an empty one (without any element or processor) to start from scratch.

Load Setup

Once a PRI-file has been opened, you may load any other VAE-file to be used with the currently opened PRI-file. The names of the open VAE and PRI-file are always shown in the title bar of the VisualAE window, if different.

If you then change any of the VAE settings and save back the VAE file (e.g. by using the "Save" tool button), you will overwrite the most recently loaded VAE instead of the VAE file with the name of the PRI-file.

Save Setup As

Saves the current VAE-file to another file name.

Zip project files…

Starts a **Zip Wizard** that packs all files belonging to the current project.

Print (shortcut <F2>)

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

Print all pages

Opens the **Print Preview** dialog for printing and prints all pages of the current project.

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.

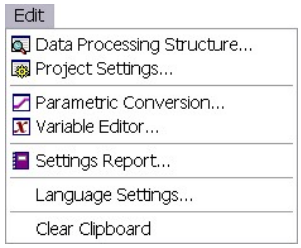
Exit

Exit quits VisualAE™.

Title: Menu-2: Menu File
Link: AESuite/VisualAE/Menu/VisualAE_MenuFile.htm

Edit Menu

The Edit menu is the entrance point for changes of the Structure and for determining the Project Settings.



Data Processing Structure

Calls the Data Processing Structure dialog. See chapter **Data Processing Structure** for details.

Project Settings

Calls the Project Settings dialog. See chapter **Project Settings** for details.

Parametric Conversion

Calls the Parametric Conversion dialog. It is used to convert the voltage measured at PAx into physical units, such as N, bar, MPa, and/or others. See chapter **Parametric Conversion** for details.

Variables

User defined Variables can be used as filter criteria that can be changed at one central point for the complete VisualAE analysis project.

Setup Report

Creates a report with all information about the current project: which data processors exist (including all attributes and settings) and which Visuals exist (including all attributes and settings). This report provides a complete documentation of your analysis.

Language Settings

Calls a dialog to change the current language shown.

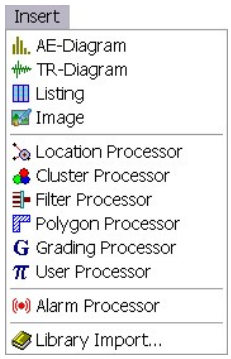
Clear Clipboard

Deletes the content of the Windows clipboard. Useful after a Copy-And-Paste operation when having a lot of data in the clipboard. This data allocates memory that cannot be used by applications. Therefore you can use this function to empty the clipboard after usage.

Title: Menu-3: Menu Edit
Link: AESuite/VisualAE/Menu/visualae_MenuEdit.htm

Insert Menu

The Insert menu allows one to add Diagrams, Listings, Processors. This Insert menu is part of the menu bar.



To add the appropriate elements to a page just click on the item. A wizard will guide you through the process of setting up an AE-Diagram or Processor.

Listing and TR-Diagram are added to the page without the need of a wizard. Any settings of diagrams can be modified at any time - even during online analysis. Prepared diagrams, listings and processors can easily be imported from the **Library**.

There are separate chapters describing each individual Visual and Data processor.

Hint: To get data displayed you need to **Reset** and **Run** after adding new elements to your **VisualAE™** project.

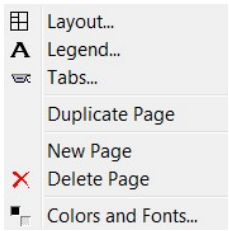
Title: Menu-4: Menu Insert
Link: AESuite/VisualAE/Menu/visualae_MenuInsert.htm

Pages Menu

The Pages menu offers everything required to modify the pages. The Pages menu is part of the menu bar.

Layout

Calls the Page Layout dialog. See chapter Page Layout for details.



Legend

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

Tabs

Allows one to rename and rearrange pages.

New page

Creates a new page.

Delete page

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

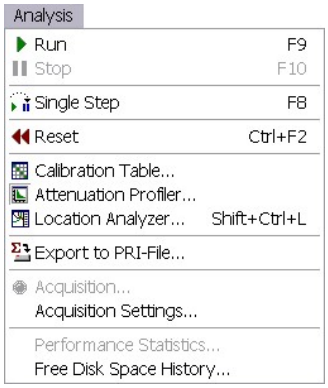
Colors and Fonts

You can select either black background (better contrast) or white background (as printed). Changing this setting will take effect after the next start of VisualAE™.

Title: Menu-5: Menu Pages
Link: AESuite/VisualAE/Menu/visualAE_MenuPages.htm

Analysis Menu

The Analysis menu is mainly to control the analysis. This Analysis menu is part of the menu bar.



Run (shortcut <F9>)

Starts the analysis. The analysis automatically runs up to the termination criterion or until the Stop command is given.

There is also a command-line option available to perform this operation automatically on start.

Stop (shortcut <F10>)

Stops the analysis of data at the current analysis position. This does not influence any data acquisition task running.

Single Step (shortcut <F8>):

Starts the analysis like Run but terminates automatically depending on the current Single Step Mode settings. The Single Step Mode is set up in the Project Settings.

Reset (shortcut <Ctrl+F2>)

Finds the start criterion, has to be done before the analysis is run.

Calibration Table

Calls a separate window showing a table for each pulsing run that has been performed. See chapter **Calibration Table** for details.

Location Analyzer

Calls the Location Analyzer, which is a powerful tool for qualifying location results. See chapter **Location Analyzer** for details.

Export to PRI-File

Allows you to create PRI-files from the presently analyzed PRI-file (e.g. after filtering). First specify directory and name of the new file to be written, then select the processor which output shall be written to the new PRI-file and then select the lines you want to have included in the new file. This new file will contain only those data that has passed the selected processor.

Acquisition...

Switches to the acquisition software (if active).

Section Settings

Displays the settings of all sections created during data acquisition. Contains all information of the Acquisition Parameter Settings dialog (accessible by a double click on the section) and start and end data set number of the section itself. A section is created by stopping and resuming data acquisition. If you select one section and then click on report the software asks you if you want a report over all sections or only the selected one.

Performance Statistics

Provides information about the processing speed.

Free Disk Space History

Shows a line indicating the evolution of free disk space of every logical HDD. The current status is visible at the right end of the diagram. The red area at the bottom indicates a warning: if the free disk space tends to drop into this area you should take care since Windows needs quite some HDD space for swapping. The total space allocated for data acquisition is taken into account right from the beginning. If the lines indicating free disk space are declining either Windows is not working properly or you are running more and more applications in parallel.

Title: Menu-6: Menu Analysis
Link: AESuite/VisualAE/Menu/visualae_MenuAnalysis.htm

Window Menu

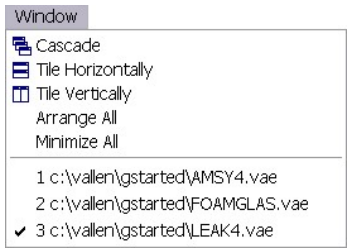
The Window menu offers the standard Windows functions for managing separate open windows inside the application window.

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 **VisualAE™** projects, the currently active (the one having the keyboard input focus) is checked.



Title: Menu-7: Menu Window
Link: AESuite/VisualAE/Menu/VisualAE_MenuWindow.htm

Help Menu

The Help menu calls the online help system and tutorials. The help can also be opened by pressing the <F1>-key.

Contents & Index

Link to Contents and Index.

Data Processing Structure

See chapter Data Processing Structure.

Software Introduction

See chapter Overview.

Key Reporter

Creates a report about currently installed keys.

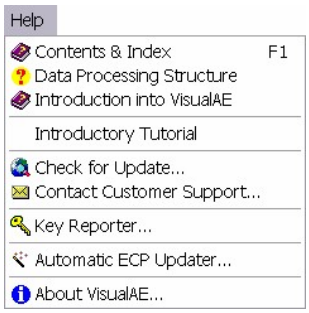
See chapter Software Protection for details.

Automatic ECP Updater

Starts a simple procedure for performing ECP updates.

About

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

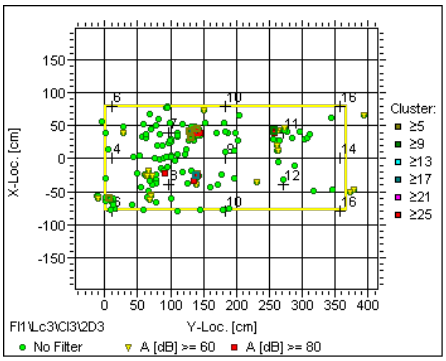


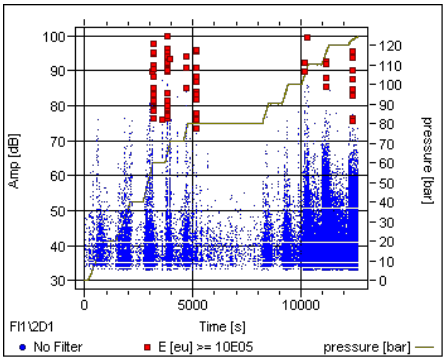
Title: Menu-8: Menu Help
Link: AESuite/VisualAE/Menu/VisualAE_MenuHelp.htm

Overview: Correlations and Distributions

VisualAE diagrams offer numerous settings that can be adjusted to the users' needs. Different filters, planes, legends and many more are possible. Those possibilities are accessible via the context menu (right mouse button) of the appropriate diagram, choosing "Properties".

In addition the context menu allows one to access all processors to which the diagram is linked, by "Processor Properties...". Also the position of the diagrams on the page can be changed (option VAE2 needed).





The graphs above shows location results (on top) and two correlation planes (different filtering, different color and symbols) and one distribution plane (below).

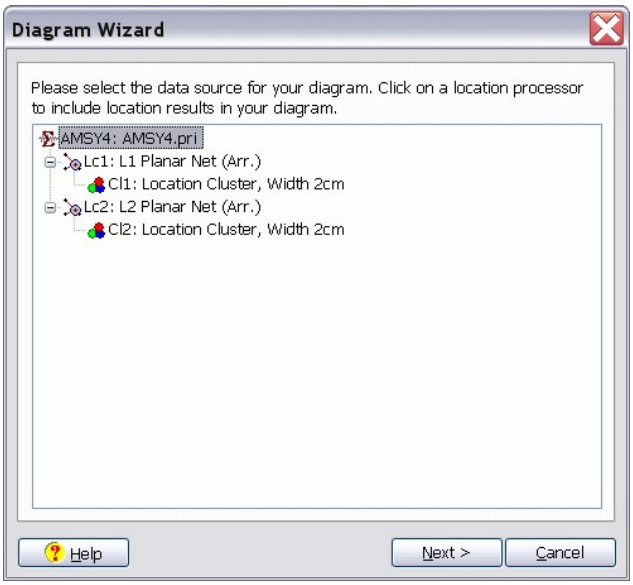
Diagrams can be easily exported as bitmap (via the clipboard) or stored in ASCII format (*.TXT) for later import into any other Windows program.

Title: Diag-01: Diagram Properties Overview
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_Overview.htm

Diagram Wizard: Creating a new Diagram

To create either a 2D or 3D diagram use either the menu Insert/AE-Diagram, or the icon "Insert AE diagram" from the Data Processing Structure dialog window.

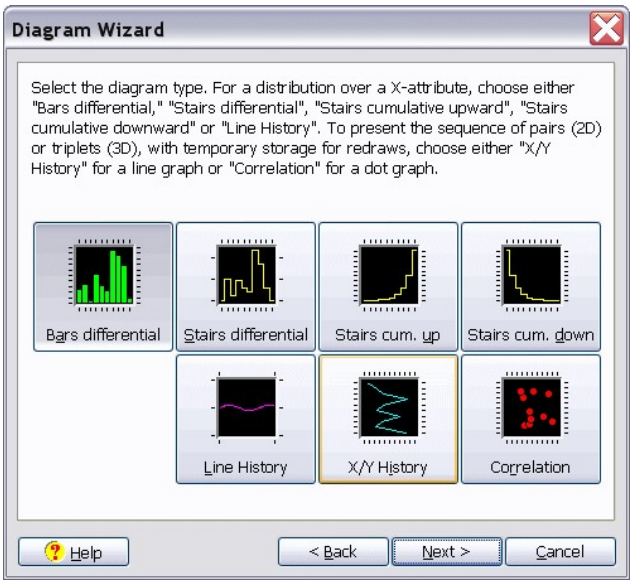
The next window allows to select the place in the Data Processing Structure where the 3D diagram shall be placed. Select a processor (or the .PRIDB file) by a single mouse click, then click Next>.



2D-Diagrams

The appearing dialog window has selected "2-dimensional" as default. To select the desired axis attributes click on the buttons. Then click on Next.

The dialog shown below allows to choose the desired diagram style by clicking on it, then click on Next. Some of the options may be disabled according to the selected attributes (e.g. when displaying PAx vs. time a stairs cum. up representation is nonsense and therefore disabled).



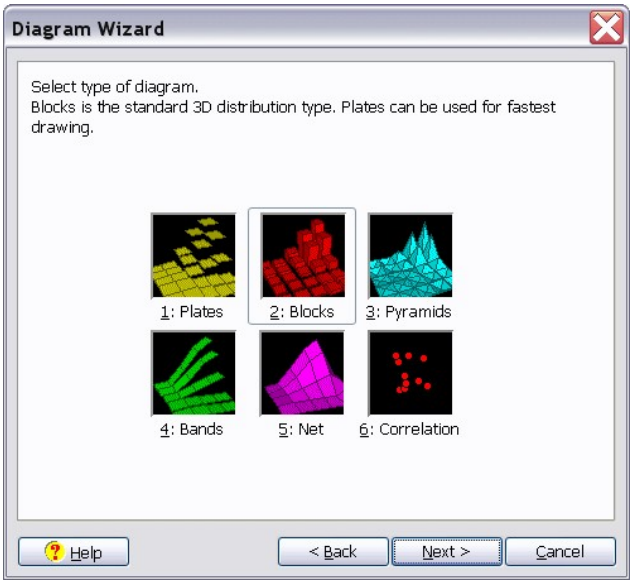
3D-Diagrams

Note: Coordinate axes of 3D-Diagrams are oriented the same way as in a left-handed coordinate system.

To create a 3D-diagram simply check the box for "3-dimensional" on the previous page and select the result for the 3rd axis.

Example: create a diagram Hits over X- and Y- location, place the 3D diagram behind the corresponding location processor, select Hits as vertical axis attribute, select x-coordinate as horizontal attribute, select y-coordinate as depth axis attribute.

The dialog shown below allows one to choose the desired diagram style by clicking on it, then click on Next.



For both diagram types

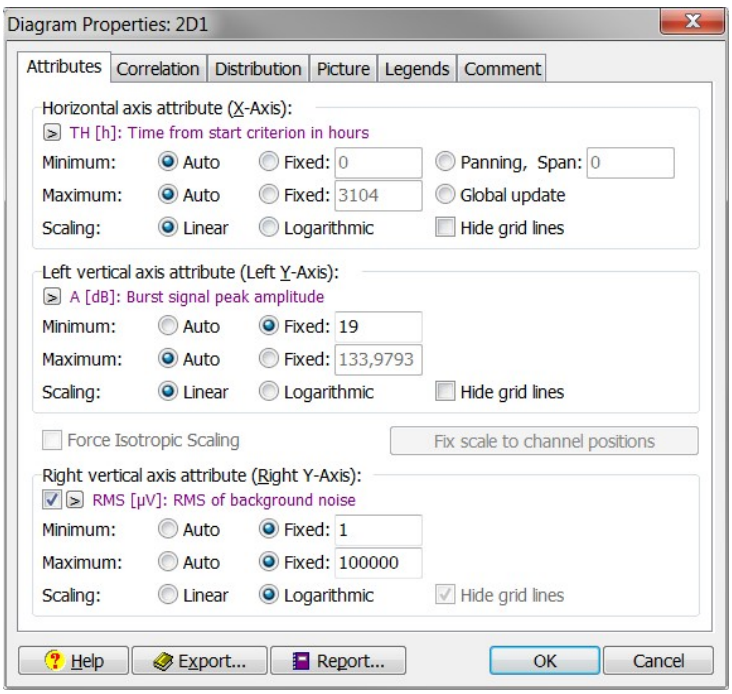
Select the **VisualAE™** page on which the new diagram shall appear. Last click on Finish and the graph will be displayed, but empty. In order to see data you have to Reset and Run.

Hint: Every property of the diagram may be changed via Properties, accessible by the context menu of the diagram (right mouse click).

Title: Diag-03: The Diagram Wizard
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_Wizard.htm

Diagram Properties: Attribute Setup

Diagram properties can be changed via the diagram properties dialog. By default this dialog opens with the Attributes tab selected (see image below). There are 6 tabs on which the diagram properties can be defined. The Attributes tab presents general settings for a diagram: what is displayed on the x- and y-axis. The Correlation tab and Distribution tab define how the data is displayed: as correlation plot or as distribution. The Picture tab is used for defining a background image. With the Legends tab the appearance of legends is handled. Finally the Comment tab is for documentation purposes.



Horizontal axis attribute (X-Axis)

- button

Select the axis attribute from a drop down list

Minimum

Lower limit (minimum or left hand side) for the horizontal axis which can be:

- Auto: the dataset with the smallest x-axis attribute sets the lower limit. As new data sets are generated, the lower limit may change resulting in a re-scaling of the axis.
- Fixed: user sets a fixed lower limit. No re-scaling of lower limit will be done as new data sets are generated.
- Panning, Span: only available if x-axis attribute is time and "Global update" has been selected. It defines a window size for a running plot. Basically the lower limit is running with a lag according to the settings with regards to a running upper limit.

Maximum

upper limit (maximum or right hand side) for the horizontal axis which can be:

- Auto: the dataset with the largest x-axis attribute sets the upper limit. As new data sets are generated, the upper limit may change resulting in a re-scaling of the axis.
- Fixed: user sets a fixed upper limit. No re-scaling of upper limit will be done as new data sets are generated.
- Global update: only available if x-axis attribute is time. It defines a running upper limit. The upper limit is updated regardless of data generation. It is updated globally and results in the same running behavior for all plots with "global update" in the analysis setup.

Scaling

Linear and logarithmic scaling for axis attributes available

Hide grid lines

Check this box to hide the grid lines which refer to the horizontal axis.

Left vertical axis attribute (Left Y-Axis) and Right vertical axis attribute (Right Y-Axis)

› - button

Select the axis attribute from a drop down list

Minimum

Lower limit (minimum or left hand side) for the horizontal axis which can be:

- Auto: the dataset with the smallest x-axis attribute sets the lower limit. As new data sets are generated, the lower limit may change resulting in a re-scaling of the axis.
- Fixed: user sets a fixed lower limit. No re-scaling of lower limit will be done as new data sets are generated.

Maximum

upper limit (maximum or right hand side) for the horizontal axis which can be:

- Auto: the dataset with the largest x-axis attribute sets the upper limit. As new data sets are generated, the upper limit may change resulting in a re-scaling of the axis.
- Fixed: user sets a fixed upper limit. No re-scaling of upper limit will be done as new data sets are generated.

Scaling

Linear and logarithmic scaling for axis attributes available

Hide grid lines

Check this box to hide the grid lines which refer to the vertical axis.

Fix scale to channel positions

Automatically fix-scales the diagram to fit the outmost sensors inside the diagram. This is available only for location diagrams showing channel positions.

Please see chapter **Details about scaling** for description for this option.

Force Isotropic Scaling

Forces the same unit scaling for vertical and horizontal axis. This is only activated if both axis have the same type of attribute, for instance "coordinates in cm".

Please see chapter **Details about scaling** for description for this option.

Additional Buttons

Export

Exports the complete diagram into the **Library**.

Title: Diag-02: Diagram Attributes
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabAttributes.htm

Diagram Properties: Scaling

After generation of a diagram by using the Diagram Wizard, the scaling parameters are appropriate for most cases. However, you have the following options to optimize the scaling: "fix scaling", "auto scaling", "force isotropic scaling", and "fix scale to channel positions". Please consider the following details, if you change the scaling settings:

Fix and auto scaling is controlled by the check boxes next to "Minimum" and "Maximum" in the "Diagram Property/Attribute" setup.

Fix scaling versus auto scaling

Fix scaling

This indicates that a lower (minimum) and/or upper (maximum) limit is defined for each axis (X and/or Y). So fix scaling allows to zoom out a certain area of interest. Fix scaling is often more suitable to compare different data in the same diagram style.

See also fix scaling for small ranges at high absolute values (e.g. ratio of 1:10'000 and more).

Auto scaling

This indicates that the software scales the Visual to display the smallest possible area while still showing all data (like hits/events) and other items (like clusters and channel positions if applicable).

Of course one can mix fix/auto scaling within one diagram, even within one axis (e.g. fix the lower limit and have the upper limit defined by auto scaling). The values shown in gray in the dialog fields minimum/maximum after switching from fix to auto represent the last fix scaling setting. They might well differ from the current auto scaling settings of the diagram.

Hint: If you selected auto scaling (which is also the default setting) but have not yet analyzed data (e.g. before **Run**) the diagram is scaled according to default values. This default values are not related in any way to the final scaling shown with data (after Reset and Run).

How auto scaling works

1. If there are channel positions from a location group, the axis scaling is adapted to those.
2. If there are clusters, the axis scaling is extended (if needed) until all clusters are completely visible.
3. If there are polygons from a Polygon Processor, the axis scaling is extended (if needed) until all clusters are completely visible.
4. If data are available for display, the axis scaling is extended accordingly.
5. If there is none of the above, the default scaling is used until any of the above applies.

Force isotropic scaling

Isotropic scaling is available if both axis show location units, for instance "coordinates in cm". It assures equal pixels per unit on both, the x- and y-axis.

Isotropic scaling example

A diagram has a coordinate system with 1000 pixels for both, the x- and y-axis. Scaling range is requested (either by auto or fix scaling) from 0 to 40 units for the x-axis, and from 0 to 20 units for the y-axis.

If "Force isotropic scaling" is off, the x-axis scales to 25 pixels per unit, the y-axis to 50 pixels per unit. The x-axis appears compressed, the y-axis stretched. A circle in real world would make an ellipse in the diagram.

If "Force isotropic scaling" is on, the axis with the minimum pixels per unit decides the scaling of the other axis. The x-axis would still show the requested range from 0 to 40 units, but the y-axis would show an extended range from –10 to 30 units. The center of the modified y-axis remains centered.

The shape of the diagram may change on various reasons, for instance by adding or removing a diagram, selecting another page layout, changing the printer from landscape to portrait, and more. If the above mentioned diagram changes, for instance, to 1200 pixels for x, and 400 pixels for y, then the y-range of 20 units per 400 pixels determines a scaling of 20 pixels per unit for both axis. The y-axis shows the requested range from 0 to 20 units, the x-axis an extended range from -10 to 50 units with the center of the x-range still at unit 20.

Depending on the range of data to be shown, you can select an optimum diagram shape from "Pages/Layout...".

Note: Force isotropic scaling overrides the fix/auto scaling settings.

Fix scale to channel positions

This is available only for location diagrams showing channel positions. A click on this item fix-scales the diagram to the outmost sensors.

Title: Diag-04: About Diagram Scaling
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_Scaling.htm

Fix scaling for small ranges at high absolute values (e.g. ratio of 1:10'000 and more)

The diagram range is limited to a certain ratio (1:1'000) of the center value in order to allow for reasonable numbers on the axis (e.g. for middle value 1'000'000 the diagram range can't be smaller than 1'000).

Example: if you are running a high cycle fatigue test with more than a million of cycles, but you would like a diagram to display 10 cycles on the horizontal axis from cycle no. 1'000'000 to cycle no. 1'000'010. If you use fix scaling and enter these values, then the diagram will show data e.g. from cycle 999'500 to

1'000'500 (range = 1'000 cycles, centered at 1'000'000).

To show only the 10 cycles you are interested in you could:

a. Create a user attribute (software option VAEUPE required) to shift the desired value to 0 (by an offset). Then use this attribute on the axis and select fix scaling, because the allowed range is virtually unlimited.

   Example: user attribute PCTEoff = PCTE - 1'000'000, and use it as x-axis of the diagram, then select fix scaling min=0 and max=10 and you will get the 10 cycles shown you are interested in.

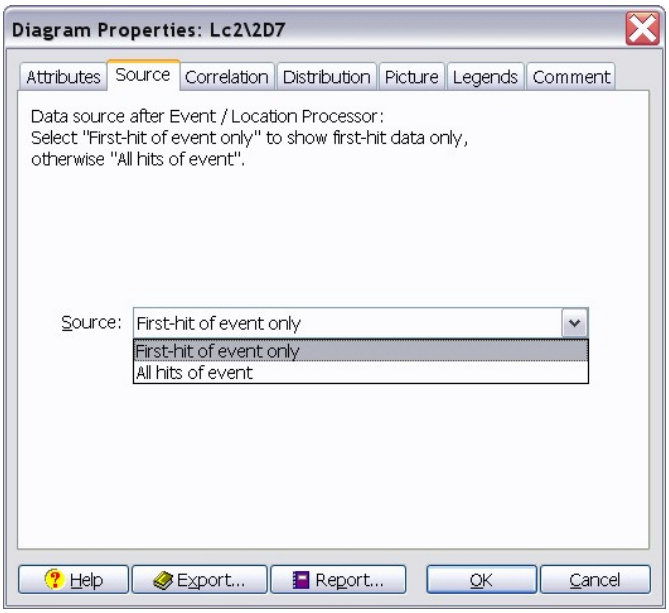
b. Only if the axis in question is 'time': use a listing (or the blue ID window opened by a double click) to find the data set numbers of the first and last hit of the range you are interested in. This is very easy and quick if you place the listing behind a filter processor allowing only the data from the desired time range to pass: then the first and last line in the listing show the data set numbers you need. Then use start and termination criteria to show only the range you want to see.

Title: Diag-05: Fix Scaling for high absolute values
Link: AESuite/VisualAE/Visuals/Diagram/Fix_Scale_High_Values.htm

Data Source: First-Hit of Event only or All Hits of Event

If a diagram is connected behind an Event-Builder, the First-Hit of an event is used to represent that event.

Behind the Event Builder only the First-Hit of an event is passed on to represent that event. This is the default setting: First-hit of event only.



If you are interested in the other, subsequent hits of the event you can now select the option All hits of event on Tab Source of the Properties. When doing so all hits of located events (and only of those) will be displayed in the diagram.

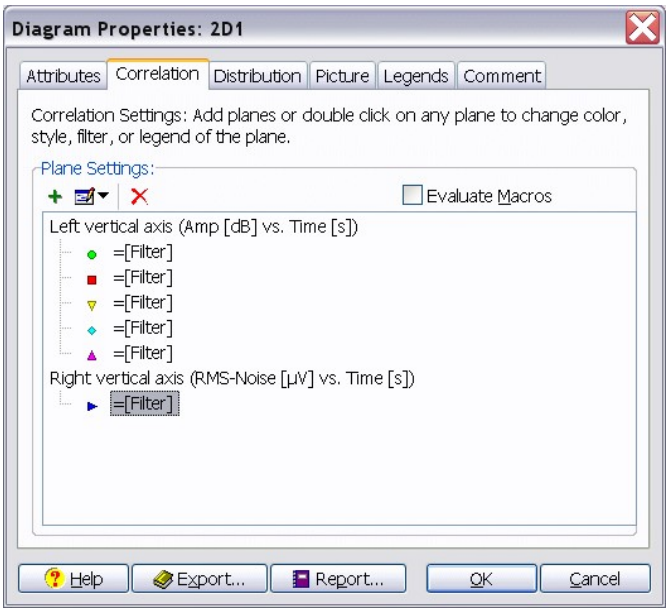
For background information see chapter Event Building Principles.

Title: Diag-06: Diagram Data Source
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabSource.htm

Correlation Setup

A click with the right mouse button on a diagram calls the context menu for this diagram. Select Properties get the Diagram Properties.

The Correlation tab provides access to the settings for all correlations in the diagram.



Plane-Settings

Each correlation is on a separate plane. The right axis is available for 2D diagrams only and will be shown if there is a right vertical axis. Planes can be added (Add button; green plus sign) or deleted (red x-sign).

The way how the correlation is displayed is completely controlled by the user. The corresponding dialog is accessed either by the "Edit" button or a double click on the highlighted line.

Additional Function

Right mouse button

A right mouse click on a plane calls a context menu.

Export

Stores the complete graph to the **Library**.

Title: Diag-07: Correlations
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabCorrelation.htm

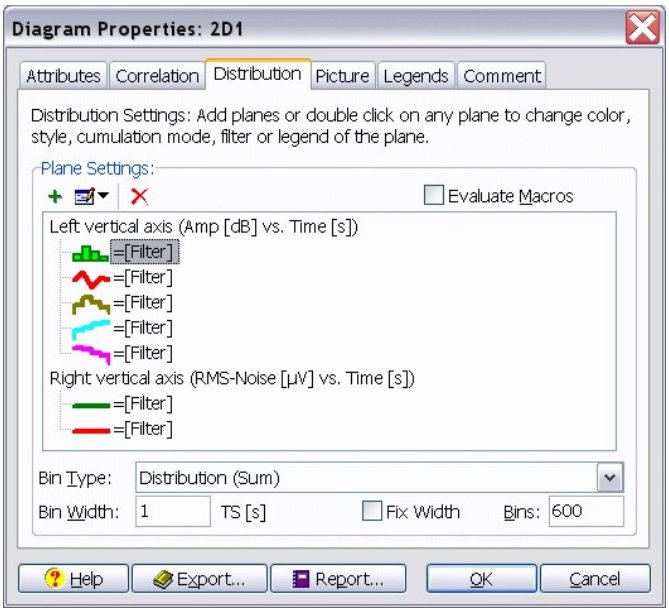
Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > 2D / 3D Diagrams > Distribution

Distribution Setup

2D-Distribution specific

(For 3D-Distribution specific, see below)

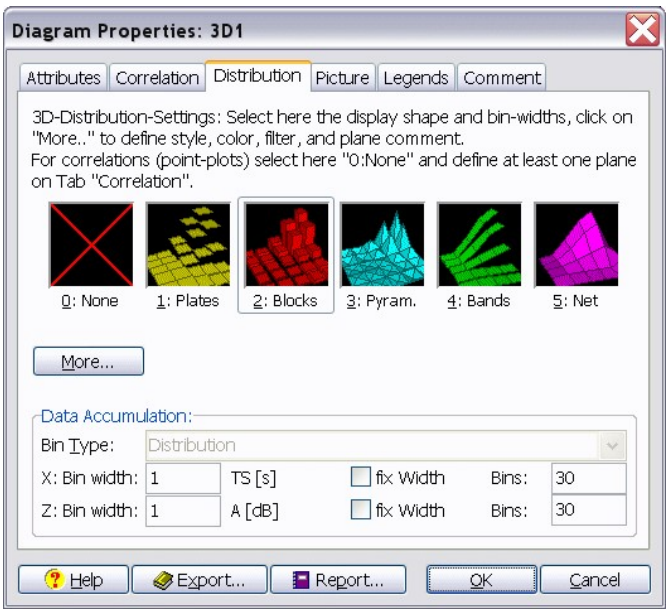
Using this tab the distributions which are to be displayed can be added, deleted or edited. The example below shows 4 planes linked to the left y-axis and 1 plane linked to the right y-axis.



Right vertical axis

Only available if added to the diagram setup (see tab attributes).

3D-Distribution specific



Select how the distribution shall be displayed (Plates, Blocks, Pyramids, Bands, Net, <None> hides the distribution).

Clicking on "More..." calls a dialog window for setting the color scaling.

For both diagram types

Bin Type

Depending on the chosen type of distribution different Bin Types can be selected (only available for diagram types where a selection is reasonable):

- History: Draws the part of the bin between maximum and minimum value in the color of the distribution, connects this to the previous and next bin respectively. Mostly used for evaluating the time evolution of AE parameters when the time resolution is about the same as the screen resolution.
- Distribution: Shows the sum of the y-values per bin, strictly statistical result.
- Average: Shows the sum of the y-values per bin, divided by the number of y-values in this bin.
- Absolute Maximum: Shows the absolute maximum per bin.

Hint: The bin type (former accumulation type) "rate" has been removed because it frequently caused irritations (because depending on the settings it could result in values smaller than 1 for attributes that are definitely integer). The behavior of "rate" is possible by selecting "Distribution", fixing the Bin Width to 1s, and choosing the number of bins larger than the expected duration of the test.

Bin Width

Describes the minimum size of the bins. Will be extended by the software if the numbers of bins times the size is not enough to cover the range to be displayed. Default is 1 unit/bin, e.g. 1s/bin. A macro exists allowing one to display the presently used Bin Width in e.g. the legend of the diagram.

Bins

Number of bins to be used for storing internal values. Minimum number is 10, maximum number is 32000. Bins which are not needed to display data are left unused. If more bins than defined are necessary (for instance if you have defined 200 bins, but your test lasts longer than 200s and you use an Amplitude vs. time [s] diagram), the Bin Width is doubled. If your test lasts longer than 400s the Bin Width will be doubled again and so on.

Fix Width

If this is enabled the doubling of the width is suppressed. If more than the specified number of bins with the fixed width should be required, the values belonging to additional bins will not be displayed (but of course written correctly to HDD by the acquisition software).

Note: Bin Width, Bins and fix Width are common settings for left and right (if existing) vertical axis.

Hint: If a screen resolution of 1280 x 1024 is used, approximately 1000 points can be displayed by the graph. The rest is used for window frames, diagram background,... This corresponds to a maximum of 1000 bins which can be resolved. Even if a higher resolution can be calculated, it can't be displayed due to the restrictions of the monitor.

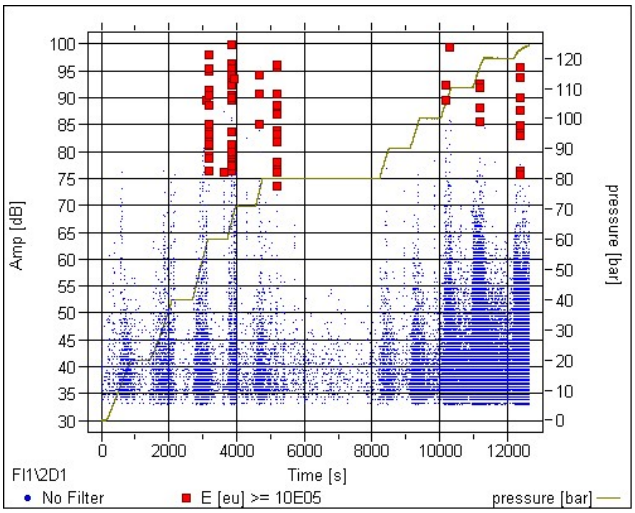
Title: Diag-08: Distributions
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabDistribution.htm

Diagram Planes Overview

Planes are a powerful concept for visualizing information within graphs. You can compare planes with transparencies: they can carry (and display) information and if you place several of them on top of each other, the information of all of them will be superposed.

A graph must contain at least 1 plane to display data. But it can contain as many planes as you like. And each plane can have its own color, symbol (square, triangle,...), a filter allowing only selected data to be shown on that plane, and a legend describing the plane.

Example:



The Visual shown is a 2D diagram containing 3 planes: 2 planes carrying correlations and 1 plane carrying a distribution.

Description of the 3 planes in the example

Plane 1

Data is displayed as correlation plot in blue dots, associated with the left vertical axis. To this plane no filter is applied: all of the is displayed. The plane shows for each hit a dot at its peak amplitude and time of occurrence.

Plane 2

Data is displayed as correlation plot, red squares, associated with the left vertical axis. This plane has a filter applied: only hits having an energy of 10E05 eu (energy units) or higher will be displayed. The plane shows for each hit a square at its peak amplitude and time of occurrence.

Plane 3

Plot is of type distribution (history type), green line, associated with the right vertical axis. In this plane a green line shows the pressure vs. time from a parametric channel. Note that these values are already converted to engineering units. This is done by the parametric conversion.

Due to the long duration of the test (more than 6 hours) the software automatically enlarged the Bin Width in order to be able to show all data of the test.

Title: Plane-1: Diagram Planes Overview
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneOverview.htm

Plane Context Menu

Planes are a powerful tool to get more information out of your graphs. If you have more than one plane in a graph, the context menu found by clicking the right mouse on a plane (in the diagram properties window) is very helpful:

Evaluate Macros

The macros used for the legend of the planes will be evaluated and the result will be displayed in the plane settings list.

Quick Setup

Call a special dialog for quick setup of different plane filters and legends. See chapter **Quick** Setup for details.

Edit Plane

Opens a new dialog to edit current plane settings.

Add Plane

Adds a new plane like the "Add" button at the bottom.

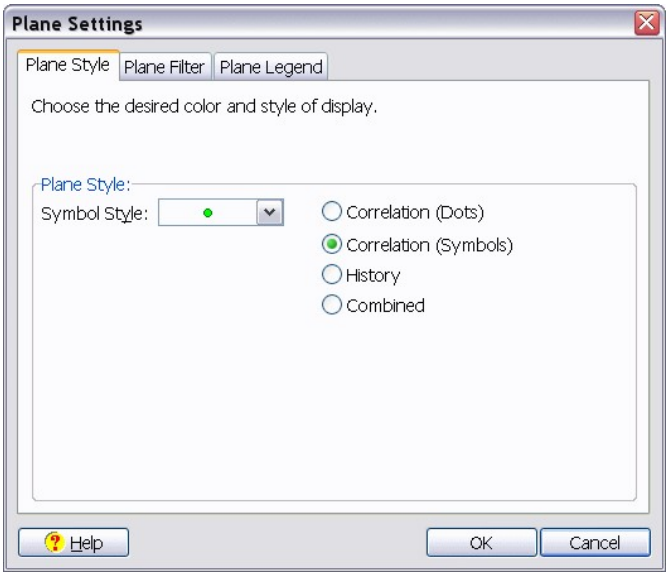
Delete Plane

Removes the selected plane from the graph

Title: Plane-2: Context Menu
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneContextMenu.htm

Plane Styles for Correlation

The style of each plane can be individually adjusted. The drop down list "symbol style" allows to select symbol shape and color of the currently selected correlation plane.



Plane Style

Symbol Style

The symbol style (color and shape) for the according plane can be chosen from a drop down list.

The four checkboxes are for selecting the style of the correlation which fits the users needs best:

- Correlation (dots): Each value-pair (xy) is represented by a small dot,
- Correlation (symbols): Each value-pair (xy) is represented by a big symbol (square, triangle,...),
- History: The places where the xy pairs are located are chronologically connected by straight lines,
- Combined: The places where the xy pairs are located are marked by big symbols and chronologically connected by straight lines

Title: Plane-3: Correlation Styles
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneTabStyleCorr.htm

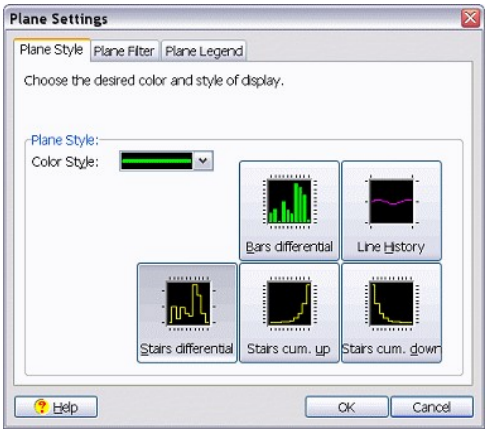
Plane Styles for Distributions

The style of diagrams can be adjusted by these dialogs:

2D Distribution specific

Select the desired color from the combo box on top and press the button with the desired style. Diagram data can be displayed as

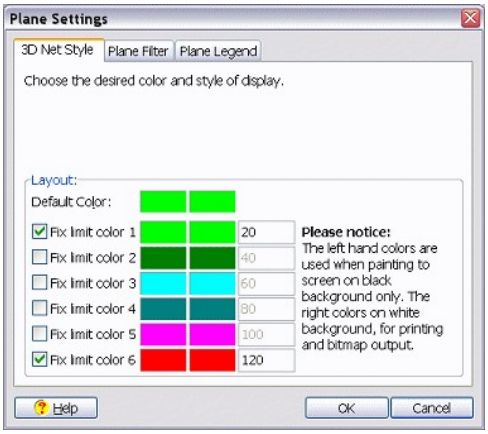
- bars differential
- line history
- stairs differential
- stairs cum. up: diagram data is shown in a cumulative up way.
- stairs cum. down: diagram data is shown in a cumulative down way.



3D Distribution specific

If the checkboxes are enabled, the scaling of the color grading is fixed to the numbers shown in the most right column. If they are unchecked, the scaling will adapt automatically to the analyzed data.

Clicking on a color opens a dialog window which allows one to adjust the color. The left color column is used for black background, the right color column is used for white background (and for printing). They can be set independently.



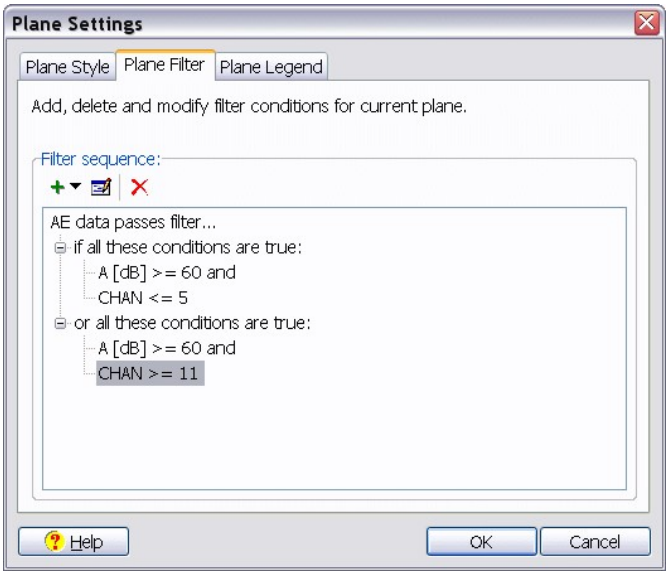
Title: Plane-4: Distribution Styles
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneTabNet3D.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > 2D / 3D Diagrams > About Diagram Planes > Plane Filter

Plane Filter Setup

The filter dialog provides the possibility to create and apply complex filters during the analysis of your data that act only on one single plane! This allows e.g. for displaying different ranges in different colors.

Any measured or calculated magnitude can be used for filtering: The AE parameters, parametric inputs, location results and others.



Filter sequence

The plane filter of a diagram behaves similar to the Filter processor. The filter sequence window gives an overview about the defined filter conditions. AE-data will pass the filter and is plotted in the according plane if all filter conditions equate true. The filter conditions can be connected by logical AND or logical OR conditions. All logical AND conditions are grouped under "if all these conditions are true:" while all logical OR conditions are grouped under "or these conditions are true". Conditions can be added by clicking the green plus sign. They can be removed by clicking the red x-sign. Conditions can be edited by double clicking on a certain condition.

Defining complex filters

Definition of complex filter conditions is possible by i.e. stacking different AND and OR conditions.

Each entry can be selected, clicking the right mouse calls a context menu.

Available controls

The following controls are available in the toolbar of the Filter sequence group:

- And: adds a new filter condition connected by logical And
- Or: adds a new filter condition connected by logical Or
- Delete: removes the selected condition
- Edit: calls the edit dialog to edit the selected filter condition

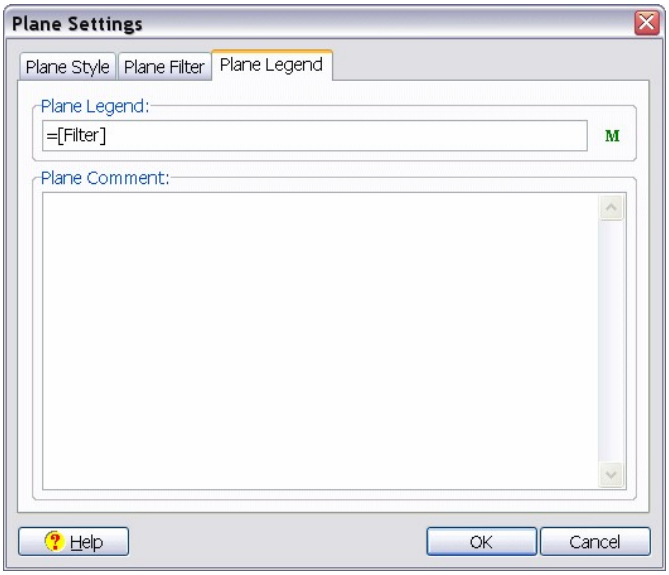
Note: Use the "=" relation only for results which are definitely integer values (e.g. channel number, counts). If you use the EQUAL condition for other results the condition might never come true as most results internally are handled with more digits than displayed.
If filtering according to an EQUAL condition (e.g. condition A=45dB, while the internal number is 45.005dB) no data will pass the filter and nothing will be displayed.

Title: Plane-5: Plane Filter
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneTabFilter.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > 2D / 3D Diagrams > About Diagram Planes > Plane Legend

Plane Legend Setup

For every plane a legend and a comment can be specified.



The comment field can be used to describe the plane in plain text.

A number of macros exist for automatic legend and caption generation.

Hint: If a user-defined legend is inserted the automatic legend update should be disabled.

Title: Plane-6: Plane Legend
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneTabComment.htm

Quick Setup: Filter and Legend Setup for Multiple Planes

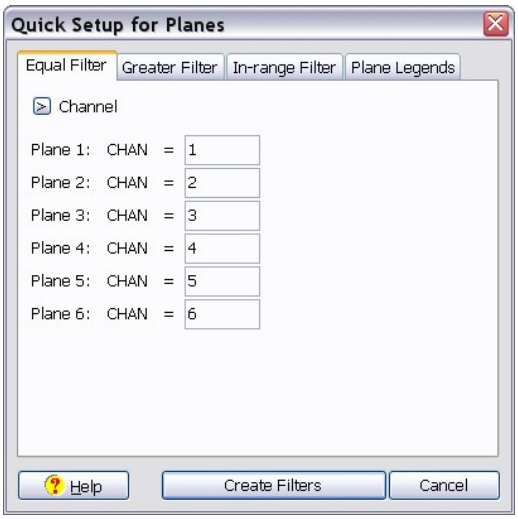
Overview

The Quick Setup for Planes is a dialog providing a convenient means if similar filters and/or legends shall be applied to several planes: e.g. each plane shall display a different channel or subsequent ranges (0-20, 20-40, 40-60,...dB) shall be shown by different planes.

How to call Quick Setup for planes

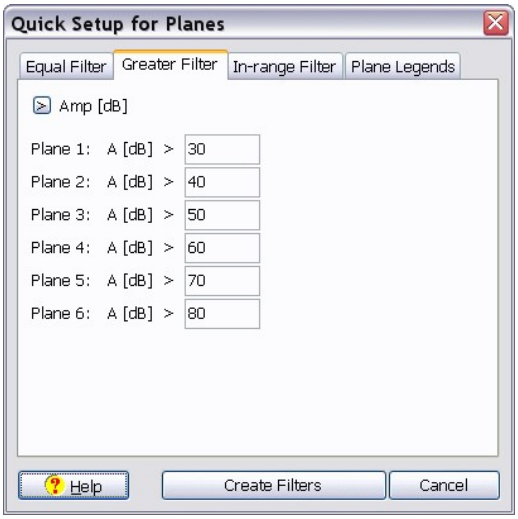
The Quick Setup is accessible via context menu in the plane settings list on Distribution tab or Correlation tab of either 2D or 3D diagrams.

Condition Equal Filter



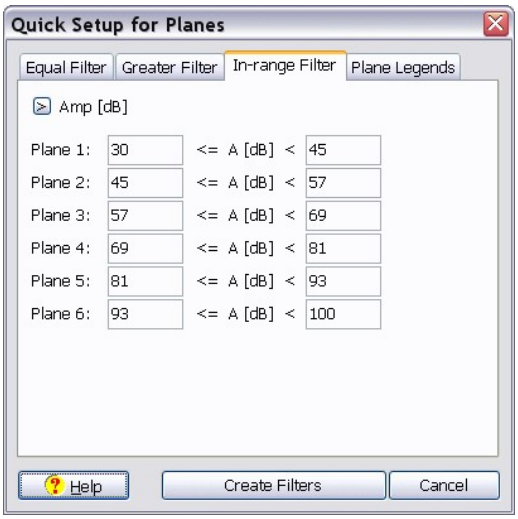
Select an attribute (e.g. Channel) and enter the channel number of the first plane. Then press tab or click in any of the other fields and all the numbers will increase by one (compared to the previous one). When changing e.g. the 4th plane, only the planes with higher numbers will be changed. Clicking on "Create Filters" will apply the changes to the planes.

