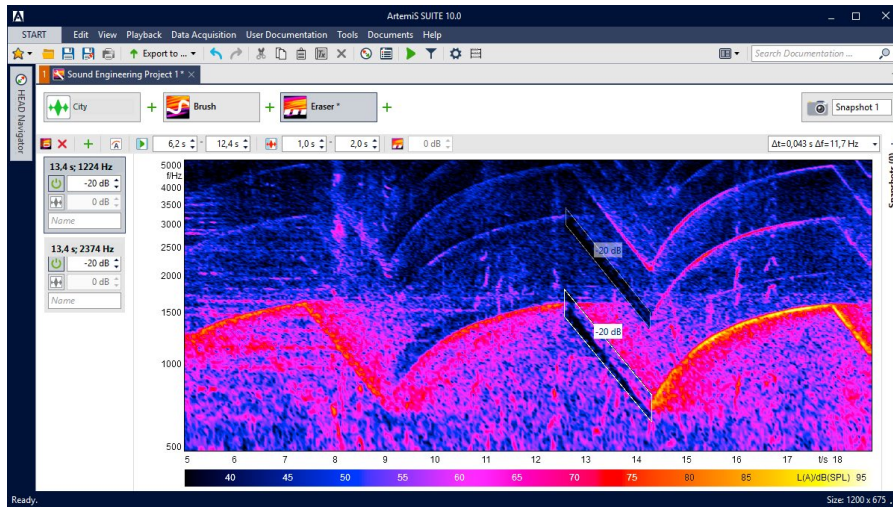


## ArtemiS SUITE Advanced Filters Module (Code 5019)

Module with various filter tools for sound design



### Overview

With the Sound Engineering Project and the Real-time Filtering, ASM 19 provides two useful interactive applications:

With the Sound Engineering Project, undesired noise can be quickly identified using FIR and IIR filters, sound components or orders can be selectively removed or synthesized, and target sounds can be created based on the users requirements. Furthermore orders can be created without exact pulse information.

For this purpose, the module provides processes which can be used to manipulate interactively the sound directly in the spectrogram.

The interactive operation resembles the workflow of graphic image processing. All manipulations become immediately effective both visually and acoustically, allowing you to shape the sound interactively.

The Real-time Filtering allows real-time filtering of airborne and structure-borne sound signals. With up to four filter sets each with four filters, users can modify and play back signals interactively, where the original signal is replaced by the filtered signal with zero latency.

For Real-time Filtering, the front end SQadriga III or SQadriga II is required.

In addition, the function Pitch Shift is included.

### Features

#### Sound Engineering Project

- Interactive application of different sound engineering for removing or emphasizing sound components
  - Eraser
  - Brush
  - IIR Filter
  - IIR Order Filter
  - Target Order
  - Order Generator
- Easy workflow via the graphic user interface
- Manipulation of amplitude curves for frequencies and orders and immediate acoustic and visual feedback after each change
- Addition of noise for a natural acoustic rendition of areas where significant portions have been removed by filtering
- Remove, edit, synthesize, or add complete or parts of engine orders with editable, time-variant level course
- Save multiple processing stages for A/B comparisons etc.

#### Real-time Filtering

- Real-time filtering with four independently configurable filter sets
- Easy switching between filter sets
- Each filter set includes up to four customizable 4<sup>th</sup> order real-time filters
- Zero-latency playback of filtered signals (latency < 1 ms)
- Data acquisition, filtering and playback with the USB front ends SQadriga III and SQadriga II
- Support of binaural sensors (e.g. HMS IV), standard microphones and acceleration sensors as input signals
- Acquisition of RPM information (via pulse input or CAN) and display of pulse signals in a tachometer
- Peak hold with adjustable decay
- Playback via closed headphone (mono playback of one channel is possible, too)

#### Pitch Shift

- Filter for changing the pitch of an input signal without affecting the signal length

# Sound Engineering Project

## Processes