Condition Greater Filter



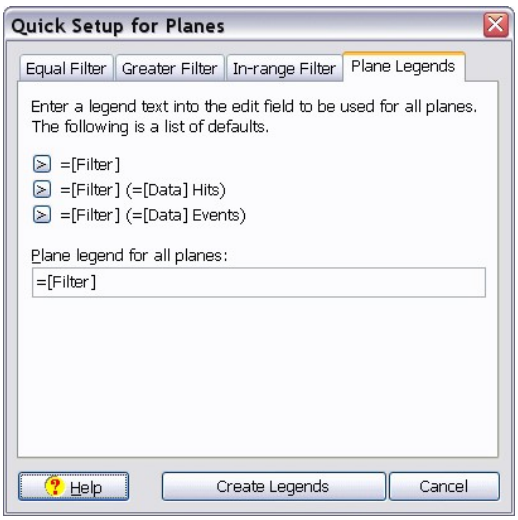
Select an attribute (e.g. Amplitude) and the desired lower limit (e.g. 33 dB) for a plane. Then press tab or click in any of the other fields and all the planes with higher numbers will get subsequent ranges of the same size. Clicking on "Create Filters" will apply the changes to the planes.

Condition In-range Filter



Select an attribute (e.g. Amplitude) and the desired range (e.g. 0 to 20 dB) for a plane. Then press tab or click in any of the other fields and all the planes with higher numbers will get subsequent ranges of the same size. Clicking on "Create Filters" will apply the changes to the planes.

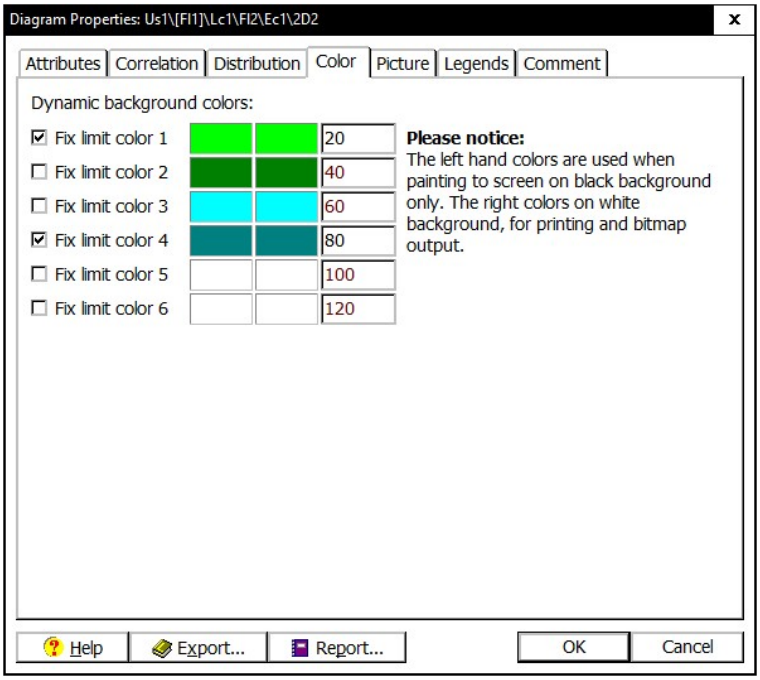
Plane Legends



Three possibilities using the **VisualAE™** macros for Plane Legends are offered on this tab. Just click on the appropriate button to select. Of course any other macro can be used if desired. Clicking on "Create Legends" will apply the changes to the planes.

Title: Plane-7: Quick Plane Setup
Link: AESuite/VisualAE/Visuals/Diagram/Planes/Diagram_PlaneQuickSetup.htm

Background Colors



Dynamic background colors

Defines colors for limits along the y-axis of a plot. The value in the field indicates from what y-value on the color is used for increasing y-values.

In the above example limit color 1 will be used as background color in a diagram from y-axis value from 20 onwards up to value 40. Limit color 2 will be used from y-value 20 up to y-value 60, etc.

The color on the left hand side is used when the diagram background is black, the color on the right hand side is used when diagram background is white (and for printing).

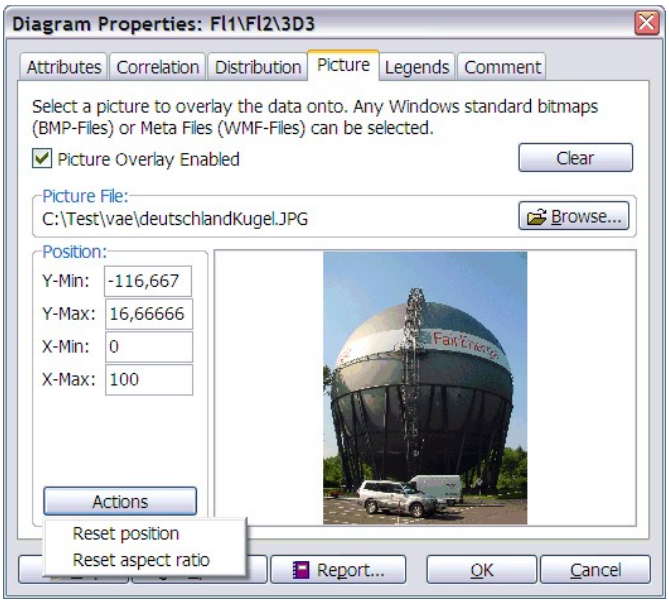
Colors and limits can be set by the user.

Picture Overlay

VisualAE offers the possibility to place graphic files on 2D/3D diagrams: For instance on location diagrams you can indicate the shape of the object under test.

By a right mouse click on the diagram you call the **Properties** dialog, **Tab Picture**. Here you can enable the Picture Overlay functionality, select the desired picture using the Browse button and specify where (relative to the 2 axis of your diagram) the graphic shall be placed.

The following formats can be used: .JPG, .JPEG, .BMP, .ICO, .EMF, .WMF.



The picture above demonstrates the overlay capability. You could use e.g. a drawing of welds, the geometric shape, or other information about your test object to enhance your diagrams.

Overlay image on 2D diagrams

For 2D diagrams, the position is given in absolute units.

Overlay image on 3D diagrams

For 3D diagrams, the scaling and positioning of the overlay image on the 3D graph is rather complex, because there is no 2D coordinate system available to match to 2D overlay image. So the scaling is given in percentage in reference to the 3d coordinate cube width, if 3D perspective is off (see 3D diagram rotation). This means the values X-Min: 0 [X], X-Max: 100 [%] scales the image to the width of the cube in x-direction. Same is valid for y-axis for Y-Min: -100 [%], Y-Max: 0 [%].

The offset of these values give the position in relation to the origin of the 3D coordinate cube. For easier positioning of the overlay image in 3D please use 3D Rotation Dialog.

Reset Position (3D only)

Resets the position of the overlay image to the initial position, in case the image got "lost" in scaling.

Reset aspect ratio (3D only)

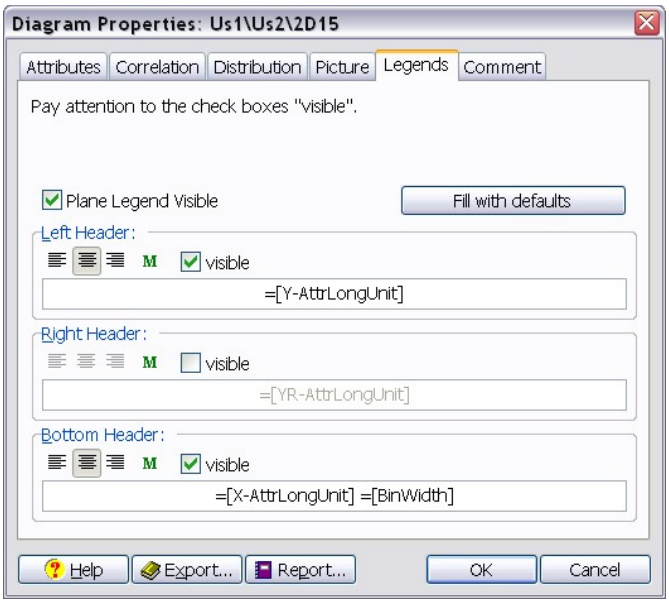
Resets the aspect ratio of the overlay image. For easier positioning of the overlay image in 3D please use 3D Rotation Dialog.

Title: Diag-09: Picture Overlay
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabPicture.htm

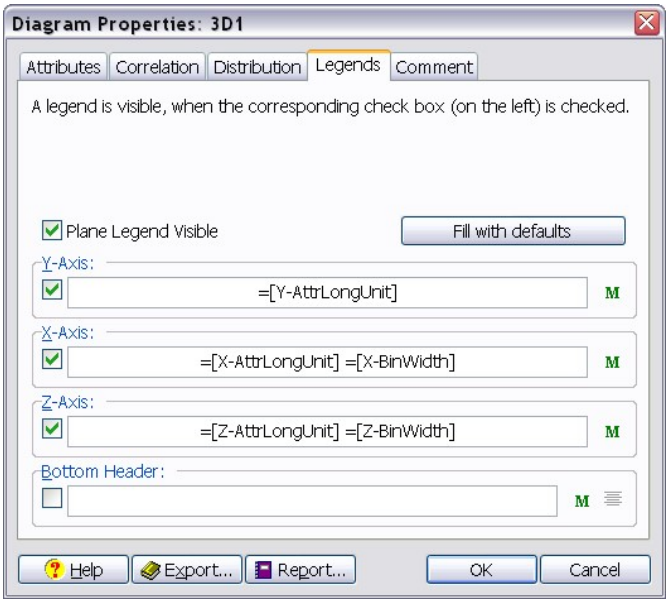
Diagram Legends

Individual legends for each axis can be used to give all different kind of information, e.g. which attributes are displayed along which axis.

2D specific



3D specific



The axis legends can be selected to be visible or not (by the checkbox at the left). Items made visible will be printed as well. The alignment of each legend can be individually adjusted (left or right justified, centered). A number of macros exist for automatic legend and caption generation.

Fill with defaults

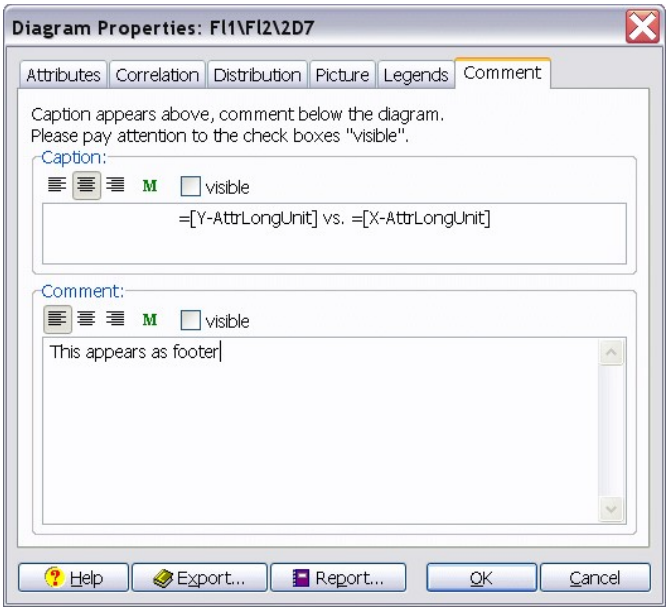
Fills all available fields with the default macros, a quick and convenient possibility to establish legend texts.

Title: Diag-10: Diagram Legends
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabLegend.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > 2D / 3D Diagrams > Comment

Diagram Comment

Specifies legends and comments and their attributes for the current page. The caption appears above the diagrams in large bold text. The comment appears below the diagrams in smaller plain text.



Caption/comment visible

When selected, this specifies that the caption/comment will appear on the computer display monitor. It is useful to leave this option off to make the most use of the available monitor resolution.

Caption/comment text entry block

The text for the caption/comment is entered in this space.

Text alignment

Icons above the text entry blocks are for left justified/centered/right justified text. The text will be aligned according to which of these three icons is selected. The three icons, left to right, are left-justified (text aligned with the left margin), centered, and right justified (text aligned with the right margin). The defaults are centered for the caption and left-justified for the comment.

Hint: A number of macros exist for automatic legend and caption generation.

Title: Diag-11: Diagram Comment
Link: AESuite/VisualAE/Visuals/Diagram/Diagram_TabComment.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > 2D / 3D Diagrams > How to Create a Sphere Diagram (3D only)

How to Create a Diagram showing Location Results on a Sphere

The easiest way to add a such a diagram to your analysis is to import it from the Library: Insert/Library Import/3D-Diagrams, then select Spherical Location Plot.

Requirements are: software modules VAELS and VAE2, and a location setup for sensors on a sphere.

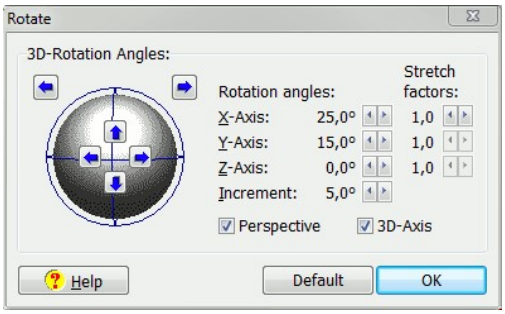
The following is a short guide how to set up a graph showing location results on a sphere from scratch. We recommend to do the exercise below only if you have worked through the introductory exercise or have some experience with **VisualAE™**.

- Insert a new AE-Diagram below the location processor for your sphere.
- Select "number of axis" to be 3-dimensional, select x-axis attribute to be X-Location, y-axis attribute to be Y-Location, z-axis attribute to be Z-Location, click on Next.
- Leave the diagram type as blocks, click Next.
- Select the target screen page on which you want the diagram to be displayed and click Finish. Now the diagram appears on the selected screen page, showing a sphere without data.
- Make a right mouse click on the diagram and select Properties.
- Go to the tab Distribution and select None.
- Go to the tab Correlation, press the Add button, and select the kind of symbol which you prefer. Click OK two times.
- Click on Reset and Run to display location results (if available).

Title: 3D-1: How to Create a Sphere Diagram
Link: AESuite/VisualAE/Visuals/Diagram/3D/Diagram_3DLocSphere.htm

Rotating 3D diagrams

3D diagrams can be rotated in order to show them from any angle. Additionally each axis can be stretched.



3D-Rotation Angles

Rotation is always carried out about X-Axis first, followed by Y- and Z-Axis. Please note that coordinate-system and therefore rotations are a according to a left-handed coordinate system.

X-Axis

Specify rotation angle around X-Axis, whereby X-Axis is always x-axis of screen, i.e. horizontal axis from left to right.

Y-Axis

Specify rotation angle around Y-Axis, whereby Y-Axis (actually Y'-Axis) is resulting axis from rotation about X-Axis.

Z-Axis

Specify rotation angle around Z-Axis, whereby Z-Axis (actually Z"-Axis) is resulting axis from rotation about X-Axis and Y-Axis.

Increment

Specify the increment/decrement of rotation angle for a single mouse-click on arrow buttons

Stretch factors

Specify for each axis individually a scale factor. In case of isotropic diagrams (as e.g. in location diagrams) a stretch factor for all three axes is specified.

Perspective

If checked a perspective view (more naturally) will be displayed. If unchecked parallel projection is used. The latter allows one to compare distances graphically.

3D-Axis

If box is checked the coordinate grid will be shown, otherwise it will be switched off.

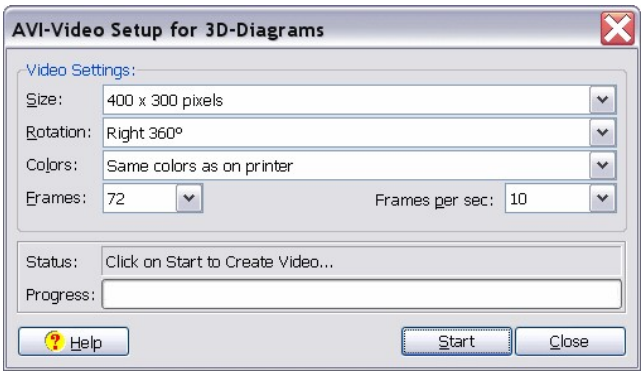
Blue Arrow buttons

The blue arrows allow to turn the diagram around the 3 coordinates X, Y, and Z. The corresponding angles are shown under Rotation Angles.

Title: 3D-2: Rotating 3D diagrams
Link: AESuite/VisualAE/Visuals/Diagram/3D/Diagram_3DRotate.htm

Create Movie of rotating 3D diagram (3D only and only Releases before R2011.0509)

A possibility to create an AVI video is implemented in **VisualAE**. Using this option a movie with e.g. a rotating 3D diagram can be created. Click the right mouse button on the 3D diagram and select Video...



The dialog window shown above allows for selecting the desired settings for the AVI-movie.

Video Settings

Size

defines the graphic resolution of the frames (bitmaps).

Rotation

a selection of rotation types is offered

Colors

choose either like "on screen" or "on printer"

Frames

define number of frames to be created

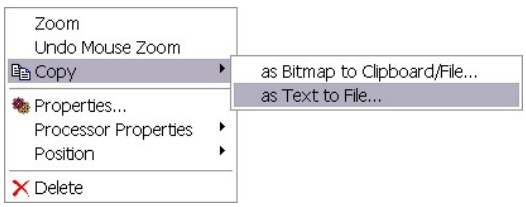
Frames/sec

specifies the time resolution of the video

After clicking on start you specify a file name and the compression type for the AVI-file to be created.

Title: 3D-3: Movie of rotating 3D diagram
Link: AESuite/VisualAE/Visuals/Diagram/3D/Diagram_3DVideoAVI.htm

Copy text to Clipboard/File



Clicking the right mouse button on any diagram opens a context menu. Second item from top is "Copy..." where two options exist:

a. bitmap to clipboard

b. text to file

Text to file allows one to write a *.TXT file containing the table which is displayed in the diagram. If you have several planes in your diagram the software asks you to select one of them for writing into the ASCII file. The content of that table is defined by the settings of: Bin Width, bins, fix Width, and the actual range being displayed.

Example for 2D distribution diagram

diagram Hits vs. Time, cumulative up. Imagine there were 9 Hits at 3s, 2 Hits at 4s, and 7 Hits at 11s, Bin Width 1s, 50 bins, fix Width disabled, and actual duration of the test 50s.

The table looks like

"Time [s]"	"Hits"
3	9
4	2
11	7

If the same test has a duration of 80s, the table would looks like

"Time [s]"	"Hits"
4	11
12	7

The reason for this is that the Bin Width is automatically doubled if the required x-axis exceeds the product of Bin Width and number of bins (unless you enable "fix Width"). The change in time results from the fact that always the center of the bin is given.

Every line shows the results belonging to the appropriate bin, empty bins (1-3,5, 7-10, 12-50 in the upper example) are not shown. And even if cumulative up is selected every bin shows only the values belonging to it. The summation resulting in a "cumulative up" representation is only a certain way of presenting the data. The data itself is not influenced by this.

Exporting 3D diagrams

In case of copying a 3D diagram to a text file, the output format will be:

- the most left column contains the z-axis values
- the top line contains the y-axis values
- inside this rectangle are the x-axis values corresponding to the appropriate y- and z-values.

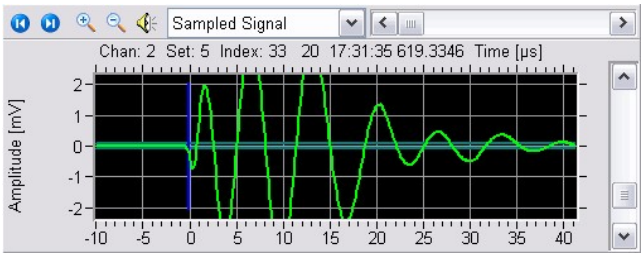
Hint: Always mind the **Bin Width**, **fix Width**, and **number of bins** currently used when interpreting such tables.

See also: Copy bitmap to clipboard/file

Title: DiagGen-3: Copy text to clipboard/file
Link: common/DiagGen/VisualAE_storeASCII.htm

Waveform Diagram: Context menu and controls

This is the Vallen standard waveform diagram (TR-diagram). You will find this type of diagram in any Vallen program that shows waveform data. The left header explains the vertical axis and shows "Amplitude [mV]" in this example. The information header on top of the diagram shows numerical values about the currently displayed data set.



In this example the information header shows

- the channel number
- the data set number, a sequential number of the position of this waveform in the TR-file
- the TR-Index, a special unique index given during acquisition. If the file has not been filtered it is the same as the data set number.
- the absolute time of the threshold crossing, beginning with day, hh:mm:ss ms.ms
- the units for the horizontal time axis, here "Time [ms]".

Threshold and time of first threshold crossing

The two horizontal lines close to zero amplitude (in cyan color) show the positive and negative threshold levels that have been used during data acquisition.

The vertical line at time zero (in blue color) shows the time of the first threshold crossing, which occurs when the signal intersects the positive or negative threshold levels for the very first time. This time is also used to reference the horizontal time scaling of the diagram. So time zero on the horizontal axis of the diagram always refers to the time of the first threshold crossing.

The Toolbar

When you click on the diagram it shows a toolbar on top with the following controls:

Navigation

These two buttons are used to navigate through a waveform data file. The left button navigates to the previous set, the right button to the next set.

Hint: navigation by next/previous button will display next/previous transient of TR-file. Sometimes TR-diagrams are located in a branch with parent processors. In such cases it is sometimes convenient to navigate from one transient to the next filtered/processed one (which may not necessarily be the next transient on file). To do such navigation simply hold Control key down and click navigation buttons.

Time Zoom

These two buttons increase and decrease the time resolution shown.

You can also zoom in/out by use of mouse wheel and <ctrl>/<shift> key combination.

Turning the mouse wheel one position corresponds to a time shift of 5%.

Turning the mouse wheel and holding the <shift> key down results in a time shift of 50%.

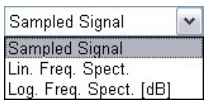
Turning the mouse wheel and holding the <ctrl> key down results in a zoom to 80%/125% of the TR-window.

Play waveform via sound card

This button is available only if a sound card is installed. It sends the waveform to the sound card and makes it audible. Therefore the sample rate is adapted to the audible range. The human ear offers a lot of pattern recognition possibilities to discriminate different waveforms.

Time-Frequency domain

This combo box changes the waveform display between time and frequency domain. In frequency domain the waveform can either be scaled linear and logarithmic.



Time scrollbar

Use the horizontal time scrollbar to move the displayed time axis. You can also scroll with the wheel if using a wheel mouse. This scroll bar is available only if the displayed range is smaller than the page length (see Time Zoom above).

Fix scale scrollbar

Use the vertical scrollbar to adjust the vertical scaling. This scrollbar is available only if auto scaling is disabled (see context menu below).

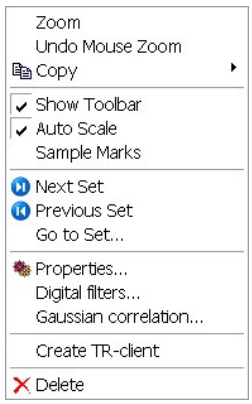
The Context Menu

The context menu pops up when clicking the right mouse button on the diagram.

Zoom

Zoom allows expanding the currently displayed diagram to the full size of the window and to hide all others. When the diagram is zoomed the zoom item in the context menu is checked.

Click Zoom again to un-zoom the diagram.



Copy

There are more sub items. Please see corresponding chapters:

- as Text to Clipboard
- as Bitmap to Clipboard / File
- Auto Image Creation Wizard
  (link available in VisualAE™ help only)

Show Toolbar

This item enables (when checked) the toolbar on top of the diagram. To remove the toolbar click Show Toolbar again. For a description of the controls on the toolbar see above.

Auto Scale

This item has two conditions: checked or unchecked. It allows the enabling (when checked) or disabling of auto-scaling for the diagram's vertical axis. If auto scale is disabled a vertical fix scale scrollbar is visible on the right hand side of the diagram. Use this scroll bar to change the vertical scaling for the diagram.

Sample Marks

This item has two conditions: checked or unchecked. When checked, a circle is drawn around the position of each sample (sample mark). The sample marks are visible only if you have zoomed the diagram in the dimension of time sufficiently so that the samples can be separated.

Next set, Previous set

These items have the same function as the navigation buttons on the toolbar and show either the next or previous data set.

Go to set

Opens a dialog to enter a specific target data set or index to navigate to. See chapter Go to Set or Index for details.

Properties

This item opens the TR-display settings dialog, which allows one the numerical selection of the beginning and size of both master and client windows. See chapter TR-Display Settings for details.

Digital Filter

Opens the digital filter dialog. See chapter Digital Filters (link available in VisualAE™ help only) for detailed information.

Note: This function is available for extended TR-diagrams in VisualAE™ and VisualTR™ only. Options VTR for VisualTR™ diagrams in VisualAE™ required. Not supported in VisualClass™ or TR-Viewer.

Gaussian Correlation

Available for extended TR-diagrams in VisualAE™ and VisualTR™ only. Opens the Gaussian Correlation dialog. See chapter Gaussian Correlation (link available in VisualAE™ help only) for detailed information.

Note: This function is available for extended TR-diagrams in VisualAE™ and VisualTR™ only. Options VTR for VisualTR™ and for extended TR-diagrams in VisualAE™ required. Not supported in VisualClass™ or TR-Viewer.

Create TR-Client

Shows a TR-client diagram on the right hand side of the master diagram. The TR-Client shows a part of the (master) waveform along side of it. The default setting for the TR-client is to show a frequency spectrum of a part of the diagram. The client has also its own toolbar and context menu.

The range shown in the client window is indicated by a frame in the master window. This frame can be horizontally moved while pressing the left mouse button on either the left or right vertical frame line. The range shown in the client window is adapted accordingly. The horizontal size of the frame can be changed if you also press the <Shift>-key in combination with the left mouse button. This allows you to quickly adapt the range shown inside the client window according to your interest. When using the time scrollbar of the client window the frame in the master window is also adapted automatically.

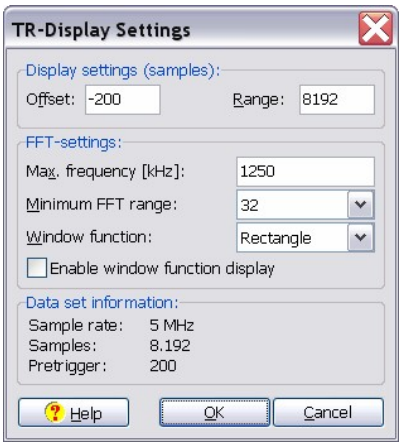
Remove Diagram

Removes the diagram.

Title: TRDiag-1: Waveform Diagram Overview
Link: common/TRDiag/Basic/TRDiag_Overview.htm

Waveform Diagram: Settings for master and client window

The diagram setting dialog specifies settings for both the master and client displays in the diagram.



Display settings (samples)

Offset

The master/client offset value specifies the starting point of the master/client time window in number of samples relative to the trigger point.

- The master offset value specifies on which sample the master time window begins, relative to the trigger point.
- The client offset value specifies on which sample the client time window begins, relative to the trigger point.

Range

The master/client range value specifies the size of the master/client time window in samples.

- The master range value specifies the size of the master time window in samples.
- The client range value specifies the size of the client time window in samples.

Note: The following FFT settings are available for extended TR-Diagrams in **VisualAE™** and **VisualTR™** only.

FFT-settings

Max. frequency [kHz]

Specifies the maximum frequency on the x-axis of frequency displays. The minimum frequency is zero.

Minimum FFT range

Minimum frequency acts on short time windows. If the minimum frequency range is greater than the window size, the window is padded with additional zeros to produce an FFT window of specified minimum size. This process increases the frequency resolution of short windowed events.

Window function

The time data is passed through a window function before the FFT is performed. This dialog allows the user to select which window function is used. The possible window functions are: Rectangular (default), Hamming, Hanning, Trapezium, Bartlett and Welch.

Enable window function display

The window function can be visualized in a TR-display when this function is activated. When activated, a display shows the current filter generating function with logarithmic frequency representation being the default settings. The same TR-diagram icons used in sampled signal analysis function can be selected for the window function display: time-zoom, time offset and display type (samples, linear frequency magnitude, and logarithmic frequency magnitude).

Data set information

Sample rate

rate at which TR-data was sampled.

Samples

Number of samples per TR-data set (per TR-page).

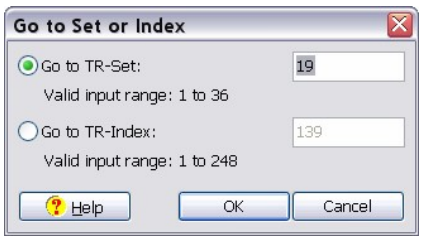
Pretrigger

Number of pretrigger samples.

Title: TRDiag-2: Display Settings
Link: common/TRDiag/Basic/TRDiag_Settings.htm

Waveform Diagram: Direct data set navigation

The item Go to set... out of the waveform diagram's context menu opens a dialog which allows you to immediately access any set on file by either specifying the TR-set or the TR-index number.



Either select Go to TR-Set or Go to TR-Index and specify the set or index number.

Sets and Indices

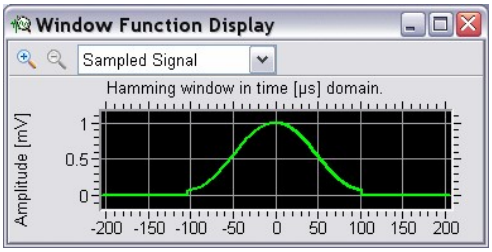
- TR-Sets refer to the actual number and order of TR-signals stored in a file. When there are 36 sets, the last set is always 36.
- TR-Index refer to the number and order of TR-signals when originally acquired and stored. The index is also stored in the primary data file, and can be used as a means to filter data with TR-Copy or TR-Combi (included in option VTR: VisualTR™). Many indices can be missing if the data file has been filtered, sets have been deleted or part of the file has been copied to another file.

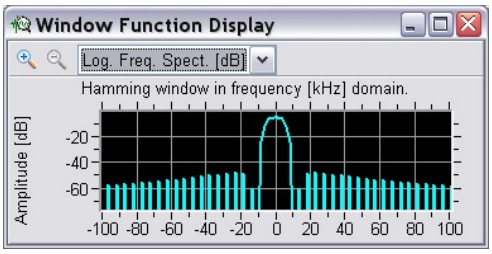
Title: TRDiag-3: Direct data set navigation
Link: common/TRDiag/Basic/TRDiag_GotoSet.htm

Waveform Diagram: Window functions for FFT calculation

Note: Option VTR required

A TR-Client usually contains only a part of the TR-Master. This part is cut out using a window function which can be selected.





The above example shows a Hamming window (green: time domain, blue: frequency domain).

The following window functions are available: Rectangle, Hamming, Hanning, Trapezium, Bartlett, Welch.

Title: TRDiagEx-1: Window Functions
Link: common/TRDiag/Extended/TRDiagExt_WindowFunctions.htm

Waveform Diagram: Applying digital filters

Note: Option VTR required

The digital filter dialog specifies parameters to defining a digital filter:

- type: none, low pass, high pass, band pass, band reject
- filter slope (when applicable)
- lower and upper cut-off frequencies (when applicable)

It also visually displays the digital filter generating function in a screen below the data options.

Digital Filters settings

Type of Filter

This option specifies the selected filter type from no filter (none, which is the default filter), low pass, high pass, band pass and band reject.

Filter slope

This option specifies the frequency roll off from the cutoff point. The accepted range of values is between 12 and 480 dB/octave.

Lower cutoff frequency

This option specifies the frequency cutoff for high pass, band pass and band reject filters. Note: lower cutoff frequency <= upper cutoff frequency for band pass and band reject filters.

Upper cutoff frequency

This option specifies the frequency cutoff for low pass, band pass and band reject filters. Note: lower cutoff frequency <= upper cutoff frequency for band pass and band reject filters.

Display

This display shows the current filter generating function with logarithmic frequency representation being the default settings. The time-zoom, time offset and

display type (samples, linear frequency magnitude, logarithmic frequency magnitude) can be selected from icons in the same fashion as diagrams to visualize details and effects of different window sizes with each filter.

Hint: The digital filter display is a diagram of a TR-set with defaults of log-frequency. The generating function can be viewed by selecting "Sampled Signal". In any case, the Zoom/Unzoom and scroll tools in filter display effect which part of the sampled signal are being viewed.

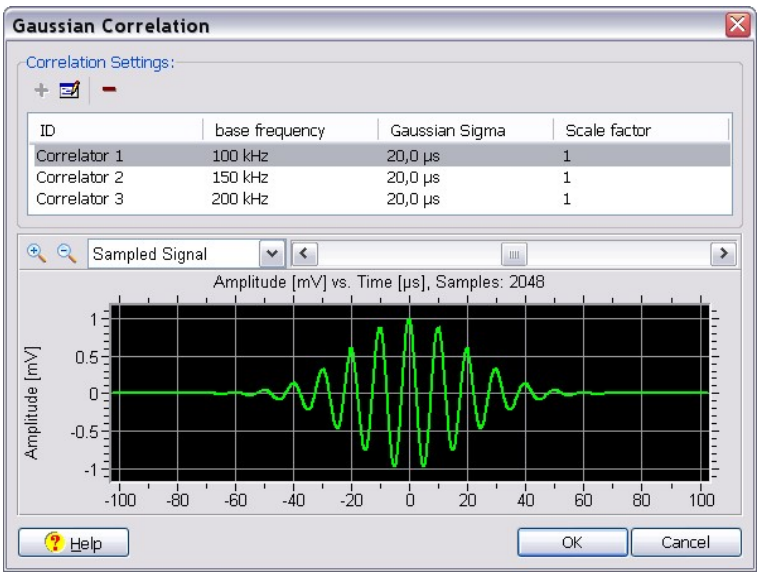
Title: TRDiagEx-2: Digital Filters
Link: common/TRDiag/Extended/TRDiagExt_DigitalFilters.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > Waveform Diagrams > Gaussian Correlation

Waveform Diagram: Gaussian Correlation

Note: Option VTR required

A correlation with a Gaussian function is typically used, or at least interpreter as, a means to show or highlight a single frequency component of a signal. The dialog below is used for setting up and displaying up to three available Gaussian Correlations. For each correlation defined, one signal will be overlaid on the master diagram. The correlation is between the Gaussian function defined (shown in the display) and the sampled signal.



Correlation Settings list

This list shows the currently defined Gaussian filters for the selected diagram, if any. The selected diagram is highlighted in blue.

Add

This function adds a new correlation function and calls the correlation settings dialog. Note: if there are already three correlations assigned for the diagram, this option cannot be selected.

Delete

This function removes the currently selected correlation.

Edit

Calls the correlation settings dialog for the selected correlation.

Gaussian Diagram

This diagram displays the Gaussian function currently selected in the correlation settings list. It has the basic diagram capabilities: it can be scrolled, zoomed and its type can change between sampled data and frequency.

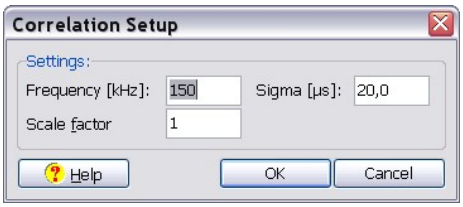
Title: TRDiagEx-3: Gaussian Correlation
Link: common/TRDiag/Extended/TRDiagExt_GaussianCorrelation.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > Waveform Diagrams > Gaussian Correlation Setup

Waveform Diagram: Gaussian Correlation Setup

Note: Option VTR required

This dialog specifies the settings for a Gaussian Correlation.



Settings

Frequency

The carrier frequency of the correlation function.

Sigma

This parameter is related to the full width at half maximum of the function in time (or time resolution).

Scale

The scale factor helps to visualize small frequency values.

Gaussian Function

The Gaussian function is = (1/Sigma) * e^- (t/Sigma)^2/2 * Cos(f t)

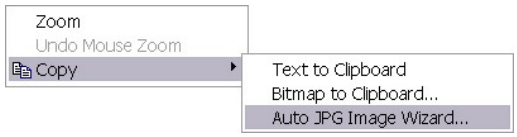
where t is the time, f is the carrier frequency and sigma is the full width at half maximum.

Return to: Gaussian Correlation

Title: TRDiagEx-4: Gaussian Correlation Setup
Link: common/TRDiag/Extended/TRDiagExt_GaussianCorrelationEdit.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Visuals > Waveform Diagrams > Export to JPG image wizard

Waveform Diagram: Auto JPG Image Wizard



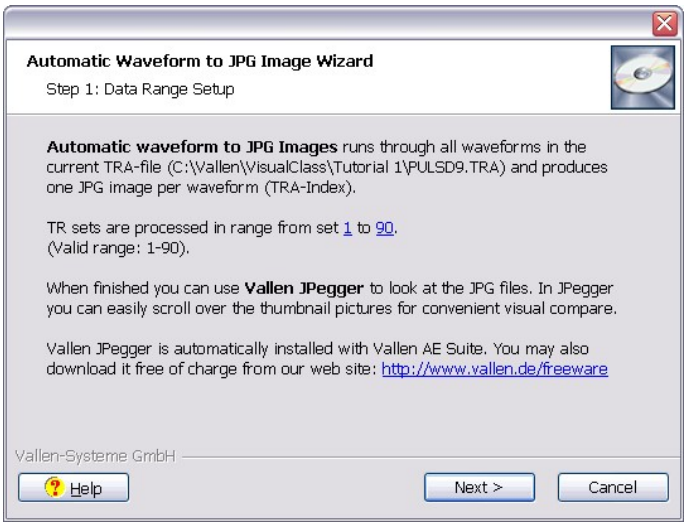
The Auto JPG Image Wizard is available from the context menu of a TR diagram. It runs automatically the Bitmap to File export on all waveforms in the current TRA file and produces one JPG file per waveform (TRA-Index).

When finished you can use Vallen JPegger to look at the JPG files. Vallen JPegger is automatically installed with Vallen AE Suite. You may download it also for free from our web site:

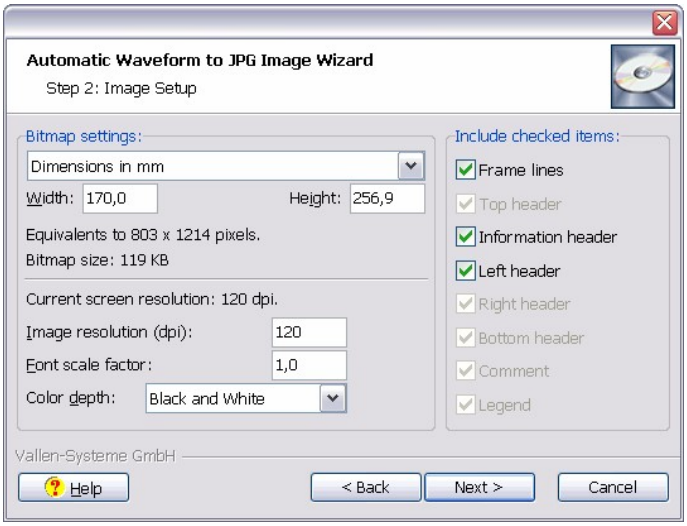
http://www.vallen.de/products/software/jpegger

Usage

First select TR set range for the output. Click on the text links in blue to modify parameters parameter:

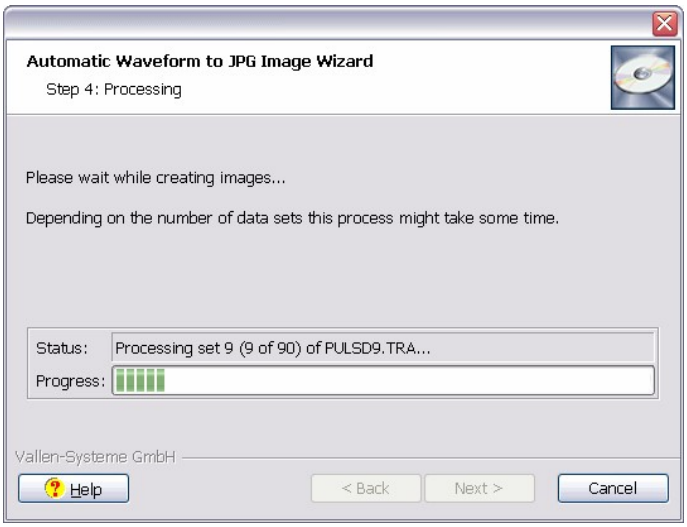


Then specify the image output size. This has exactly the meaning described in Bitmap to Clipboard/File dialog.



Finally select the target folder where the images are to be saved to and press Start.

The picture below shows the progress of the automatic process. The user can abort the process using the "Cancel" button.



When done, the last page shows the result of the process. Open one of the JPG files with Vallen JPegger or simply click on the blue link in the wizard.

Title: TRDiagEx-5: TR to JPG image wizard
Link: common/TRDiag/Extended/TRDiagExt_JPGwizard.htm

Waveform Diagram: Copy text to clipboard/file

This function allows you copying the ASCII data of the currently displayed waveform or frequency spectrum to clipboard and to paste it into any other program, for example into an EXCEL spreadsheet or any text editor.

To paste data from clipboard, simply click on Paste in the Edit menu of any windows program that supports importing of text data.

Data format

Time domain data	Frequency domain data
[FILEINFO]	[FILEINFO]
Filename: c:\gstarted\test.tra	File: c:\ae-data\ast-test.tra
SampleRate[Hz]: 5000000	SampleRate[Hz]: 10000000
SetsOnFile: 93	SetsOnFile: 229
Samples: 4096	Samples: 8192
[SETINFO]	[SETINFO]
Set: 2	Set: 206
Index: 2	Index: 206
Time: 19 21:34:57 451.0108	Time: 0 00:04:06 698,0474
Channel: 2	Channel: 2
PreTriggerSamples: 400	PreTriggerSamples: 4096
DataUnit: [mV]	DataUnit: [mV]
[DATA]	[FFTDATA]
0,0061	Freq[kHz] Amp
0,0061	6,104e-1 2,496e-2
0,0061	1,831e+0 2,369e-2
0,0061	3,052e+0 2,368e-2
0,0061	4,272e+0 2,380e-2
0,0061	5,493e+0 2,373e-2
0,0061	6,714e+0 2,378e-2
0,0061	7,935e+0 2,380e-2
0,0061	9,155e+0 2,389e-2
-0,0061	1,038e+1 2,379e-2

-0,0061 ...

-0,0061 [ENDDATA]

...

[ENDDATA]

Description of the data format

The data is separated into three areas:

1. File information header [FILEINFO]

This section contains information about the filename, the sample rate in Hz, the number of sets on the file and the number of samples per set.

2. Set information header [SETINFO]

This section contains information about the set number, the TR-Index, the absolute time (format dd hh:mm:ss ms.xxx), the channel and the number of pre trigger samples. The first detected threshold crossing is found at the sample position specified by the PreTriggerSamples.

3a. ASCII data [DATA] to [ENDDATA]

This section contains the sample data in ASCII values. The unit for the values is given in the set header in the files DataUnit. There is only one value per line and there are as many lines as samples per TR-data set (see field Samples in the file information header).

3b. ASCII data [FFTDATA] to [ENDDATA]

This section contains the data of frequency domain in ASCII values. The unit for frequency is given as column header. The unit of column "Amp" is given in section [SETINFO] attribute DataUnit.

Note: if the data is too large for the clipboard, a save file dialog appears. The data is stored to hard disk drive because of insufficient memory.

See also: Copy bitmap to clipboard/file

Title: TRDiag-4: Copy text to clipboard/file
Link: common/TRDiag/Basic/TRDiag_Text2Clipboard.htm

Waveform Diagram: About Scaling

Scaling in Time domain

The linear scaling of the waveform display refers to the sensor output in mV. To compare the peak amplitudes of a waveform with the amplitude given in dB use the dB formula:

U**dB** = 20 * log (U / U**0**), with U**0** = 1µV

In literature the term U**dB AE** is used to indicate the reference of U**0** = 1µV.

Conversion Table: dBAE to mV

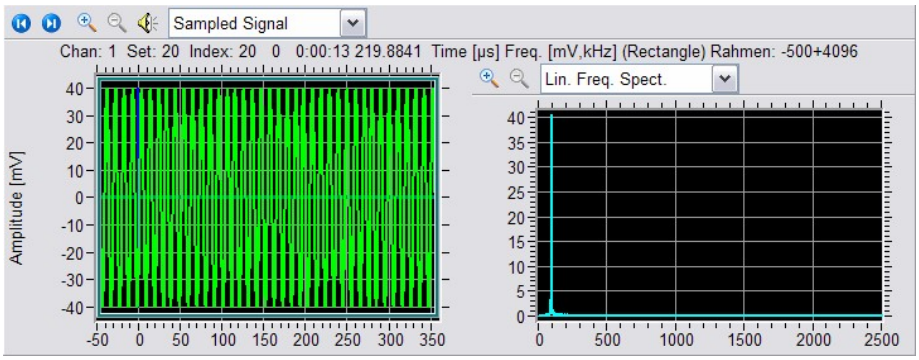
100 dB	<->	100 mV
80 dB	<->	10 mV
60 dB	<->	1 mV
46 dB (= 40 dB + 6dB)	<->	200 µV (= 100 µV * 2)
40 dB	<->	100 µV
34 dB (= 40 dB - 6 dB)	<->	50 µV (= 100 µV / 2)
20 dB	<->	10 µV
0 dB	<->	1 µV

Note: The values above are not exact and rounded for demonstration. For exact numbers 6dB gives a factor of 1.99526, instead of 2 as shown in the table. Use the function above if exact values are required.

Scaling in FFT frequency domain

The FFT is scaled in that way that a pure sine wave with 1 mV (60dB) peak amplitude shows a 1 mV (or 60 dB log) peak in the FFT display, if the FFT window has a length of 2N (256, 1024, 2048, 4096 etc.) samples. If the window used for FFT calculation is shorter than 2N, it is zero padded until the next 2N boundary. As a result the FFT shows a smaller value depending on the length of the zero padded range. The same happens if the sine wave is not continuous and doesn't fill the full window.

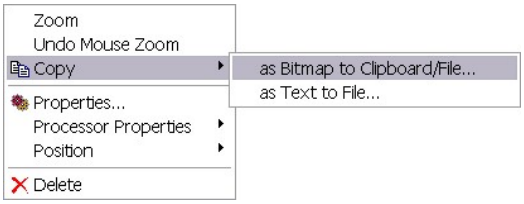
In real world one will never have continuous, periodic, symmetric waveforms. Instead an AE signal that rises in time domain to a maximum peak and decays, comprises of a mixture of frequencies which are not continuous and not periodic at all. The maximum peak in time domain evolves out of the superposition of different frequencies. In frequency domain all magnitudes are shown per frequency and as an average over the whole FFT window. As a result, the maximum peak amplitude in time domain doesn't correspond to the maximum magnitude of a certain frequency in frequency domain.



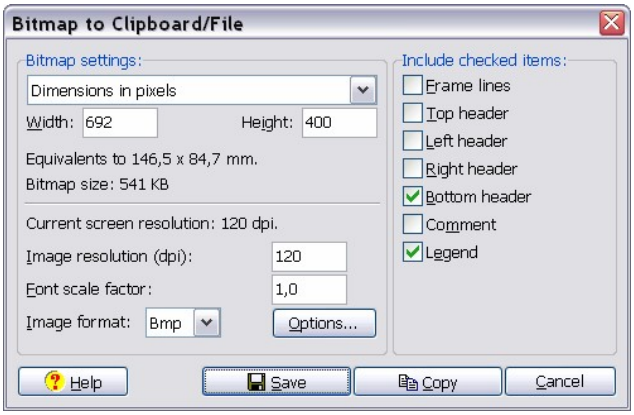
Title: TRDiag-5: About Scaling
Link: common/TRDiag/Basic/TRDiag_Scaling.htm

Copy bitmap of diagram to clipboard or save it to file

Copy bitmap to clipboard/file is a powerful means for fast report generation. It allows one to copy a diagram as a bitmap into any other Windows program, for instance Microsoft Word or PowerPoint. The bitmap can also be saved to file for later import. This chapter describes the available items of this dialog.



Bitmap Settings



Dimensions

The width and height of the bitmap should be specified in mm. Use pixel dimension only if you are aware how the printer driver will interpret your bitmap. The resulting units (pixels when dimension is in mm, or mm when dimension is in pixels) are shown below the edit fields. Also the estimated size (in bytes) of the bitmap is shown. After importing the bitmap into e.g. Windows Word or PowerPoint, set the size of the bitmap in the final document to the size here specified. This ensures an optimum pixel resolution considering the size of the bitmap, the printer resolution and the purpose of the printout. (See next paragraph)

Image Resolution

The bitmap resolution is defined in pixels per inch (ppi) and corresponds usually to the used printer resolution for both, reports and OHP transparencies. If the bitmap is for an on-line presentation with screen resolution, use the "Current screen resolution" as shown in the menu. If the bitmap dimension is given in mm, the program automatically optimizes the pixel resolution according to the size and purpose of the bitmap. This avoids disturbing effects, such as truncation or doubling of single pixel items in the final document.

Note: A printer resolution in dots per inch (dpi) is usually equal to pixels per inch (ppi). Since some printer modes compose each colored pixel by several dots, the definition "ppi" is more straight for bitmaps.

Font Scale Factor

A Font Scale Factor of 1,0 creates text fonts of size 10pt. (3,53mm) which is well suited for printed reports. (Bitmap dimension must be specified in mm). For OHP- transparencies you might prefer a bigger font, e.g. 14pt. This is achieved by setting the Font Scale Factor to 1.4 (14pt divided by 10pt). A Font Scale Factor lower than 1.0 is helpful with diagrams with large comment fields or many planes.

Color depth

The color depth defines the number of colors available for the bitmap. The larger the color depth the larger the bitmap size (in bytes). In most cases 16 or 256 colors are sufficient. If disk and memory space is not limited you can always use 64K colors or True Color mode.

Note: The bitmap size should not exceed the available main memory. If it does, then the creation of the bitmap might last up to minutes or even longer.

Image format

The bitmap can either be saved in Windows standard .BMP-format (uncompressed), .JPG format (compressed, lossy) or .PNG format (compressed, lossles). The output format can also be change via the file type combo box in the Windows Save Dialog after pressing the Save button.

BMP

The BMP-format is the best with respect to quality and standard but will produce extremely huge files, especially with higher color depths.

JPG

The JPG-format supports best compression and is a good selection for images with many colors, like digital photographs. But it uses a lossy compression method which means that the high compression rate is achived by removing information out of the image. The higher the compression the more information is removed which results in some typical compression artefacts. This format is not adequate for line graphic pictures with less than 256 colors.

Note: Each time a JPG image is saved, it is compressed again and information is removed which results in poorer image quality. So, when using the JPG-format, you should move the compression slider to Better Quality.

PNG

The PNG format is a newer lossless format which supports very good compression for images with a small number of colors (e.g. 256). It is the best choice for saving line graphic diagrams, if there are no high color background images.

Which format to use depends on the application. Use PNG for diagrams and JPG for digital photographs. To import the image into another application the BMP format is the most supported format.

Include checked items

This group influences the layout of the bitmap. Only the checked items are created and occupy space in the bitmap.

- Frame lines: the border lines around the diagram.
- Top header: the caption line on top of the diagram.
- Information header: Another comment line on top of the diagram. Available in waveform diagrams only to display the current TR-set information.
- Left/Right header: the attribute and unit line at the left/right vertical axis.
- Bottom header: the attribute and unit line below the horizontal axis.
- Comment: a multi-line comment field at the bottom.
- Legend: e.g. plane legend(s) (VisualAE), cross-correlation legends (VisualTR), class legends (VisualClass) etc., shown below the Bottom Header.

Items that are inactivated (gray) are not created.

Hint: For further information about creating bitmaps with best settings and how to import it into other applications please refer to the chapter **Creating Bitmaps**.

Title: DiagGen-1: Copy bitmap to clipboard
Link: common/DiagGen/DiagGen_BitmapToClipboard.htm

Details about creating bitmaps

Bitmaps are created to be imported into another document, e.g. when preparing a test report, a scientific paper, or a presentation. In most cases the bitmap shall be presented in high quality. The **Bitmap to Clipboard/File** dialog lets you perform this task in a comfortable and quick way. This chapter goes deeper into the details and should help to solve or avoid any problem that might occur.

How to create a bitmap for my application

Bitmaps can be created using "Copy to clipboard" out of the context menu of any Visual (AE-diagram, listing, waveform diagram, VisualClass diagrams, and others). This calls the Bitmap to Clipboard/File dialog.

Please proceed as follows:

1. Select the height and width the bitmap shall have in the final document (in mm). If you are not sure, try any bitmap and resize it to the final size. Nearly all Windows programs present the current size of any graphic in mm (try context menu, then bitmap or graphic properties and search for size). These are the size settings you have to specify for the bitmap.
2. Select the printer resolution you will use for the final printout. Get this information from your printer settings and use it for the bitmap resolution. The following is a list of recommended values:
    - For laser printers use a bitmap resolution of 300ppi (equal to dpi). Even if your printer supports 600, 900 or 1200 ppi, use a bitmap resolution of 300 as the bitmap might get too big for higher resolutions.
    - For inkjet printers use either 180 or 360 ppi. Even if your printer supports 720 or 1440 ppi, do not use a higher value than 360 as the bitmap might get too big for higher resolutions.
    - For online PowerPoint presentations use a resolution of 120 (if large fonts are defined in the graphics setup) or 96 (if small fonts are defined in the Windows graphics setup). The Bitmap to Clipboard/File dialog shows the current screen resolution (120 or 96). (This value does not depend on the

size of your screen but on settings in Windows, via "Start / Settings / Control Panel / Display / Settings / Extended", see the combo box for the font size settings and the value below.)

3. Adapt the font size to your requirements. If you want to change the font sizes inside the bitmaps you can use the Font Scale Factor.

4. Copy the bitmap to clipboard (or save it to a file).

How the bitmaps are imported into other applications

While importing the bitmap you should know the width and height in mm you have specified for the creation of the bitmap. Even though this information is stored in the bitmap header, some applications do not read this information in the header and assume a standard resolution of 72 dpi, and then reduce your bitmap to the width of the current document's page. That leads to a size for which the bitmap resolution might not be the optimum.

In your application, where you want to import the bitmap, select either Paste out of the Edit menu or Import out of the File menu (the menu commands might vary with different applications). This imports the bitmap into the application. If the bitmap is not shown in the specified size, select the bitmap properties and set the size of the bitmap in mm, as defined for its creation, otherwise the bitmap might not appear perfectly on the printout, even if it is shown perfectly on the screen.

Some basics about bitmaps

Differentiating two kinds of bitmaps

Bitmaps showing pictures. Their shape (height-to-width-ratio) usually never changes. Those bitmaps can be superposed to the graphic area of a diagram. Then the width and height of the bitmap is bound to the axis scaling. In case of auto-scaling, the height-to-width ratio of such bitmaps might indeed vary and the picture may then appear distorted.

Bitmaps showing diagrams. Flexible shaping of those bitmaps is important, since the shape of the diagram on screen is not always suited for the final document. Diagrams include a mixture of graphics and text elements. Make sure the text size is appropriate, does not disturb the graphics, thin lines should not be lost, lines should be printed in constant thickness, and more.

Bitmap resolution versus printer resolution

Let's assume you want to print a screenshot of a 1024 * 768 Windows desktop to a laser printer with 300 dpi and an inkjet printer with 180 dpi. If no additional scaling parameters are considered, the laser printer will size the bitmap to a

- width of 25.4 [mm/inch] * 1024 [pixels] / 300 [dpi] = 86.70 mm and a
- height of 25.4 [mm/inch] * 768 [pixels] / 300 [dpi] = 65.02 mm,

the inkjet printer will size it to a

- width of 25.4 [mm/inch] * 1024 [pixels] / 180 [dpi] = 144.92 mm and a
- height of 25.4 [mm/inch] * 768 [pixels] / 180 [dpi] = 108.37 mm.

You may enlarge the printed size of the bitmap using the scaling factors offered in Windows Word, PowerPoint etc., but this can cause undesired effects, such as loosing thin scaling lines, false line thickness, unsuited text size, distorted text fonts, and more. Vallen Systeme programs create bitmaps of highest quality by adapting the bitmap to the size and resolution of the final document considering the resolution of the printer to be used.

Size of text fonts

The default text size used for bitmap creation equivalents to a 10pt font in word processor programs like MS-Word. The unit [pt] equivalents 1/72 inch, that means a 10[pt] font has a height of 10[pt] * 1/ 72[inch/pt]) * 25.4 [mm/inch] = 3.53 mm which is well legible and accepted.

Title: DiagGen-2: Creating Bitmaps
Link: common/DiagGen/DiagGen_CreatingBitmaps.htm

Visual Image: Overview

VisualAE™ offers the possibility to show images on a page instead of a diagram or listing. This is especially useful in a report, when showing a digital still image of the structure under test.

Only Jpeg images are supported, because those offer the best compression for digital still images. Images included in a VisualAE™ setup are stored within the VAE file.

If the same image is used on more than one page, internally the image is saved only once in order to reduce memory requirements.

The visual Image can be inserted by Insert out of menu Edit.

Simply for structural reasons and compatibility to other visuals you are asked for a position to locate the new Image visual. But this visual is non-processing. As a result its position has no influence on the data processing.

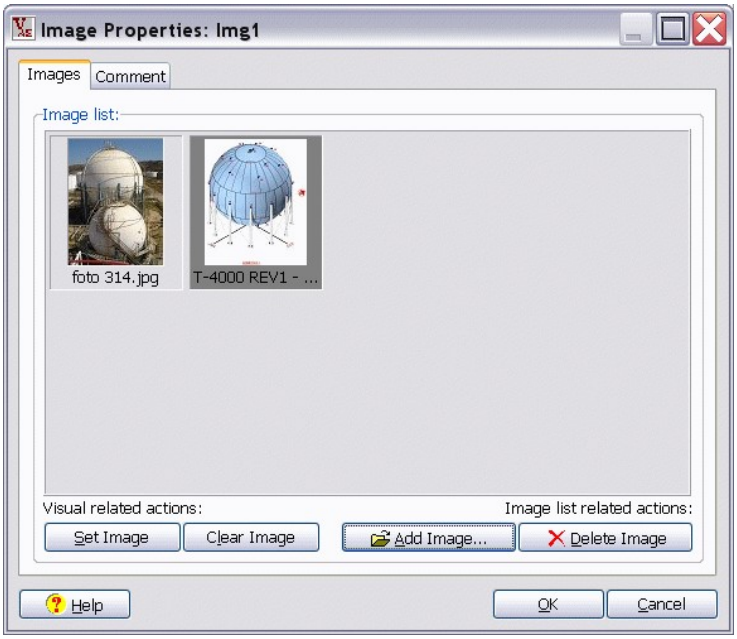
See Image Properties for more information on how to Edit this visual.

Title: Image-1: Overview
Link: AESuite/VisualAE/Visuals/Image/Image_Overview.htm

Visual Image Properties

The Image Properties are similar to the properties of other visuals. There is one tab to setup the image and one to assign a title and a comment.

But there is one major difference to other visuals: Behind the Image visual there is an image handler that administrates the internal list of images imported. This image handler is the same for all image visuals that might have been created inside the current setup.



Adding and deleting images

In the image below there are two buttons on the right hand side to add and delete images to and from the internal image list. This image list is valid for all Image visuals created. All imported images are shown as thumbnails.

Hint: When importing a JPG file then it is stored inside the VAE file as a copy of the original file. The image file is not modified by VisualAE™ anymore. You should resize and compress the JPG file to a reasonable size **before** importing it into VisualAE™.

Selecting a certain image from the list

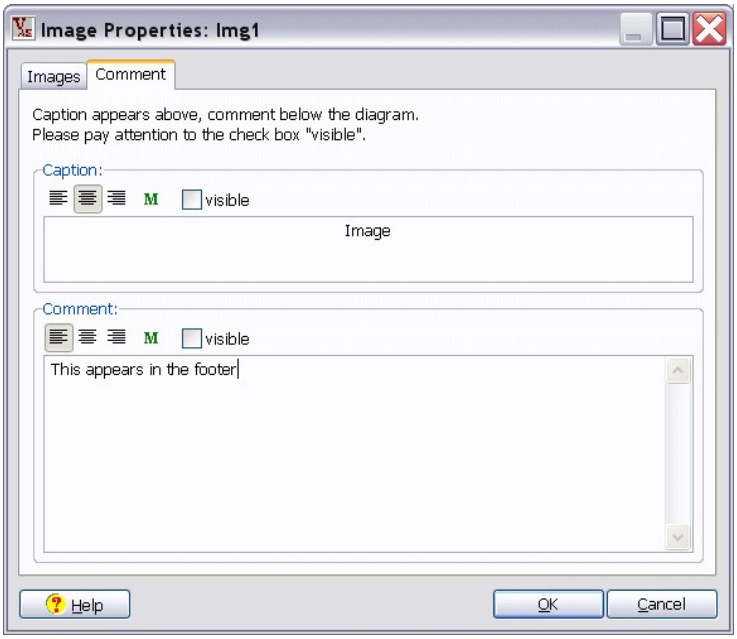
Click on Set Image or simply double click on an image to activate this one to be shown in the current Visual. Clear Image will hide the image but not delete it from the internal image list.

Note: The image list is saved into the VAE file only, if there is an Image visual inside your setup. If no Image visual is inside the VAE file is compatible with earlier versions of VisualAE™.

Title: Image-2: Properties
Link: AESuite/VisualAE/Visuals/Image/Image_Settings.htm

Visual Image Comment

Specifies legends and comments and their attributes for the current page. The caption appears above the diagrams in large bold text. The comment appears below the diagrams in smaller plain text.



Caption/comment visible

When selected, this specifies that the caption/comment will appear on the computer display monitor. It is useful to leave this option off to make the most use of the available monitor resolution.

Caption/comment text entry block

The text for the caption/comment is entered in this space.

Text alignment

Icons above the text entry blocks are for left justified/centered/right justified text. The text will be aligned according to which of these three icons is selected. The three icons, left to right, are left-justified (text aligned with the left margin), centered, and right justified (text aligned with the right margin). The defaults are centered for the caption and left-justified for the comment.

Hint: A number of macros exist for automatic legend and caption generation.

Title: Image-3: Comment
Link: AESuite/VisualAE/Visuals/Image/Image_Comment.htm

Location Principles

Introduction

The system acquires hits in each channel completely independent from the other channels. In order to calculate the location of a source which has generated hits at different sensors. These hits have to be identified and grouped to form an event data set (see chapter Event Building Principles for details).

The location algorithm calculates the location of a source from arrival time measurements of hits within an event data set. It adds results, such as X, Y, LUCY (location uncertainty), and more, to the event data set for further processing by subsequent processors or Visuals. Different location algorithms can be chosen according to requirements of the application.

Results of event data set and location algorithm can be displayed in Visuals inserted behind the processor. Any other processor (e.g. filter, cluster,...) can be used subsequent to a location processor.

Elements of the location processor

Event (Data Set) Building

See chapter Event Building Principles for details

Channel Groups

A Channel Group can contain up to 254 channels. Multiple Channel Groups can be defined. A channel may be member of more than one Channel Group. With multiple Channel Groups locating sources on complex structures is possible, since different location algorithm can be assigned to Channel Groups. E.g. if sensors are located around a cylindrical vessel, the cylindrical part and the end caps can be calculated by different Channel Groups within one location processor.

All Channel Groups of a location processor receive the event data sets from the Event Builder. Data is processed by a Channel Group, if

- the event data sets contains at least the minimum number of hits required by the location algorithm of the Channel Group, and

- the first-hit channel of the event data set is member of the Channel Group.

Hits from sensors not belonging to the Channel Group and all hits from sensors not within the Max. Neighborhood Distance are not considered in location algorithm.

This channel grouping includes but is not limited to the former Multi-Triplet location algorithm known from the Vallen MultiPlot program.

Location Calculation

Calculating the location of a source requires knowledge of sensor positions, speed of sound and arrival time measurement. Location algorithms are designed for specific surfaces (e.g. planar plane, planar cylinder, tank bottom, spheric or cuboid), geometries (linear rod, linear circle, liner 3D) or a solid (solid 3D) and sensor positions (e.g. for cuboid algorithm sensors have to be immersed into liquid inside cuboid structure). Location algorithms are options of the analysis software and only purchased algorithms can be used. The algorithms usually place some restrictions on minimum number and position of sensors. For instance the algorithm "Solid 3D" requires at least 4 hit sensors which should not be positioned in one geometric plane.

If there are more hits than required to calculate the location, a location uncertainty result (LUCY) is available with most of the algorithms.

Other location settings, such as speed of sound, velocity units, sensor positions, maximum distance between sensors, etc. have to be specified during set-up of location processor

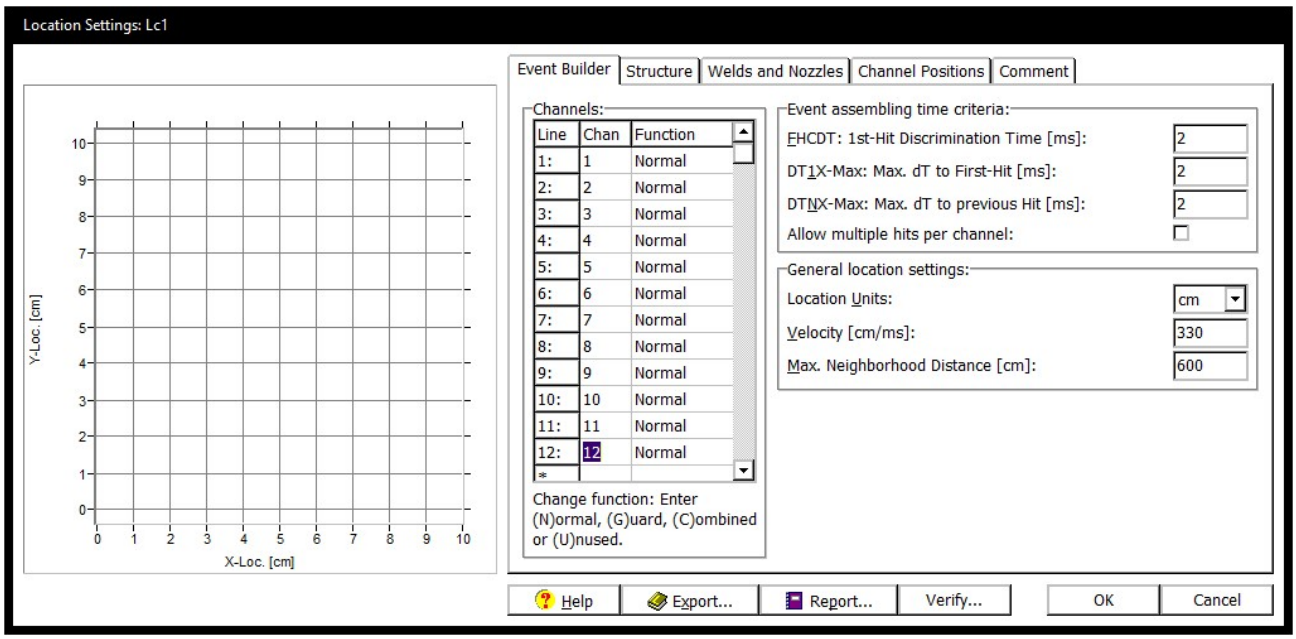
Sensor and source locations are relative to a co-ordinate system defined by the user. If the sensors are not exactly at the position as entered in the software, this will influence the location accuracy.

Note: The calculated kind of location results depend on the kind of location algorithm and can be x-, x-y-, x-y-z-coordinates, or latitude and longitude, for example. These results are assigned to the event data set (not to each single hit of the event).

Title: Loc-01: Location Principles
Link: AESuite/VisualAE/Processors/Location/Loc_LocPrinciples.htm

Event (Data Set) Builder

The Event (Data Set) Builder assembles single hits into event data sets. Event data sets are assembled from participating channels and according to event data set time criteria (FHCDT, DT1X-Max, DTNX-Max) settings. For background information see Event Building Principles.



Event Builder Setup for tank bottom location. Please note large FHCDT setting of 50ms and Velocity setting of 1.2m/s

Channels

Channels listed in this window contribute to the event data set assembly. Channels can be added or removed from this list. Only hits measured in channels that are specified in this list are considered for event data set assembly. For a more detailed description please see the section Channel function in event building.

Event assembly time criteria

Only hits from channels specified in "Channels" are considered for event data set assembly. Hits form an event data set if they fulfil the event data set time criteria. These time criteria are the

- first hit channel discrimination time (FHCDT)
- maximum time difference between first hit and last hit of an event (DT1X-Max)
- maximum time difference between consecutive hits (DTNX-Max)

FHCDT (First Hit Channel Discrimination Time)

FHCDT specified minimum time window between a hit in one of the channels specified in "Channels" list and first hit of an event data set. For more information see the section Event Building Time criteria.

DT1X-Max

DT1X-Max defines the time window of the event data set. For more information see the section Event Building Time criteria.

DTNX-Max

DTNX-Max defines the maximum allowed time window between two consecutive hits in an event data set. For more information see the section Event Building Time criteria.

Allow multiple hits per channel

Usually an event-set is closed if a channels receives a second hit. This closing criteria may be not optimal in case of AE-source location on tank-bottoms. Check this box in order to avoid closing of an event-set when a channel receives subsequent hits.

General location settings

This group contains settings needed for the location processor.

Location Units

Specifies units of distances and positions used in location processor.

Velocity [in location units]

Specifies the speed of sound used in location algorithm.

Max. Neighborhood Distance

Specifies maximum distance of neighborhood of first hit channel. Only channels in the neighborhood contribute to the location algorithm. Any channel further away from the first hit channel than the maximum neighborhood distance is not considered for calculation of the location of the AE-source.

For more information see the section General location settings.

Conversion / Import location settings

Location processor settings can be imported from MultiPlot location (AMS3). For more information see section Importing MultiPlot Locations into VisualAE.

Buttons

Export...

Push this button to export the location processor the library. For more information see the section Export to library.

Report...

Push this button to open the report window which contains all the settings for the location processor. For more information see the section Report Overview.

Verify...

For more information see the section Location Setup Diagnostics.

Hint: Zonal Location is a result of the Event Builder and does not need any location algorithm. A more specific location calculation can only be done with an optional location algorithm.

Title: Loc-02-M: Event Builder
Link: AESuite/VisualAE/Processors/Location/Loc_TabEvent.htm

Event Data Set Assembly Principles

The Event Builder groups hits into event data sets. Grouping is based on three time criteria (see the section Event data set assembly time criteria) which have to be specified by the user. The event data set assembly time criteria define the conditions for grouping hits into event data set. An event data set consists of the first hit and all subsequent hits meeting the time criteria.

Hint: The Event Builder is independent from the location calculation. You can apply an Event Builder to your data without having a location algorithm (this corresponds to zonal location). On the other side location calculation is based on the results of the Event Builder.

The Event Builder provides a number of results which are mainly assigned to the first-hit channel (FHC) of that event data set. Each event data set is represented by the AE parameters (such as amplitude, counts, etc.) of the first-hit of the event data set. If you create a diagram (e.g. Amplitude vs. Time) behind a location processor (a location processor contains an Event Builder), only the amplitudes of the first-hit channels are displayed.

You can enable the display of the subsequent hits: if a 2D/3D-Diagram is behind an Event Builder the Diagram Properties dialog shows a tab "Source". Here you can select "All hits of event" to be displayed (default setting is: First-hit of event data set only). The corresponding setting for a listing is on the tab "Lines" from the properties dialog: subsequent hits in event.

If the diagram shows any location result, e.g. Amplitude vs. x-Location, only the data of the first-hit channel are displayed.

Title: Loc-13: Event Building Principles
Link: AESuite/VisualAE/Processors/Location/Loc_EventPrinciples.htm

Event Building Time Criteria

First Hit Channel Discrimination Time (FHCDT)

The "first-hit channel discrimination time" (FHCDT) is used to separate event data sets and to identify the first-hit channel. A first-hit is detected, when the time period to the previous hit (of the same or any other channel considered by the Event Builder) is larger than FHCDT and the potential new first-hit has no A-flag. The arrival time of an A-flagged hit (A = artificial start) cannot be used for location calculation. The default value for FHCDT is 2ms.

Hint: Recommended setting for small structures (sensor distance << detectable distance):
2 or 3 times the (sensor distance)/(velocity of sound).

Recommended setting for large structures (sensor distance near to the max. detectable distance):
1.5 * (max. detection distance)/(velocity of sound).

Hint: There are different definitions of the "Maximum Detection Distance":
with respect to the best FHCDT-setting:
The maximum detection distance is the distance at which a high amplitude source (e.g. pencil break) just crosses the set threshold.
with respect to assured coverage of a structure (following prEN13445-5 Annexe E):
The maximum sensor distance depends on the minimum amplitude of the source to be detected, the wave attenuation during wave propagation, the sensitivity of the sensor and the threshold setting with reference to the electrical sensor output signal. In the presence of background noise, the threshold should be set at least 6dB above the peak amplitude of the back ground noise. Sensors should be positioned so that a source of minimum amplitude (As) occurring anywhere on the structure under test must exceed the threshold. It is convenient to express the value of As relative to that of the Hsu-Nielsen Source (Ao) as follows: As = Ao – K. The value of K depends on the material's yield strength and pressurization history. (e.g. 12dB for a subsequent pressurization of a material with > 355N/mm^2 yield strength)

Maximum time difference between first hit and last hit of an event data set (DT1X-Max)

Maximum time difference between first and last hit allowed within one event data sets. Hits arriving less than DT1X-Max after the first-hit are assigned to the same event data set. The event data set is closed, if the time difference between a new hit and the first-hit is longer than DT1X-Max.

Maximum time difference between two consecutive hits of an event data set (DTNX-Max)

Maximum time difference to the previous hit within an event data set. If DTNX-Max expires without detecting a hit, the event data set is closed. The next hit will not be assigned to this event data set, even if DT1X-Max is not yet expired.

End of event data set

An event data set is closed if

a. DT1X-Max expires without detecting a hit or

b. DTNX-Max expires without detecting a hit or

c. if "allow multiple hits per channel" is NOT checked: a second hit in a channel of the event data set builder. This second hit will not be used for the active or the following event.

A new event data set assembly process can be started only if the previous event data set is closed and the FHCDT has expired without detecting a hit. Remember, FHCDT is reset with each detected hit, even in case the previous event data set has been closed and no new event data set has been opened.

Hint: It is recommended to set DT1X-Max and DTNX-Max to the same value as FHCDT. Different values can help the advanced user to optimize the event building process and to reduce the generation of false events (if events overlap in a structure e.g. due to extraneous noise).

MultiPlot offers the parameters FHCDT1 and FHCDT2. FHCDT1 corresponds to DT1X-Max, FHCDT2 to DTNX-Max and FHCDT.

Title: Loc-19: Event Building Time Criteria (FHCDT Definition)
Link: AESuite/VisualAE/Processors/Location/Loc_TabEventFHCDT.htm

General Location Settings

Within one location processor the following settings are made for all channel groups.

Location units

Choose whether distances and positions are to be given in mm, cm, m, inch, or feet.

Velocity (of sound)

The setting for speed of sound is used by location algorithms of all channel groups. Only one speed of sound setting is possible. In cases where speed of sound is anisotropic (e.g. fiber reinforced composites) or if sound wave propagation is subject to dispersion it is recommended to use the speed of sound of the wave which carries most of acoustic energy. In case of plate waves this is usually the speed of the slower A_0 wave.

The closer an AE-source is to the geometrical center of a sensor array (i.e. the less the measured arrival time differences) the less is the influence of deviations in speed of sound setting. If the difference in arrival times between channels increase, the influence of the speed of sound on the location result increases as well.

The real speed of sound in a material may differ from setting, which reduces accuracy of calculated location. Reasons for such a deviation can be that different

wave modes cause the first threshold crossing, attenuation, indirect wave propagation paths, and other effects. Even though absolute location accuracy decreases in such a case, the location result for a source will not deviate (i.e. it will always be located at same position).

Velocity corresponds to "Arrival Time Velocity" in the MultiPlot program.

Hint: A macro exists that can display this velocity e.g. in diagrams.

Max Neighborhood Distance

Channels being more than the Max. Neighborhood Distance away from the First-Hit channel of an event data set are not used for location calculation.

The Max Neighborhood Distance should be a little bit larger than the maximum sensor spacing. We recommend a factor of 1.5.

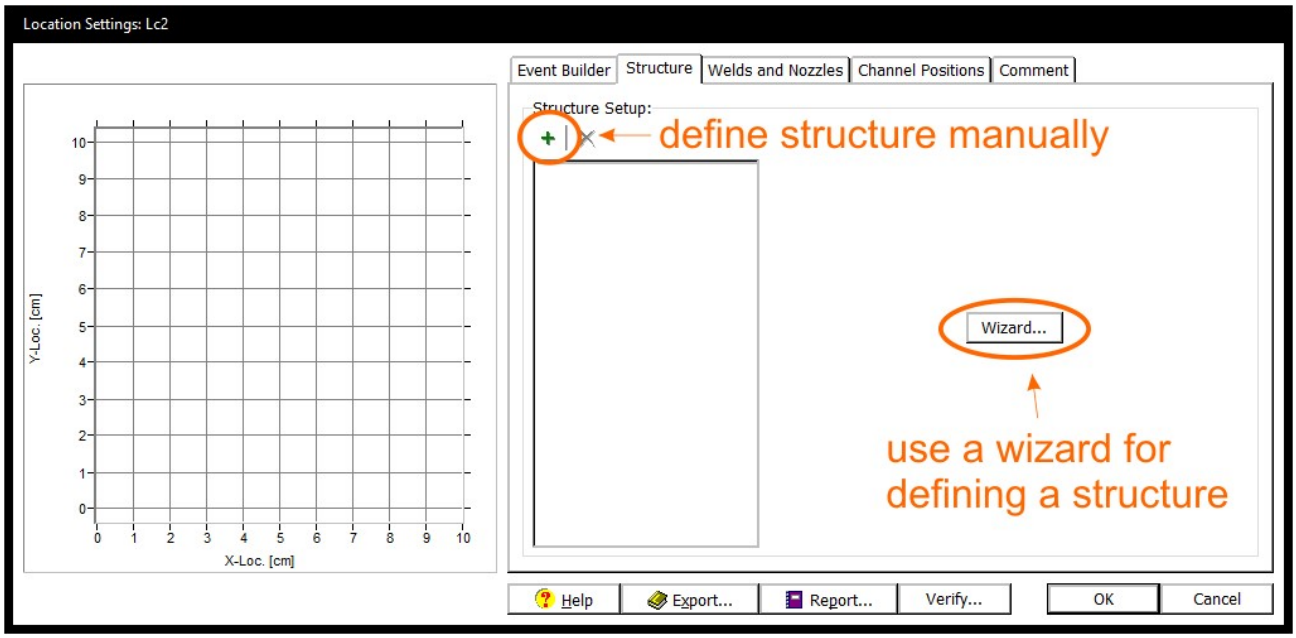
Technical Detail: Neighborhood Relations.

Hint: If the distance between sensors is less than "Max Neighborhood Distance divided by 10'000", one of the positions might be erroneous and a **Warning** will be displayed.

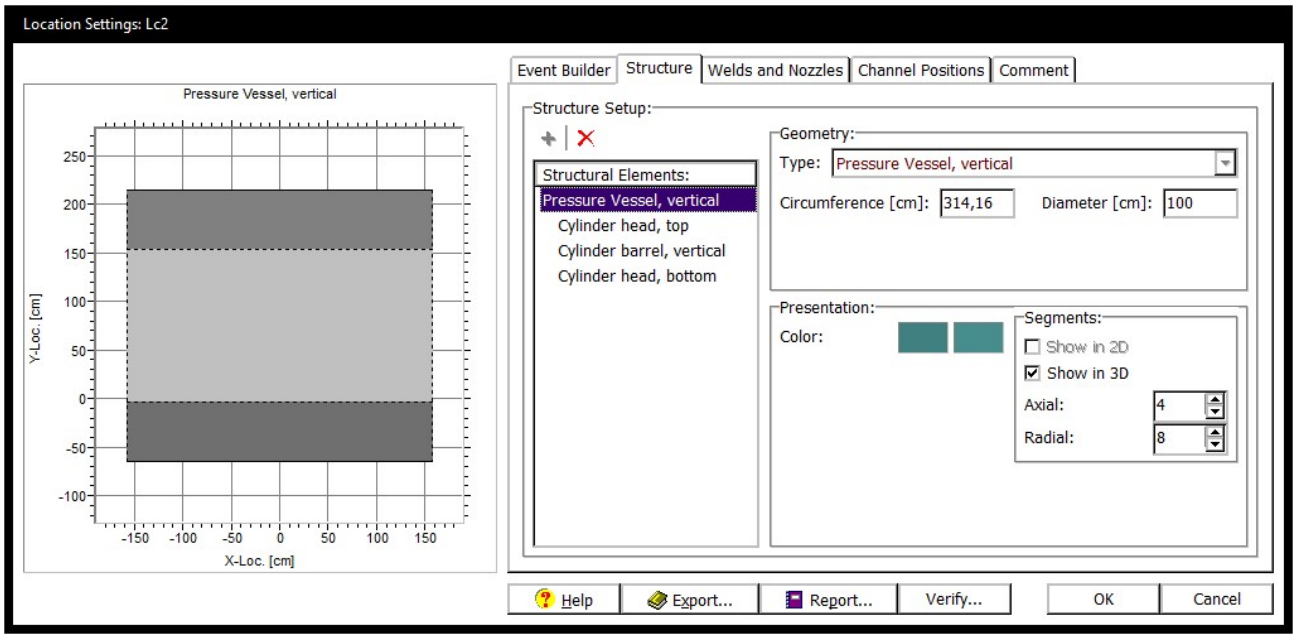
Title: Loc-14: General Location Settings
Link: AESuite/VisualAE/Processors/Location/Loc_TabEventGeneral.htm

Defining a structure

A structure can be defined manually or using a wizard

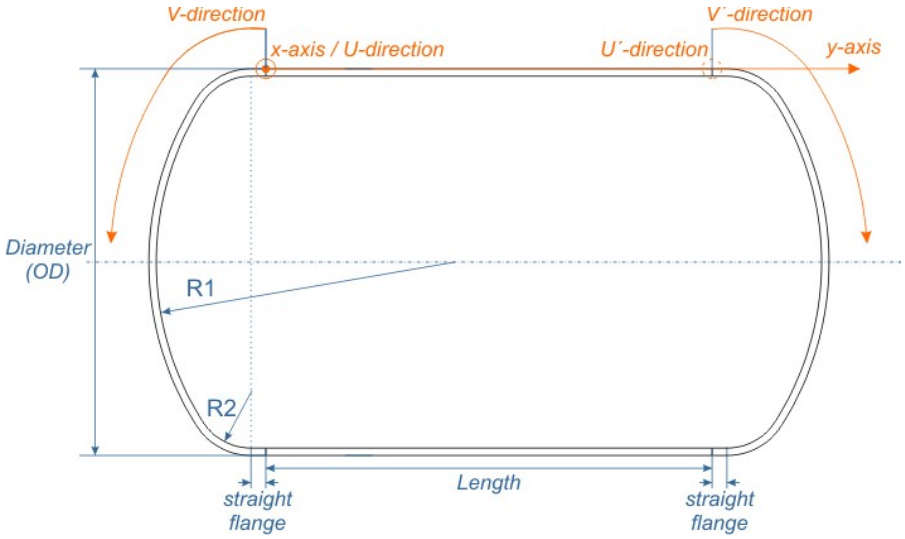


It is recommended to use the wizard for defining a structure such as a pressure vessel consisting of a cylindric hull and two endcaps. If only one endcap or a cylindric hull shall be monitored then the manual way of defining a structure is preferred.



Structure Setup

Following structural elements are available: (i) sphere, (ii) pressure vessel with endcaps, (iii) cylindrical barrel (without endcaps) and (iv) heads by itself. A structure is added by clicking the green "+" sign and selecting the appropriate one from a drop down list. After selecting a structure the table displays the parent element and all child elements, if any. Clicking on the nodes will display the according properties on the right hand side of the dialogue.



Sketch of a pressure vessel (horizontal) with dished heads. Origin of x-axis/y-axis, U-direction and V-direction is indicated.

Geometry

Type

For the parent element, the type cannot be changed. Similarly for the cylindrical barrel the type cannot be changed. In both cases "type" reflects the choices made during structure setup (e.g. horizontal or vertical).

For endcaps, there are several types of heads available. The head type defines the radius of curvature of the spherical part and the knuckle region. Some head types are governed by standards (e.g. Korbbogenboden and Klöpperboden)

Circumference

Circumference of the pressure vessel (automatically updated when diameter is changed)

Diameter

Outer diameter of the pressure vessel (automatically updated when radius is changed)

Height/Length (Cylinder barrel, only)

dimension of vertical or horizontal cylindric hull (from weld seam to weld seam)

Straight Flange (endcap, only)

length of the straight flange, the part connecting the head to the cylindric hull

R1 (endcap, only)

radius of curvature of spherical part of head

R2 (endcap, only)

radius of curvature of knuckle region

Note: for the semi elliptical head R1 and R2 selection is not available since it resembles a true ellipse.

Presentation

Color:

defines the colors on black (left hand side) and white (right hand side) background

Transparency:

sets the transparency of the according part: hull or head

2D Projection:

A drop down list with two entries: Planar and Azimuthal Equidistant. A planar projection of the dished head is basically an orthographic projection. An Azimuthal Equidistant projection conserves the radial distances (distances in V-direction). In a location plot location results of a planar projection are plotted in a rectangle resembling the projected dished head, whereas in case of an azimuthal equidistant projection they are plotted inside a circle marking the edges of the projected head.

Segments

Segments are a visual feature for easing orientation on the structure when viewed in a location plot.

Show in 2D

Checkbox that when enabled will activate display of boundaries of arbitrary defined segments in a 2D diagram.

Show in 3D

Checkbox that when enabled will activate display of boundaries of arbitrary defined segments in a 3D diagram.

Axial

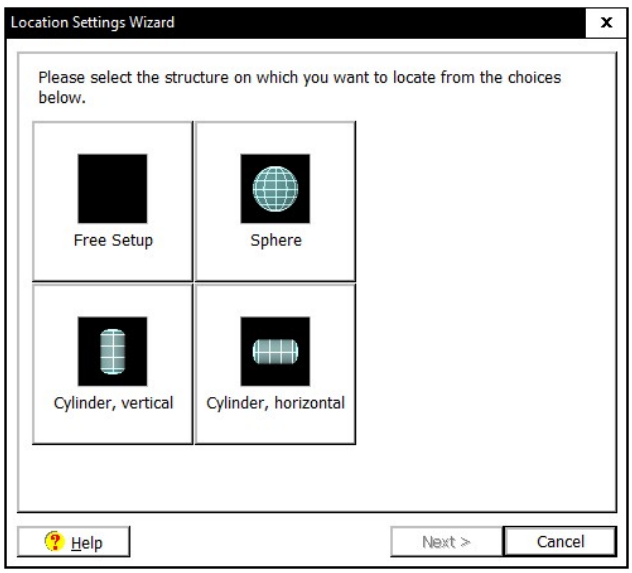
number of axial segments

Radial

number of radial segments

Title: Loc-03-M: Defining a structure
Link: AESuite/VisualAE/Processors/Location/Loc_TabStructure.htm

Structure Wizard - Type of Vessel



The Structure Wizard allows one to define a pressure vessel, be it spherical or cylindric one. It guides through the steps of setting up the geometry, welds and sensor positions.

Free Setup

Define the structure of the vessel in the Structure dialogue.

Sphere

defines a spherical pressure vessel

Cylinder, vertical

defines a cylindrical pressure vessel that is standing upright

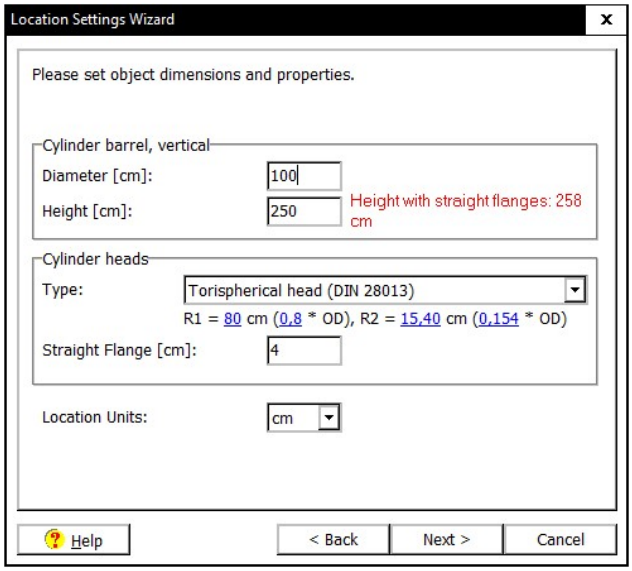
Cylinder, horizontal

defines a cylindrical pressure vessel that is laying of the ground

Title: Loc-07-M: Structure Wizard - Type of Vessel
Link: AESuite/VisualAE/Processors/Location/Loc_StructureWizard_VesselTypel.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Structure Wizard - Dimensions

Structure Wizard - Dimensions



Cylinder barrel

Diameter:

Define the diameter of the pressure vessel. Same setting is used for diameter of heads.

Height / Length:

Defines the height/length of a pressure vessel. It is measured from flange weld to flange weld.

Cylinder heads

Type:

Define the shape of the head from pre-defined shapes.

Straight Flange:

Length of the straight flange (the cylindric interface part of the head for fitting the head onto the cylindric hull of the pressure vessel)

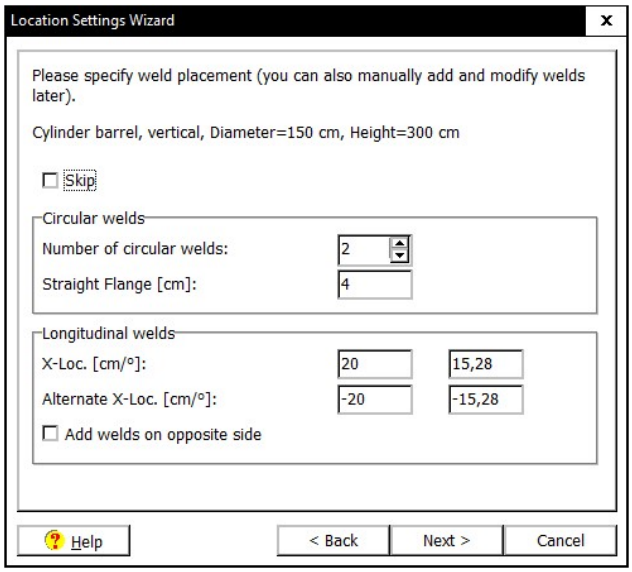
Location Units:

Define the length units which are used throughout the location processor and in reporting location results.

Title: Loc-08-M: Structure Wizard - Dimensions
Link: AESuite/VisualAE/Processors/Location/Loc_StructureWizard_Dimensions.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Structure Wizard - Welds

Structure Wizard - Welds



skip

Check box, that when enabled skips the setup of welds when clicking Next> button

Circular welds

Number of circular welds

define the number of circular welds

Straight Flange

Longitudinal welds

X-Loc. [cm/°]:

Specify position of longitudinal weld. Position can be given as x-coordinate (-circumference/2 to +circumference/2] or in degree (-180° to +180°]

Alternate X-Loc. [cm/°]:

Specify position of a second, fourth,... longitudinal weld. Position can be given as x-coordinate (-circumference/2 to +circumference/2] or in degree (-180° to +180°]. This setting is only applied when 3 or more circular welds have been defined. The first, third, fifth, etc. longitudinal weld will receive x-coordinate of X-Loc. setting whereas the second, fourth, sixth, etc. longitudinal weld will receive the x-coordinate of Alternate X-Loc.

Add welds on opposite side

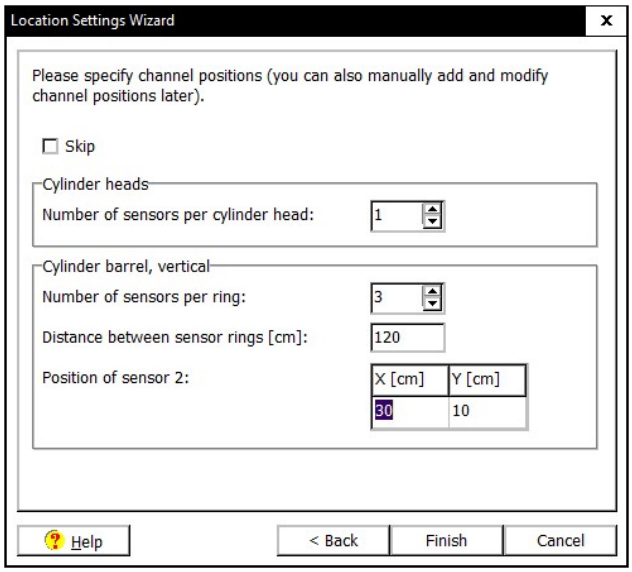
Enable this check box when two horizontal welds per axial segment have to be given. The additional weld is drawn at the opposite side.

Title: Loc-09-M: Structure Wizard - Welds
Link: AESuite/VisualAE/Processors/Location/Loc_StructureWizard_Welds.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Structure Wizard - Channel Positions

Structure Wizard - Channel Positions

sets up a default sensor map on a pressure vessel. In most cases the proposed positions of sensors in the default map need to be adjusted to actual positions.



Skip

Enable the check box to discard default settings and continue without a default sensor arrangement.

Cylinder heads

Number of sensors per cylinder head:

Define the number of sensors which are used on the cylindrical head. Per default one sensor is placed at latitude of 65°. Longitude settings depends on the adjacent sensor ring. The sensor at the head is placed in between sensors of the adjacent ring.

Increasing the number of sensors will add sensors at latitude of 65° equally spaced along the 65° circle of latitude.

Note: sensor position defined by the wizard need to be adjusted to actual sensor positions.

Cylinder barrel

Number of sensors per ring:

Define the number of sensors per ring. Usually this is three or four sensors. A sensor ring is a circular arrangement of equally spaced sensors.

Distance between sensor rings:

Define the distance between sensor rings The distance between sensor rings is measured axially and has an influence on the number of rings that are proposed by the wizard. The distance between sensor rings must not exceed 89% of maximum sensor spacing as measured/calculated with the attenuation profiler.

Position of sensor *X*

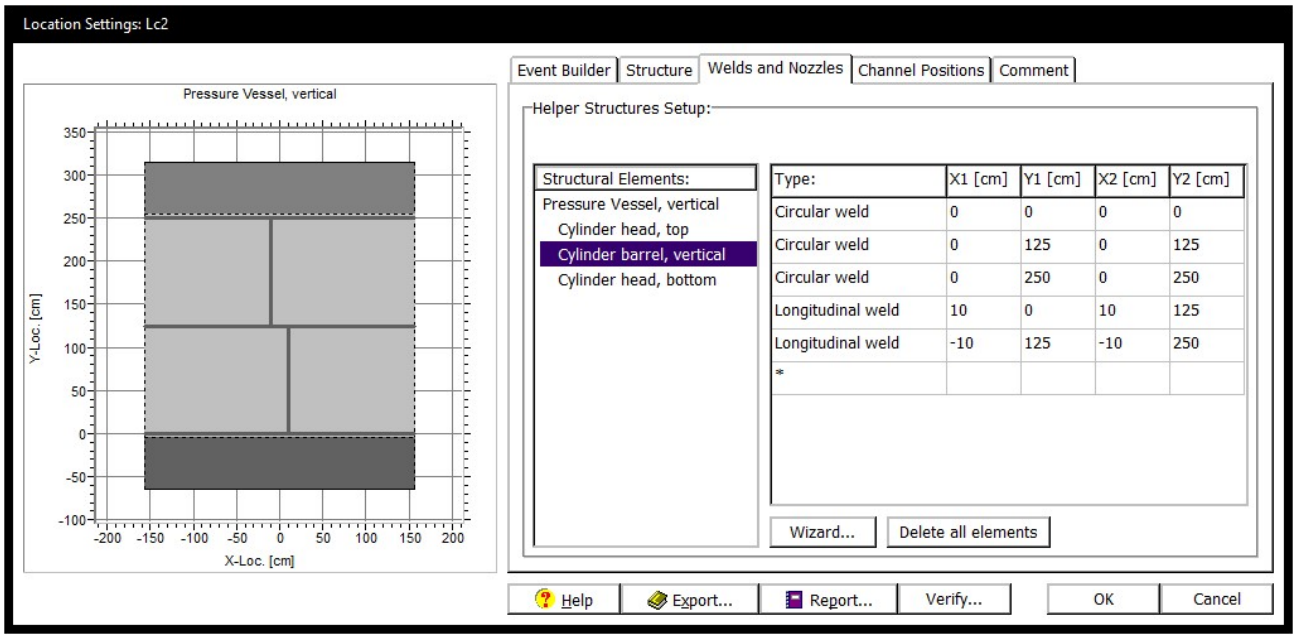
Per default the first sensor on the cylindrical hull is placed 30 cm away from straight flange and 10cm left of the axial weld. All other sensors are arranged with respect to this sensor according to the settings "number of sensors per ring" and "distance between sensor rings".

Note: origin of the co-ordinate system is always the intersection of ridge and the plane defined by (i) either the bottom face of the cylindric hull in case of vertical pressure vessels (ii) or by the front face of the cylindrical hull in case of horizontal pressure vessels (in this case it is up to the operator to define which end is considered "front face").

Title: Loc-10-M: Structure Wizard - Channel Positions
Link: AESuite/VisualAE/Processors/Location/Loc_StructureWizard_Positions.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Welds and Nozzles

Welds and Nozzles



Welds and nozzles can be defined for a cylinder barrel, only. Two types of welds are available: (i) circular - and (ii) longitudinal welds. Nozzles can be defined as circular objects. Welds and nozzles as defined in this menu do not have an effect on the location algorithm nor the location results.

Helper Structures Setup

Structural Elements

List of structural elements. Select and highlight the element to which welds and/or nozzles shall be applied. Welds and nozzles can only be defined for a cylinder barrel.

Table with welds and nozzles

For welds following convention is applicable: X1, X2 define the starting point of a weld whereas X2, Y2 define the end point of a weld. Please note that Y1=Y2 for circular welds and X1=X2 for longitudinal welds.

In case of nozzles X1,Y1 define the center of a circular nozzle and X2=Y2 define the radius of a nozzle.

Hint: for deleting just one weld element, click in the "type" column the weld or nozzle which shall be removed. From the drop down list that appears, select the "*" in order to remove the elements from the structure.

Buttons

Wizard...

Opens a wizard menu for setting up welds and nozzles

Delete all elements

Deletes all table elements.

Title: Loc-04-M: Welds and Nozzles
Link: AESuite/VisualAE/Processors/Location/Loc_TabWelds.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Neighborhood Channels and Location

Neighborhood Channels and Location Calculation

The following describes the basic principle of event set assembly and subsequent location calculation.

Event Building

The very first step is to group individual hits (signals detected by individual channels) to an event data set. Hits of an event data set are assumed to originate from the same source. Event data sets are assembled on basis of three timing criteria (see the section Event building time criteria for more information):

Evaluating Channel Groups

From the defined channel groups, only those channels which contain the first hit channel (FHC) of the event data set will be used for further processing (i.e. those channel groups closest to the source will be used).

Checking for Neighbors

It is usually desired that only immediate neighbors to the FHC contribute to location calculation. Therefore it is checked for each channel group which channels

are within neighborhood distance of first hit channel of an event data set. Only event data sets which have at least the required number of FHC-neighbors (depends on the location algorithm) are used for location calculation.

Neighborhood handling

The neighborhood-handling depends on the used location algorithm:

- Neighborhood-handling for the Linear Location Algorithm
- Neighborhood-handling for the other algorithms

Neighborhood-handling for Linear Location Algorithm

With the location algorithm "linear (ring)" which is used for circular structures each channel has two neighbors, the left-hand and the right-hand neighbor. The sensor distance must be less than half the circumference.

With the location algorithm "linear (rod)" the first and last channel have only one neighbor. All other channels have two neighbors, the left-hand and right-hand neighbor.

Three cases are possible:

- Case 1: Both neighbors of the first-hit channel are hit: The algorithm calculates a first location by using the delta-t between the two neighbors of the FHC and determines, whether the source position is on the left-hand or right-hand side of the FHC. This is important in case the sensor distances are not equal. In such a case the source can be located between the FHC and the 3rd-hit channel. A second source location is then calculated by using the delta-t between the FHC and its neighbor in direction of the source. The final (displayed) result is the average of the two location calculation results. The result LUCY is set to half the distance between the two locations.
- Case 2: Only one neighbor of the first-hit channel is hit: Only one location result can be calculated. The location uncertainty LUCY is set to -1.
- Case 3: The second-hit channel of the channel group is not a neighbor of the first-hit channel. In this case no location result is presented. Only the channel-sequence is given as a result for that event.

Neighborhood-handling for the other algorithms:

Within the channel group it is checked which channels are within then neighborhood distance of the first hit channel (FHC). To be a neighbor a channels distance to the FHC has to be smaller or equal to the maximum neighborhood distance (see General Location Settings for more information).

For each channel group a neighborhood table is created automatically. For each channel all neighbors are listed in one line (e.g. for channel 3 the line is C3).

Location Calculation

After event assembly (first step), evaluation of channel groups (second step) and checking for nearest neighbors (third step), the information from the FHC and its neighbors is passed on to the user-selected location algorithm. From this input the algorithm calculates a location result.

Hint: The neighborhood table is derived from the sensor positions, definition of channel groups, and the Max. Neighborhood Distance. The information presented helps the advanced user to optimize the event building process and to reduce the generation of false events (if two or more events overlap in a structure, e.g. due to extraneous noise).

Title: Loc-23: Neighborhood Channels and Location
Link: AESuite/VisualAE/Processors/Location/Loc_Neighbourhood.htm

Channel function in Event Builder

In the Channel group of the Event Builder tab channels are defined that may contribute to an event data set. To add a channel enter the according channel number in the column labelled Chan. A function has to be assigned to the channel. Channel function can be Normal (abbreviated N), Guard (abbreviated G) or Combined (abbreviated C). If a channel is specified as Unused (abbreviated U) it is removed from the channels table.

Channel Functions

Unused

The channel is removed from the Event Builder and is used neither for Event Building nor for Location Calculation. Hits from "unused" channels are not available behind the Location Processor.

Normal

The channel is considered by the Event Builder and can be used for Location Calculation, if the channel and its position are assigned to a Channel Group.

Guard

The channel is only used by the Event Builder:

a. If a guard channel is the first-hit channel of an event data set then this event data set is not used for location.

b. If a guard channel is not the first-hit channel, but comes later in the sequence of hits forming an event data set, then the data from the guard channel is not used for location calculation.

Guard channels are placed outside the area of interest and cannot be used for location calculation. Use guard channels to reject event data sets from disturbing sources outside of the area of interest.

Combined

A combined channel is used as a guard channel, when it is the first-hit channel and as a normal channel else. Combined channels are placed outside of the area of interest but can be used to locate sources in the area of interest.

Removing channels from the Event Builder

There are three ways to remove a channel from the Event Builder:

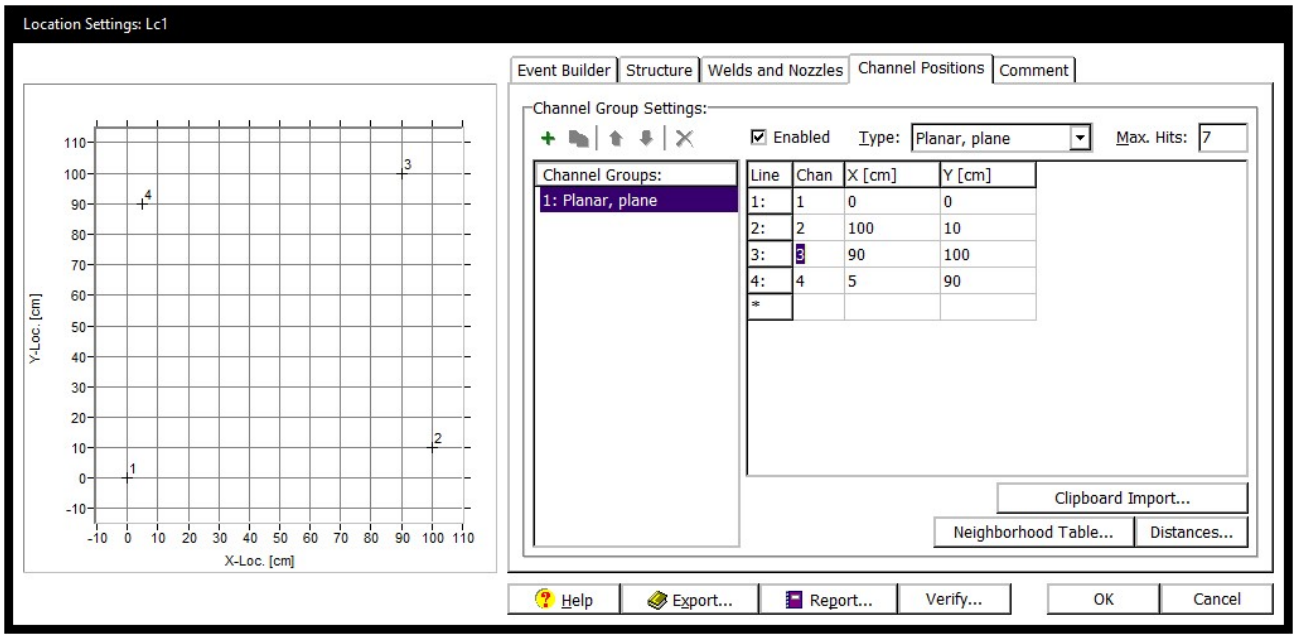
- Enter zero as channel number
- Delete the channel number
- Enter U (for Unused) as channel function.

The Event Builder of **VisualAE™** is equal to MultiPlot, its' predecessor.

Title: Loc-24: Location Channel Function
Link: AESuite/VisualAE/Processors/Location/Loc_TabEventChannel.htm

Channel Positions for location calculation

A channel can be used for calculating source location, if it belongs to at least one Channel Group. A Channel Group can contain up to 254 channels. A sensor may be part of several Channel Groups.



Channel Group Settings

This menu is to assign channel numbers and positions to Channel Groups. It is divided into two steps:

- defining channel groups and type of location algorithm and
- defining position of channels

Channel Groups

The listbox on the left shows the individual channel groups. To each channel group a location algorithm is assigned. Use the Add (green plus sign) and Remove (red x-sign) buttons to add a new or remove an existing Channel Group. Right mouse click on a Channel Group opens a context sensitive menu. Channel Groups can be rearranged by drag and drop.

Channel position table

The table with columns "Line", "Chan X[..]" ,... displays for each line the channel number and its position. To add a channel enter its number and position on the last line. The channel is added to the active channel group. To remove a channel from the group delete the channel number and then select another line in the table.

Channels that belong to more than one Channel Group: After entering the channel number the software initiates the channel position with that of the other Channel Group and lets you then modify the values as desired.

Enabled Checkbox

The Enabled checkbox can be used to temporarily disable individual channel groups. This allows using different channel groups alternatively.

Type drop down list

The Type drop down list allows to select a location algorithm. For descriptions and information of location algorithms see section Location Algorithms:

Overview. For "Linear (ring)", "Planar (cylinder)", "Spherical" and Tank bottom location algorithm the circumference or radius have to be specified.

Max Hits

Max. Hits defines the maximum number of hits per event that are considered for location calculation. Allowing more hits than are actually necessary for the location algorithm results in an over determination of the mathematical system of equations. Only in an overdetermined system a value for LUCY will be reported. The LUCY value is a measure for the reliability of the calculated location.

Buttons

Clipboard Import...

Imports channel positions from Clipboard. Table / list copied to clipboard must have same number of columns as required by location algorithm. First column is always Channel number, following columns contain coordinates of channel. Delimiter can be a tab, space or semi colon. Tables / lists from MS Excel or simple text editor can be imported via Clipboard.

Neighborhood Table...

Pushing this button displays the neighbors of each channel of the channel group.

Distances...

For more information see the section **Location Processor: Channel distances**.

Channels can be deleted either by entering 0 as channel number or by deleting the channel number.

See also: Settings compatible to the MultiPlot program

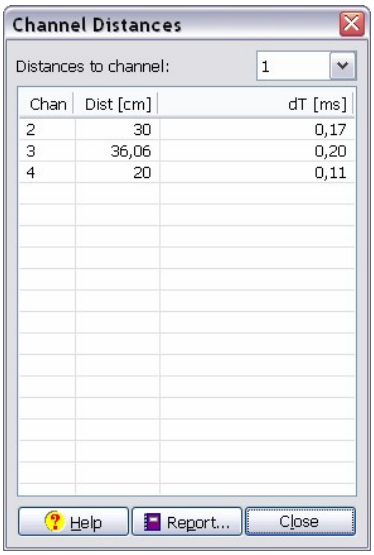
See also: Warnings/Verify

Title: Loc-05-M: Channel Positions for location calculation
Link: AESuite/VisualAE/Processors/Location/Loc_TabChannelPositions.htm

Location Processor: Channel Distances

The channel distances dialog is assessed via the Location Settings menu and the Distances... button of the Channel Position tab.

For each channel a list with the distances to the other channel group members is available.

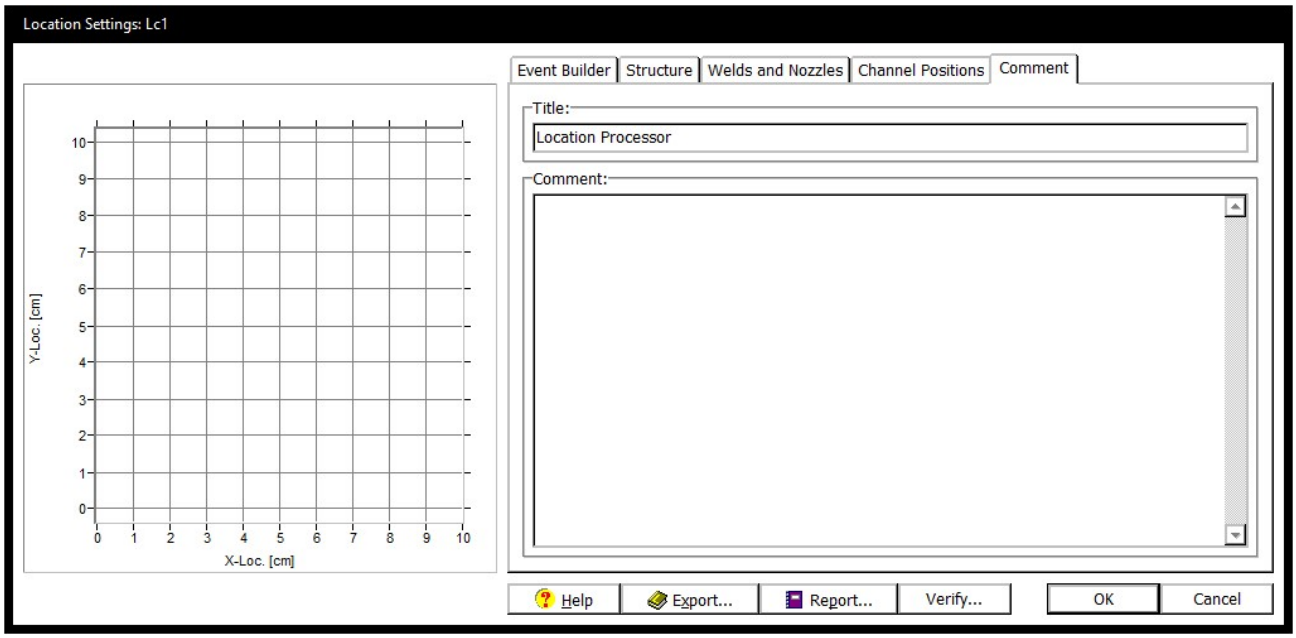


It shows the distances between one sensor and the others of that group and the time an acoustic wave needs to propagate from the chosen sensor to the other ones (calculated: distance divided by velocity of sound). Channels of the channel group which are not neighbors to the selected channel, because their distance is larger than the Max. Neighborhood Distance, are displayed in red.

Title: Loc-11-M: Channel Distances
Link: AESuite/VisualAE/Processors/Location/Loc_ChannelDistances.htm

Location Processor Comment Tab

This tab can be used for a description of the Location- or Event Builder processor:



Title

Specify a title for the processor. This title will be used in the Data Processing Structure Tree.

Comment

It is a possibility for documentation, e.g. what structure the location set was created for and which assumptions have been made.

Title: Loc-06-M: Caption and Comment
Link: AESuite/VisualAE/Processors/Location/Loc_TabComment.htm

Location Algorithms: Overview

This page describes the properties of the different available location algorithms. In order to calculate a location incoming hits have to be assembled into event data sets. Click here for description of the Event Builder.

Various location algorithms covering a wide range of applications are available. Each algorithm uses a specific method for specific structures and has its specific properties and advantages.

The task of source location calculation is to produce a source location by considering the arrival time differences from hits that have been grouped into one event data set.

The Location Algorithm defines the rule how this source location is determined. Location algorithms are different for different geometric structures but can be based on similar principles. To calculate a location the location algorithm requires:

- the channel positions,
- an event data set, the measured delta-ts,
- the velocity of sound.

Below you will find a list of all location algorithms available with VisualAE™. For each algorithm discussed:

- The description section gives a short overview about the algorithm and the structures it can be applied for.
- The sensor positions section tells how a channel position is defined and in which coordinates it is to be specified.
- The limitations section provides information about specific limitations of this algorithm against other algorithms.
- Finally the minimum number of hits required for location calculation.

General assumptions for these algorithms:

- isotropic and homogeneous velocity of sound (otherwise location errors increase)
- undisturbed wave propagation (straight wave paths, without obstacles).
- reasonable sensor positions (see sensor positions and limitation section for each algorithm)

Groups of Location Algorithms

- Linear

- Planar/Cylindrical
- Tankfloor (for tank bottom testing)
- 3D Algorithms (location in a volume)
- Spherical

Linear (rod)

Description:

For location calculation on test objects with one-dimensional sound propagation along a line (e.g. pipes, bars... where length>>width). The location result is a one-dimensional X-position.

The sensors are placed along the line of sound propagation. For optimum results, the sensor-distances should be equal. Special arrangements in the software render possible proper results, even if the sensor distances are very different. For details refer to the Neighborhood Channels and location calculation section.

Sensor positions:

Sensor positions are entered as X-coordinates. The origin of the coordinate system can be selected by the user. It is recommended to use equal or similar sensor distances.

Limitations:

None specific.

Minimum number of hits required: 2

(if sensor distances are not equal: 3 hits provide better results).

Linear (ring)

Description:

For circular structures (e.g. rings) with circumference >> width. This algorithm is based on the method Linear (rod). The location result is a one-dimensional X-position.

Sensor positions:

Sensor positions are entered as X-coordinates in the range of minus half of circumference to plus half of circumference. It is recommended to use equal or similar sensor distances. The origin of the coordinate system can be selected by the user.

Limitations:

With 2 hit sensors always 2 possible location results exist on a ring, but the algorithm presents only one of them.

Minimum number of hits required: 2

(better results with 3 hits)

Lin3D

Description:

The algorithm is an extension to the linear chain algorithms, such that each sensor position can be assigned to any point in a 3-dimensional space. The location result is a 3D-point on the straight line connecting the first-hit sensor with a directly neighbored (later hit) sensor. Multiple chains (groups) of sensors can be set-up, in an open-loop (rod) or closed-loop (ring) configuration, so that a sensor has either one neighbor (when at the end of an open-loop chain), or else two neighbors. Each sensor can be a member of multiple groups. As many groups with as many sensors as desired can be setup. Groups may have different location algorithms assigned, whereby Linear(3D), Planar Net, and Spherical Net location can be combined.

The algorithm produces two location results: location on the left as well as on the right of the first-hit sensor can be plausible. The user must then be aware that the true AE source, which may be anywhere in the 2D or 3D-space, is then projected to a point on the (invisible) line connecting the sensor-pair, according to the measured arrival time difference.

Sensor positions:

Sensor positions are to be entered in X/Y/Z-Triples. Minimum hits from 2 sensors required.

Limitations:

Locations are only produced between two sensor pairs. If AE-source is not in the line of two sensors, only the projection of the AE source to a point on the (invisible) line connecting the sensor-pair, according to the measured arrival time difference, is produced.

Minimum number of hits required: 2

More Information: Location Algorithm: Lin3D

Planar (plane)

Description:

Standard algorithm for planar location on structures with 2-dimensional sound propagation along a plane. Location calculation is an iterative gradient method. Fast and precise algorithm for standard planar applications. Results are X-, Y-coordinate, LUCY.

Sensor positions:

The algorithm allows for arbitrary sensor positions with respect to a selected origin. The sensor positions are entered as X- and Y-coordinates. Sensor arrangements being close to squares or equilateral triangles give best results.

Hits from at least two sensors in the direct neighborhood of the 1st-hit sensor are required.

Limitations:

Best location results in area between channels. This algorithm cannot locate beyond sensor positions. Sensors must not be placed on one straight line.

Minimum number of hits required: 3

Planar (cylinder)

Description:

For location on a cylindrical surface. Location calculation is based on upper **Planar (plane)** algorithm. Results are X-, Y-coordinate and LUCY.

Sensor positions:

Sensor positions in x-direction are to be specified as distance around circumference up to plus/minus half circumference. Values entered beyond are shifted to plus/minus half circumference. Sensor positions in y-directions are to be entered along height of cylinder.

Using only 3 sensors causes a problem on cylindrical surfaces: there are at least two possible locations per event; one at the "front" and one at the "back" of the cylinder which makes results ambiguous. If you have 4 sensors on a cylinder (2 rings with 2 sensors, rotated 90° against each other) small errors in the delta-ts can cause the result to "jump" from one side of the cylinder to the other. We recommend to use at least 4 (better 5) channels on cylindrical surfaces. Ideal would be 3 or more sensors per ring, each ring rotated about 180°/(no. of sensors per ring).

Limitations:

Best location results in area between channels. This algorithm cannot locate beyond sensor positions in y-direction. Sensors should not be placed on one straight line. Sensor positions should be selected carefully (see above).

Minimum number of hits required: 3

(better results with 5 hits)

Special Planar (N1)

Description:

Special numerical algorithm in experimental stadium. This algorithm is intended for special testing purposes and might be changed in later versions. A numerical iteration method is used to find the location result with minimum Lucy. Results are X-, Y-coordinate, LUCY.

Sensor positions:

See above: Planar (plane).

Limitations:

Sensors should not be placed on one straight line. Method might be changed in future software versions.

Minimum number of hits required: 3

Special Planar (A1)

Description:

Special analytical algorithm in experimental stadium. This algorithm is intended for special testing purposes and might be changed in later versions. It uses an analytical method to solve the location equation. Results are found within one step without iterations. Therefore it is much faster than Planar (plane) and Special Planar (N1). But a minimum of 4 channels is required to perform location calculation. Results are X-, Y-coordinate, LUCY.

Sensor positions:

Same as Planar (plane).

Limitations:

Sensors should be placed non-symmetrical, i.e. not at the vertices of a rectangle (in case of 4 sensors used). Otherwise the algorithm has to cope with singular matrices leading to large deviations in the results. Method might be changed in future software versions. Best results with not too many hits (around 5) as this algorithm is sensitive to delta-t errors.

Minimum number of hits required: 4 (!)

Tank Floor (MP)

Description:

Specially designed algorithm for Tank Floor setups of above ground storage tanks. The sound propagates mainly through the medium in the tank. This algorithm is compatible to the tank floor algorithm from MultiPlot (MP).

It uses an analytical method to find the location from hits of three adjacent sensors. If there are not three adjacent sensors hit no location can be calculated. If more than 3 sensors are hit AND more than one set of three adjacent sensors being hit exist, location is calculated between all sets of three adjacent sensors being hit. The result with the smallest LUCY is taken as final result.

Results are X-, Y-coordinate, LUCY.

Sensor positions:

Requires equal sensor spacing around circumference of tank. The sensor spacing depends on the number of sensors used and the tank circumference.

Limitations:

Requires equal sensor spacing around circumference of tank. No support for an additional or missing sensor.

Minimum number of hits required: 3 (at adjacent sensors)

Hint: The **Planar (plane)** algorithm can be applied to tank bottom data as well. It will provide location results only if channels on opposite sides of the tank are hit. The accuracy for events from the tank center is higher than with **Tank Floor (MP)**. Close to the tank walls the **Tank Floor (MP)** delivers better results.

Special Tank Floor (N1)

Description:

This special algorithm in experimental stadium is based on the **Special Planar (N1)** algorithm and is adapted for tank floor applications. This algorithm was introduced to overcome the limitations of the **Tank Floor (MP)** like equidistant sensor spacing and the requirement of three adjacent sensors being hit. Results are X-, Y-coordinate, LUCY.

Sensor positions:

See above: **Linear (Ring)**

Limitations:

See above: **Special Planar (N1)**

Minimum number of hits required: 3

Special Tank Floor (A1)

Description:

This special algorithm in experimental stadium is based on the **Special Planar (A1)** algorithm and is adapted for tank floor applications. This algorithm was introduced to overcome the limitations of the **Tank Floor (MP)** like equidistant sensor spacing and the requirement of three adjacent sensors being hit. Results are X-, Y-coordinate, LUCY.

Sensor positions:

See above: **Linear (Ring)**

Limitations:

See above: **Special Planar (A1)**

Minimum number of hits required: 4 (!)

3D Algorithms (location in a volume)

Solid 3D (steps)

Description:

This a numerical iterative algorithm for volumes (solid/liquid) with 3dimensional sound propagation. Results are X-, Y-, Z-coordinate, LUCY.

1. A source position is assumed.
2. A cube of certain length is drawn around this position.
3. Six new virtual source positions are defined and reside at the center of the cube surfaces.
4. For the 6 new positions LUCY calculated.
5. The solution with smallest LUCY becomes the new source position.
6. Step 2 to 5 is repeated until the center position has smallest LUCY.
7. Then the length of the cube is reduced.
8. Steps 2 to 7 are repeated until the cube length reaches a certain minimum. The center position is returned as location result.

Sensor positions:

Sensor positions are to be entered in X/Y/Z-Triples. Minimum hits from 4 sensors required. If sensors can be placed on one plane only (e.g. all with Z=0) at least one sensor position has to be entered as Z=0.1.

Limitations:

Best location results in area between sensors. Sensors should not be placed on one plane. Best results for cubic sensor arrangement.

Minimum number of hits required: 4

(better results with 5 hits)

Note: it is recommended to start with the Solid 3D(gradient) algorithm because of it is a fast algorithm. Use the Solid 3D(steps) algorithm to cross check your results.

Solid 3D (gradient)

Description:

This a numerical iterative algorithm for volumes (solid/liquid) with 3dimensional sound propagation. Results are X-, Y-, Z-coordinate, LUCY.

1. In the beginning a source position is assumed. In subsequent steps a source position has been calculated. An error function is developed based on the source position and measured arrival times.
2. The resulting error function is developed into Dx, Dy and Dz.
3. Choose the Dx, Dy and Dz with smallest error and shift source position accordingly.
4. Repeat steps 1 to 3 until the result of the error function drops below a predefined level.
5. The calculated position is returned as source position.

Sensor positions:

Sensor positions are to be entered in X/Y/Z-Triples. Minimum hits from 4 sensors required. If sensors can be placed on one plane only (e.g. all with Z=0) at least one sensor position has to be entered as Z=0.1.

Limitations:

Best location results in area between sensors. Sensors should not be placed on one plane. Best results for cubic sensor arrangement.

Minimum number of hits required: 4

(better results with 5 hits)

Cuboid 3D (box)

Description:

This a numerical iterative algorithm for liquid filled volumes (e.g. a cuboid tank) with 3dimensional sound propagation confined by 6 walls. Results are X-, Y-, Z-coordinate, LUCY.

The algorithm calculates the position on the walls for which LUCY becomes smallest.

Sensor positions:

Sensor positions are to be entered in X/Y/Z-Triples. Minimum hits from 3 sensors required. Sensors to be placed **inside** the liquid (not on the walls).

Limitations:

Best location results in area outside the volume spanned by the sensors.

Minimum number of hits required: 3

(better results with 4 hits)

More Information: **Cuboid location algorithm**

Special Solid 3D (A1)

Description:

Special analytical algorithm in experimental stadium. This algorithm is intended for special testing purposes and might be changed in later versions. As this algorithm uses an analytical method to solve the location equation it finds its results within one step without iterations. Therefore it is much faster than iterative algorithms. But a minimum of 5 channels is required to perform location calculation.

Sensor positions:

Sensor positions are to be entered in X/Y/Z-Triples.

Limitations:

Sensors must not be mounted on one plane. Method might be changed in future software versions. At least 5 hit sensors required. This Algorithm is sensitive to delta-t errors.

Minimum number of hits required: 5

Spherical

Description:

Special numerical algorithm for spherical structures. This algorithm is native spherical, which means it really moves internally on the surface of a sphere. The minimum number of hits required for location is 3 which might result in ghost locations on the other side of the sphere. Better results are obtained with 5 hits. For practical applications (e.g. on LPG storage spheres) you will have to use more channels anyway to grant the minimum required sensor distance.

Sensor positions:

Sensor positions are to be entered in Longitude (0° to 360°, clockwise) and Latitude. There are no special sensor setup limitations. Sensors can be arranged according to requirements but should cover the whole sphere.

Limitations:

None specific.

Minimum number of hits required: 3

(better results with 5 hits).

Hint: The spherical algorithm can be used to locate sources on spherical end caps of a pressure vessels. Technically speaking, the spherical algorithm can be used to locate AE-sources on spherical segments, i.e. the shell does not have to be a full sphere.

Title: Loc-50: Location Algorithms
Link: AESuite/VisualAE/Processors/Location/Loc_AlgorithmDescript.htm

Location Algorithm Details: Lin3D

Overview

This algorithm is to supplement the planar and/or spherical location algorithm, where the geometry of a test object is too complex for a planar/spherical location setup, or the attenuation is so high that events do not produce enough hits for useful planar location, but are still suitable for linear location.

The algorithm is an extension to the linear chain algorithms, such that each sensor position can be assigned to any point in a 3-dimensional space. The location result is a point with x-,y- and z-coordinate on the line connecting the first-hit sensor with a directly neighbored (later hit) sensor. Multiple groups of sensors can be set-up, each defining a single chain of sensors in an open-loop (rod) or closed-loop (ring) configuration. Each sensor has two neighbors in a closed loop setup. In an open-loop setup the first and last sensor in the chain has only 1 neighbor. Each sensor can be a member of multiple groups. As many groups with as many sensors as desired can be setup. Groups may have different location algorithms assigned, whereby Linear(3D), Planar Net, and Spherical Net location can be combined. The algorithm Planar Net can only process 2 dimensional sensor positions.

If the Lin3D algorithm is used for a planar - or 3D geometry, one has to be aware of limitations of linear location algorithm compared to planar/solid location algorithms.

Setup

A channel group can be added to a location processor by clicking on “Add Channel Group”. Then the algorithm (e.g. Linear(3D)) can be selected and then the members (channels) and their locations can be entered.

Each channel is listed on one line. Channels listed on two subsequent lines are direct neighbors. Location calculation is only performed on sensor pairs consisting of one first-hit sensor and one directly neighbored later hit sensor.

A closed-loop group configuration can be setup by defining the same sensor as the first and last member of the group.

One and the same channel can be a member of different groups.

Location Calculation Principle

The location result between two sensors are calculated by the formula MD = (TL-T1) * V/2; with:

MD: The location result given as distance from the mid point between both sensors in the direction towards the first-hit sensor. This result is then converted to the corresponding X,Y,Z-triple.

TL: The absolute arrival time of the later hit sensor.

T1: The absolute arrival time of the first-hit sensor.

V: The applied (assumed) wave velocity.

The Linear(3D) algorithm produces the following externally available results:

MDR

The mid point distance ratio, which is 2*MD, divided by the distance of the processed sensor pair. This value should be in the range 0 to 1.1. The location result shall be suppressed for Delta-ts that lead to a MDR greater than 1.1.

X, Y, Z

The location result in the 3D-space.

RNKL3D

The location with minimum MDR gets RNKL3D=1, the location with next higher MDR gets 2 etc.. A filter criterion “RNKL3D=1” is true only for the result that produces the lowest MDR. If there are more than 1 results with same MDR minimum, the result from the lowest channel group number shall be selected.

Planar Selection Rule

The Lin3D and the planar/spherical location algorithm can be used as different channel groups in the same location processor. Results produced by the different channel groups (i.e. different location algorithms) have to be ranked amongst each other with regards to reliability. Results from the planar or spherical

algorithm can be ranked by ascending LUCY. However, the Lin3D algorithm does not provide a LUCY.

Ranking rules can be summarized as follows

- The best Linear(3D) result can be selected by using the filter criterion: RNKL3D=1.
- The best planar/cylindrical result can be selected by: RANK=1.
- The best result from linear(3D) AND planar/cylindrical algorithm can be selected by: RNKPL3=1

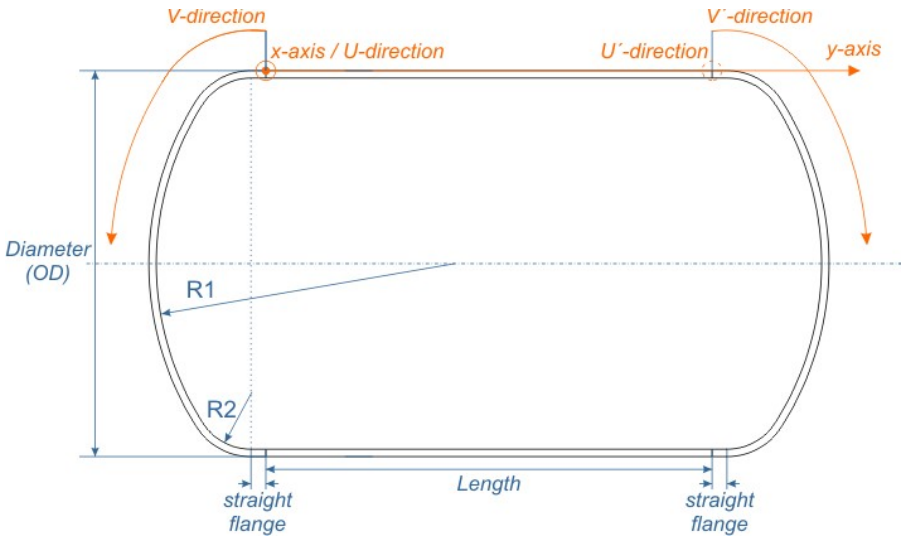
If the channel group yielding the best result is of type Lin3D then RNKPL3 = RNKL3D. On the other hand, if the channel group yielding the best result is of type planar RNKPL3 = RANK

Title: Loc-52: Location Algorithm: Lin3D
Link: AESuite/VisualAE/Processors/Location/Loc_Lin3D.htm

Location Algorithm Details: Dished heads

Overview

The location algorithm for dished heads can locate AE-sources on dished heads as they are used for endcaps of pressure vessels. Prerequisite for doing that is the capability of computing distances on rotation symmetric elliptical shells. Technically a dished head is supposed to be a rotation symmetric ellipsoidal shell. However, it has some shape deviations from the ideal elliptical shell caused by the conditions of the manufacturing process. In general a rotation symmetric elliptic shell is a sufficiently good approximation for conventional dished heads or even customized dished heads.



Sketch of a pressure vessel (horizontal) with dished heads. For sake of clarity U' and V' indicate the co-ordinate axes of the right endcap. VisualAE does not distinguish between U and U' or V and V' because it models the encaps independent from each other.

Origin of the coordinate system

A pressure vessel consist of two heads and a cylindrical hull. The origin on the cylindrical hull is the intersection of the ridge (horizontal vessel) with the plane that contains the left end of the cylinder. In case of a vertical vessel the position of the "ridge" is somewhat arbitrary and can be chosen by the user and the origin will be lying in the plane that contains the bottom of the cylindric hull. The planes this description is referring to contain the circular weld seam that joins the head to the cylindric hull.

For the left head or bottom head the origin coincides with the origin of the cylindric hull.

For the right head or top head the origin is on the y-axis (symmetry axis of vessel) lying in the plane that contains the right end or top end of the cylindric hull.

Setup

The algorithm for dished heads is only available (and automatically selected) when a structure is defined (either manually or via the Structure Wizard) - see Defining a structure. The channel positions are given in coordinates U and V (measured in length units) or -not recommended- in longitude and geodetic latitude (both measured in degree).

U [m/cm/mm]

Distance measured around the circumference of the flange of a dished head. In general it is measured in the plane that bisects the rotation symmetric elliptical shell and that contains the long semi-axis

V [m/cm/mm]

Distance measured from the flange circumference in direction of the apex. The distance is measured in the plane that contains the axis of revolution. The distance includes the straight flange height!

Longitude [°]

Longitude given in degree. This will be automatically updated with the correct value if U and V are given.

(geodetic) Latitude [°]

It is not recommended to specify the latitude as coordinate since it is the geodetic latitude (not the spherical latitude). It is automatically updated with the correct value if U and V are given.

Location calculation principle

The location algorithm on a dished head uses the Simplex (Nelder-Mead) method for finding the AE-source location that best fits the measured arrival times.

Output results

X

x-coordinate of a location result. In case of a head the x-coordinate refers to the planar (orthographic) or azimuthal equidistant projection of the head to the xy-plane. Shall be used when plotting location results in a 2D diagram.

Y

y-coordinate of a location result. In case of a head the y-coordinate refers to the planar (orthographic) or azimuthal equidistant projection of the head to the xy-plane. Shall be used when plotting location results in a 2D diagram.

Long

Longitude of a location result in degree. Only valid for location results on the head, not defined for location results on the cylindrical hull.

Lati

Geodesic latitude of a location result in degree. Only valid for location results on the head, not defined for location results on the cylindrical hull.

Gx

Global x-coordinate. Has to be used when plotting location results on the structure in a 3D diagram.

Gy

Global y-coordinate. Has to be used when plotting location results on the structure in a 3D diagram.

Gz

Global z-coordinate. Has to be used when plotting location results on the structure in a 3D diagram.

Ranking of location results

Location results are ranked based on LUCY if more than one channel group is defined in the location processor.

Title: Loc-54: Location Algorithm: Dished Heads
Link: AESuite/VisualAE/Processors/Location/Loc_dished_head.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Cuboid Location

Location Algorithm Details: Cuboid

Overview

Cuboid location algorithm was developed and tested during EU funded project "Corrosion Testing of Ships", contract no EVG1-CT-2002-00067. The algorithm will find positions of AE-sources that are located on a wall of a cuboid confinement. Such cuboid confinements can be frequently found on e.g. tanker ships and are used for storage of crude oil or other petrochemical liquids. The Cuboid location algorithm is part of VAEL3D and VAELTB software module.

Note: the algorithm is still considered to be under development. While it has been proven to work, changes will be made to the algorithm when field work experience indicates that adaption to the algorithm are necessary.

Description

Cuboid location algorithm is based on the planar (plane) location algorithm and is therefore considered to be a 2D location algorithm. The name "cuboid" refers to the fact that the location algorithm tries to interpret the measured delta t pattern and come up with a possible location on a cuboid confinement. It is assumed that this confinement is filled with a (liquid) medium and that AE-sensors are inside of the (liquid) medium. So to say, AE-sensors are placed inside the liquid and listen to signals produced on the walls.

The confinement is always rectangular with the walls parallel to the planes defined by the coordinates system.

In principle, the cuboid algorithm determines as first step from which wall of the cuboid confinement an AE-source emits. In a second step a planar (plane) location algorithm is used to come up with a position on the wall. AE-sensors do not have to be placed on the same plane in order that the planer location algorithm works, if possible locations of an AE-source are confined to a specific plane.

Setup

A channel group can be added to a location processor by clicking on “Add Channel Group”. The algorithm (e.g. Cuboid) can be selected and then the members (channels) and their locations in 3D as X,Y and Z triplet can be entered.

The dimensions of the cuboid confinement are specified as two sets of X,Y,Z triplet coordinates whereby one triplet consists of min(Xi), min(Yi) and min(Zi) and the other triplet of max(Xi), max(Yi), max(Zi), whereby Xi, Yi and Zi are the coordinates of vertices of a cuboid (i=1...8). The two sets of X,Y,Z triplets are

specified as coordinates for virtual channels 254 and 255.

Results of location algorithm

X, Y, Z

The location result in the 3D-space, but confined to the plane of a certain wall.

LUCY

location uncertainty

Title: Loc-56: Location Algorithm: Cuboid
Link: AESuite/VisualAE/Processors/Location/Loc_Cuboid.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Location Uncertainty (LUCY)

Location Uncertainty (LUCY)

Description

LUCY describes how well a calculated source position fits with the measured arrival time differences.

Definition

LUCY is a scaled least squares distance between a set of measured range differences to a set of calculated range differences.

"Measured range differences" refers to the measured arrival time differences multiplied with the wave speed ("speed of sound"), in the following equation called "Di". They correspond to the real world AE-source.

The index i identifies the i-th hit sensor. As the differences are always computed relatively to the first hit sensors, i=2 is the smallest possible value and n, the number of sensors, is the largest possible value.

"Calculated range differences" refers to calculated arrival time differences multiplied with the wave speed, in the following equation called "Pi". They correspond to a computed source position that fits the measured data in the best possible way. The "goodness of fit"-measure is LUCY - n denotes the number of hits:

$LUCY=\mathrm{sqrt}\ [\Sigma(Di-Pi)^2 / (n-1)]$

If Di and Pi are the same, then the calculated source location yields the same arrival time differences as the measured ones. Deviations from the calculated range differences (caused by deviations in the wave path, attenuation, background noise etc.) are reflected in LUCY.

At the moment a LUCY value is only available as a result in VAE in case there is at least one more hit used by the algorithm than actually needed. In the other case a value of -1 is the default output value for LUCY. This behavior might change in the future.

Title: Loc-15: Location Uncertainty (LUCY)
Link: AESuite/VisualAE/Processors/Location/Loc_LUCY.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Location Processor > Location Setup Diagnostics

Location Setup Diagnostics

Built-in tools check if the settings for location calculation seem to be reasonable.

Clicking the OK button in the Location Settings dialog starts these checking routines. If the settings are not consistent, warnings will be generated. This helps making sure that settings are consistent. Warnings can be ignored, but we recommend to check if the settings are really intended.

These routines can also be started and the warnings made visible by clicking on Verify...

Description of warnings:

LW #011

Event Builder: DT1X-Max lower than DTNX-Max. DT1X-Max should be equal or longer than DTNX-Max.

LW #012

Event Builder: FHCDT lower than DTNX-Max. FHCDT should be larger than DTNX-Max.

LW #013

Event Builder: Channel A, B,... defined in Event-Builder but never used for location. The mentioned channels are not included in any channel group and therefore not used for location calculation.

LW #101

Location: Velocity invalid (lower or equal 0).The velocity of sound has to be greater than 0.

LW #102

Location: All channels are positioned on a straight line. The selected algorithm may not work properly if the channels are on a straight line.

LW #103

Location: All channels are positioned in a plane. The selected algorithm may not work properly if the sensors are placed on a plane.

LW #104

Location: Symmetric setup of channel positions. With symmetric channel positions the selected algorithm doesn't provide solutions on the symmetry axis of the channel positions.

LW #105

Location: Not enough channels defined (N, required: M). The selected algorithm needs more channels for location calculation than defined in the mentioned channel group.

LW #106

Location: Channel A - Not enough neighbors (N, required: M). To calculate location (with the selected algorithm) M neighbor channels are necessary.

LW #107

Location: Positions of channel A and B might be too close. If channels are closer than "Max. Neighborhood Distance divided by 10'000", it might not be possible to calculate locations.

LW #108

Locations: Channels A, B defined as neighbors, but distance greater than "Max channel distance" of x meter. Only channels being closer than the "Max. Neighborhood Distance" will be used for location calculation.

LW #109

Reserved.

LW #110

Location: Channel (s) A with function "Guard" have assigned a position. Guard channels don't need a position (they will never be used for location calculation). You may delete the guard channel(s) from the channel group(s).

LW #111

Location: Circular position of channel A beyond half circumference. The valid range for positions on circular structures is plus/minus half circumference.

Title: Loc-20: Location Setup Diagnostics
Link: AESuite/VisualAE/Processors/Location/Loc_Verify.htm

Importing MultiPlot Locations into VisualAE™

Location-Settings entered into **MultiPlot** can be easily imported into **VisualAE™**.

Clicking on the button "Import from PRI-File..." calls a standard windows dialog for selecting a PRI-File.

When the PRI-File has been selected, a dialog is displayed providing a list of the Locations sets in this file. You can select the Location to be imported. All the settings used within **MultiPlot** will be imported to **VisualAE™**. This provides the same location results.

VisualAE™ provides some additional settings options for location calculation. A description which settings correspond to **MultiPlot** is available.

Hint: The Location currently displayed in **VisualAE™** will be overwritten (but you get a warning dialog). We suggest to add a new Location Processor to **VisualAE™** before importing a Location Set from **MultiPlot**.

Title: Loc-21: Importing MultiPlot Location
Link: AESuite/VisualAE/Processors/Location/Loc_PRI-Import.htm

MultiPlot Compatible Location Setups

For planar location compatible to the MultiPlot program:

1. Define ONE channel group only:
2. Select Planar (plane) out of the Type combo box. Planar (cylinder) allows for cylindrical location and requires a circumference or radius to be specified.
3. Define Max Hits as 7. This number limits the number of hits of an event used for location.
4. Use the grid to add all the channels used for location. Each line represents one channel position. To remove a channel, clear the channel number and then select another line in the grid.

For multi-triplet location compatible to the MultiPlot program:

1. Define one channel set per triplet

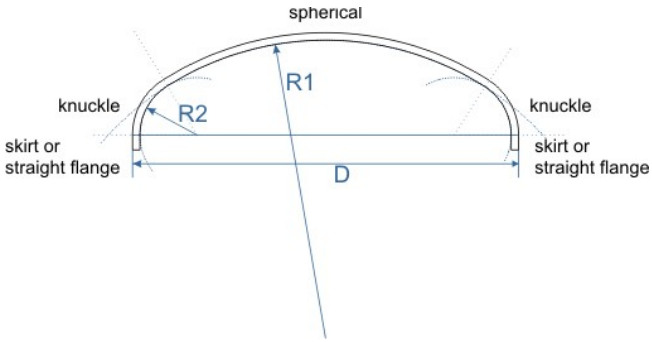
2. Select Planar (plane) out of the Type combo box for each channel set
3. Define Max Hits as 4 for each channel set.
4. Enter three channel positions per triplet.

MultiPlot is the predecessor of **VisualAE™**.

Title: Loc-16: MultiPlot Compatible Setups
Link: AESuite/VisualAE/Processors/Location/Loc_MultiplotCompatibility.htm

Types of heads of a pressure vessel

Structure dialogue of the location processors lists some common head types for pressure vessels. These types will be shortly described with their standard parameters. Basically a dished head is defined by two radii (R1 and R2) that are defined depending on the outer diameter (D) of the cylindrical hull and the height of the straight flange which extends the dished part to fit onto the cylindrical hull. R1 usually refers to the radius of the spherical cap part of a dish and R2 refers to the radius of knuckle, the joining part of spherical cap and straight flange.



Sketch of a dished head (in this case it is a torispherical head) with D, R1 and R2 indicated. These variables are used in the same manner for characterisation of dished heads below.

Hemispherical head

A hemispherical head has R1=0.5 x D.

2:1 Semi elliptical head

is modelled as a true ellipse with semi axis ratio of 2:1. A torispehrical head is a very good approximation for this head type.

Torispherical head (DE: Korbbogenboden, DIN 28013)

Torispherical head is sometimes referred to as "deep dished torispherical head", "ellipsoidal head", "basket arch" or "semi-ellipsoidal head" and "ellipsoidal head according to DIN 28013". Its shape is close to the 2:1 semi elliptical head.

R1=0.8 x D

R2=0.154 x D

Decinormal head (DE: Klöpperboden, DIN 28011)

Decinormal head is a bit flatter than the torispherical head and very common in Germany.

R1=D

R2=0.1 x D

ASME 80-10 Flanged and Dished

R1=0.8 x D

R2=0.1 x D

ASME High Crown Flanged and Dished

Also known as AMSE 80/6 flanged and dished head

R1=0.85 x D

R2=0.06 x D

Standard Flanged and Dished

Also known as ASME flanged and dished.

R1=D

R2 is usually set to 3x material thickness

Custom Dished Head

A custom dished head is defined by the two radii R1 and R2, whereby R1 is the radius of the spherical part and R2 is the radius of the knuckle.

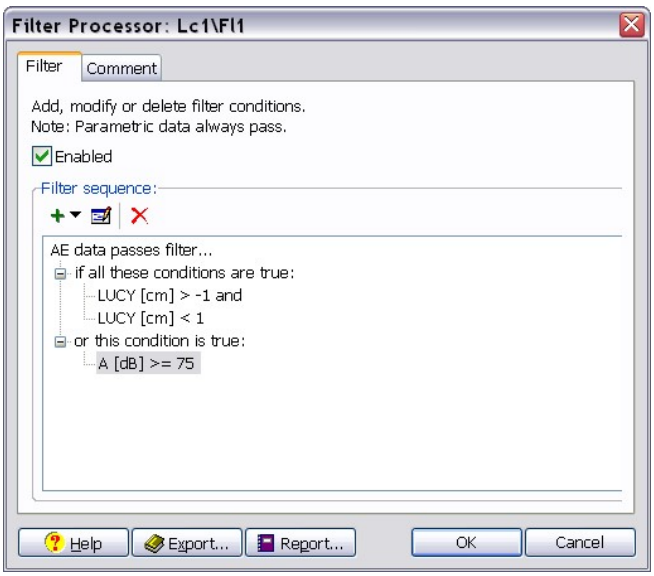
Title: Loc-25: Types of heads of a pressure vessel
Link: AESuite/VisualAE/Processors/Location/Loc_HeadTypes.htm

Filter Processor Overview

Filter Processors are a powerful tool to modify the data flow and to separate meaningful from not so important data. Filters do NOT change stored data, they just prevent some data from being processed further. A filter processor does not process status data sets.

Filters can be placed anywhere in the data flow/ Structure affecting every element behind them. They can be interpreted as secondary data source (the PRI-file being the primary data source). Any processor or Visual can be placed behind a filter.

After inserting a filter processor (choose Insert / Filter Processor from the menu bar) a data source for the filter processor has to be chosen. Sources can be the primary data source (the pri-file) or any other processor. Finally after specifying a data source the following window is displayed (already with example filter condition definitions):



Enable / disable a filter processor

A filter processor is enabled by default. However, for analysis purposes a filter processor can be disabled. To disable a filter processor uncheck the Enabled check box. If a filter processor is disabled all data passes the processor unfiltered.

Filter sequence

The filter sequence window gives an overview about the defined filter conditions. AE-data will pass the filter if all filter conditions equate true. The filter conditions can be connected by logical AND or logical OR conditions. All logical AND conditions are grouped under "if all these conditions are true:" while all logical OR conditions are grouped under "or this condition is true". Conditions can be added by clicking the green plus sign. They can be removed by clicking the red x-sign. Conditions can be edited by double clicking on a certain condition.

Defining complex filters

The filter processor allows definition of complex filter conditions, i.e. stacking different AND and OR conditions.

Each entry can be selected, clicking the right mouse calls a context menu. One of the items of the context menu is "Duplicate". Selecting "Duplicate" duplicates the selected element. Then it can be repositioned by drag and drop.

Filters can be exported to the library. Then they can be used again in other **VisualAE™** projects.

Comment Tab

The Comment tab allows entering a descriptive title and a complete description. The descriptive text is shown in the Data Processing Structure and can be used to distinguish or identify a filter processor amongst many of them.

Hint: A number of macros exist for automatic legend and caption generation.

Title: Filter-1: Filter Processor Overview
Link: AESuite/VisualAE/Processors/Filter/Filter_Overview.htm

Filter Condition Setup

The > button calls a drop down list for selecting the result you want to use for filtering. Location/Cluster/User results are only available if the filter is placed behind an processor delivering those results.

The comparison operator can be selected from the combo box, and the comparison value has to be entered in the most right field.

If you are using Variables, these can be selected from the lower combo box.

Note: Use the "=" relation only for results which are definitely integer values (e.g. channel number, counts). If you use the EQUAL condition for other results the condition might never come true as most results internally are handled with more digits than displayed.
If filtering according to an EQUAL condition (e.g. condition A=45dB, while the internal number is 45.005dB) no data will pass the filter and nothing will be displayed.

Note: Filtering according to cumulative and/or statistical results has to be done very carefully. Statistical cumulative results are defined for an entity of hits. Although each hit gets a result assigned, this result is depending on the preceding processing steps (and not a property of the hit itself like e.g. amplitude).

Title: Filter-2: Filter Condition Setup
Link: AESuite/VisualAE/Processors/Filter/Filter_Settings.htm

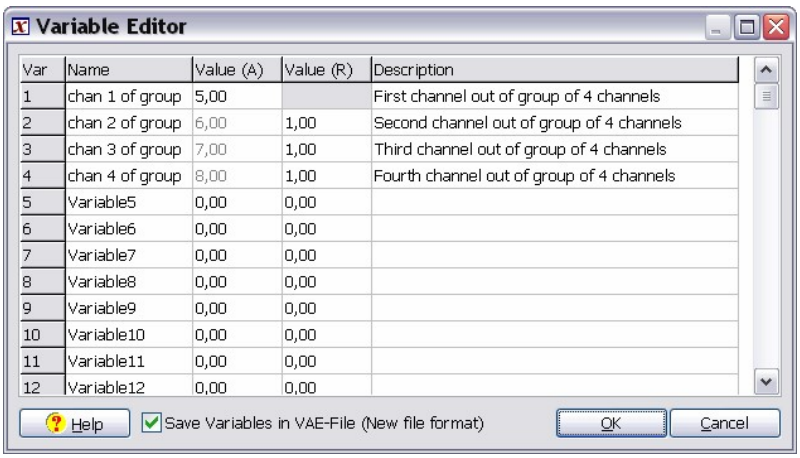
Variables as Filter Criteria

VisualAE allows the definition of variables by use of the Variable Editor. Variables can be used for example in filter conditions of the filter processor.

Changing Filter Criteria Globally for an Analysis Project

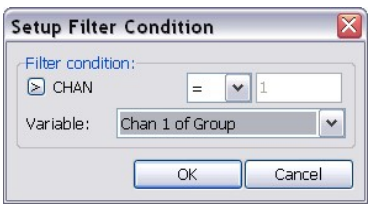
In some cases it is useful to change a filter condition which is used in more than one filter processor. For example an analysis that is carried out only for a small group of channels. In a first step only channels 1 to 4 are investigated. In a second step channels 5 to 8 are investigated, and so on. This can be done when using Variables, quickly and easily.

The definition of the Variables is done in a dialogue window accessible through the menu bar: Edit/Variables.

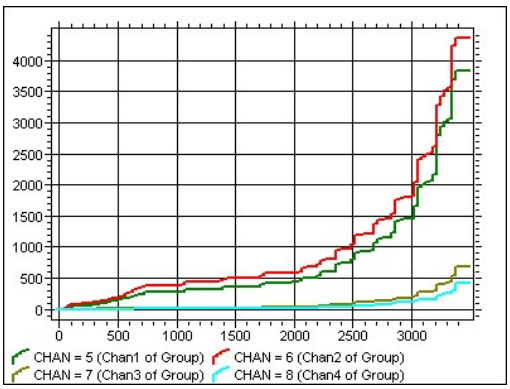


Here the names and values for up to 32 variables can be entered/edited. In the left column the name of the variable is defined. It is recommended to use short names as they will appear in the diagram legends (if activated). In the column 'Value(A)' an absolute value for this variable is given (for instance channel number = 1). The next column 'Value(R)' specifies a relative offset to the absolute value of the previous variable. Example: specify the 'Value(A)'=1 for first variable, then specify 'Value(R)'=1 for the second and third variable. The 'Value(A)' for variable 2+3 will be shown in grey color and no longer be directly accessible. But upon changing variable 1 of 'Value(A)', the values of variable 2+3 will be changed according to the given offset.

These variables can then be selected as filter criteria in the VisualAE analysis project. An example would be to make analysis channel by channel, or to do it groupwise (e.g. 4 by 4 channels, as in the example given).



The filter conditions can be changed throughout the complete VisualAE project by editing the variable definitions. An example for a graph using the example variables is below.



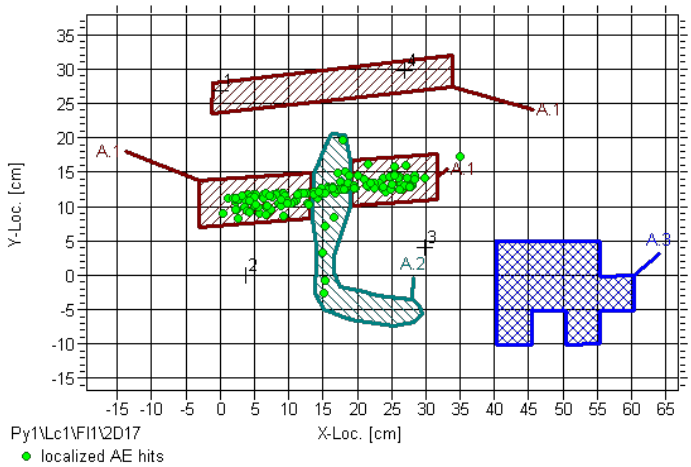
Title: Filter-3: Variables as Filter Criteria
Link: AESuite/VisualAE/Processors/Filter/Filter_Variables.htm

Polygon Processor Overview

The purpose of the Polygon Processor is grouping, selecting, and filtering AE data on a graphical basis. It allows one to draw polygons during set up and detects during analysis whether a hit, event or located event is inside the polygon or not.

Polygons are defined by vertices and can be of arbitrary shape (convex or concave). There is no limitation (except memory and processing power) neither for the number of polygons nor for the number of vertices per polygon.

The Polygon Processor can be used to define a graphic filter.



The example above illustrates the capabilities of creating polygons. Please note that polygon A.1 consists of several parts separated from each other. More regular shapes like circles, ellipses, and rectangles can be created as well (see section Polygon processor setup).

A polygon is two dimensional and can be set up with any 2 attributes available in your VisualAE™ project (e.g. amplitude vs time, X vs Y, energy vs duration,...).

The Polygon Processor checks to which polygon each hit belongs and assigns the polygon ID to the hit (it is even possible to combine several polygons). The polygon-ID can then be used e.g. for filtering to select only those data from within one or more polygon(s).

A polygon will only be displayed in a Visual that is located behind the polygon processor inside the **Structure Tree** and if the polygon attributes are the same as the Visual's left and horizontal axis.

Title: Poly-1: Polygon Processor Overview
Link: AESuite/VisualAE/Processors/Polygon/Poly_Overview.htm

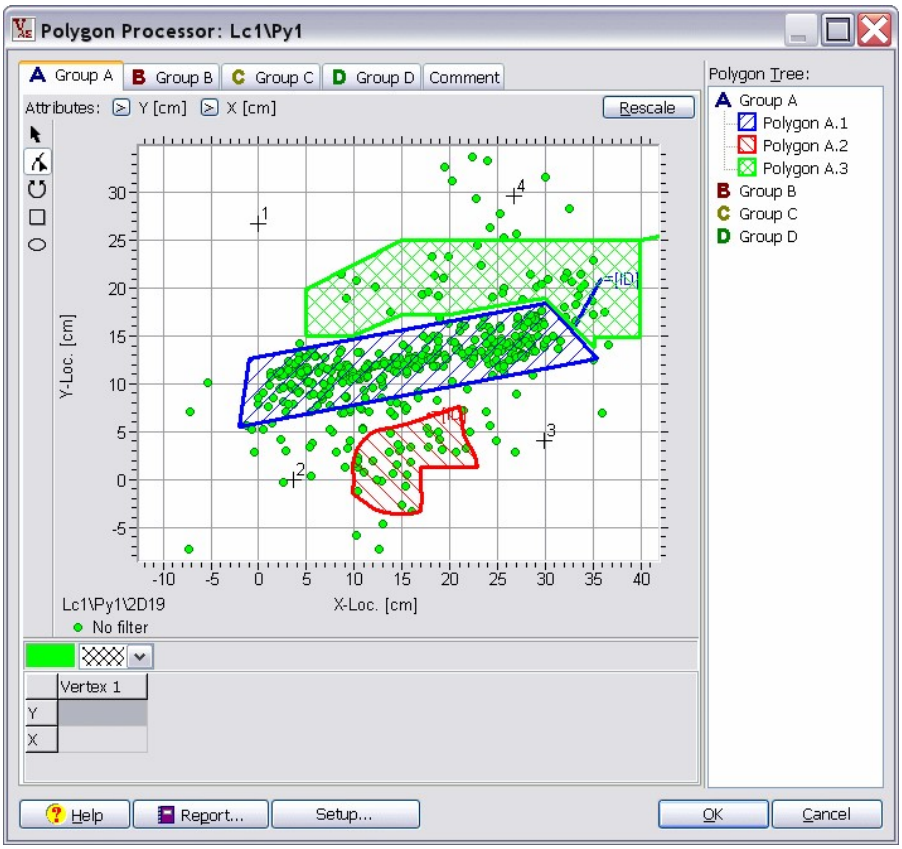
Polygon Processor Setup

There are different ways to access a polygon processor:

- Edit/Data Processing Structure/select an existing polygon processor

- Right mouse click on a Visual and selecting Processor Properties/Polygon Processor
- Inserting a Polygon processor from the menu bar choosing Insert/Polygon Processor

The window below shows how polygons can be created and modified.



Graphical Setup of polygons

There are four different tabs labelled "A Group A", B Group B", "C Group C", "D Group D" which correspond to four different planes in which polygons can be defined. In each plane A,B,C, or D any number of polygons can be created.

Attributes

lets the user select the attributes for which the polygon(s) will be defined.

Graphical Tool bar (left hand side)

The active tool is always highlighted

Pointing mode: to select an existing polygon click on its line. The handles of the polygon will be shown. Press the left mouse button and move a handle to resize the polygon. Pressing <Shift> while moving a handle keeps the center of the polygon fixed. Pressing <Ctrl> keeps the upper left corner fixed. Pointing with the mouse on the center changes the mouse to a cross and allows one to move the polygon.

Vertex mover mode: to display the vertices of a polygon click on its line. Then you can move each vertex separately to change the shape of the polygon. Right mouse click on a vertex allows one to delete it. In this mode you can move the polygon-ID by pressing the left mouse button on it.

Turning mode: select a polygon by clicking on its line, then press the left mouse button on a corner to turn the polygon around its center.

Rectangle mode: Draws rectangular polygons consisting of 4 vertices. For squares please see note about additional key commands below.

Ellipse mode: Draws elliptic polygons consisting of 24 vertices. For circles please see note about additional key commands below.


: Click on the color box to change the color of the polygon. Click on the combo box to select a pattern to fill the polygon.

Note: When creating a new rectangle or ellipse you can hold the <Ctrl> key while drawing to create circles respectively squares.
Holding the <Shift> key keeps the center for the polygon. This also works when resizing a polygon.

When a polygon is selected a list with the coordinates of that polygon is displayed at the bottom of that window. Each column entry represents a vertex and can be edited numerically.

Rescale

Rescales the display of the polygons in such a way that all polygons are visible again. Very useful in case you have moved a polygon out of the display.

Polygon Tree

The polygon tree displays the different polygons in a folder like structure. For more information see the section Polygon Tree, Processing Hierarchy and Polygon Legends.

Additional Buttons

Setup...

Offers a list of all 2D diagrams in the current setup. Pick any 2D diagram to use it as basis for the polygon definition. The current group will get its left and horizontal axis, the same scaling and Legends, and will copy all correlation data into the polygon setup window. Now polygons can be drawn around the data of interest.

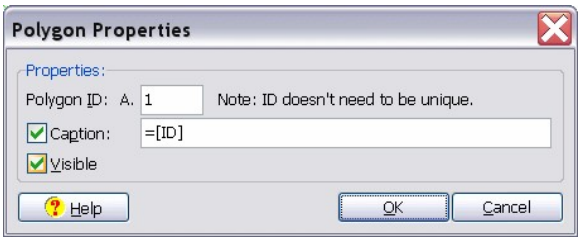
However the data and setup shown is only a temporary copy of the selected diagram and not the visual itself. The next time the Polygon Processor is opened only the pure polygons are shown without the data.

Note: Polygons are only shown in 2D-diagrams that are located behind the Polygon Processor in the **Structure Tree**. Picking a diagram to setup the Polygon Processor doesn't change the selected Visual in any way.

Title: Poly-2: Polygon Processor Setup
Link: AESuite/VisualAE/Processors/Polygon/Poly_Setup.htm

Polygon Processor Properties

Clicking the right mouse button on a polygon inside in the **Polygon Tree** displays a context menu with the entries Properties and Delete.



Polygon-ID

The letter (e.g. A in the example above) indicates the group to which the polygon belongs. The number can be edited manually. Thereby arbitrary numbers (also equal numbers are possible) can be assigned to different polygons. A valid ID is greater zero and must not exceed 4 digits (<=9999).

The ID zero is returned as result if no matching polygon could be found. Thereby one can select all data OUTSIDE the polygons of a group (e.g. group A) by using a filter (e.g. Poly-A = 0).

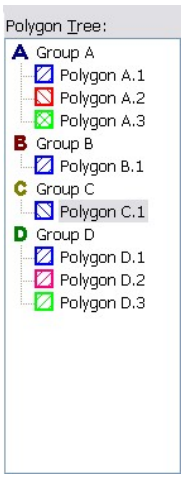
Caption

The checkbox enables/disables the display of the polygon's caption. The caption can be any text up to a maximum length of 63 characters. For the polygon-ID exists a special macro: =[ID] which is used as default caption.

Title: Poly-3: Polygon Properties
Link: AESuite/VisualAE/Processors/Polygon/Poly_Polygon.htm

Polygon Tree, Processing Hierarchy and Polygon Legends

The Polygon Tree provides an overview of the existing polygons of the polygon processor.



For each polygon group all of its members are shown. The polygon list can be rearranged by drag and drop.

A context menu is available via a right mouse click on the polygon entry. It allows deleting polygons and provides access to the polygon properties.

When processing data, the Polygon Processor checks the polygons in the given order beginning with the top polygon in the tree of group A. The first polygon into which the data fits is taken as result for this group. This procedure is repeated for all groups.

If data fits into an overlapping region of polygons of the same group then data is always assigned to the polygon which is higher up in the tree.

This implies the following:

- A data set can belong to only one polygon per group.
- Data is checked if it is inside a certain polygon according to the order of the polygons defined in the polygon tree. The ID of the first polygon in which the data is contained is returned as result. If no matching polygon can be found a result value of zero is returned.
- If two polygons in a group overlap the one higher up in the polygon tree has priority.
- A data set can get up to 4 polygon-IDs (one from each group A-D) assigned together but only one single ID per group.

Hint: The polygon ID does not need to be unique. A valid polygon ID is greater zero and must not exceed four digits (<= 9999). You can assign the same ID to more than one polygon (see group A in the example above). This is useful if you want to filter data which is inside of more than one polygon. Faster filtering can be performed if one single filter condition is required to check for in-/exclusion in one or more polygons.

Title: Poly-4: Polygon Tree
Link: AESuite/VisualAE/Processors/Polygon/Poly_PolygonTree.htm

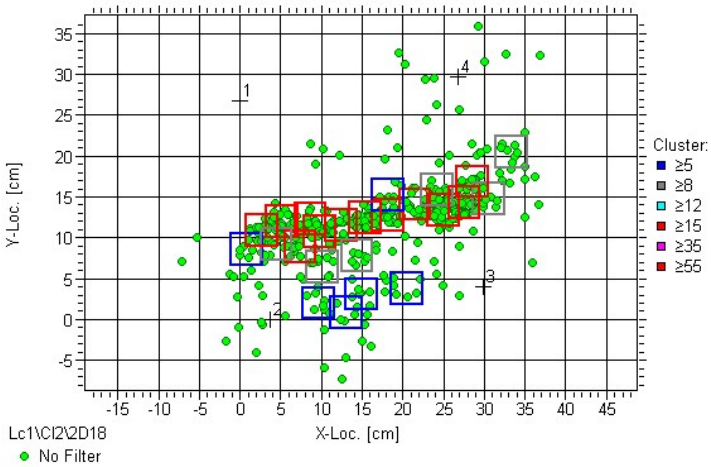
Cluster Processor Overview

Clustering is a powerful tool for recognizing data having certain similar characteristics. The cluster process looks (online) for data being similar with respect to attributes selected by the user. If such data is found it is marked as cluster. These clusters can be addressed and evaluated separately.

Example: location clustering is frequently used because it allows for displaying areas of high acoustic emission activity (a location algorithm is required). If working with planar location select X- and Y-location as cluster attributes. Specify a cluster width (e.g. x=4cm and y=4cm), and a minimum number of cluster members (e.g. 5). Then the cluster process checks if a 4x4cm² area can be found with at least 5 located events in it. Such an area would be highlighted in a Y vs X diagram as colored rectangle, indicating a agglomeration of events (see diagram below).

Of course any other AE parameter (Amplitude, Duration, Energy,...) can be used for clustering. **VisualAE™** allows for multidimensional clustering.

Clusters can only be displayed if the Cluster-Attributes correspond to the Diagram-Attributes.



Example: XY-Clusters on a plane, indicating the number of events per cluster by the color code.

A double click on the cluster frame displays the unique Cluster-ID number and the center of the cluster. Each data set belonging to a cluster gets the clusters' ID number assigned. This Cluster-ID can then be used e.g. as filter criterion to select data from a specific cluster. This allows performing detailed analysis of a cluster's content.

Or it can be used as diagram attribute in order to compare e.g. the number of hits, the energy, or other results, per cluster.

Clustering process in detail

For sake of simplicity a clustering process in two dimensions is described. Multidimensional clustering is just an extension of the principles of two dimensional clustering to more dimensions.

Every data set (can be hit- or event data set if clustering is done after an event-set- or location processor) that is processed by a cluster processor produces a point in the plane defined by the two attributes of the cluster processor. For each new point the Euclidian distance, **d**, is calculated to the centers of already existing clusters. A data set will be attributed to the nearest cluster that meets the distance criteria. The distance criteria which is evaluated is defined the following way:

- **d** < 1.95 x cluster-halfwidth if only one data set is making up a cluster (1st criterium)

- **d** < 1.00 x cluster-halfwidth if more than one data set is constituting a cluster (2nd criterium)

If the distance criteria is met by more than one cluster the data set will be attributed to the nearest cluster. If the data set cannot be attributed to any existing cluster it will - technically speaking - become a new cluster and get a unique ID.

The center of a cluster is defined by the center of gravity of all cluster members. Only after a cluster member has been added the new center of gravity is calculated.

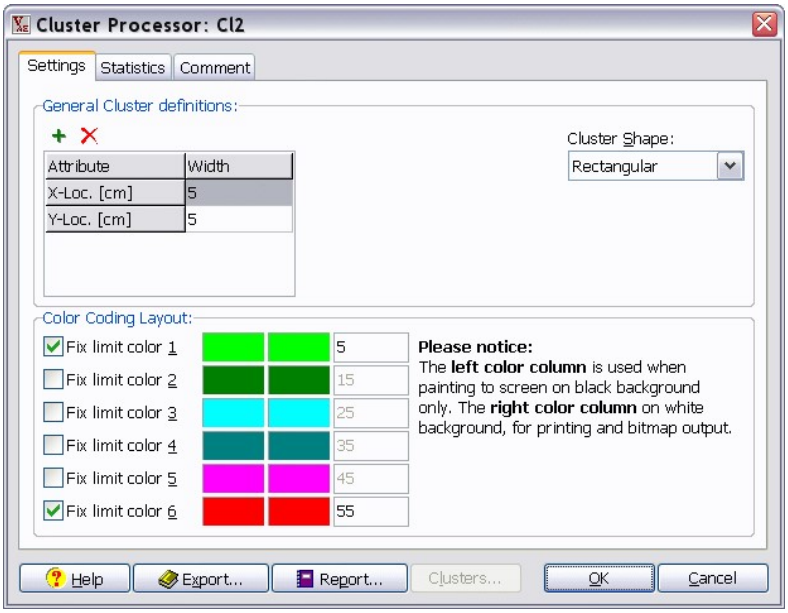
The described clustering process may lead to following behavior:

- as new data sets are added, the cluster center shifts. It may happen that data sets "drop out" of the cluster, if there is a certain bias in the direction of shifting. While technically these data sets are still cluster members (and considered in evaluating the cluster statistics), they are laying outside the cluster indicated by the rectangle or circle in a cluster diagram.
- new data sets generate new clusters more frequently as a result of the second distance criterium. In some cases a data set could rather be assigned to an existing cluster if (i) the new center of gravity of a cluster would be calculated considering the new data set and (ii) the distance criteria is evaluated only after the new cluster center is calculated. However this procedure will have a high demand on computer power since every existing cluster member has to be reevaluated if it is still inside the cluster.

Title: Cluster-1: Cluster Processor Overview
Link: AESuite/VisualAE/Processors/Cluster/Cluster_Overview.htm

Cluster Processor Settings

Each cluster processor can be set up independently. The attributes used for clustering and the width of the cluster (with respect to each attribute) can be specified. As many attributes can be added as needed. The cluster shape can be chosen rectangular or circular.



General Cluster definitions

General cluster definitions contain the size and attribute definition for a cluster. In case of a location cluster (planar) the cluster attributes will be the x- and y-coordinate. The size of the cluster will be a measure for width in x- and y-direction.

The Cluster Shape can be either rectangular or circular and has to be chosen from the drop down list.

Color Coding Layout

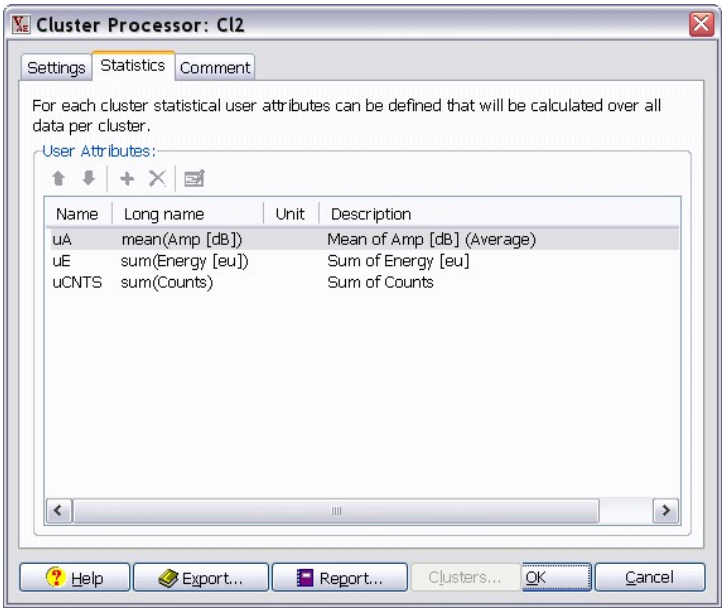
The color coding and cluster members can be modified. Either **VisualAE™** performs an auto-scaling or the color limits can be fixed by the user. Therefore, the color limits have to be checked and values for the cluster members have to specified in the right most fields.

To adjust the colors click on the colored areas: a palette will be displayed which allows selecting suitable colors. The left color column is used with black diagram background, the right column with white diagram background and for printing.

Title: Cluster-2: Cluster Setup
Link: AESuite/VisualAE/Processors/Cluster/Cluster_Settings.htm

Cluster Processor Statistics

For each cluster some statistical values are calculated in order to provide additional information about the content of it.

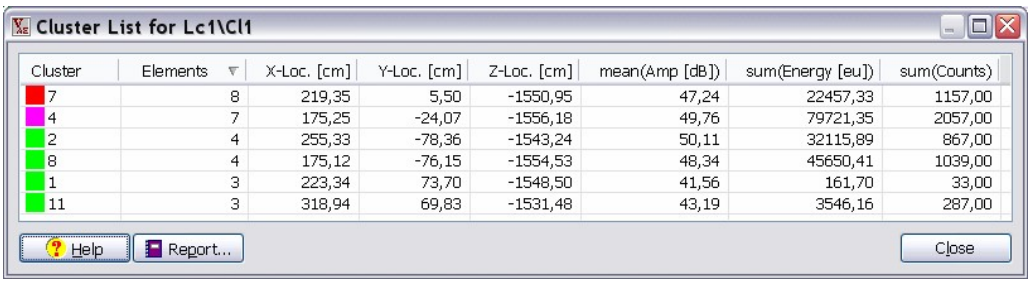


The 3 standard statistical values are shown above. Having the user processor software option (VAEUP/VAEUPE) you can create and add additional results.

Title: Cluster-3: Cluster Statistics
Link: AESuite/VisualAE/Processors/Cluster/Cluster_Statistics.htm

Cluster Report

Clicking on the "Clusters..." button at the bottom of the Cluster Setup window displays a list providing information about the existing clusters (if no data is displayed, perform "reset" and "run").



Cluster:

Each cluster has a Cluster-ID number for identification.

Elements:

Number of elements in the cluster.

Other columns:

The other columns indicate the center of the cluster and statistical values about the cluster content.

Title: Cluster-4: Cluster Report
Link: AESuite/VisualAE/Processors/Cluster/Cluster_Report.htm

User Processor Overview

User defined results (software option VAEUP and VAEUPE) are powerful tools allowing to implement user specific analysis tasks. Based on the existing attributes - that are measured - new results can be derived. Within a user processor hit and time driven data sets (see Acquisition setup: parametric channel setup for more information) are processed.

A number of mathematical and statistical operations is available. Using them new features can be calculated. Those can be displayed like any other attribute.

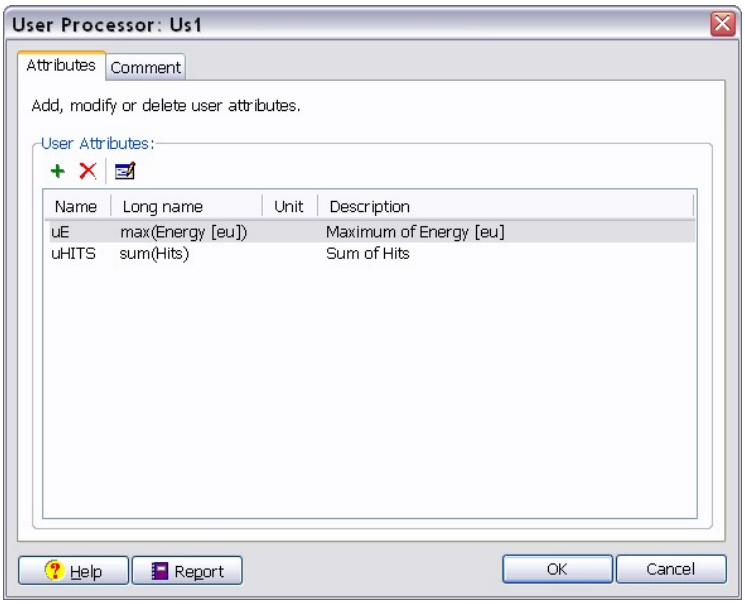
With MultiPlot, for instance, something like a frequency defined as Counts/Duration was implemented as standard attribute. This standard attribute no longer exists. But it can easily be derived with the user processor.

Title: User-1: User Processor Overview
Link: AESuite/VisualAE/Processors/User/User_Overview.htm

User Attribute Setup

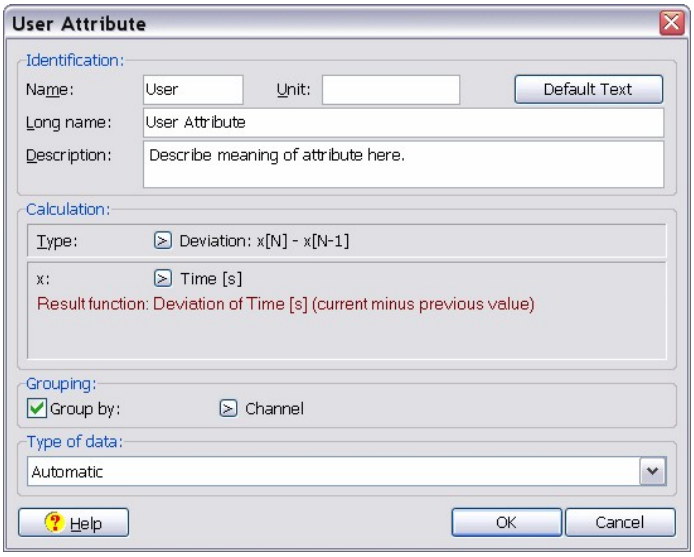
The existing user results are displayed in the list shown below. Those listed here will be available to any element placed in the structure behind this user processor.

Note: the result of an algorithm/evaluation is available for all algorithms/evaluations defined subsequently. E.g. in the example below the result "uE" is available in the algorithm/evaluation defined below it with descriptive name "Sum of Hits"



You can add new results, and delete or modify the existing ones.

In order to define a new user result, select Add and complete the dialog window which appears.



Identification

Name

the name of the attribute as it appears in menus of VisualAE.

Unit

Units of the result. Will be used for axis labelling in diagrams.

Long Name

Descriptive long name of result that is used for axis labelling in diagrams.

Description

Description of the attribute which will be shown as descriptive text in menus of VisualAE.

Calculation

This group specifies the mathematical operation of how to calculate the user attribute from other attributes.

Type

This specifies the type of calculation which is done by the user processor. This can be simple calculations like sum, mean value, etc. but also more complex ones such as rates, deviations, amplitude correction, etc (see User-3: Mathematical Operations and User-4: Amplitude Correction). Depending on the selection of the algorithm one or more attribute fields can be chosen in the section which is located below.

Grouping

Grouping allows to group statistical attributes by Channel or other attributes.

Example: Without grouping sum of hits will return the sum of hits over all channels. When grouping by channel it returns the sum of hits per channel.

Type of Data

This allows to define on which type of data set the user specified algorithm is executed. Set it to "Automatic" if unsure about correct setting. Otherwise bind the feature either to parametric, status or Hit / Event / Location data.

Note: This type only specifies on which type of data the user processor responds itself. Depending on data combinations certain features from the user processor might also be available on the next level behind the user processor, as for example parametric dependent features are also available with hit data.

Title: User-2: User Attribute Setup
Link: AESuite/VisualAE/Processors/User/User_Attributes.htm

Mathematical Operations

Definition

In the description below the lower case characters "**x**" and "**y**" represent any user selectable attribute. Upper case characters represent user-definable constants.

The following mathematical/statistical operations are available within the user processor:

min(x1...xN):	Minimum over all values $x_1...x_N$
max(x1...xN):	Maximum over all values $x_1...x_N$
sum(x1...xN):	Sum over all values = $x_1...x_N$
mean(x1...xN):	sum($x_1...x_N$)/N
variance: var(x1...xN):	$[1/(N-1)]*sum[(x_i-x_{mean})^2]$
Standard deviation: stddev (x1...xN)	$var(x_1...x_N)^{1/2}$
Deviation: x(N)-x(N-1)	x_N-x_{N-1}: Current value minus previous value
Average Change:	$[1/N * sum(dx^{-2})]^{1/2}$, where dx: x_N-x_{N-1}

The following mathematical/statistical operations are available within the user processor extension (option VAEUPE):

Ratio:	A*x/y (x, y: 2 already existing results; A: constant factor)
Product:	A*x*y (x, y: 2 already existing results; A: constant factor)
Sum:	(A*x)+(B*y) (A, B: constant factors)
Power:	A*x^K (A: constant factor, K: constant power)
Lg:	A*lg(x), base B (A: constant factor, B: base for the logarithm)
Ln:	A*ln(X) (A: constant factor)
Linear Scale:	(M*x)+K (M: constant factor, K: constant offset)
Linear Scale:	(K+x)*M (M: constant factor, K: constant offset)

The following statistical rate functions are defined (option VAEUPE):

Given a reference variable (b, usually pressure or time), a generic interval for this variable (DB), and the sum (integral) of another variable (x, usually energy, counts, hits or events) over the given interval DB, we can define:

- Sum1 = Sx calculated over the most recent interval (b-DB .. b)
- Sum2 = Sx calculated over the previous interval (b-2DB .. b-DB)

Based on this definition we define the rate values:

Rate1:
Sum1 / DB
Expanded expression: S(x[b-DB]..x[b]) / DB
Sum1 / Sum2

Rate2:
Expanded expression: S(x[b-DB]..x[b]) / S(x[b-2DB]..x[b-DB])
Sum1 / (Sum1 + Sum2)

Rate3:
Expanded expression: S(x[b-DB]..x[b]) / S(x[b-2DB]..x[b])

With Rate 2, the user can specify a minimum for Sum2 that is used if the normal calculated value for Sum2 is lower.

By using Rate1, Rate2 or Rate3 it is attempted to describe discrete data e.g. attributes of a hit-, status- or parametric data sets in a continuous way: Energy per time interval or hits per pressure interval. For discrete attributes which are generated in a periodic pattern such as ENYS (Energy during a status set interval) the selection of DB is important. If DB is close to the interval of the periodically generated attributes, small changes in DB may cause large changes in the rate result. This effect is caused by the fact that for large DB more attributes are considered, while for smaller DB some attributes are not taken into consideration. This effect is decreased if DB is choosen large compared to the periodicy of the attributes.

Title: User-3: Mathematical Operations
Link: AESuite/VisualAE/Processors/User/User_Operations.htm

Amplitude Correction

VisualAE includes the amplitude correction (option VAELAC required) according to the following formula:

If distance to source of first hit channel (DST1) is smaller than 20 times the thickness of the material (d20)

Then Ac = A + DST1 * (At20/D20) //for near field distance
Else Ac = A + At20 + (DST1-D20) *(Atmax - At20) / (Dmax - D20) //far field

where

Ac:	corrected amplitude (of 1st hit) in dB
A:	measured amplitude (of 1st hit) in dB
DST1:	calculated distance of 1st hit
At20:	attenuation at distance "20 times material thickness" from source
or:	Amplitude at source minus measured amplitude at D20
D20:	20 times material thickness in location units, e.g. cm
Atmax:	Attenuation at maximum detectable distance
or:	maximum amplitude minus threshold
Dmax:	maximum detectable distance at given threshold in location units

Hint: Form more information on how to get the required values refer to **Attenuation Profiler**

Setting up the amplitude correction (options VAEUPE and VAELAC needed):

Before specifying the amplitude correction, please specify a location processor and define the location units there (cm, m, inches etc.)

1. Insert a User Processor and link it behind a location processor.
2. In menu section "Calculation", select type "Amp. correction A+f(distance)"
3. at At20 enter the attenuation (in dB) at 20 times material thickness
4. at Amax enter the amplitude at maximum distance (usually the threshold)
5. at D20 enter 20 times the material thickness in location units
6. at Dmax enter the maximum detectable distance in location units
7. in the section "Identification" click on "Default Text"

Hint: To use the amplitude correction in a graph, insert an AE-graph below the User Processor (Structure Setup), then select as vertical attribute "User defined Results" and then select the result name you have assigned in the User Processor (Ac). Complete the graph specification as usual.

Title: User-4: Amplitude Correction
Link: AESuite/VisualAE/Processors/User/User_AmplCorrect.htm

ECP Processor Overview

The new ECP (Embedded Code Processor) is a significant extension to the user processor. It allows one to specify not only input and output attributes, but also processing instructions. The instructions are coded directly within VisualAE. This code can use any of the available VisualAE attributes and can produce any number of results (like the user processor).

ECP includes a debug window and log file.

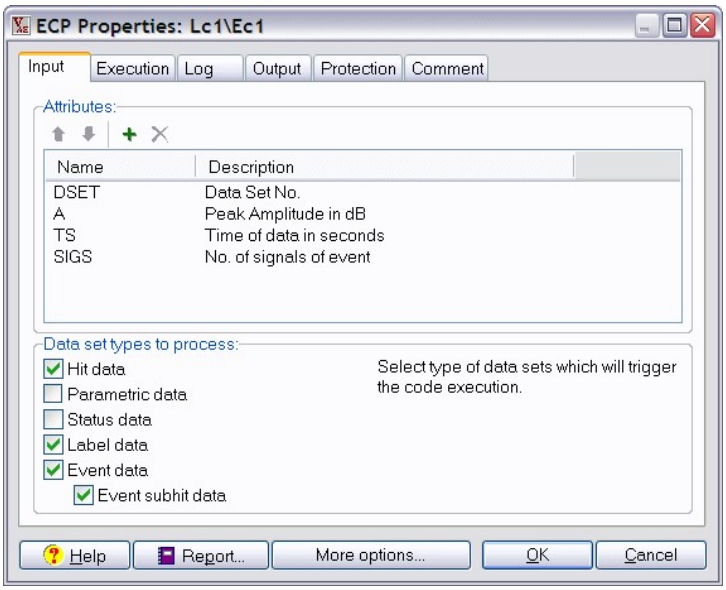
ECP provides a mechanism for protecting your source code and to licence it (allow someone else to use) without disclosing it.

To use an ECP, an ECP-option is required. See the Protection Page for a full list of restrictions based on the installed options.

Title: ECP-1: ECP Overview
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Overview.htm

ECP Input

Define input properties for the ECP here.



The input attributes list defines which attributes are available within the processor. Use the toolbar or context menu to edit the list.

In ECP code, the attributes are referenced by their name as shown in this list (A, E, ...). The list order is not important.

See ECP Language for more details.

The data set types define which events the processor should react on.

In ECP code, the data set type can be identified (when needed) using the "**SET_TYPE**" variable. For example, the code could use a label set as a marker, process hits / parametric / event in a different way...

Defined values are:

- 0 -> unknown ; invalid, should not happen
- 1 -> hit data from hit sets; available when there is no event (location) processor as parent (see 5)
- 2 -> parametric data
- 3 -> status data
- 4 -> label data
- 5 -> (located) event / data; it also contains hit data of first-hit channel
- 6 -> subsequent hits in event; it is triggered for all other hits in an event

Note: Be sure that the parent processor provides the data sets as expected. The ECP can't respond on data sets, which are not forwarded or created by the parent (e.g. event data requires parent event or location processor).

Hint: When moving a diagram from one ECP to another the following may occur: Diagrams/listings behind the ECP stay empty and you get a warning on the top of the screen, indicating that e.g. for the diagram ...\2Dxx the result is not available. Although the diagram was moved behind the new ECP it still expects data from the place where it previously was located.
Solution: just reassign the axis attributes in order to link them to the current ECP.

Hint: If an ECP uses results behind a user processor or another ECP, and you duplicate or move that ECP behind another ECP or user processor, it still (internally) expects the data from the data processing branch where it was before the move or duplication. Since these results are not available at the new branch, the ECP will not receive any input result and not pass any output result to subsequent diagrams or processors. A warning on the top of the screen will indicate that for certain diagrams or listings, result are not available.
Solution: You just need to reassign the input results. Only results available at the new branch are offered for the reassignment.

Background information

The technical reason for having the Input Attribute List is to optimize the internal communication between VisualAE code and ECP code.

Without it, there were 2 options: either pass all attributes to the ECP code or provide a function for retrieving attributes values as needed. The first alternative would consume more stack space on each call, while the second would introduce some internal overhead for function calls. Both could make the processing significantly slower.

Note: input arguments can also be accessed via an anonymous list. This is done by command select(n, ...), whereby n is the number of the input argument out of a list of input arguments (as specified in Attribute group). For the first input argument n=2, for the second n=3 and so on. This command can only be used inside of ECP_ExecuteOnDataSet tags.

VisualAE variables

In addition to attributes, the ECP code can use VisualAE variables similar to the filter processor (see here).

This is a very convenient way to define parameters for ECP in several situations:

- The user does not need to go and change the ECP code (eventually search through the code) each time he is trying a new value for a parameter.
- In case the ECP is protected and the user does not have access to the code, it is the only way to change parameters (of course, if the author of the ECP code used such variables).
- The user could use same variables/parameters for more processors (ECP and/or filters).

The VisualAE variables (as defined in the Variable Editor) are provided to ECP environment in a table with a fixed predefined name, "**VAEVariables**".

Each variable can be accessed by name (VAEVariables.Variable1) as user defined in Variable Editor or by index (VAEVariables[1]) starting with 1. When using an invalid name or index, the result value is undefined (nil).

A suggestion for ECP code writers is to use variables if available, otherwise define default values.

Example (ECP code) "by name":

<ECP_ExecuteOnReset>

--this is material dependent

Alpha1 = VAEVariables.Alpha1 or 1;

</ECP_ExecuteOnReset>

This example uses a VisualAE variable defined in the Variable Editor as "Alpha1". In ECP code the same variable is accessed by name as VAEVariables.Alpha1. The ECP statement assigns VAEVariables.Alpha1 to a ECP variable with the same name "Alpha1". Please note that these are two different variables.

The sample code above shows another feature of the language: In case there is no variable defined as "Alpha1" in the Variable Editor, then VAEVariables.Alpha1 returns nil. The statement with "or" assures that the ECP variable "Alpha1" still gets defined with 1.

Labels

In addition to variables, ECP code can also access the last label text using the predefined variable "**LABEL_TEXT**" or the field "**LastLabelText**" of variables table (**VAEVariables**):

e.g.: print(LABEL_TEXT) or print(VAEVariables.LastLabelText)

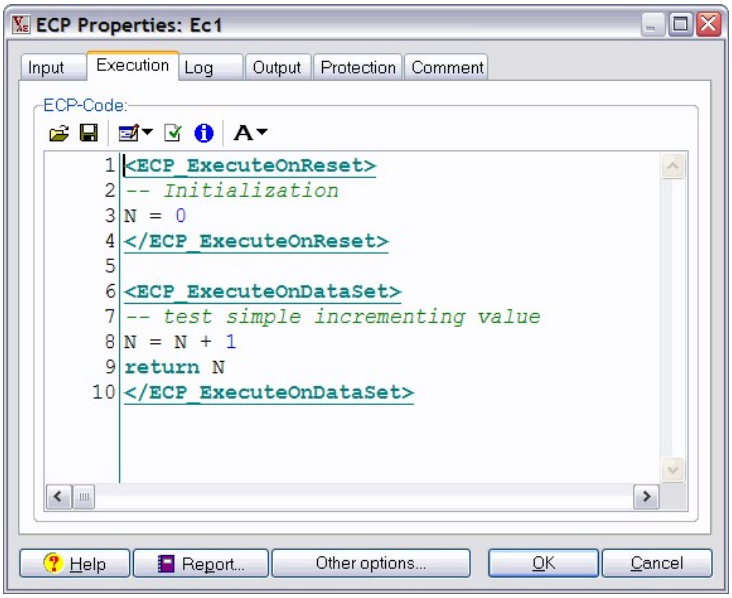
As with variables, the content is always valid (independent of the current data set type).

ECP has powerful string matching routines, so it's easy to set attributes like "test N active" for filtering / diagrams.

Title: ECP-2: ECP Input
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Input.htm

ECP Execution

Define the execution code for the ECP here.



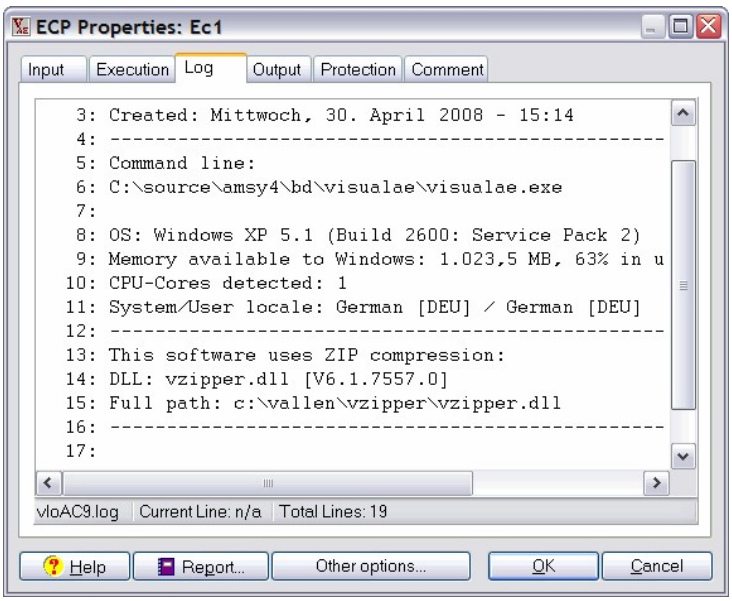
The code must follow the ECP Code Layout rules.

The toolbar provides a way to load/save the code from/to a text file (with extension ".ecp"), insert some simple test code and perform syntax check.

The code editor provides syntax highlighting (in 2 color schemes, can be turned off), line numbers and search capabilities.

Title: ECP-3: ECP Execution
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Execution.htm

ECP Log



The log page shows the user defined debug messages. The "Other options" / "Debug Log" option opens a persistent window which is available above the main window after closing the properties dialog.

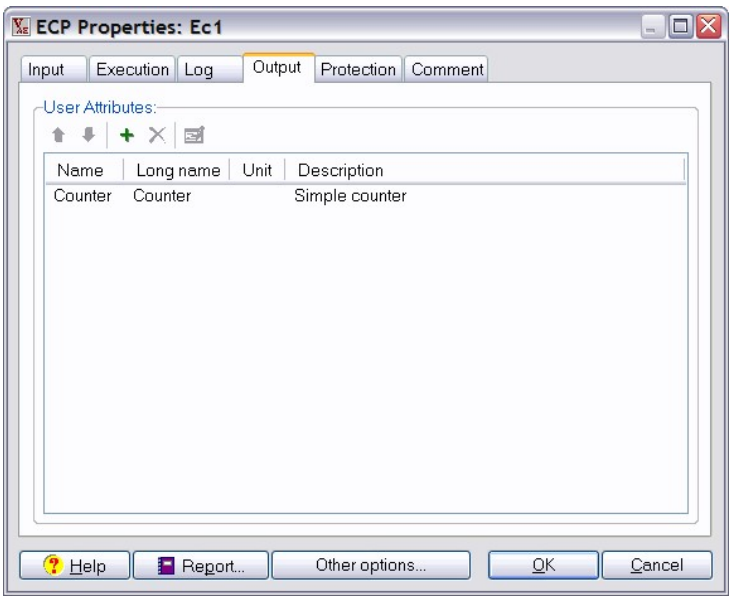
All outputs using the "print" function go to the log (debug message display). It is commended not to use log messages in the final version of any code, because it significantly slows down the execution speed.

Log messages are especially useful in combination with Single Step Mode for easier debugging.

Title: ECP-4: ECP Log
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Log.htm

ECP Output

This list is exactly the same as for the user processor. Use the toolbar to add/delete/edit/arrange the attributes.



The ECP code can return any number of results (using the syntax "return x, y, z, ...", see language reference for details).

The results are assigned to the user attributes in the output page by sequence: if the output page defines a sequence of user attributes, e.g. "aaa, bbb, …", then the statement "return xxx, yyy, …" assigns the ECP result "xxx" to the user attribute "aaa", the result "yyy" to the attribute "bbb", etc.. The ECP code returns only the value of a variable to the User Attributes listed in the output tab. Therefore the user attribute can have any name and does not need to correspond to the variable name in the ECP code. The attribute sequence can be changed by the up and down buttons.

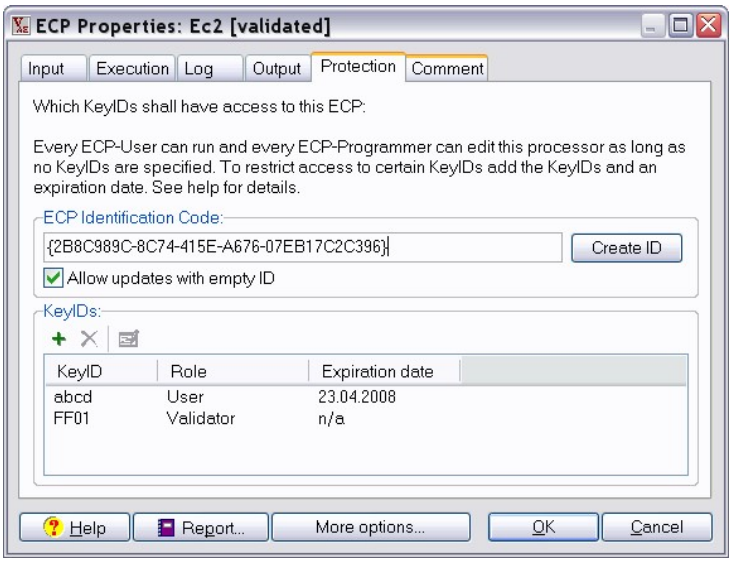
If there are more user attributes defined than results returned, no values will be available for the extra attributes.

As VisualAE only supports numeric attributes, ECP code must return numeric results only; any non-numeric result (different type, i.e. string, boolean...) is invalid. Invalid numeric results (i.e. results from division by 0) are invalid, too. As ECP language assigns the type of variables dynamically, no check can be done at the time of compilation of the ECP code (e.g. when the VAE file is loaded). Invalid results are not available for further processing (display in a diagram or else...).

Note: The total number of output attributes (summing all output attributes of all ECP and all user processors within a vae setup) is limited to 63.

Title: ECP-5: ECP Output
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Output.htm

ECP Protection



The protection page provides the interface for ECP-Validator (see below), in order to specify who will be able to Run/Use this ECP.

The ECP Identification Code is a unique string and is necessary when a protected ECP needs to be updated and (re)distributed to end users (for reasons like code updates, fixes, license updates...). Because the end users can not verify the imported code themselves, the update procedure needs this unique code to avoid mistakes (updating the wrong processor).

The "Allow updates with empty ID" option enables (if set) end users to update an ECP to this new one, even if their older ECP has no ID. This option is provided mainly as a solution for updating ECPs which were created and distributed before the new update feature (based on ECPID) being implemented. It should not be enabled for new distributions of validated ECPs.

Steps for the redistribution / update of an ECP:

- perform all necessary changes (code, license).
- ensure ECPID contains a unique value; use the "Create ID" button to automatically create one.
- use the "Export" function (available when pressing "Other options" button) and save the content with a meaningful name.
- distribute the saved file in any electronic way (CDs, eMail ...).
- the end users which need to update their protected ECP should use the "Update" function (in main window), then select the file with the update content provided by the validator.

Note: the update procedure only changes the ECP code (e.g. bug fixes, small changes) and the license list (e.g. license extension). It does not change the input / output properties.

The KeyID list contains the users (their keys) allowed to Run/Use the ECP.

If any key is added to the list, the ECP becomes protected. Only keys which are in this list can use (run) the processor (from a predefined setup file). Nobody can access the source code, except the original ECP-Validator.

VisualAE defines several roles for a user in relation to ECP:

Role	Description
No ECP Key:	Any user with a valid VisualAE installation, but no ECP related key.
ECP-User:	A user, who can run an ECP, but not modify or view the source code.
ECP-Programmer:	A user, who can create a new ECP and write code for it.
ECP-Validator:	A user, who can protect an ECP against unauthorized usage.

Each role usually includes the roles with lower access level. That means a programmer is also a user, and a validator is also a programmer.

The actions possible depending on the different keys (roles) are summarized in this table:

User/Rights	No ECP Key	ECP - User	ECP-Programmer	ECP-Validator
Open VAE w/ ECP	X	X	X	X
Delete ECP	X	X	X	X
Copy/duplicate ECP	X	X	X	X
Move ECP	X	X	X	X
Create ECP			X	X
Run validated ECP		X*	X*	X*
View validated ECP / Export Code				X**
Edit validated ECP / Import Code				X**
Run non-validated ECP		X	X	X
View non-validated ECP / Export Code		X	X	X
Edit non-validated ECP / Import Code			X	X
Validate ECP				X
The following lines indicate which dialog pages are visible to the license holder				
Input, LogFile and Output Pages		X	X	X
ECP-Execution Page, unvalidated code		X	X	X
ECP-Execution Page, validated code				X**
Protection Page, unvalidated code				X
Protection Page, validated code				X**

*) KeyID must be in Licensee List and Expiration Date valid

**) KeyID of original Validator only

Title: ECP-6: ECP Protection
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Protection.htm

ECP Code Layout

General Layout

The ECP source is in text format and divided into sections using markers similar to XML elements (it is NOT valid XML). There are simple rules to follow:

- A section starts with a marker, which is a line containing only a text like "<section>" (without quotes), where "section" is the name of the section.
- A section ends with a line containing only "</section>", with the same section name.
- Sections can not be nested.
- Sections must be closed.

If the text does not follow any of these rules, an error is produced.

There can be as many sections as wanted. However, only the sections which have a defined meaning are used (according to their definition, other sections might be defined in future). Extra sections are ignored.

All text present outside of any section is also ignored.

Definition of sections

Section: ECP_ApplicationText

This section defines a text which is displayed in a dialog when loading a setup file containing an ECP. The content has no predefined meaning, but it is displayed together with a disclaimer from Vallen. Therefore the usual usage is to write here something similar or a copyright note if the ECP is protected.

Properties sections

The ECP code can contain some sections which can be used for initializing ECP properties when loading from a file. It is a convenient way to help the user skip most of the configuration details required by a specific ECP code.

These sections are not mandatory, but then of course the user must properly configure the ECP.

Section: ECP_Input

This section contains the definition of the input attributes for the EC processor. Each line should contain one attribute (no white spaces); unknown attribute names are ignored.

It is convenient to switch off an attribute just by commenting it (therefore it won't be recognized).

<ECP_Input>

A

E

D

</ECP_Input>

Section: ECP_ProcessType

This section contains the definition of the data set types to process.

Each data set type should be specified on a standalone line (no white spaces); unknown lines are ignored. The recognized identifiers are only the ones listed here.

It is convenient to switch off a line just by commenting it (therefore it won't be recognized).

<ECP_ProcessType>

WantHit

WantPAX

;WantStatus

;WantLabel

WantEvent

;WantSubhit

</ECP_ProcessType>

Section: ECP_Output

This section contains the definition of the output attributes for the EC processor.

Example:

<ECP_Output>

Name1=Description 1

Name2=Description 2

<ECP_Output>

Based on this information, the attributes get the specified name (both short and long name) and description.

Empty lines are ignored, but nothing else should appear.

Section: ECP_Title

This section defines the title of the EC processor.

<ECP_Title>

Custom ECP

</ECP_Title>

Section: ECP_Comment

This section defines the comment of the EC processor.

<ECP_Comment>

This ECP calculates some results based on input attributes.

</ECP_Comment>

Sections containing executable code

These are the sections which contain executable code. They are called (invoked) from VisualAE according to their definition.

Each executable section is internally wrapped into a function (transparent and invisible to the user). Therefore local variables are not visible outside of that

section. Of course, variables declared local to a smaller block are only visible in that block (as defined by the language).

On code execution, the input attributes are already defined (as global variables) and they contain actual data. On reset, all those variables contain 0; this is useful for checking if all required attributes are available.

The executable code itself must follow the ECP language specification.

Section: ECP_ExecuteOnReset

This section contains the portion of code to be executed on reset of the processor. It is used for initializing variables, defining functions, checking input attributes, etc.

Functions defined in this section can be called later, in ECP_ExecuteOnDataSet.

If the code does not require any specific initializing, this section can be omitted.

Section: ECP_ExecuteOnDataSet

This section contains the code to be executed on each dataset that reaches the processor (depending on parent processors and on data set type settings).

It is the most important section, and the only one which is required. Without it, the processor has no meaning.

The code has full access to input attributes (as global variables) and to any other definitions (functions, variables) declared in ECP_ExecuteOnReset section.

Title: ECP-7: ECP Code Layout
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Code.htm

ECP Code Examples

Hint: One can quickly insert the code samples below into an ECP by clicking the "A" toolbar button within the ECP/Tab Execution (VAECPP = ECP programmer rights required).

Simple Counter

This is a very simple example:

- on reset a global variable (N) is initialized with 0

- on each processed dataset, the counter is incremented and its value is returned

```
<ECP_ExecuteOnReset>

-- Initialization

N = 0

</ECP_ExecuteOnReset>

<ECP_ExecuteOnDataSet>

-- test simple incrementing value

N = N + 1

return N

</ECP_ExecuteOnDataSet>
```

Simple Transformation

This example implements a simple transformation of amplitude from dB to uV.

It requires "A" as input, and one output attribute (the name is user defined). The reset section is not required.

```
<ECP_ExecuteOnDataSet>

-- test simple transform to uV

return 10^(A / 20)

</ECP_ExecuteOnDataSet>
```

Of course we could add extra check to see if A is available:

```
<ECP_ExecuteOnDataSet>

-- test simple transform to uV

if A then return 10^(A / 20) end

</ECP_ExecuteOnDataSet>
```

While this is safer, it is also slower. If not checked and A is not present, an error is logged and it should be quite easy to solve the problem. Either A is not added to input attributes, or the code is executed for a dataset which does not contain this value (like a parametric set).

A more elaborated way to check if a parameter is present is to verify in the reset section:

<ECP_ExecuteOnReset>

-- Check for required attributes

if not A then error("Attribute 'A' not available") end

</ECP_ExecuteOnReset>

<ECP_ExecuteOnDataSet>

-- test simple transform to uV

return 10^(A / 20)

</ECP_ExecuteOnDataSet>

This will protect and warn about a missing parameter. The other situation (a dataset which does not contain this attribute) can be avoided by properly defining which data set type to execute or testing in code as in the first example.

Grouping Example

This shows how grouping can be implemented. It gives the same result as ClMem attribute, based only on ClID input.

<ECP_ExecuteOnReset>

--create table to contain counters

clm = {}

</ECP_ExecuteOnReset>

<ECP_ExecuteOnDataSet>

-- test calculate ClMem value based on ClID

if not ClID then return end

-- if the counter was previously present, increment it; otherwise initialize with 1

if clm[ClID] then

  clm[ClID] = clm[ClID] + 1

else

  clm[ClID] = 1

end

return clm[ClID]

</ECP_ExecuteOnDataSet>

Other notes

Some VisualAE attributes have names which are not valid identifiers for variables, like **Py-A** (or user attributes with custom names). In this case, the language allows access to these values using indexing by string. For the same example, the variable could be accessed using this construct: **_G**["**Py-A**"]. Read the language reference for technical details.

Hint: An additional example (improved b-value) is available at: c:\vallen\ecp\foamglas-ib.PRIDB. Once you double-click this file you can run the ECP processor (at least VAECPU = ECP user rights required) and make use of this special evaluation tool.

Title: ECP-8: ECP Code Examples
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Code_Examples.htm

ECP Language

Each ECP-Programmer License comes with a detailed reference manual.

Contact customer support for more information.

Title: ECP-9: ECP Language
Link: AESuite/VisualAE/Processors/User/ECP/ECP_Language.htm

ECP: VisualAE Variables

VisualAE provides variables and their values to ECP Processors. Variables can be user defined in the Variable Editor. Additionally setup parameters of a location processor that is on a branch before an ECP processor can be accessed. Variable values are read only. Changing these variables in ECP processor does not have any influence on the settings in VisualAE.

Accessing variables defined in the Variable Editor

addressing by index of variable:

```
local var1  = VAEVariables.1
local var32 = VAEVariables.32
```

access by variable name:

```
local var16 = VAEVariables.Variable16
local var30 = VAEVariables.Variable30
```

VisualAE results

Date time as string

```
local date = VAEVariables.ReferenceDateTimeStr
```

Date time as a number

```
local year = VAEVariables.ReferenceDateTime.year
local mon  = VAEVariables.ReferenceDateTime.month
local day  = VAEVariables.ReferenceDateTime.day
local hour = VAEVariables.ReferenceDateTime.hour
local min  = VAEVariables.ReferenceDateTime.min
local sec  = VAEVariables.ReferenceDateTime.sec
local msec = VAEVariables.ReferenceDateTime.msec
```

Miscellaneous information

```
local bool = VAEVariables.Processing=false
local str  = VAEVariables.LastLabelText
local file = VAEVariables.DataFile
```

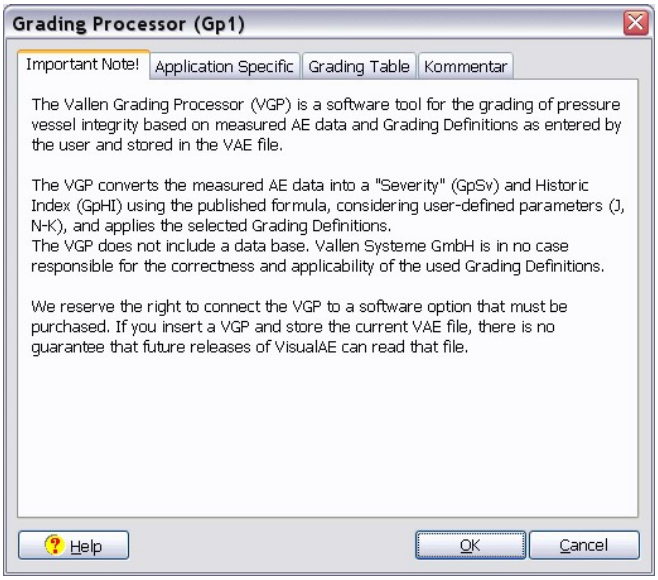
Location Processor setup parameters

```
local SoS  = VAEVariables.Lc.Velocity          -- speed of sound in units as defined in location processor setup
local rad  = VAEVariables.Lc.Group2.Radius=50   -- radius that is needed for location algorithm used in channel group 2
local aph1 = VAEVariables.Lc.Group2.Chan1.Angle -- angle from origin of position of 1 channel in case of tank floor location algorithm
local aph2 = VAEVariables.Lc.Group2.Chan2.Angle
local x1   = VAEVariables.Lc.Group1.Chan2.X     -- x coordinate of channel 2 used in channel group 1
local y1   = VAEVariables.Lc.Group1.Chan2.Y     -- y coordinate of channel 2 used in channel group 1
```

Title: ECP-10: ECP VisualAE Variables
Link: AESuite/VisualAE/Processors/User/ECP/ECP_VisualAE_Variables.htm

Grading Processor Overview

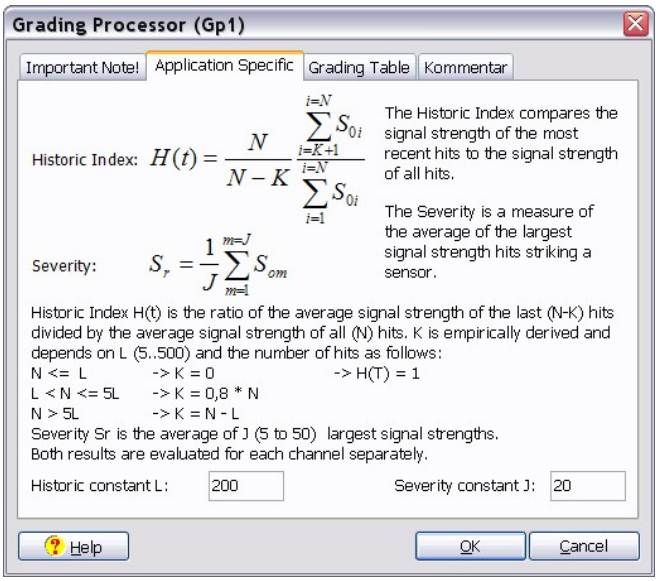
When performing AE measurements the interpretation of the acquired data is of highest interest. Therefore different approaches to standardize and automate the interpretation have been done.



For pressure vessel integrity testing (metal as well as FRP vessels) an interpretation scheme for results of AE tests has been proposed and published by T. Fowler et al..

These features are the Historic Index and the Severity Value. The Historic Index compares the signal strength of the most recent hits to the signal strength of all hits (of all channels). The Severity is a measure of the average of the largest signal strength hits striking a sensor (evaluated per channel).

The exact numeric definitions can be found on the tab Application Specific (see below) of the grading processor.



Hint: Please read the "Important Note!" on the dialog before using the grading processor!

This release of the Vallen VisualAE contains a preliminary version of the Vallen Grading Processor (VGP) that is still in development. Presently it is included in VisualAE for testing and feedback purposes. A description of the results of the Grading Processor can be found in VisualAE: Result Description.

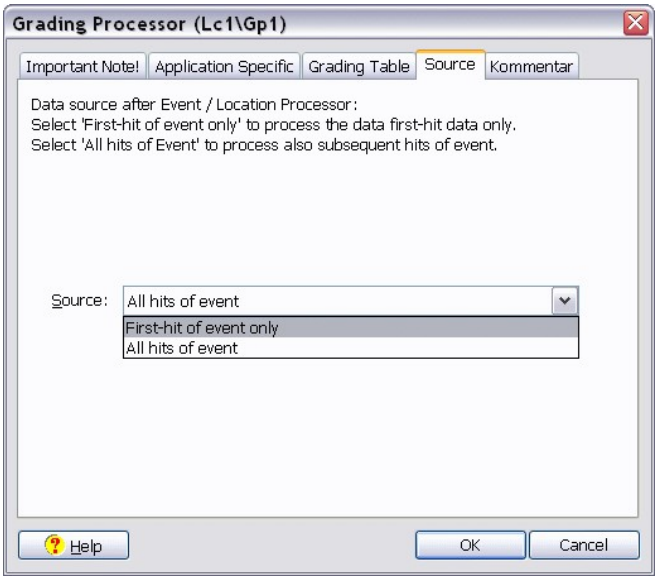
The display of the Grading Processor results in a listing follows special rules, because the value for each data set depends on other data sets as well (click here for details).

Title: Grad-1: Grading Processor Overview
Link: AESuite/VisualAE/Processors/Grading/Grading_Overview.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Processors > Grading Processor > Evaluation Source

Grading Processor Data Source: First-Hit of Event only or All Hits of Event

If the Event-Builder is applied, usually only the First-Hit of an event is passed on to represent that event. This is the default setting: First-hit of event only.



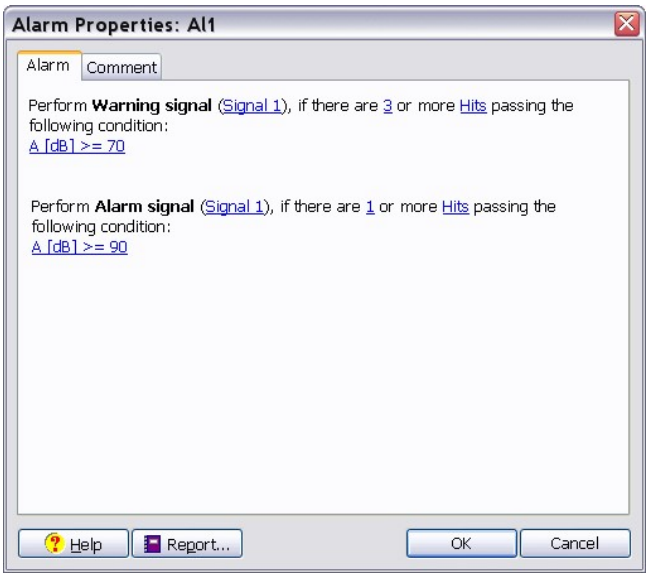
If you are interested in the other, subsequent hits of an event you can now select the option "All hits of event" on the Source tab of the Grading Processor Properties menu. When doing so all hits of located events (and only of those) will be evaluated for grading.

Title: Grad-2: Data Source for Grading
Link: AESuite/VisualAE/Processors/Grading/Grading_TabSource.htm

Alarm Processor Overview

Alarm Processors in VisualAE are part of the Alarm system. Somehow they are similar to Filter Processors as they also contain filters, one for Warning and one for Alarm. But compared to other processors the Alarm Processor has the behavior of a visual, i.e. no other processors or visuals can be connected to them.

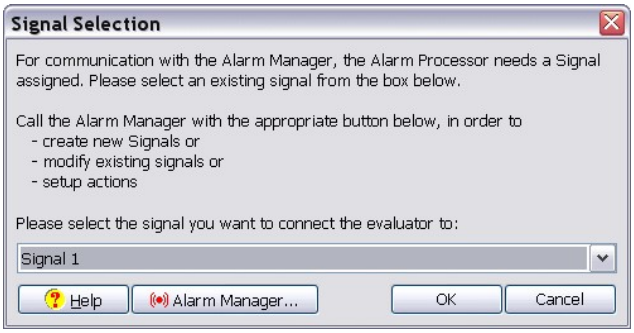
During analysis a built-in evaluator monitors the filter condition in combination with a counter. If the filter condition comes true the counter is increased. When the counter reaches the value of the user defined counter limit the evaluator signals either Warning or Alarm to the Alarm Manager and all bound actions are fired.



The Alarm Processor has two logical groups for Warning and Alarm with the following parameters

Signal

Specifies a signal defined in the Alarm Manager. The user can choose the signal using the following dialog, which pops up on when clicking on the signal within the text. To edit the signal (add, remove or edit attached actions) or create a new signal the user can press the "Alarm Manager" button.



Counter

A simple counter over the condition. It specifies that the condition should be satisfied that number of times before signaling the alarm (or the warning).

Condition

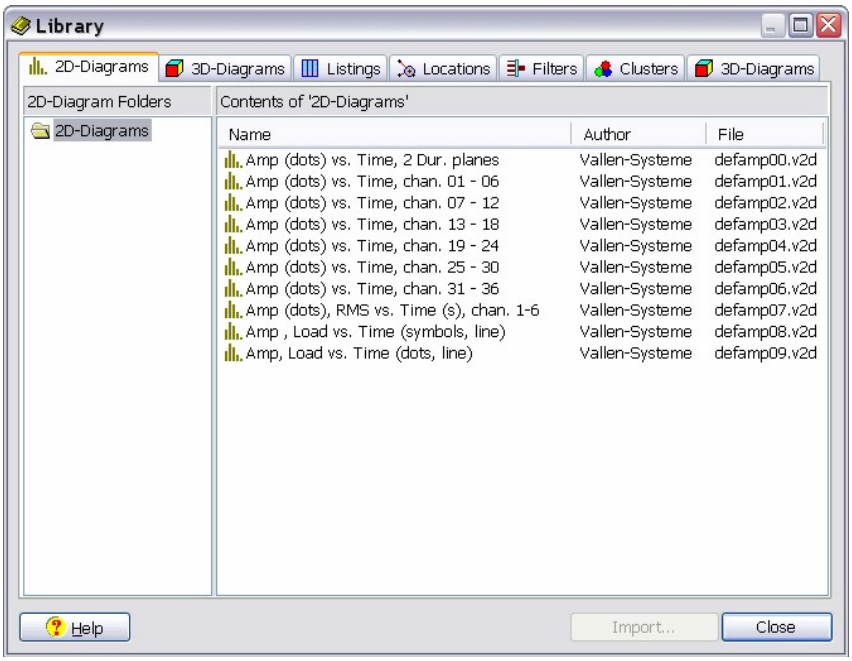
The condition to monitor. It is the same kind of condition that can be used with a filter processor.

When an alarm processor is created or reset, it registers within the Alarm Manager as an evaluator bound to the specified signal. The Alarm Manager application is always started if it is not running and shows up in the taskbar as a red alarm symbol. At any time you can double click on this symbol to open the Alarm Manager.

Title: Alarm-1: Alarm Processor Overview
Link: AESuite/VisualAE/Visuals/Alarm/Alarm_alproc.htm

Library Overview

The library is a container for diagrams, listings and processors which are ready to use. **VisualAE™** is delivered with a selection of the most frequently used graphs available in the library.



Graphs and processors can be added, changed or deleted from the library. Thereby the library can be adapted to the specific needs of the user.

The library allows one to use a diagram or location in different VisualAE™ projects.

Importing Diagrams, Listings

Importing Locations, Filters

Each type of elements (2D-Diagrams, 3D-Diagrams, Listings, Locations, Filters) is presented on a separate tab. This tab is similar to the Windows Explorer: Clicking on the directory (left side) displays a context menu concerning the folders in that directory. Selecting an element (right side) and clicking the "Edit" button calls a dialog window concerning the element.

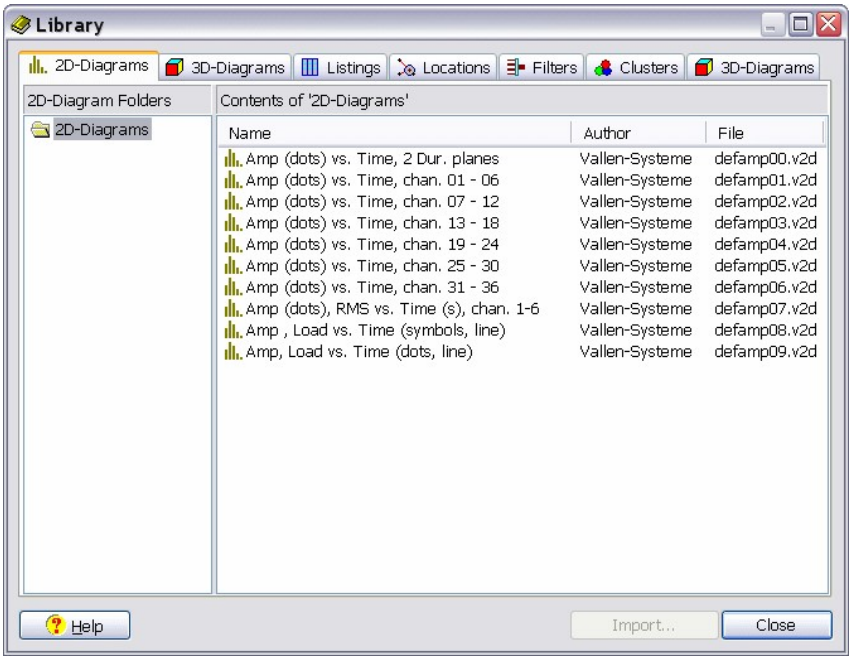
A right mouse click on an element of the library calls a context menu.

Title: Library-1: Overview

Link: AESuite/VisualAE/Library/Library_Overview.htm

Import of Diagrams and Listings

In order to import a diagram/listing from the library into the current **VisualAE™** project select "Insert / Library Import" from the menu. Select the tab containing the elements which type you want to import.



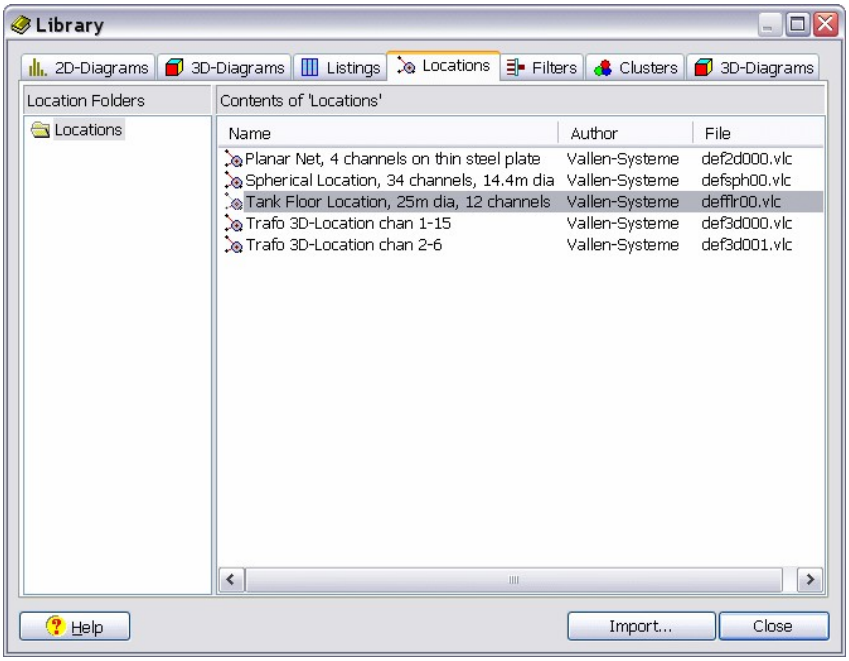
The list contains the descriptive names and authors of the diagrams/listings which are stored in the library. Select by either mouse or keyboard.

The "Edit" button allows one to modify name and author of the diagram/listing. The "Delete" button removes the graph from the library. The "Import" button places the selected diagram on the currently active page of your **VisualAE** project. During the process of adding the diagram/listing you will be asked where in the structure it shall be located.

Title: Library-2: Import Diagrams/Listings
Link: AESuite/VisualAE/Library/Library_Visuals.htm

Import of Processors

In order to import a location or filter from the library into the current **VisualAE** project select "Insert \ Library Import" from the menu. Select the tab containing the elements which type you want to import.



The list contains the descriptive names and authors of the locations/filters which are in the library. Select by either mouse or keyboard.

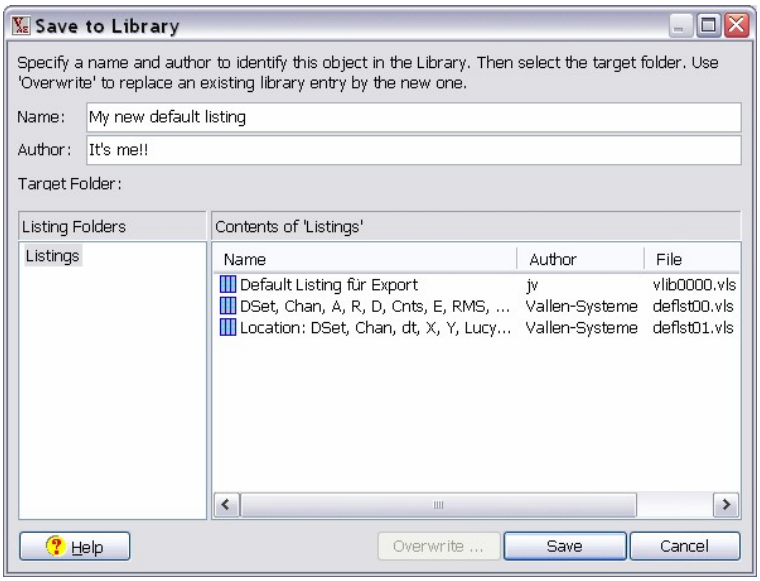
The "Edit" button allows to modify name and author of the location/filter. The "Delete" button removes it from the library. The "Import" button places the selected location/filter at the bottom of the Data Processing Structure of the current **VisualAE** project. Then you can move it (via drag and drop) to its proper final place in the structure.

Title: Library-3: Import Processors
Link: AESuite/VisualAE/Library/Library_Processors.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Library > Export to Library

Export to Library

To add an element to the library: Go to the Data Processing Structure, select the object which shall be added to the library and click on the "Properties" button (or click the right mouse button on the object and select the "Properties" menu). Then click on the "Export" button and the dialog below appears:



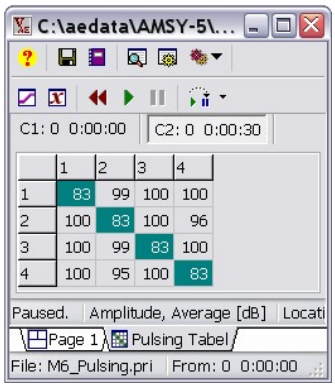
Enter descriptive name and author, select the appropriate subfolder, and click on "Save as New" if the object shall be added to the library. If you want to replace an object: select the object (in right window) and click on "Overwrite...".

Title: Library-4: Export to
Link: AESuite/VisualAE/Library/Library_SaveTo.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Pulsing Table > Overview

Pulsing Table Overview

The Pulsing Table is a helpful tool for checking variations in sensor coupling and for measuring the speed of sound. It uses data generated by performing a pulsing run.



A right mouse click on the Pulsing Table opens a context menu where different types of results can be selected.

The data recorded while one channel is pulsing is displayed in one line. The pulsing channel has a green background. E.g. in the example above: in line 4 channel 4 was pulsing and channels 1-3 were receiving these pulses.

If several pulsing runs have been performed, each of them will appear on a separate tab (2 in the above example: C1 to C2).

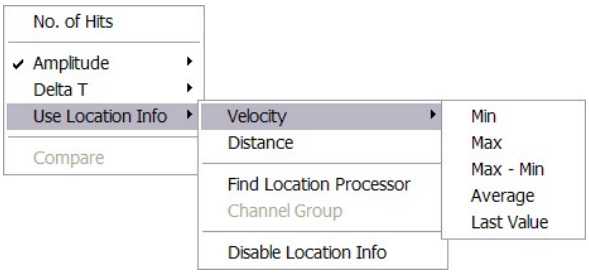
To create a report of the pulsing table click the purple notepad icon in the toolbar.

Title: CalTable-1: Pulsing Table Overview
Link: AESuite/VisualAE/Tools/CalTable/CalTable_Overview.htm

Pulsing Table Context Menu

Two modes are available: one is not using any location information, the other additionally uses that information (if available).

The result selected for display is checked. The meaning of the entries is explained below:



No. of Hits

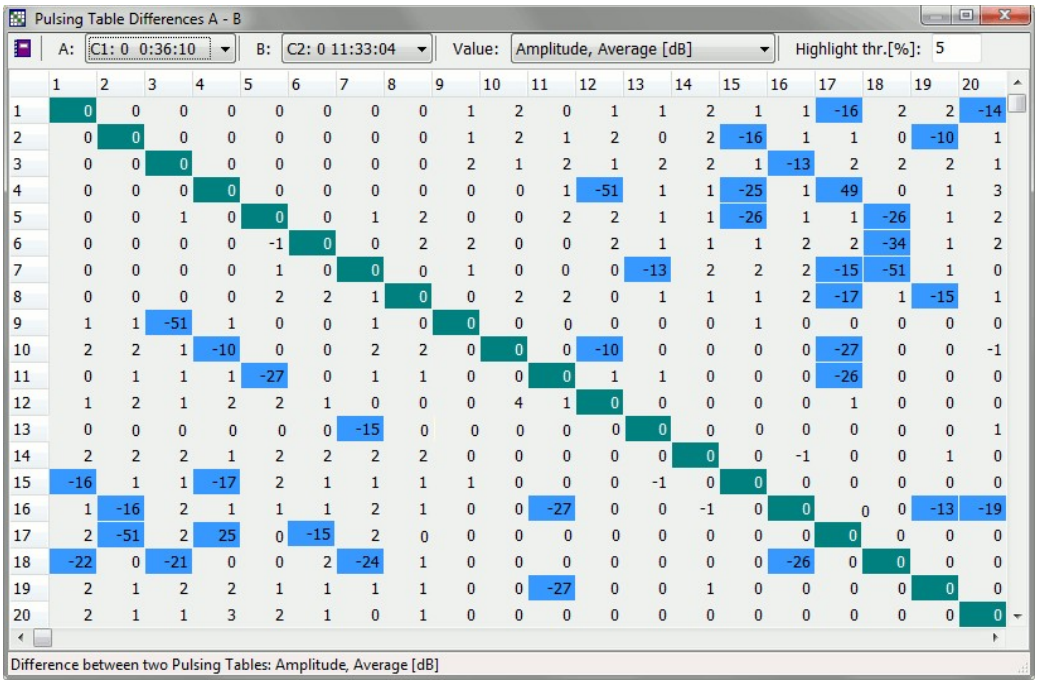
No. of hits that have been received.

Amplitude, Delta T

Either one of Min (=Minimum), Max (=Maximum), Max-Min (Difference of Max minus Min), Average and Last Value can be selected.

Compare

Allows one to subtract one Pulsing Table from another and displays the results.



Any two Pulsing Tables can be selected for comparison (=subtraction). Any available result can be selected, e.g. amplitude, propagation time or speed. Cells are colored when a subtraction result exceeds a user specified deviation. Threshold for color coding is set as percentage. A cell is colored if ratio of first table (A) compared to second table (B) exceeds the set percentage. Threshold setting can be done via "Highlight thr.[%]" input field.

Use Location Info

To use Location Information, the appropriate Location Processor has to be selected. If it contains several Channel Groups, one of them has to be specified as well.

Velocity

Select one of the result types

Min: Minimum, Max: Maximum, Max-Min: Difference of Max and Min, Average, Last Value

Distance

Distances calculated from the entered sensor positions.

Find Location Processor

Click here to get a list of the Location Processors available.

Channel Group

Provides a list of the existing channel groups (if there are several) to select one of them.

Disable Location Info

Changes the mode of the Pulsing Table: turns off the use of the Location Information.

Title: CalTable-2: Context Menu of Pulsing Table
Link: AESuite/VisualAE/Tools/CalTable/CalTable_ContextMenu.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Step-by-Step > Listing > Overview

Listing Overview

A listing is a powerful tool for displaying the numerical values of the measured data. It can be placed on the **VisualAE** pages like, for instance, a diagram.

ID	DSET	HHMMSS	MSEC	CHAN	A	R	E	D
		[hhmmss]	[ms.µs]		[dB]	[µs]	[eu]	[µs]
Ht	5979	13:55:18	254,5182	2	50,6	0,2	71E00	0,4
Ht	5980	13:55:18	256,6564	3	52,5	7,6	29E01	28,4
Ht	5981	13:55:18	256,7206	1	52,5	7,2	24E01	28,8
Ht	5982	13:55:18	257,0340	2	55,4	16,8	10E02	230,8
Ht	5983	13:55:18	260,4652	3	52,5	8,8	30E01	52,8
Ht	5985	13:55:18	267,6124	2	55,1	7,2	88E01	132,0
Ht	5986	13:55:18	268,8786	4	61,1	14,0	16E02	72,0
Ht	5987	13:55:18	270,3798	2	53,9	15,4	42E01	98,8
Ht	5988	13:55:18	270,4362	3	51,6	0,2	23E01	13,0
Ht	5989	13:55:18	271,4758	4	51,2	3,2	15E01	4,2
Ht	5990	13:55:18	271,5438	1	51,2	3,8	31E01	41,0
Ht	5992	13:55:18	278,8376	4	57,6	23,4	19E02	235,4

The columns and results being displayed can be adjusted to the users requirements. The first column (ID) is always present; it is not a standard result, but a short identifier showing the type of the current dataset. Possible values are described in lines tab.

The listing offers a context menu called by clicking the right mouse button on the listing:

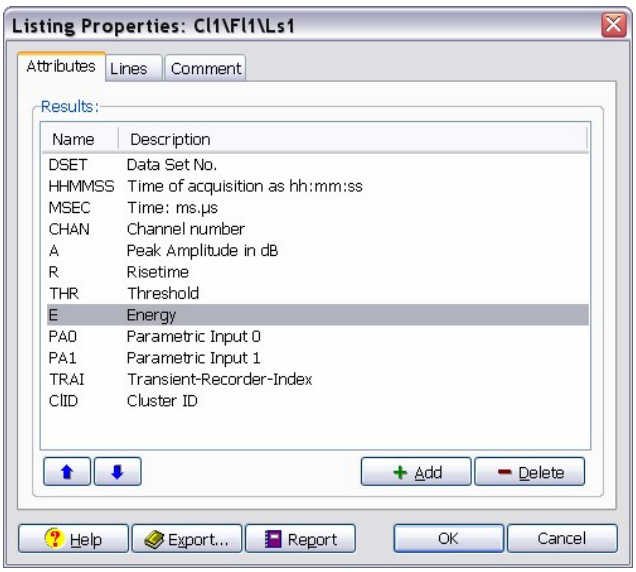
- Zoom: to make the listing full screen size (or reduce it to its original size).
- Copy: allows one to export the listing as bitmap, as text to a file (the latter needs option VAE2), to printer or to clipboard; there is also a simple function to copy the current line to the clipboard.
- Properties: to define the listings properties.
- Go to...: select either a label or a data set number to go to.
- Position: needs option VAE2, allows one for rearranging the Visuals on the current screen.
- Remove: remove the listing from the current setup.

Hint: For text (ASCII) export of listing data of a PRIDB file use **Copy** and **...as text to file** out of the context menu of the listing. See also command **Copy** above.

Title: Listing-1: Overview
Link: AESuite/VisualAE/Visuals/Listing/List_Overview.htm

Attribute Setup: Selecting results to be shown

The Attribute Setup is available via "Properties" in the context menu of a listing.



This dialog defines which results are to be displayed in the listing. Use the **Add** and **Delete** buttons to modify the results shown. The sequence of the result columns can be adjusted by the up/down arrows and by drag & drop.

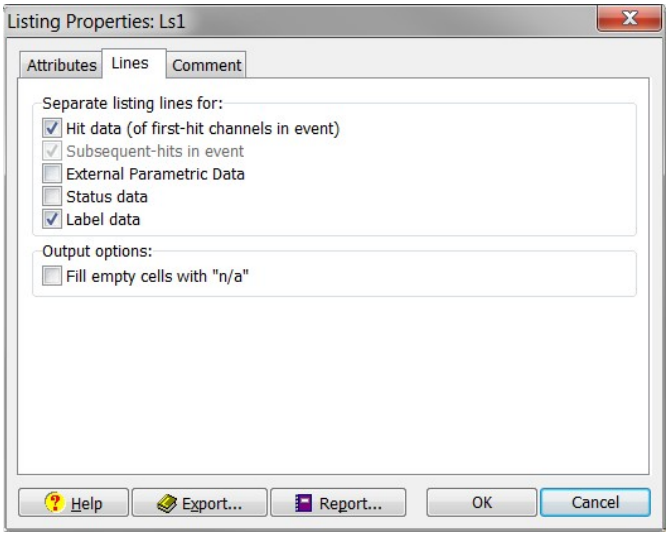
In the listing, each selected result occupies one column in the listing output. The width of the column (in characters) depends on the type of the result itself, which is pre-defined.

Note: In case a statistical result shows only "- - -" please see also Fast Processing Mode in the next chapter.

Title: Listing-2: Attributes
Link: AESuite/VisualAE/Visuals/Listing/List_Attributes.htm

Selecting Listing Lines to be shown

On this tab the type of lines to be displayed can be selected; at runtime, the type is shown in the first column, listing ID.



Separate listing lines for

The Acquisition software produces different data set types. In this section it is specified which data sets are displayed in the listing

First-hits

When the box is checked, only the First-Hits of an event will be shown. If the listing is placed behind a location processor, these lines are indicated by "Ev". If used without location calculation, these lines have a "Ht" (Hit) at the beginning.

If location calculation for an event was successfully performed, it will be indicated "LE" (located event).

Hint: If not using an event builder (e.g. in a location processor), this box enables to display hit data. If you deselect this box and have no other box selected, you will get only the labels displayed.

Subsequent-hits in event

If enabled the subsequent hits of an event are shown. This checkbox is available only if the listing is placed behind a location or event processor. Subsequent hits are indicated by "Ht" at the beginning of each line.

For background information about first- and subsequent-hits please see chapter Event Building Principles.

External Parametric data

If enabled parametric data (from the parametric inputs PAx) is shown. Parametric lines have the "Pa" indicator at the beginning of each line.

Status data

If enabled status data is shown. Status data lines do have the "St" indicator at the beginning of each line.

Label data

If enabled label data is shown. Label data lines do have the "La" indicator at the beginning of each line.

Output options

Fill empty cells with "n/a"

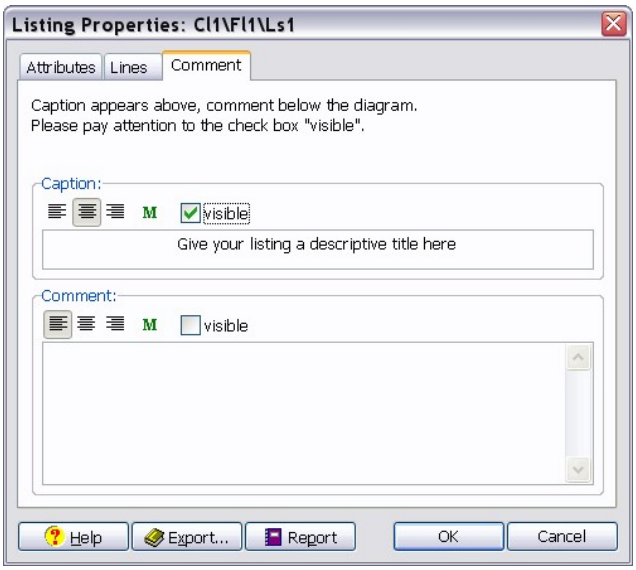
When checked, empty cells (resulting from not available attributes) are filled with "n/a" text.

This option can be used for easier exporting to a spreadsheet.

Title: Listing-3: Lines
Link: AESuite/VisualAE/Visuals/Listing/List_Lines.htm

Listing Comment

Specify a caption and comment for the current listing. The caption appears above the listing as large bold text. The comment appears below the listing in smaller plain text.



Caption/comment visible

When selected, this specifies that the caption/comment will appear on the computer display monitor. It is useful to leave this option off to make the most use of the available monitor resolution.

Caption/comment text entry block

The text for the caption/comment is entered in this space.

Text alignment

Icons above the text entry blocks are for left justified/centered/right justified text. The text will be aligned according to which of these three icons is selected. The three icons, left to right, are left-justified (text aligned with the left margin), centered, and right justified (text aligned with the right margin). The defaults are centered for the caption and left-justified for the comment.

Hint: A number of macros exist for automatic legend and caption generation.

Title: Listing-4: Comment
Link: AESuite/VisualAE/Visuals/Listing/List_Comment.htm

Navigating through Listing Data

There are very comfortable possibilities to navigate a listing:

- Use the scrollbars which are displayed after clicking on the listing.
- When the listing has the input focus one line is highlighted with a yellow bar. This bar can be moved up and down line by line using the <Up> and <Down> keys. Using <Page-Up> or <Page-Down> to scroll a full page.
- Keeping <Ctrl> pressed together with the navigating keys keeps the yellow bar fixed at the same line but moves the entire listing up or down. You can then easily come back to the line where the bar has been fixed.
- <Pos1> jumps to the beginning of the listing. <End> jumps to the end of the listing.
- <Space> (or double click) selects the line which is currently marked yellow and turns it to blue. If there are other diagrams at the same processing branch like the listing, the corresponding points will be marked by a blue information window.
- You can move the listing in horizontal direction letter by letter by using the left/right keys. Pressing <Ctrl+Left> or <Ctrl+Right> causes a horizontal move of around 5 letters.
- If you have a wheel mouse you can also use the wheel to scroll through the listing. Holding <Ctrl> while scrolling with the wheel keeps the yellow line fixed while scrolling. Holding <Shift> down while scrolling with wheel scrolls a page and moves the yellow line.

Note: The listing must have input focus to navigate through it using keys. Click with the mouse on the listing or use <Tab> to move the input focus onto the listing. The listing shows vertical and horizontal scrollbars (if the content exceeds the displayed area) when it has got the input focus.

Title: Listing-5: Navigating
Link: AESuite/VisualAE/Visuals/Listing/List_Navigation.htm

Attenuation Profiler Overview

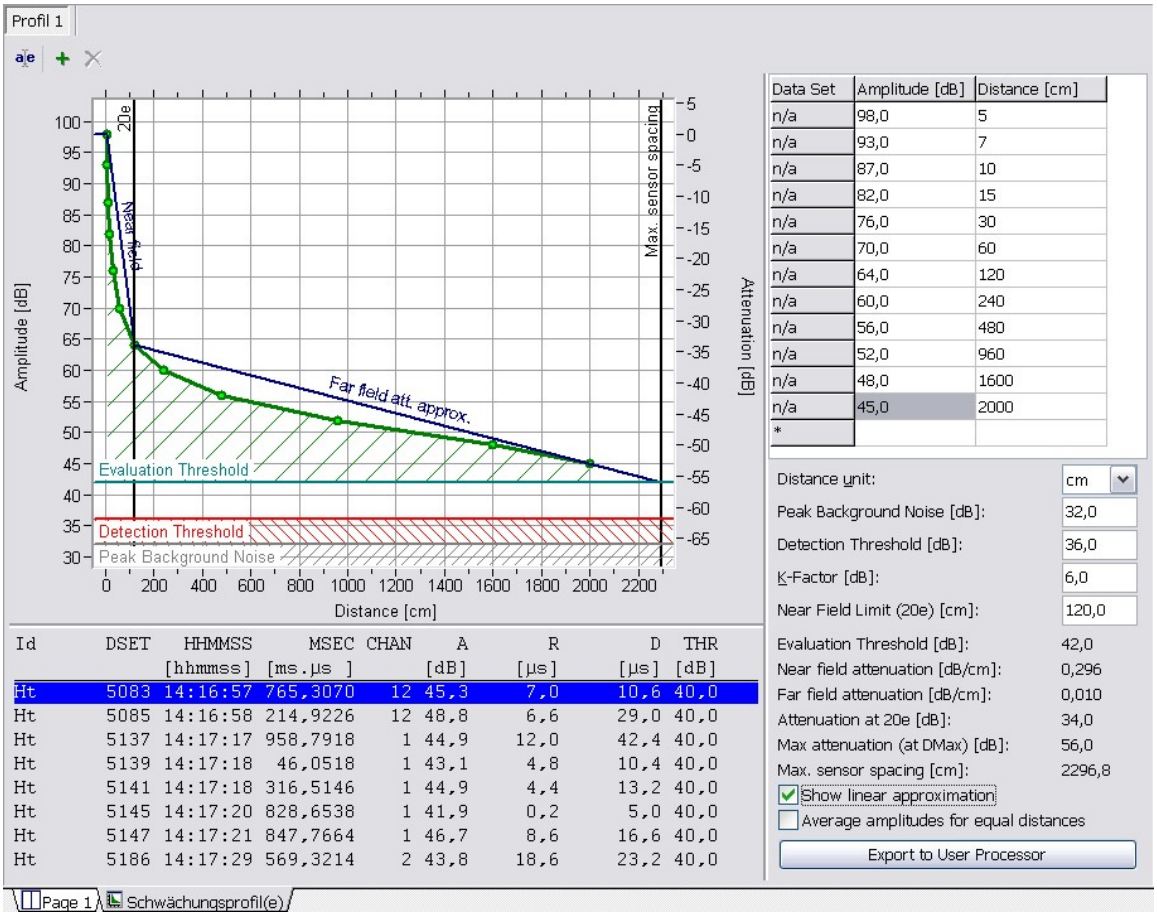
Purpose

- Visualize the attenuation profile
- Visualizes the **different thresholds** (EN14584) within the attenuation profile
- Determine maximum sensor spacing (EN14584)
- Determine parameters for **amplitude correction** (EN14584)

Overview

The Attenuation Profiler is a tool for the visualization of a sensor's distance dependent peak amplitude response to a series of artificial sources, such as the Hsu-Nielsen source.

The Attenuation Profiler can be used in VisualAE from the Analysis menu.



The screen is divided into three segments:

a. The Attenuation Diagram (top left)

b. The Amplitude Distance Table (on the right)

c. A listing (on the bottom left)

Attenuation profiles can easily be produced, displayed, hard copied, saved (on AnalysisFileName.VAP) and recalled. Multiple profiles can be created, e.g. one per channel.

Usage

1. When creating a new profile, this is initialized with an empty amplitude-distance table.
2. Fill in the table by manually entering amplitude and distance values, or by double click on a line which amplitude should be copied into the table. See "Attenuation Profile Listing"
3. Enter the distance values for each amplitude. See "Amplitude Distance Table".
4. Fill in the appropriate threshold values below the "Attenuation Table Grid". See "EN14584 Thresholds"
5. Determine the maximum allowable sensor spacing. See "Maximum allowable sensor spacing" under EN14584 Thresholds.
6. Determine the parameters for the amplitude correction. See "Amplitude Correction".

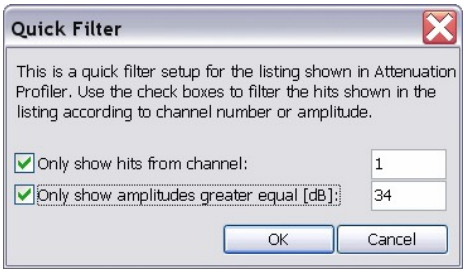
Hint: When printing this page (e.g. for a report), the table below the diagram is usually not required. By clicking on the Reset icon this table is cleared. When empty the table is **NOT** printed and the diagram is enlarged to cover the space released.

Title: AttuProf-1: Attenuation Profiler Overview
Link: AESuite/VisualAE/Tools/AttuProf/AttuProf_Overview.htm

Attenuation Profiler Components

Attenuation Profile Listing

During or after an analysis run, the listing in the Attenuation Profile shows hit data as usual. A double click on a certain hit adds the amplitude of that hit to the Amplitude-Distance Table on the top right.



The listing is similar to any other listing in VisualAE. It is pre-defined and cannot be modified. It always treats the data directly from the PRIDB file and cannot be placed behind a processor. It includes a simple filter processor to show data of only a certain channel and above a certain amplitude, if the user desires so. The filter parameters are available from the context menu (right mouse click into the listing). They are saved on the Profile-File (*.VAP). Changes in the filter settings need a re-run of the analysis.

Amplitude-Distance Table

The Amplitude-Distance table consists of three columns:

Dataset

The data set of the hit added by a double click on a listing line. If a value is added manually to the grid then the data set number is not defined and shows "n/a".

Amplitude

The amplitude measured (or entered) at a certain distance from the source. Be sure to immediately note the distance when creating the hits or to enter a label during data acquisition.

Distance

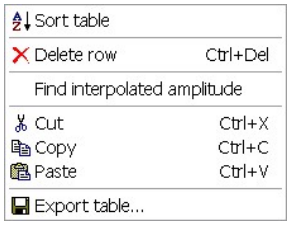
The source-to-sensor distance in a user definable unit. If a new table entry is created and no Distance is provided then this value shows "n/a" for "undefined".

Data Set	Amplitude [dB]	Distance [cm]
n/a	98,0	5
n/a	93,0	7
n/a	87,0	10
n/a	82,0	15
n/a	76,0	30
n/a	70,0	60
n/a	64,0	120
n/a	60,0	240
n/a	56,0	480
n/a	52,0	960
n/a	48,0	1600
n/a	45,0	2000
*		

Table entries can easily be added by filling in values in the last row (the one that shows an asterisk (*)) or by a double click on a certain hit in the listing.

Table context menu

Right click on the grids to open the context menu for additional functionality.



Sort table

Use Sort table out of the context menu to re-sort the rows according to distance. Useful if values have been added manually.

Delete row

Delete Row deletes the selected row.

Find interpolated amplitude

Find interpolated amplitude is available only if there is a distance given but the field for the amplitude is empty. This item allows the user to add new points (by distance) and calculate the amplitude on the near field or far field approximation lines (when they are available), even outside of the current distance range. This is useful for example when trying to approximate the amplitude at 2 cm, where it might not be possible to make a pencil break. Note that all calculated parameters are re-evaluated using the new point, and different values can result (especially when the new point is among the furthest points).

Note: This function is available only, if check box **Show Linear Approximation** is checked (see below) and the amplitude field is empty.

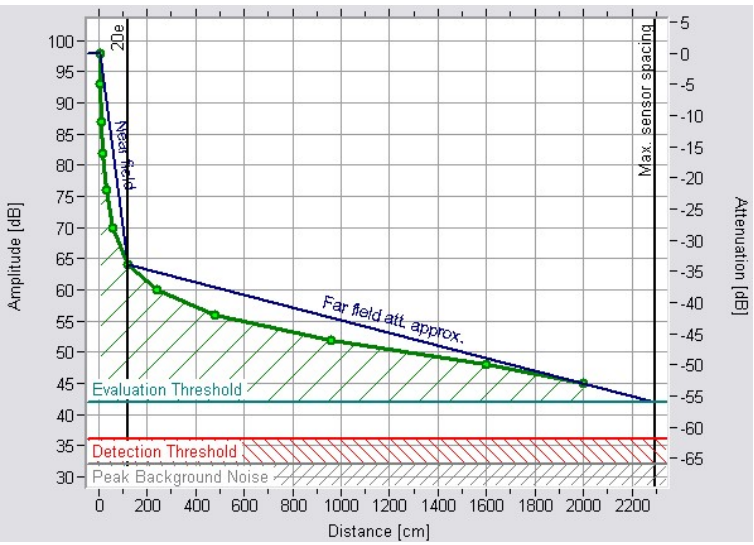
Export table

This exports the table to file. The Amplitude-Distance table is saved to a text file in standard ASCII format. The columns are separated by <Tab> characters.

Attenuation Diagram

This diagram shows the attenuation curve according to the currently defined amplitude-distance table.

Each table entry is shown as a green circle. The circles are connected with a green line for better viewing.

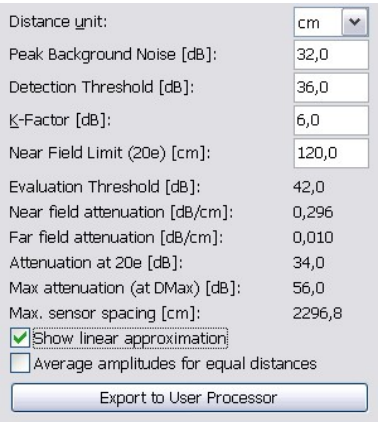


On the right top of the diagram, one can select one of the stored profiles, or add a profile via the context menu (right mouse click).

From the bottom of the diagram upwards, there are shown the Peak Background Noise (in grey), the Detection Threshold (in red), and the Evaluation Threshold (in blue). See **prEN14584 Thresholds** for their definitions.

prEN14584 Thresholds

This section describes also the values to be entered or shown below the Amplitude-Distance table from top:



Distance Unit

Select the desired distance unit (mm, cm, m, in, ft)

Peak Background Noise

The maximum peak amplitude during a 10 minute verification measurement prior a test. For this measurement a threshold setting below the normal Detection Threshold must be used in order to get false hits. See prEN14584 7.2.3

Detection Threshold

The threshold setting of the instrument during the test. If the AE signal crosses the Detection Threshold, a hit-quantification process is initiated (or prolonged) by the AE-channel. The Detection Threshold shall usually be set 6dB above the Peak Background Noise, in order to avoid false hits, even when the background noise increases a little during pressurization.

K-Factor

This factor shall be obtained from the relevant product standard and given in the written AE test procedure. It is usually a value between 6 and 18 dB.

Near Field Limit 20e

20 times the material thickness.

Evaluation Threshold:

Acquisition Threshold + K (in dB).

Near field attenuation

Attenuation for the near field (in dB/unit).

Far field attenuation

Attenuation for the far field (in dB/unit).

Attenuation at 20e [dB]

The amplitude of the Hsu Nielsen Source at 20mm distance minus the amplitude at distance 20e.

Max attenuation (at DMax)

Shows the attenuation at the calculated distance DMax.

Maximum allowed sensor spacing (Dmax)

The distance where the attenuation curve crosses the Evaluation Threshold. Calculated by the Attenuation Profiler according to the entered values.

Checkbox: Show Linear Approximation

Check this box to see the linear approximations according to EN 14584 used to calculate the corrected amplitude by the user processor in VisualAE. The attenuation curve is approximated by two straight lines representing the near and far field attenuation. The transition between both is defined by the value 20e. So the near field attenuation is the line from the amplitude at distance 20mm to the amplitude at distance 20e. The far field approximation is the line from the amplitude at distance 20e to the intersection of the attenuation curve with the evaluation threshold. These approximation lines are shown in blue.

Checkbox: Amplitude Averaging for equal Distances

This checkbox is useful if there are several hits in the list with different amplitudes but at the same distance. If checked then the average amplitude is used of all hits with equal distance (instead of just connecting hits with equal distance from highest to lowest amplitude by a line).

Title: AttuProf-2: Components of Attenuation Profiler
Link: AESuite/VisualAE/Tools/AttuProf/AttuProf_Setup.htm

Amplitude Correction

The attenuation profile supports the determination of the parameters for the source amplitude correction in VisualAE, according to the European Standard prEN 14584.

Amplitude correction according to prEN14584:

(for far-field, means at a distance greater than 20* plate thickness):

Ac = Am + A20e + alpha*d

Ac	corrected amplitude
Am	measured amplitude
20e	20 times the plate thickness
A20e	measured attenuation between 20mm and 20e distance
D	distance from AE source to sensor minus 20e (in m)
Alpha	attenuation coefficient between 20e and maximum detection distance (in dB/m)

Automatic Amplitude Correction

For the automatic amplitude correction by the user processor in VisualAE, the distance from the source to the first-hit sensor of a located event (DST1) is calculated. Since Greek characters are not always available on all PCs, different abbreviations, compared to prEN14584 had to be used:

For Near Field attenuation (DST1 < E20):

Ac = A + DST1 * (At20/E20)

For Far Field attenuation (DST1 >= E20):

Ac = A + At20 + (DST1-D20) *(Atmax - At20) / (Dmax - D20)

Definitions

Ac	corrected amplitude (of 1st hit) in dB_{AE}
A	measured amplitude (of 1st hit) in dB_{AE} (Am in prEN14584)
DST1	calculated source-to-sensor distance of 1st hit (d in prEN14584)
20e	20 times the material thickness in location units, e.g. cm
At20	attenuation at distance e20 is the difference between the amplitude of a Hsu Nielsen Source (HNS) in 20mm distance and the amplitude at distance E20, in dB
Atmax	Attenuation at maximum detectable distance, the same as "amplitude in 20 mm distance (dB_{AE}) minus threshold (dB_{AE})" in dB
Dmax	maximum detectable distance at given acquisition threshold in location units

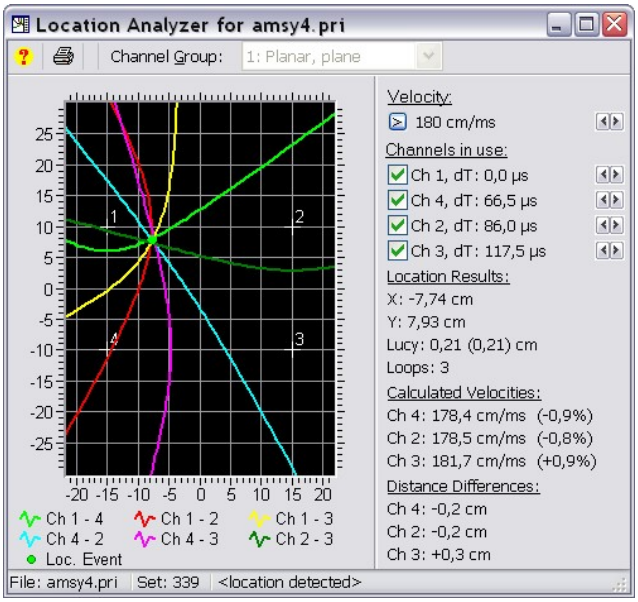
The relevant parameters for the amplitude correction are numerically and graphically shown on the screen according to the user-entered values.

Hint: For more information on how to setup a user processor for automatic amplitude correction see UserProcessor: Amplitude Correction**.**

Title: AttuProf-3: Amplitude Correction
Link: AESuite/VisualAE/Tools/AttuProf/AttuProf_AmpCorr.htm

Location Analyzer: Evaluating the Accuracy of Location Calculation

When locating AE-sources the "Location Analyzer" is a very helpful tool to assess the accuracy of the location results. The graph below shows the hyperbolae for a planar location using 4 sensors (indicated by the numbers). The intersection of the hyperbolae is taken as location result.



In order to use the Location Analyzer a location processor with attached graph or listing showing located events is required. Clicking on a located event (in either a graph or a listing) displays the event together with the appropriate hyperbolae in the Location Analyzer.

Channel Group

Selects one channel group, if more than one defined.

Velocity

Velocity of sound, can be modified by clicking the arrow left from the number. Can be increased or decreased by clicking the arrows at the right.

Channels in use

Defines which channels are used for the location calculation of the selected event. Allows one to exclude channels from location calculation.

dT

specifies the arrival time differences to the first hit channel. The dTs can be modified in order to optimize location results (this may help to take different effects - e.g. like detecting different wave modes - into account).

Location Results

Display of the numerical location results, LUCY, and the number of iteration loops (The number of loops **cannot** be used to estimate location accuracy or to compare location algorithms. This value is for maintenance purposes only). The number in parenthesis is a standard deviation and results from the arrival time differences of a fictive signal emitted from the assumed source position and the measured arrival time differences. While there is only a valid LUCY in cases when more sensors than absolutely necessary contribute to the location, the standard deviation will always have a valid value.

Calculated Velocities (XX cm/ms):

"Velocity: 180 cm/ms", shown on top of the legend, defines the Used Velocity, the speed of sound the software uses for location calculation and for determining the time of source.

The "Calculated Velocities" and "Distance Differences", also shown in the legend, help the customer interpret the uncertainty of the source position. These values are based on the time of flight (TOF) between assumed source location and sensor. The TOF is the difference between Time of Source (TOS) and Arrival Time (AT). The AT is measured by the channel, the TOS results from first hit AT minus (first hit sensor-source distance divided by Used Velocity). "Calculated Velocity" means "source-to-sensor distance divided by TOF". "Distance Difference" means "source-to-sensor distance minus TOF x Used Velocity". A positive Distance Difference indicates that the shown result is too far away from the sensor, or, the hit was triggered by a wave mode faster than Used Velocity, or, the wave reached the sensor over a shorter path, e.g. through a liquid in the structure.

These calculated velocity values being quite similar is an indication for an accurate result. If they are quite different it's a hint that the result may be not plausible. The percentage given in brackets is calculated with respect to the Used Velocity given above. The "calculated velocity" can not be determined for the first-hit channel.

Note: The location analyzer is implemented for the planar/cylindrical, tank bottom, and Multi-Triplet location algorithms.

Title: Loc-17-M: Location Analyzer
Link: AESuite/VisualAE/Processors/Location/Loc_LocAnalyzer.htm

Macro Overview

Definition

Macros are a set of predefined mnemonic names which are used as place holders within legend and description texts. These place holders are automatically replaced when the legend is shown on a diagram or report.

Syntax

=[name] "name" stands for a specific macro.
A variety of macros exist to ease the use of standard descriptions in legends for diagrams and comments on diagrams and data processors.

The text displayed is updated on reset or during data analysis if required.

General macros

These macros can be used wherever a descriptive text can be entered.

=[Date]	Displays the date using the format given by the windows short date format. e.g.: 21.5.00
=[LongDate]	Displays the date using the format given by the windows long date format. e.g. Friday, 21. May 2000
=[Time]	Displays the time in hours and minutes. e.g.: 14:55
=[LongTime]	Displays the time in hours, minutes and seconds. e.g.: 14:55:11

Hint: To change the appearance of the macros texts, change the settings in the country specific systems settings of Windows.

Diagram legend macros

These macros can be used in legends and comments to describe the usage of a diagram axis.

For user processors these texts can be edited by the user. All preset attributes have also preset descriptions.

=[X-Attr]	Mnemonic name of result assigned to x-axis.
=[X-AttrLong]	Long name of result assigned to x-axis. e.g.: sum(Energy)
=[X-AttrLongUnit]	Long name and unit of result assigned to x-axis. e.g.: sum(Energy) [eu]
=[X-AttrUnit]	Unit of result assigned to x-axis. e.g.: [eu]
=[X-AttrDesc]	Description string of result assigned to x-axis. e.g.: Sum of Energy [eu]

Note: The same type of macros exist for y-axis, right y-axis in 2D-diagrams, and z-axis in 3D-Diagrams. The respective macros are named: =[Y-Attr],... , =[YR-Attr],..., =[Z-Attr], ...

=[Data]	only available for planes, shows number of processed data and is updated online.
=[BinWidth]	displays the currently used Bin Width, very useful if the Bin Width is automatically extended by the software.
=[Filter]	The filter definitions for a plane of a diagram will be displayed

Hint: Macros are not case sensitive.

Polygon Macro

=[ID]	only available within a Polygon Processor, displays the group of the selected polygon and its polygon-ID

Location Processor Macros

=[lcVelocity]	Gives current velocity out of Location Processor. A Location Processor must be within the analysis chain ahead of this visual.

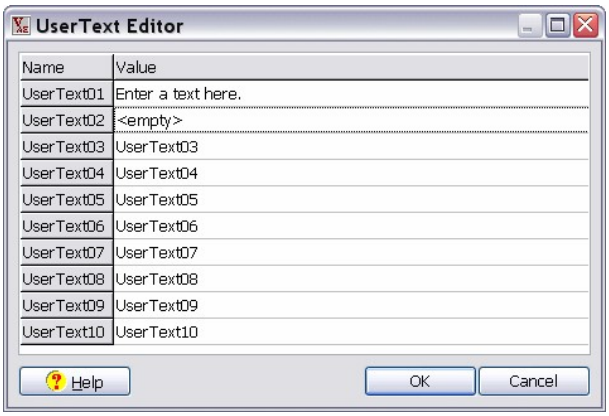
Other Macros

=[AcqTitle]	Gives the acquisition title as entered in acquisition parameters
=[Filename]	Gives the current filename without path
=[Filename /P]	Gives the current filename including path
=[FileNameSetup]	Gives the current setup filename without path
=[FileNameSetup/P]	Gives the current setup filename including path

Title: Macro-1: Macro Overview
Link: AESuite/VisualAE/Macro/macro_overview.htm

UserText Macros

There is a list of 10 global macros which the user defines. These can be used as Macros at any place where global texts are required. The texts are entered in the UserText Editor out of menu Edit.



Syntax:

=[UserText01]

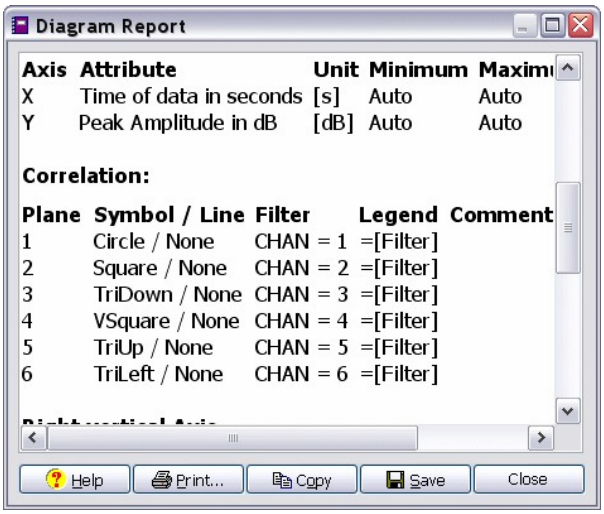
..

=[UserText10]

Title: Macro-2: UserText Macros
Link: AESuite/VisualAE/Macro/macro_usertext.htm

Report Overview

VisualAE™ can automatically create reports of all used settings. Thereby it's very easy to keep track of your analysis projects. Every important property is recorded and can be saved as ASCII- or RTF-file, copied to the clipboard or printed out.



Reports are available for the following objects:

- AE-2D-Diagram,
- AE-3D-Diagram,
- Listings,
- Filter Processor,
- Location Processor,
- Cluster Processor,
- Polygon Processor,
- Calibration Table,
- Neighborhood Table,
- Distance Table
- and also for the complete VisualAE project including all settings.

Description of controls

Print

Calls the Printer Page Settings.

Copy

Copies the report to the clipboard in RTF- and ASCII-format. If the target software is RTF-compatible (e.g. WinWord) the report will be inserted in RTF-format. If not (e.g. Notepad) it will be inserted in ASCII-format

Save

Allows one to save the current report in RTF- or ASCII-format.

Close

Closes the dialog and exits

When clicking on the report button a dialog shows up asking for the width of the report. The size you enter will be the actual width of the report. This is to make the report fit your page size.

Title: Reports-1: Overview
Link: AESuite/Report/report_Report.htm

Reports: Query Report Destination

Print Report

A report is generated for printout. The **Printer Page Settings** will be opened next that displays a Preview and defines the page settings. Select this option if you want to print the report now.

Export...

A report is generated to be saved in Text (ASCII) or RTF-Format for later import into another program. Especially for wide tables the program must know where to place column breaks. Therefore a special **Report Page Settings** dialog is opened next to specify the page width.

Title: Reports-2: Destination
Link: AESuite/Report/report_ReportQuery.htm

Reports: Page Settings

Define the maximum page width here for the report to be created.

If the report contains wide tables which exceed the specified page width then the tables are wrapped and continued below. This is useful if you want to export wide tables in to MS-Word.

If you want to export tables into programs like Excel you might not want the tables to wrap. Then please specify an accordingly big value for the page width.

Title: Reports-3: Page Settings
Link: AESuite/Report/report_ReportPageSize.htm

Result Description: Which Results are Available in VisualAE

An AMSY system offers various results which are either directly measured, such as Arrival-time, Peak amplitude, Parametric Input, etc., or calculated, such as location results, delta-t, or signal slope. In addition, there are logical results (flags) that indicate special situations, such as multi-peak, hit-time-out, etc.

The term "hit" refers to an AE signal caused by an acoustic emission event received by an independent channel and resulting in a threshold crossing. Several channels can receive hits from one and the same acoustic emission event. Those hits are collected to an event data set by the analysis software.

1. Hit Data
2. Hit-Flags
3. Other Results
4. Parametric Data

5. Location Results
6. Grading Results
7. TR-Feature Results (Feature Extraction Results)
8. VisualClass Classifier Results
9. User Processor Results
10. Hit Cascading

Hit Data

Hit data is generated by each AE channel independently, and describe usually one or a series of discrete AE-signals with a clear beginning and end. The beginning of a hit is defined by its first threshold crossing, the end, by the absence of threshold crossings for a user-defined period of time, (the Duration Discrimination Time). A hit cascade is a series of discrete hits. The end of a hit-cascade is defined by the absence of threshold crossings for the selected Rearm Time.

Hit data sets contain the following information:

HITS: Hits

This returns the value 1 for each hit data set, to be used in cumulative- or rate plots.

Visuals placed behind a location processor usually use only first hits of events. In case another hit parameter is used as axis attribute the user can select if only first hits of events or all sub hits of an event shall be used for plotting the diagram. Separate counters per channel are used, if one axis is assigned to CHAN.

CHAN: Channel Number

This is the logical number of the channel that has produced the data set.

TS: Arrival Time

This is the absolute time of the first threshold crossing of a hit. It is measured and stored by each channel indivi¬dually in steps of 100ns (can be set to 50ns or 25ns resolution with ASIP-2/A). It is used to identify a hit (in com¬bination with the channel number) and to calculate the event's source location (in combi¬nation with the arri¬val times of other hits).

In listings, the arrival time appears in long format "dd hh:mm:ss xxx.xxxx" whereby

• dd = day 0,1,2…n (optional)

• hh = hour

• mm = minute

• ss = second

• xxx.xxxx= ms, with a resolution of 0.1µs.

For graphs, the arrival time can be selected as TS (time in seconds) or as TH (time in hours).

TS and TH start at zero with the time of the start criterion of analysis. The absolute time belonging to that zero-point is shown in long format in the legend of the graph.

For longtime tests that go over the end of a month, the day is not reset to 1; instead, it is incremented each day until the test ends. This ensures that the internal time is always incremental.

A: Burst Signal Peak Amplitude

This is defined as the peak amplitude of a hit. The peak amplitude (A) is given in dB above 1µV refer¬ring to the preamplifier input (0dB = 1µV, 20dB = 10µV, 40dB = 100µV, etc.). Maximum is 99.9dB (98.9mVPK) at 34dB preamplifier gain. The peak amplitude is extracted from a stream of 16 bit samples (resolution of 3µV at ±100mV range) and then converted to and stored as an 8 bit value with a resolution of 0.3763dB (20 * log(2) / 16) and an offset of 9.9dB. The software takes the chosen preamplifier gain into account when displaying amplitude results.

ALIN: Burst Signal Linear Peak Amplitude

Peak Amplitude in µV. (Derived from the Peak Amplitude in dB)

THR: Threshold

The first crossing of the threshold level is the start of a hit. The end of the hit is reached when the input voltage does not cross the threshold for a specified period of time (called the duration discrimination time). The threshold is a dB-value of same range and resolution as the peak amplitude.

In case of a floating threshold, the threshold can vary during a test. Because of this, the threshold is not only a parameter but also a result.

E: Burst Signal Energy

By definition according to EN 1330-9, energy is the integral of the squared AE-signal over time. The ASIP-2 calculates burst signal energy from voltage samples. Insofar burst signal energy is the sum of all squared voltage samples of a hit multiplied by the sampling interval. Its unit is eu. 1 eu corresponds to 10-**14**V^2s. By definition the resistance is 10k**Ω** which is used to scale the units V^2s to Joule. Using this reference resistance 1eu corresponds to 1aJ (10-**18**J).

SS: Burst Signal Strength

Signal strength is the integral of the rectified AE-signal over time. The ASIP-2 calculates burst signal strength from voltage samples. Insofar burst signal

strength is the sum of all rectified voltage samples of a hit multiplied by the sampling interval. The unit of Signal Strength is nVs (10-**9** Vs). Signal Strength result is referred to the preamplifier input.

R: Burst Signal Rise-time

The Risetime is the time between the first threshold crossing and the first peak detected in a hit.

The resolution is 200ns if R < 800µs else 0.025% of the value. Maximum value supported by the internal representation is 50s, limited to the value of the duration.

D: Burst Signal Duration

The Duration is the time between the first and last threshold crossing of a hit.

The resolution is 200ns if D < 800µs else 0.025% of the value. Maximum value in the internal representation is 50s. Duration of a hit is limited to about 100ms by the time-out feature of the AMSY-6.

CNTS: Ring down counts

Counts are the number of positive threshold crossings of a hit. Range is limited to the maximum of 65535 (per hit).

CCNT: Cascaded Counts

Cascaded Counts are the sum of all ring down counts of hits belonging to the same hit cascade. Range is 1 to 65535 (per hit-cascade).

RMS: Background Noise

The RMS Background noise is the root-mean square value of the noise on each channel during pauses of threshold crossings. It is derived from the energy measurement. If no hits arrive, the energy is accumulated in time slices of 13ms. The energy rate per 13ms time interval is fed over a variable digital low-pass filter to achieve the user-selected time constant.

The RMS is presented in µV related to the sensor output (preamplifier input). The software takes the selected gain into account.

The result “RMS”, included in the hit data set, is a measure of the noise before the hit. The result “RMSS” is part of the status set (see below).

CENY: Cascaded Energy

The Cascaded Energy is the sum of the energies of the first-hit and all subsequent hits in a hit-cascade.

CSS: Cascaded Signal Strength

The Cascaded Signal Strength is the sum of the Signal Strength of the first-hit and all subsequent hits in a hit-cascade.

CHITS: Cascaded Hits

Cascaded hits are the total number of hits in a hit-cascade.

TRAI: Transient Recorder Index

The Transient Recorder Index is a unique number that identifies the transient recorder data belonging to a hit. A TRAI will be generated only if transient recording is triggered due to a threshold crossing. Hits that have no transient data associated to them do not have a TRAI. A filter condition of TRAI > 0 rejects all hits without transient data.

noTRAI: no Transient Recorder Index

noTRAI is a flag set to 1 if a hit has no transient data. It is set to 0 if a hit has transient data associated to it. A filter condition noTRAI = 0 rejects all hits with transient data.

Hit Data Flags

Hit Data Flags are used to indicate special conditions during a hit. These can be shown in a listing and they can be used as filter criteria.

0 means false, 1 means true. The following flags are provided:

TOAB: Time-out aborted Signal

This indicates a very long hit or hit-cascade (>100ms) which has been terminated by a time-out process. In the case of suddenly increasing noise (caused by a leakage for example), the hit evaluation is termina¬ted by a time-out function to keep the time sorting proc¬ess running.

In the listing, this flag is indicated by a "T".

ATOA: After Timeout Signal

This indicates an artificially started hit after hit time-out (see above). Arrival time, risetime and duration of this hit are not meaningful. Meaningful are the results Cascaded Counts, Cascaded Energy, Amplitude. This hit is not suitable for location calculation and therefore automatically ignored by a location processor.

In the listing, this flag is indicated by an "A".

EXTC: Extended Cascading

This indicates a temporary "long-rearm mode" which prevents buffer overflow, because the PC was not able to read out data fast enough.

In the listing, this flag is indicated by an "E".

DTOS: DDT too short

This indicates a temporary "long duration discrimination mode": At the user-defined DDT, the detected hit rate is too fast to be processed.

In the listing, this flag is indicated by a "D".

ROVL: Rearming Overlap

This indicates that at least one hit has been detected during rearming. It has the same meaning as "CHIT > 1".

Hardware rearming means waiting for a pause of threshold crossings for a user-defined period of time (the rearm time) before the channel is enabled to trigger a new evaluation of a hit-cascade.

In the listing, this flag is indicated by an "R".

CAL: Coupling Pulse

(Formerly called Calibration pulse) This indicates a signal that has been generated by the test pulse through feature of the AMSY-6; which is to be used for the determination of the velocity of sound and for the confirmation of proper sensor coupling.

The flag is set in the signal data set of the emitting channel. When the software finds that flag set, it sets the flag internally for all hits gener¬ated within the ”hit tracking time”, a user controlled parameter.

The filter operation "CAL =1" allows only the trans¬mitted and received test pulses to pass the filter. The filter condition "CAL =0" excludes such signals from an analysis process. Note: To eliminate test pulse data from a plot, you can also use a label filter.

CAL1: Coupling Pulse (sent)

CAL1 indicates hit data sets generated by the test pulse in the sending channel.

CAL1 is shown in the listing as upper case "C".

CAL2: Coupling Pulse (received)

CAL2 indicates a hit with a delta-t to the previous CAL1-flagged hit of less than the hit tracking time set in VisualAE/Edit/Project Settings/other.

CAL2 is shown in the listing by a lower-case "c".

SATR: Saturation of Measurement Chain

SATR indicates when the amplitude of a hit exceeds 95% of the input range (5Vp). If hit amplitude exceeds 95% of the input range this is also indicated by a yellow flashing THR LED at the ASIP-2 front panel.

If saturation occurred for a hit, this is indicated by a “S” flag in the listing.

Status Data

Each channel generates status data sets in a time driven manner according to the user-defined status interval. Status data sets are also generated every time the transient recorder of a channel is triggered externally. Status data sets contain mainly the following results:

CHAN: Channel Number

The number of the channel that has produced the status data set.

RMSS: Background noise

This has the same meaning as RMS in hit data. It characterizes the background noise.

ENYS: Energy between two status data sets

The total energy rate including hits and background noise during the time period between two status data sets.

SSS: Signal Strength between two status data sets

The total signal strength rate including hits and background noise during the time period between two status data sets.

Parametric Data

Parametric inputs are measured in the time interval defined by Parametric Clock (0.2…10ms). The latest measurement is stored in a parametric data set, before the next hit data set. When hits arrive in shorter time distance than Parametric Clock, only one parametric data set is stored. When no hits arrive, parametric data sets are written at user-defined Parametric Interval (10 ms…600 s). Parametric results can be used to analyze AE data versus parametric information, e.g. load, pressure, temperature, etc., in correla¬tion and distribution plots. Parametric data can be plotted independently from AE data in history plots.

PA0...PA*: Parametric Analog Inputs

At ±10V input range all analog inputs in a range of -10240mV to +10235mV are digitized with 0,315mV resolution, in the menu-selected time interval: range 200µs to 10ms.

Each measurement of these inputs is addressed by "PAx" whereby "x" identifies the channel number. The peak to peak noise of the internal ADC is 2mV maximum.

The selected input range (±10V or ±1V) is automatically taken into account.

PA0U...PA*U: Parametric Analog Inputs in user units

In addition to PA*, PA*U can be defined in any linear converted engineering unit, such as N, bar, etc.

Measured units of mV can be converted into other engineering units by use of a linear transformation. Parameters for transformation are an offset- and factor value. Offset and factor can be entered in the parametric conversion dialog (Edit/Parametric Conversion). The offset in mV is subtracted from measured value (in mV) and result is multiplied by a factor in user units per mV.

PCTA: Analog-Controlled Counter

A 64bit signed counter, which is incremented when the voltage at PA0 crosses a user-defined trigger level in a certain direction.

A tunable hysteresis band avoids triggering by noise.

PCTE: Extended PCTA

Same as PCTA, kept for compatibility reasons

PCTD: Dig. Controlled Counter

This identifies an additional 16-bit-counter. PCTD is incremented by the leading and the trailing edges of an external clock pulse, if enabled by an external enable input. This counter can be cleared by an external re¬set input (TTL-inputs, externals connector). If PCTD is to be used PCTA (but not PCTE) can be used simultaneously.

CYSL: Cycle Slope Flag

This indicates the direction of the voltage change of the analog input that is selected as the PCTA-counter-input, normally measuring a cyclic load.

This flag can be used as a filter criterion to sepa¬rate AE measured during increasing load, from AE measured during decreasing load.

Zero means a negative change.

One means a positive change.

If there is no change, the flag remains in its previous state.

Note: If noise is added to the input signal, this noise may influence the CYSL flag, too.

PULS: pulsing sequence flag

A flag set to 1 during a pulsing sequence. It is set to 0 after finish of pulsing sequence. It can be used to filter all hits and parametric data that occurred during a pulsing sequence. Please note that PULS flag is set approximately 500ms before pulsing sequence starts and reset to 0 approximately 500ms after pulsing sequence finished.

Location Results

A location processor generates location results. The setup is independent from the data acquisition and can be changed at any time during or after data acquisition. The program always uses the most recent version of that setup. The setup is stored on the .vae file.

EV: Events

This identifies a counter in the analysis program that counts the number of events detected by the channels of the selected location processor. All hits coming from a common acoustic source are collected and only the first-hit of an event increments that counter.

Selecting EV makes only sense in distributions or cumulative histories. In correlations, the value "1" would be shown for each event.

SIGS: Signals of Event

number of valid hits in an event data set. SIGS is limited by the maximum hits in an event data set.

1.CH…7.CH: Channel Sequence

This means the sequence number of a hit.

Example: An event hits first channel 2 then 4 and then 3. Then:

1.CH would be 2,

2.CH would be 4,

3.CH would be 3.

DT12...17: Time Difference

Each of these results reflects the time distance be¬tween the first-hit and the nth hit of an event (mainly provided for filtering). For listing use DT1X.

DT1X: Time Difference

This is the time difference between the first-hit of an event and the subsequent-hit currently being processed. It is mainly used in listings.

X: X-Location

This is the location result in the X direction.

For cylinders the valid range of X is (-0.5...+0.5) * circumference.

In case of a spherical location algorithm, X corresponds to the projection of the radius vector onto the x-axis.

In case of a dished head location algorithm, X corresponds to the orthographic- or azimuthal equidistant projection, whichever was selected.

Y: Y-Location

This is the location result in the Y direction.

For cylinders Y refers to the direction along the symmetry axis.

In case of spherical location algorithm, Y corresponds to the projection of the radius vector onto the y-axis.

In case of a dished head location algorithm, X corresponds to the orthographic- or azimuthal equidistant projection, whichever was selected.

Z: Z-Location

This is the location result in Z direction. Z is calculated by the 3D- and spherical location algorithm.

For spherical results, Z corresponds to the projection of the radius vector onto the z-axis.

LONG: Longitude (0 to 360°)

This means the degree longitude of a sphere. LONG is available for spherical location and in case of location results on a dished head

LATI: Latitude (-90° to +90°)

This means the degree latitude of a sphere. LATI is available for spherical location and in case of location results on a dished head. 0 means equator, +90 means North Pole (top of sphere), -90 means South Pole (bottom of sphere).

Note: in case of a dished head LATI refers to the geodesic latitude.

GX

Global x-coordinate. Global coordinates should be used when plotting location results in 3D. In case of spherical location results GX is identical to X.

GY

Global y-coordinate. Global coordinates should be used when plotting location results in 3D. In case of spherical location results GY is identical to Y.

GZ

Global z-coordinate. Global coordinates should be used when plotting location results in 3D. In case of spherical location results GZ is identical to Z.

LUCY: Location Uncertainty

LUCY represents the location uncertainty of an event in selected location units.

The calculation of LUCY requires that more channels have been hit than needed for the location calculation. For example: 3 hits are needed to calculate a planar location. 4 hits would be needed to calculate the location uncertainty for a planar location.

As a filter criterion, LUCY can separate location results by its uncertainty and show only the more trustworthy locations.

CGRP: Channel Group Number

Number of the channel group of the location processor. Using this in a plane filter of a location diagram lets one easily see which location set in a channel group has led to which result.

RANK: Location Ranking

This result gives a ranking of multiple location results per event in a location group that lets one easily select the result with the lowest LUCY (location uncertainty).

Grading Results

GpSv

Severity; value describing the hits with highest amplitudes

GpHI

Historic Index; describing the relation of the most recent hits to all previous hits

GpRs

Grading Result (in development)

GpMHI

Maximum historic index

GpCt

Number of hits used for calculation.

Administrative Results

LABL: Label Number

This means the number of a text label inserted into the data stream either automatically by the system or by the operator. It can be used for filtering and as start and termination criterion for the analysis process.

DSET: Data Set

This means a sequential number assigned to each data set in the primary data file at the time of the data analysis. For example, DSET can be used in a plot to find out the data set no. of a particular data range for using it as a start and/or termination criterion of the analysis process.

TR-Feature Extractor Results

These results are extracted from transient recorder data by the Feature Extractor Utility (part of VisualTR), stored on the Feature File and read by the analysis program (e.g. VisualAE).

FCOG: Center of Gravity of Frequency Spectrum

This gives the frequency in kHz at which the spectrum has its center of gravity.

FMXA: Frequency at max. Amplitude of Spectrum

This gives the frequency in kHz at which the spectrum shows the maximum amplitude.

PA

Peak Amplitude of a transient that has been recorded to a transient date page

RT

Rise time of a transient that has been recorded to a transient data page. Rise time is the time from first threshold crossing to time of peak amplitude.

Dur

Duration of a transient that has been recorded to a transient data page

CTP

Counts to peak, meaning number of positive threshold crossings from first threshold crossing to peak amplitude based on a transient that has been recorded to a transient data page.

FI

Initiation frequency calculated as counts to peak divided by risetime.

FR

Reverberation frequency calculated as ring down counts divided by ring down time, whereby ring down counts is simply CNTS-CTP and ring down time is Dur-RT.

Tx_FFT.CoG

Frequency of center of gravity (similar to FCOG) of xh time segment

Tx_FFT.FoM

Frequency of maximum FFT amplitude (similar to FMXA) of xth time segment

Tx_Avg

RMS/AVG FFT amplitudes of time segment x

Tx_SRY

Spectral ratio of FFT amplitudes of time segment x and frequency band Y.

Classifier Results

Class: Class number (Result Class in VisualClass report file)

The number refers to a prototype file or cluster in feature space. Each prototype file or cluster is assigned a unique class number. In the report file, the name of the prototype class is referenced to each signal.

DST1: Distance Ratio (DST-Ratio in VisualClass report file)

The distance ratio for each data set is the normalized distance from the center of all prototype data sets to each specific data set. The normalization constant is the furthest distance of all prototypes to the center. This choice of normalization means that the worst fit of the prototype data has a Distance ratio of 1.

Distance ratio is a measure of how well a signal fits to its assigned class relative to other signals in the same class.

DST2: Hit Ratio (Hit-Ratio in VisualClass report file)

Hit ratio is the distance a signal is from the center of the class it has been assigned to divided by the distance to the center of the second best class fit. By definition, a hit must be closer to its class than its second best fit, so the maximum value for Hit ratio must be less than 1. A signal that is in the center of its class would have a Hit ratio of zero.

Note: The Hit ratio is a measure of how well each signal fits to its assigned class relative to other classes.

DST3: Off Ratio (Off-Ratio in VisualClass report file)

Off ratio is the distance a signal is from the center of its class divided by the average distance the signal is from all other classes. Limits for Off ratio are the same as for Hit ratio, however normally the Off ratio must be much smaller than the Hit ratio.

The Off ratio is a measure of how representative a classifier is for each signal it analyzes.

User Processor Results

User Processor results can be defined by the user (option VAEUP needed). Then they can be used like any other result within VisualAE™.

ECP Processor (an extension of the user processor) is using the same type of results. Read details for more information and different options required to use ECP.

12. Hit Cascading

A hit cascade begins with a hit and ends when the channel closes the hit data set, that is, when the rearm time elapses due to the absence of threshold crossings.

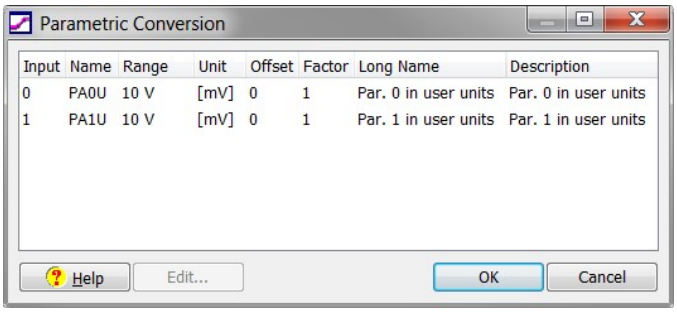
A hit is over, when the DDT (Duration Discrimination Time) elapses due to the absence of threshold crossings.

If a hit is over and a threshold crossing is detected before the Rearm Time elapsed, a new hit is processed by the channel as a subsequent hit in the frame of a hit-cascade. T, A, R, D, ENY, CNTS are derived from the 1st hit of the hit cascade, CNTS and ENY of the 1st and all subsequent hits of a hit cascade are accumulated and stored in CCNT and CENY. CHIT is the total number of detected hits during a hit cascade.

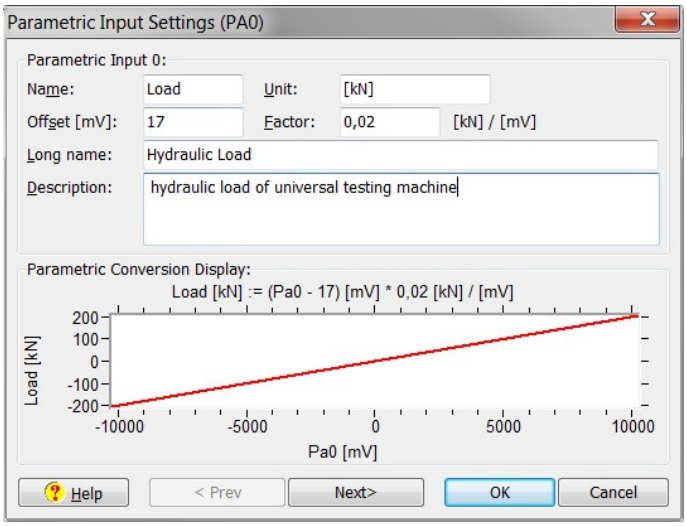
Title: VisualAE: Result Description
Link: AESuite/VisualAE/VisualAE_results.htm

Parametric Conversion: Changing Name, Unit and Scale of Parametric Inputs into User-defined Results

VisualAE (menu Edit/Parametric Conversion) allows one to convert the voltage values measured by the parametric inputs PAx (or those manually modified by **PAx-Modifier**) into engineering units. An offset and a factor can be set in order to perform a linear transformation.



Select the parametric input to be converted and click on "Edit" (or double click on the channel). A dialog window will be presented:



Options for Parametric Input X

Name, Unit, Long name, Description

Enter a name (not more than 7 characters), the unit (appears as axis labels), a long name, and a description.

Offset [mV] and Factor

These numbers are used for linear transformation of the voltage into engineering units.

The example above (Offset 17mV and Factor 0.02) represent the following: A measured voltage of 17mV at PA0 corresponds to 0kN and a voltage of 10V to 199.66kN.

Parametric Conversion Display

The Parametric Conversion Display visualizes the linear transformation graphically.

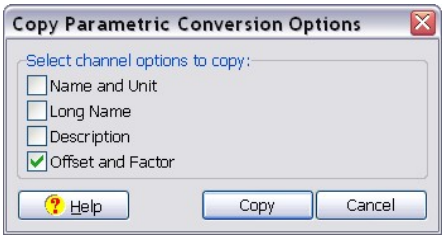
Note: The values, units and names defined in this dialog (within **VisualAE™**) will be used for diagrams/listings if you select PAxU from the attribute selection list (selecting PAx will display the measured voltage).

Title: ParamConv-1: Parametric Conversion
Link: AESuite/VisualAE/ParamConv/VisualAE_ParamConversion.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Reference > Copy conversion settings

Copy Parametric Conversion Settings for parametric channel

Use this dialog out of Parametric Conversion to copy the conversion settings from one parametric channel to another.

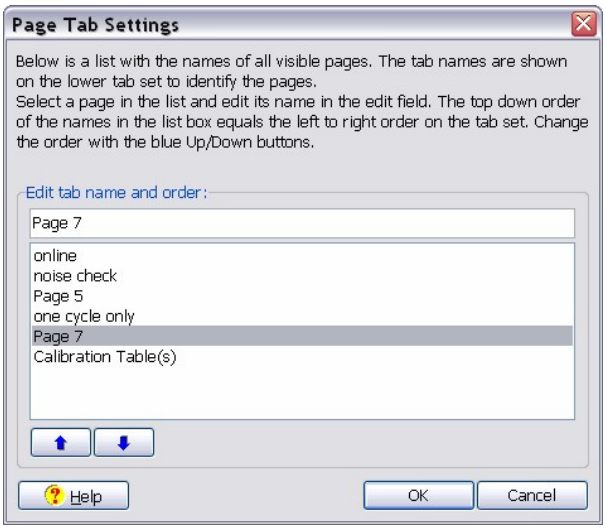


Title: ParamConv-2: Copy conversion settings
Link: AESuite/VisualAE/ParamConv/VisualAE_ParamConvCopy.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > Reference > Customizing Pages

Page Tab Settings

The Page Tab Settings dialog allows one to edit the tab names on the bottom of each page. It also allows to modify the order of the pages. This dialog can be found by Tabs out of the Pages menu.



Edit tab name and order

Text entry line

Editing the name in this box will change the identifier of the page selected in the list below.

Tab list (scrolling)

This list (with scroll bar on right) shows all the page identifiers with one selected, highlighted in blue. The order of identifiers in this window, top to bottom, corresponds to the order of page tabs on the bottom of the window, from left to right.

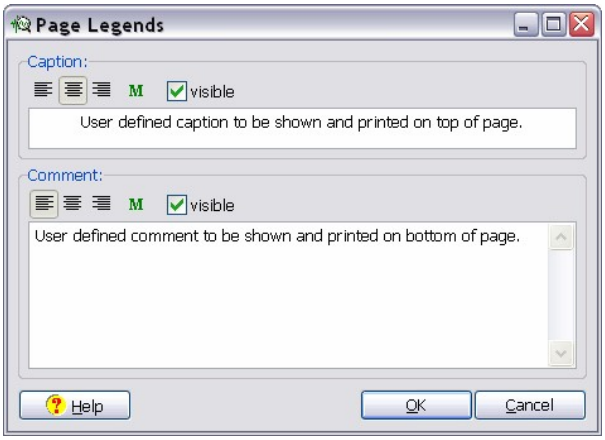
Page order positioning arrows

The up/down arrow moves the selected page left (up arrow) or right (down arrow) in the page order. Drag and drop is also supported. Clicking the right mouse button on a page tab calls a context menu (the same items as in the Pages menu).

Title: Page Tab Settings
Link: AESuite/Pagetab/PageTab_TabSettings.htm

Page Legend

Specifies legends and comments and their attributes for the current page. The caption appears above the diagrams in large bold text. The comment appears below the diagrams in smaller plain text. This dialog can be found by **Legend** out of the **Pages** menu.



Caption

Allows one to enter a caption which will be shown on top of the page. Only visible and printable if visible checked.

Comment

Allows one to enter a comment which will be shown at the bottom of the page. Only visible and printable if visible checked.

Text alignment: Icons above the text entry blocks are for left justified/centered/right justified text

The text will be aligned according to which of these three icons is selected. The three icons, left to right, are left-justified (text aligned with the left margin), centered, and right justified (text aligned with the right margin). The defaults are centered for the caption and left-justified for the comment.

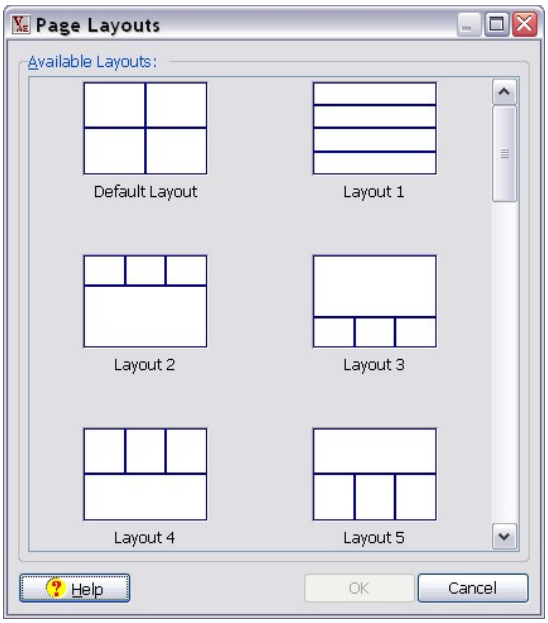
Allows one to enter a caption which will be shown on top of the page. Mind the visible/printable checkboxes.

Note: Mind the visible checkboxes.

Title: Page Legend
Link: AESuite/Pagetab/PageTab_CaptionComment.htm

VisualAE: Page Layout

The Page Layout dialog gives a number of possibilities (layouts) to split up the page. The possibilities offered are adapted to the number of diagrams on the current page. The picture below shows the dialog for a page with four Visuals.



Simply select any layout from the list and the page will be ordered accordingly. You can exchange the position of each Visual on the page with another Visual on the same page with Position out of the Visual's context menu (option VAE2 required).

Hint: There is a scrollbar on the right hand side of the dialog. Use it to show all layouts. If you cannot find a specific layout that would be useful for you, please send or fax us a drawing of your preferred layout. We can easily add new layouts for you to the list.

Title: VisualAE: Page Layout
Link: AESuite/VisualAE/VisualAE_PageLayout.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > File Converter > Overview

Vallen File Conversion Tools Overview

VisualAE™ can open and analyse PRI- and PRIDB files and read in data from TRA- as well as TRADB-files. However it is recommended to convert old file format (PRIDB, TRADB) to free file format PRIDB and TRADB. A conversion tool for this task is PRI2DB.

In case a PRI-file is opened only the according TRA- and TRF-file is used in analysis. Similarly if **VisualAE™** is used to open a PRIDB file only according TRADB and TRFDB files are considered in analysis.

VisualAE™ can also be used to analyze data that was acquired by the use of a Locan, Spartan, Mistras, and DiSP system. However according DTA files have to be converted to PRIDB and TRADB first. This is done by the use of the DTA-Converter.Due to differences between AE systems and file formats not all results within dta-files can be used with VisualAE™

As software "lives" it might happen that future changes within the dta-file format cause improper results of the DTA-Converter. In this case please VisualAE™ version is already available at http://www.vallen.de/downloads and try if the problem has already been solved. If not please send us detailed feedback including a sample dta-file showing the effect and the ASCII listing (.txt) file which you can create using the original software.

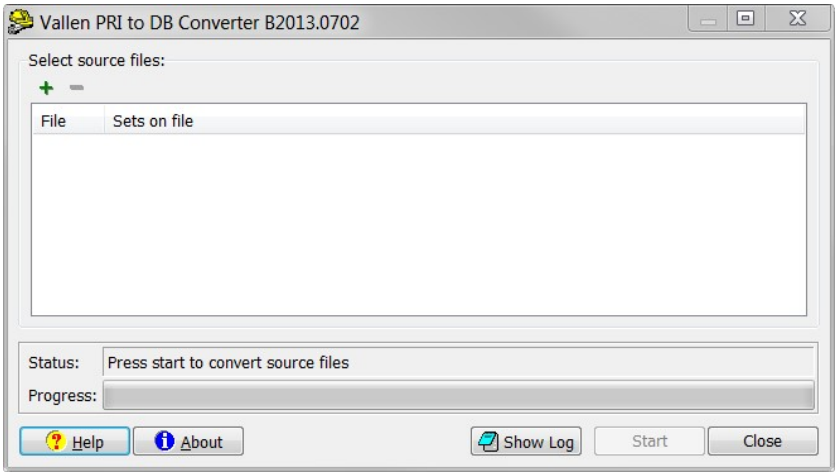
Title: File Converters: File Converter Overview
Link: AESuite/Utilities/Converter/fileconv_overview.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > File Converter > Pri2DB: Utility PRI to PRIDB converter

PRI2DB: converting PRI and TRA files to PRIDB and TRADB files

Purpose

convert PRI and TRA files to new free file format PRIDB and TRADB. PRI and TRA were files to which AE-feature data and transient data was stored, respectively, when using a Vallen AE-Suite software release of R2012.0509.4 or earlier.



Select source files

Select a number of PRI files that shall be converted to free file format PRIDB. Any TRA files that have same file name as selected PRI file will be converted to TRADB as well.

Click the green "+" sign to open a file selection dialog. Select the PRI files that shall be converted and confirm the selection. The according file names will be added to the text field.

Select a file in the text field and click the red "-" sign to remove it from the text field.

Group status

Status

shows the current status of conversion

Progress

bar that shows the progress of conversion

Start

Start button will be highlighted once at least on file has been selected for conversion.

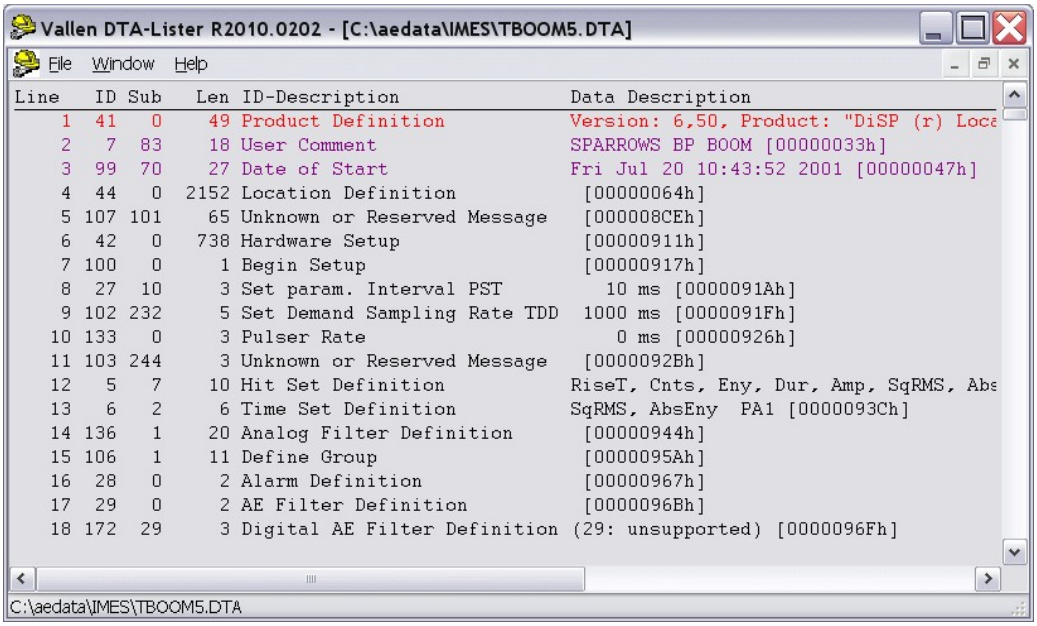
Title: Pri2DB: Utility PRI to PRIDB converter
Link: AESuite/Utilities/Converter/PRI2DB/Pri2DB_Overview.htm

Conversion Tool: Vallen DTA-Lister

The Vallen **DTA-Lister** allows one to inspect the content of a dta-file. It displays all messages as they are stored in the dta-file. When opening a dta-file using the File/Open dialog you have to select which software version you used for recording the data:

This selection affects the calculation of the parametric values. If the parametric values which are then displayed do not match the actual ones please try again selecting the other checkbox.

The **DTA-Lister** displays the following columns:



Line	Line numbers
ID	message ID, for details see your dta-file documentation
Sub	Sub-ID, for details see your dta-file documentation
Len	Length of the data in Bytes
ID-Description	Short description of the message type
Data-Description	Content of the message, e.g. channel settings, measured data, ...

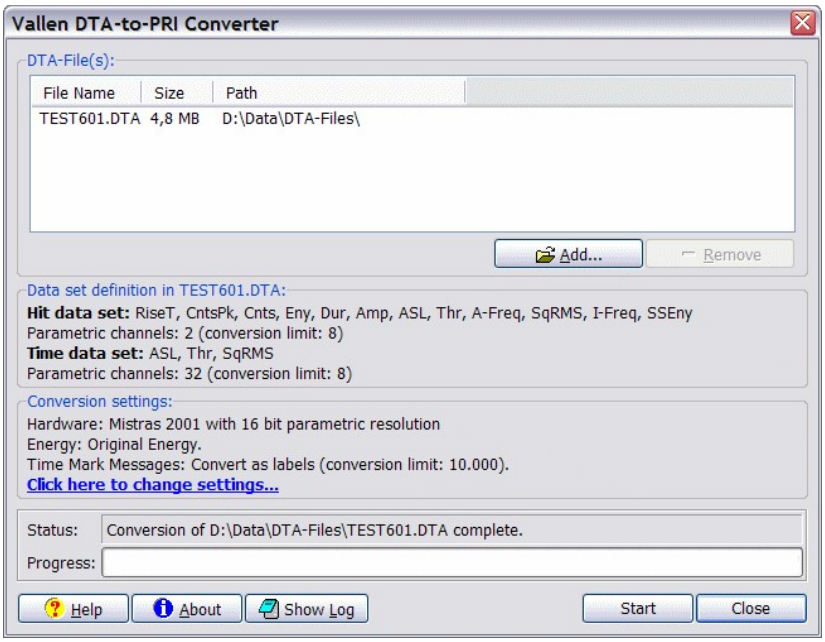
Title: DTA-2: Vallen DTA-Lister
Link: AESuite/Utilities/Converter/DTAConv/dtaconv_dtalist.htm

Conversion Tool: Vallen DTA-to-PRI Converter

Use this tool in order to convert dta-file into the Vallen format (PRIDB/TRADB). This is required to analyze your data with **VisualAE™**, **VisualTR™**, and **VisualClass™**.

The conversion works as follows:

1. Start DTA-to-PRI Converter
2. Select one or more dta files to convert.
3. Modify settings if required. See Conversion Setup for details.
4. Run the conversion
5. Check Result Report
6. Close DTA-to-PRI Converter



DTA-File(s)

Click 'Add...' to add one or more dta-file(s) to the conversion list. The conversion list shows the list of source files to be converted including their size and folder. The converted output files are stored into the same folder as the source files. Please check that you have write privileges in the folders otherwise the conversion will fail.

The source dta file is not modified by this program. If an output file already exists, it is overwritten without warning.

The following file types are created by this program. The final file name results in adding this file extension to the source file:

.PRIDB	Primary data file that contains the AE features
.TRADB	Transient data file that contains the waveforms if available.
.vac	Acquisition setup file that contains necessary acquisition settings.
.pridta	A special configuration file to be used by VisualAE that contains additional information about which Energy type has been selected.

Data set definition

This group shows the content of the Hit Definition Set (ID 5) and Time definition Set (ID 6) in the source file and as a result which attributes are available in the source file. The dta file supports independent storage of parametric data within both, Hit driven and Time driven data sets. As a result the definitions for parametric data can be different for both data set types.

Conversion settings

This group allows to adjust the settings used for conversion. See below for a detailed description.

Status

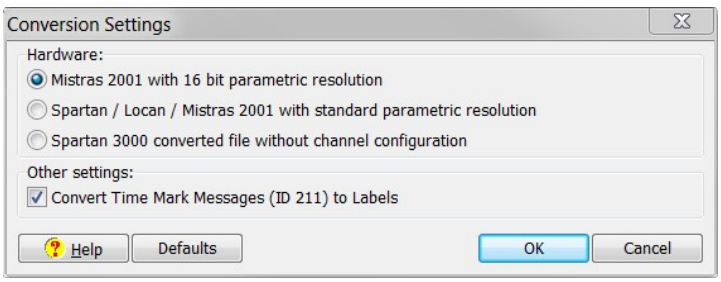
Progress bar that shows the status of the conversion process.

Hint: For more detailed information on the conversion itself please see DTA Conversion settings and how the conversion works.

Title: DTA-3: DTA-to-PRI Converter
Link: AESuite/Utilities/Converter/DTAConv/dtaconv_dtaconverter.htm

DTA Conversion settings and how the conversion works

As there are different versions of dta files around it might be necessary to adjust the default settings for best conversion results.



Hardware

Different resolutions for the external parametric inputs are used (for details see your dta-file documentation). If you are not sure which software version you used to record the data just make a try. If the parametric values you get after the conversion meets your expectations, fine. If not please convert the file once again with the other option selected.

Other settings

Convert Time Mark Messages to Labels

If this option is checked then Time Mark Messages are converted to Labels. Labels are used in the PRIDB file for easier navigation and convenient data analysis. If there are only a few Time Mark Messages this option might be useful. But if your file contains several thousands of Time Mark Messages then please uncheck this option.

However the converter program stops processing Time Mark Messages to labels after having created 10000 labels as the benefit of labels gets lost.

Remarks on the conversion

There are many differences between the dta file-format and Vallen file formats. As a result a direct conversion of one file to the other is not possible as each of the formats has its special features. However as the converter tries to convert as close as possible with respect to hit data some noticeable differences persist:

File size

A primary data file converted from a dta file is much larger in size than the original file. The reason for this is that all data sets in the PRIDB file do have the same size where dta files might have much smaller data sets when containing a minimum feature set. After conversion the data sets in the PRIDB file are not filled in an optimum way.

Parametric data

dta can files contain parametric information in both, hit and time driven data. In primary data files parametric data is stored in parametric data sets only. So for each hit data set in the dta file containing parametric data, a parametric data set is written (leads to larger PRIDB file). There is a maximum of 8 parametric channels the converter can process. Data for more channels is discarded during conversion.

Status data

Status data about background noise is stored in dta files in the time driven data. During conversion a status data set for each channel is created when converting time data that contains background noise information (leads to larger primary data file).

Waveforms

The amplitude of waveform in a dta-file reflects the voltage at the system input (up to +-10V). The amplitude of a waveform in a Vallen transient record data file reflects the voltage at the sensor output (like the AE data). This is achieved by dividing the measured voltage through the gain of the preamplifier. As a result the amplitude of waveforms in tra-files is much lower (e.g. 40dB = factor 100) than in dta-files.

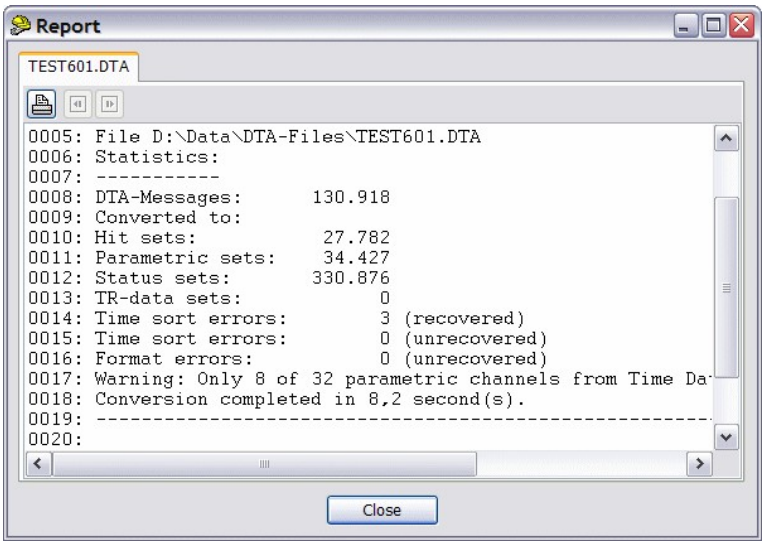
Conversion Report

After conversion a result report is shown. The report provides statistical information about the conversion process as well as warnings or errors.

First it shows the number of source dta messages processed, then the number of data sets that have been created from those.

The number of dta-messages differs from the number of (Vallen) Hit sets, Status sets, and TR-data sets due to differences in the file formats as described above.

Dta-files frequently contain time sort errors which are not allowed in PRIDB files at all. The converter recover as many problems within the dta file as possible.



Possible warnings

Warning: Only 8 of <x> parametric channels from Hit Data Sets (ID 1) were converted.

There is a limit of 8 parametric channels for the conversion. See remarks on conversion above.

Warning: Only 8 of <x> parametric channels from Time Data Sets (ID 2) were converted.

There is a limit of 8 parametric channels for the conversion. See remarks on conversion above.

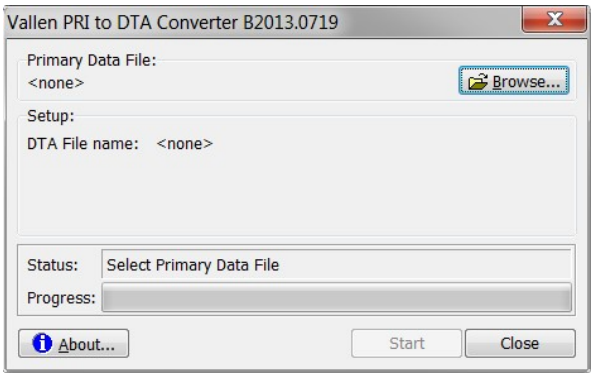
Warning: Conversion of Time Mark Messages (ID 211) to labels disabled after creating 10000 labels.

This warning is self explaining. See conversion option "Convert Time Mark messages to Labels" above for more information.

Title: DTA-4: DTA-to-PRI Converter / Setup
Link: AESuite/Utilities/Converter/DTAConv/dtaconv_setup.htm

Pri-to-DTA Converter

Pri-to-DTA Converter converts data recorded in Vallen file format (PRIDB) to DTA format. This way analysis routines like MonPAC or TankPAC can be used.



Primary Data File

Select a file that shall be converted to DTA format

Setup

Displays filename and path of converted file

Conversion

Pri-to-DTA Converter tool converts the most important AE-features and a hit's transient data to DTA file format.

Time (arrival time), channel (CHAN), risetime (R), peak amplitdue (A), ring down counts (CNTS) and duration (D) are converted to their according counterparts.

Energy is converted to Mistras' absolute energy and signal strength to Mistras' signal strength.

Only PA0 and PA1 are converted to Mistras' external parameter 1 and -2, respectively.

Label datasets are converted to user comments.

Transient data is converted also to DTA format.

Title: Pri-to-DTA: Utility Pri-to-DTA
Link: AESuite/Utilities/Converter/Pri2DTA/pri-to-dta.htm

AE Utility Programs Overview

The Basic Software Package contains a number of utility programs. Those are quite useful tools completing the software's functionality. They are located on the tabs "Normal Use" and "Acquisition Utilities" of the Vallen Control Panel.

Utilities

Bitmap Printer

Utility for easy and professional printouts. Easily reachable through the Vallen Control Panel.

PAx-Modifier

Utility for later adjustment or simulation of a parameter input (PAx-Modifier).

TR-Viewer

Utility for displaying full waveforms. Easily reachable through the Vallen Control Panel (TR-Viewer).

Pri-Glue

Utility for concatenating data (AE and TR) files (Pri-Glue).

Alarm Monitor (SWAL2)

see topic for Alarm Monitor for more information (Alarm Monitor).

File Converters

Vallen AE-Suite software offers a number of file conversion tools. For more information see the topic about File Converters (File Converters).

Title: AE-Utilities: Overview
Link: AESuite/Utilities/Utilities_Overview.htm

PAx-Modifier

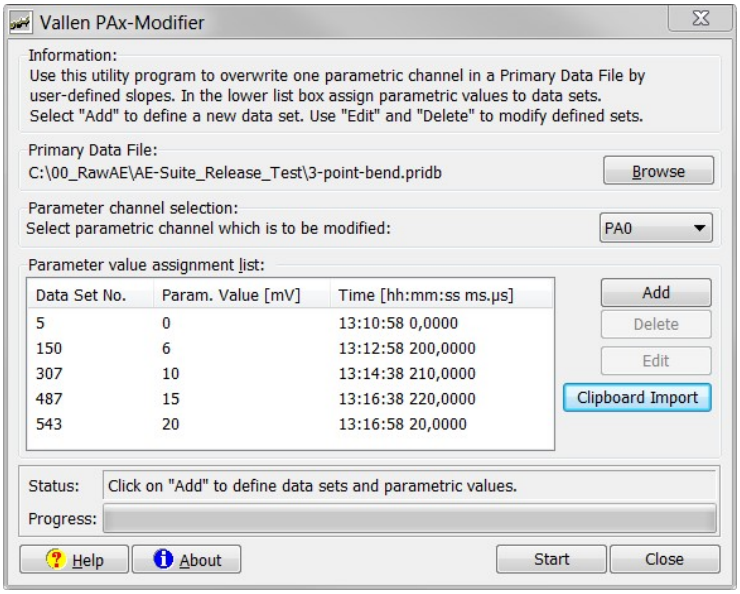
Purpose

To overwrite parametric values (analog inputs) with manually defined linear slopes.

Overview

This program overwrites the measured parametric data of a selected parametric channel with linear slopes defined by manually entered values. This program can be used on AMS3, AMSY4 and AMSY-6/-5 primary data files.

Note: Primary Data Files are modified by this program! It is highly recommended to backup your original file before using this program!



Primary Data File

Browse

Click button "Browse" to select a primary data file which parametric data sets shall be changed. When changes are applied, clicking on "Start" button will overwrite the primary data file with new parametric values. Please back up original primary data file in order to avoid loss of original data.

The selected primary data file is displayed in the line left to the "Browse" button

Parameter channel selection

PAx-drop down list

From the drop down list select the parametric channel which data sets shall be changed.

Parameter assignment list

Add

Click this button to open a pop up dialogue. A data set number and parametric value have to be provided by the user. The nearest parametric data set of the specified channel is updated with the new value if the provided data set number does not belong to a parametric data set of the selected parametric channel (data set number can belong to hit data, status data or a different parametric channel). The data set number basically specifies the time of occurrence. Confirming the pop up dialog will add a new line to the table of value assignment list.

Note: all parametric data sets of a specified channel in between two "added" parametric values are updated with linearly interpolated values once the "Start" button is clicked.

Delete

Deletes the selected line of the value assignment list.

Edit

Opens a pop up dialog displaying data set number and parametric value of the selected line of the value assignment list. Both values, data set number and parametric value can be changed. Confirming the pop up dialog will change the table of the value assignment list accordingly

Clipboard Import

Imports data from clipboard to the value assignment list. Clip board data has to be of CSV format with two columns, whereby column #1 contains the data set numbers and column #2 contains the parametric values.

Hint for usage: during data acquisition log the data set number and the parametric value (if it cannot be fed into the analog inputs of the AMSY-6) to an Excel spreadsheet. Write data set number and parametric value to first and second column, respectively. When using Pax-Modifier copy the spreadsheet data to clipboard and use the "Clipboard Import" button to past the data into the value assignment list.

Step-by-step instructions:

1. Click on "Browse" to select an existing Primary Data File which you want to be modified.
2. Select a "Parametric Channel" which you want to modify. Only parametric channels which generated data sets and that have been stored to file can be selected. The originally measured data of this channel will be lost!
3. Click on "Add" to define the data set number from where you want data file modification to begin. Specify an absolute parametric value in [mV] which you want to assign to this data set. The data set number will automatically be adapted to the closest parametric data set.
   Repeat this step to define at least one more data set. Unlimited number of data sets can be defined. The primary data file will be modified in the range of the first and the last specified data set. Between two subsequent specified data sets, a linear slope (in time) will be assigned to all parametric data sets.

To delete a defined data set assignment click on "Delete". To change an assignment click on "Edit".

Start-button

Click on "Start" to start modifying the file. The values of the specified parametric channel between the first and the last defined data set will be changed.

Title: PriPar-1: Utility PAx-Modifier
Link: AESuite/Utilities/PriPar/Pripar_Overview.htm

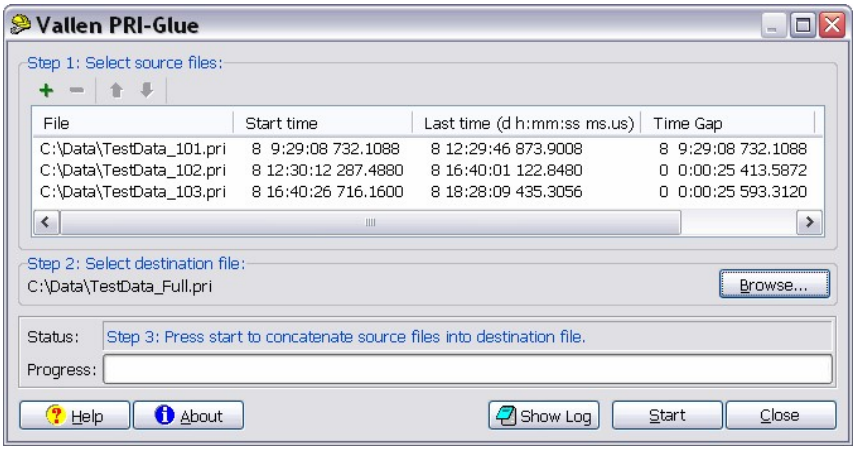
PRI-Glue

PRI-Glue concatenates primary data files and associated transient recorder files. Can be used to concatenate several files of a single test.

Hint: Only R2012.0509.4 and earlier versions will concatenate PRI-files.

Attention: PRI-Glue cannot be used on files recorded with an AMS3.

Attention: Do not run Acquisition while Pri-Glue is concatenating files!



Step1: Select Source files:

Click + in order to open a file selection dialogue. Browse and select a primary data file to add it to the list displayed in a tabular view.

Click − in order to remove a file that has been selected in the tabular view.

Click ↑ in order to move a selected file upwards. In time scale it means that the file and its data is put to an earlier point in time.

Click ↓ in order to move a selected file downwards. In time scale it means that a file and its data is put to a later point in time.

Step 2: Select destination file:

Click "Browse" button to select a folder and file name for destination file

Buttons

Start

Click "Start" to start concatenation of files. Progress of operation is shown in the Progress bar.

Show Log

A log file is created with the name of the destination file but extension ".log" in the destination folder. Click this button to view the log file

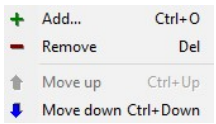
Context menu for file list

Add...

Adds a file to the list of files that are concatenated.

Remove

removes selected file from list of files that are concatenated.



Move Up

Moves a file up.

Move down

Moves a file down.

Technical details

The following are technical notes on how PRI-Glue handles the data during concatenation:

Time handling

- The time in the resulting file is always continuously increasing.
- If a time overlap between files is detected during runtime, the overlapping file is adjusted to start right after the previous file with a time gap of at least 5 seconds. Time of transient data sets is updated accordingly so that proper relations are kept.

Parametric counters PCTA/PCTE, digital counter PCTD:

- PCTA is updated to continue with the last value resulting from the previous file as offset. PCTA is continuously increasing.
- PCTE is used for all files, if used in the first section of the first file. It's behavior is like PCTA, but extended to 32 bit. PCTD is not available, if PCTE is used.
- PCTD (available only, if PCTE not used) is not modified by design. All applications using PCTD shall reset the counter on start.

TR-Index (TRAI)

- The TR-Index is the link between the AE and TR data. TR-Indices in the resulting file are renumbered. They are always increasing and start with 1, even if the first TR-Index in the first input file starts with a higher value.
- All TR-Indices in primary- and transient data files are updated and the proper relations are kept.
- Non-zero TR-Index values in the primary data file without corresponding TR-sets in the transient data file are set to 0, what is interpreted as not acquired.

TR Data

- TR data files must be compatible to be concatenated: Sampling rate and page size of all files must be identical, as given by the first file. You might use the TR-Unifier to adapt the format of the TR-files to match this requirement.
- TR data files incompatible to the first TR file are ignored. A warning is written to the log file. Corresponding primary data files are concatenated anyway.
- TR sets which are not referenced from AE data (pool triggered sets, resulting from filtering, etc.) are kept in the destination file with renumbered TR-Indices.

Labels

One extra label per source file is inserted in the resulting primary data file, holding the original source file name. During analysis these labels still identify the original source files.

Title: PriGlue-1: Utility Pri-Glue
Link: AESuite/Utilities/PriGlue/priglue_overview.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > AE-Utilities > Alarm Monitor (SWAL2) > Overview

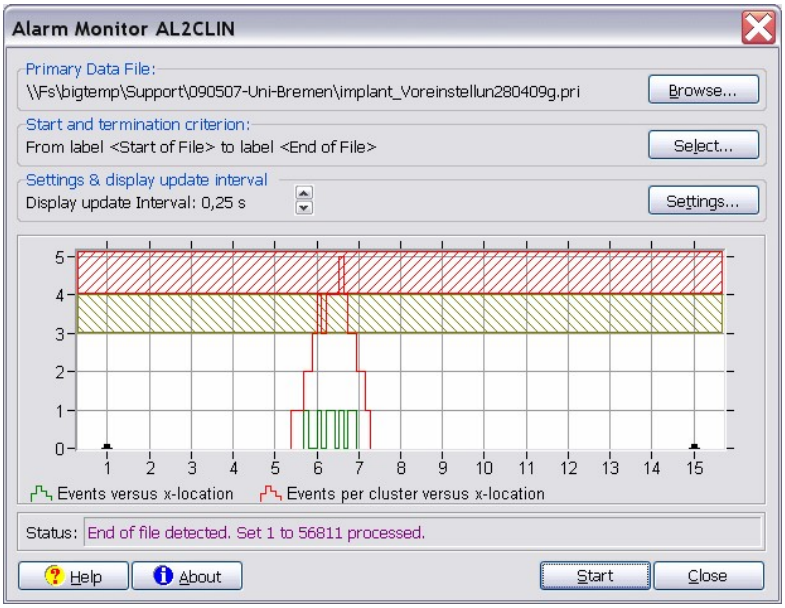
Utility: Alarm Monitor AL2CLIN (Option SWAL2)

Purpose

Monitors the Acoustic Emission activity within a location cluster

Features

- Linear Location (2 channels): to evaluate the location of each source
- Location clustering: to discriminate a repeating source
- Time clustering: to identify the activity of a cluster
- Filtering: to eliminate the influence of noise
- Warning: to warn the operator prior to an alarm
- Alarm: to switch off (e.g.) the experiment
- On-line graphic display: to indicate current AE activity
- Off-line mode: to check the parameter setting



Description of on-line diagram

The red dashed area on top of the diagram shows the currently defined alarm level.

The yellow dashed area right beneath the alarm level shows the currently defined warning level.

The lower green line shows an events versus x-location distribution of all analyzed events which passed the filter criteria. The time window and the warning and alarm levels have no effect on the events distribution display.

The red line shows the cluster distribution versus X-location. If this curve exceeds the warning level the warning action is performed. If this curve exceeds the alarm level the alarm action is performed.

Description of controls

Primary Data File

Click on Browse to select any existing primary data file you want to process. If the acquisition program is running the current acquisition status is displayed in brackets behind the selected file name.

Start and termination criterion

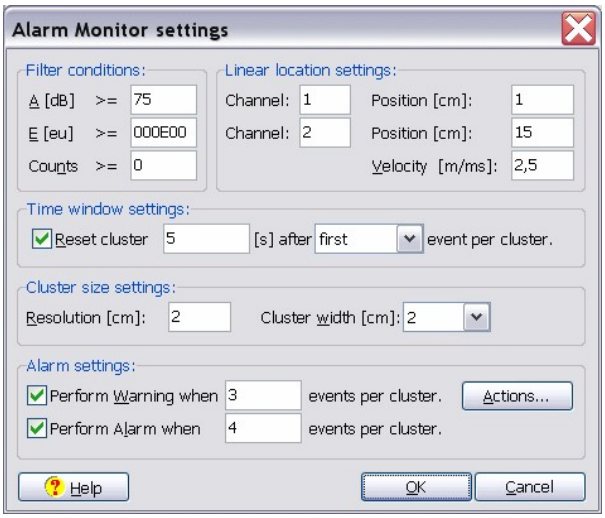
Click on Select to define a start and termination criteria. If you want to do on-line analysis define <Start of File> as the start criterion and <End of File> as termination criterion.

Settings & display update interval

- Change the update interval of the display with the spin buttons between 0.1 seconds and 30 seconds. Notice: the shorter the update interval the more computer power is drawn away from acquisition during on-line analysis.
- Click on the Settings (see Alarm Monitor settings) button to change the analysis settings.
- Click on the Start button to start the analysis. Close will quit the program.
- This functionality is only available if the software option SWAL2 has been purchased.

Title: Al2CLin-1: Alarm Monitor (SWAL2)
Link: AESuite/Utilities/Al2CLin/al2clin_overview.htm

Alarm Monitor Settings



Description of Controls

Filter conditions

Specify in this group the filter conditions that both hits belonging to the same event have to pass. Specify a minimum value for Amplitude, Counts and Energy. To disable this filter specify zero for the filter comparison values.

Linear location settings

Specify the channel numbers and the corresponding position in cm for linear location. Specify a value for the specific **velocity** of sound in the testing structure in m/ms.

Time window settings

The time window can be used to detect special time dependencies among the events. Specify the width of the window in seconds for the time period you want to keep the cluster armed. If no alarm or warning level is reached within this time the cluster is reset. The time width can be specified relative to the **first** event per cluster to be sensitive on event densities or relative to the **last** event per cluster to be sensitive on event rates.

Disable **Reset cluster** if you don't want to use the time window functionality.

Cluster size settings

Specify the base locational resolution in cm. All events passing the filters are classified into a bin of that width specified by **Resolution**.

The size of the clustering can be specified with **Cluster width** in cm. A cluster at a position X is defined as the value of the locational bin plus all bins to the left and right around X within half of the cluster width. This helps to avoid bin overlapping problems.

Alarm settings

This group defines the level of severity for all located events within clusters after passing the filters. Specify the number of events per cluster for the severity limit. Leave the check box in front of the lines unchecked if you don't want the program to perform a warning or alarm.

Click on the **Actions** button to specify what shall happen when the severity limits are reached.

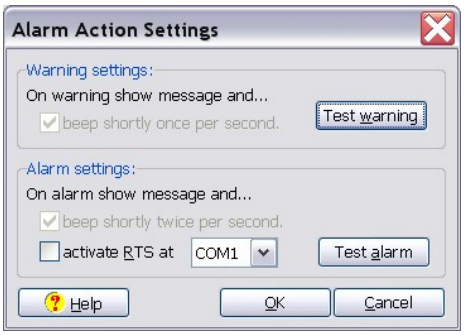
A note about clustering

In the Alarm Monitor clusters are defined somewhat differently than in **VisualAE**/MultiPlot. In **VisualAE** a cluster contains all events within a specific range which are closer to this cluster center than to any other cluster. This means that each event can only belong to one single cluster.

In the Alarm Monitor a cluster at a given position x contains all events around this position within the distance of half of the cluster width. This means, with a cluster width larger than resolution each event will be in several clusters. This effectively smoothes the data and prevents variations in warning/alarm levels due to the edge of a location bin.

Title: Al2CLin-2: Alarm Monitor Settings
Link: AESuite/Utilities/Al2CLin/al2clin_settings.htm

Alarm Monitor Actions



This dialog defines what shall happen on alarm. You can specify a serial port (COM1 or COM2) which is not used by any other device to rise the request to send (RTS) line to high when an alarm occurs. You can use this line in combination with an external relais to switch external devices.

You can force a warning or alarm for test purposes with the buttons "Test warning" and "Test alarm".

On a warning a dialog appears with warning display and a beeping and blinking once per second. "Disable warning" switches the warning off for the rest of the analysis process. "Rearm warning" will disable the warning but keep the warning armed for the next event which will exceed the warning criterion.

On an alarm a dialog appears with an alarm display that beeps and blinks twice per second. The Disable and Rearm buttons have the same functions as above mentioned for the warning. The RTS line will keep high while this dialog is shown. When clicking on disable or Rearm the RTS line will go low.

Title: Al2CLin-3: Alarm Monitor Actions
Link: AESuite/Utilities/Al2CLin/al2clin_actions.htm

Home > The Vallen AE-Suite Software > Vallen VisualAE > AE-Utilities > TR-Viewer > Overview

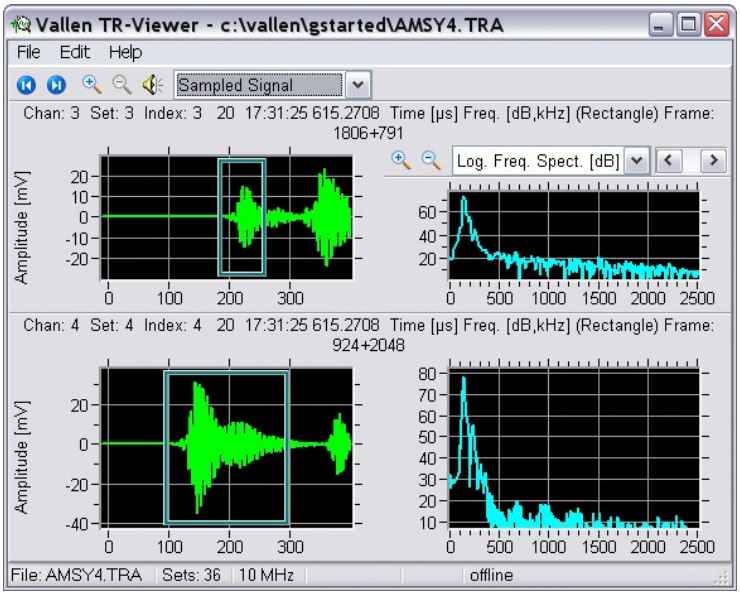
Vallen TR-Viewer

Purpose

To look at waveform data in time and frequency domain

Overview

TR-Viewer is a Windows program to analyze data acquired by the transient recorder part of the AMS3, AMSY4 or AMSY-6/-5. It offers the possibility to look through the waveforms in time and frequency domain of a Transient Data File (Extension *.TRADB) and to zoom the waveforms in time and amplitude direction.



TR-Viewer can show up to 6 of the Vallen standard TR diagrams. Each of these diagrams can show the waveform either in time or frequency domain or both together as shown above and has its own functionality (see TR-diagrams).

Below the diagrams is a status bar giving some information about the currently opened file as there are file name, total number of data sets (waveforms) on file and sampling rate. The other fields which are empty in this example show status information like Run mode enabled, diagram zoomed, online mode.

TR-Viewer File Menu

Open

Opens a transient data file. Both file formats AMS3 and AMSY4 are supported.

Print (shortcut <F2>)

Opens the **Printer Page Settings** dialog to print the waveforms.

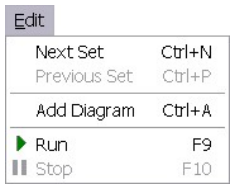
Most recently used file list (MRU-list)

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

Exit

Exit quits TR-Viewer.

TR-Viewer Edit Menu



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

These items show the next or previous data set sequentially in the diagrams. The next set is always shown in the next diagram, which is below the last used diagram or the top diagram if there is none below.

Add Diagram

Adds another diagram. A maximum number of 6 diagrams can be displayed at the same time. To remove a diagram click on remove in the context menu of the TR-diagram.

Run (shortcut <F9>), Stop (shortcut <F10>)

Enables and disables the Run mode. In Run mode the all data set in the file are shown one after each other automatically. Off-line mode the Run mode is disabled when the last set of the file is shown. On-line the Run mode keeps enabled at the end of file waiting for the newest data.

Title: TRView-1: TR-Viewer Overview
Link: AESuite/Utilities/TR-Viewer/trview_overview.htm

Other Utilities

AGU-Vallen Wavelet

AGU-Vallen Wavelet is a freeware tool to calculate the wavelet transform (Gabor) on individual waveform data sets out of Vallen transient recorder data files (*.TRADB). It also includes a tool to calculate plate wave dispersion curves (**Vallen Dispersion**).

The latest version is available for download at http://www.vallen.de/products/software/wavelet.

AGU-Vallen Wavelet has been developed in collaboration between Vallen Systeme GmbH and Aoyama Gakuin University (AGU), Tokyo, Japan. The AGU group has pioneered in the research of wavelet analysis in the field of Acoustic Emission and Vallen has actively generated software tools.

Vallen JPegger

Vallen JPegger a free (private use only, but license for commercial use include in Vallen AE software) handy, and full featured image viewer, which shouldn't be missing on any PC. Now in 20 different languages including full Unicode language and file support. It is designed for large image libraries with thousands of files. This little power pack reads 40 different image file formats, supports lossless JPEG rotation and includes an unique MP3 Organizer including a simple player: MP3 files are categorized according their MP3 tag information into artist, genre and album in a comfortable tree structure. Great for larger music archives.

The latest version is available for download at http://www.vallen.de/downloads.

Title: Other-1: Other Utilities
Link: AESuite/Utilities/Other/utilities_other.htm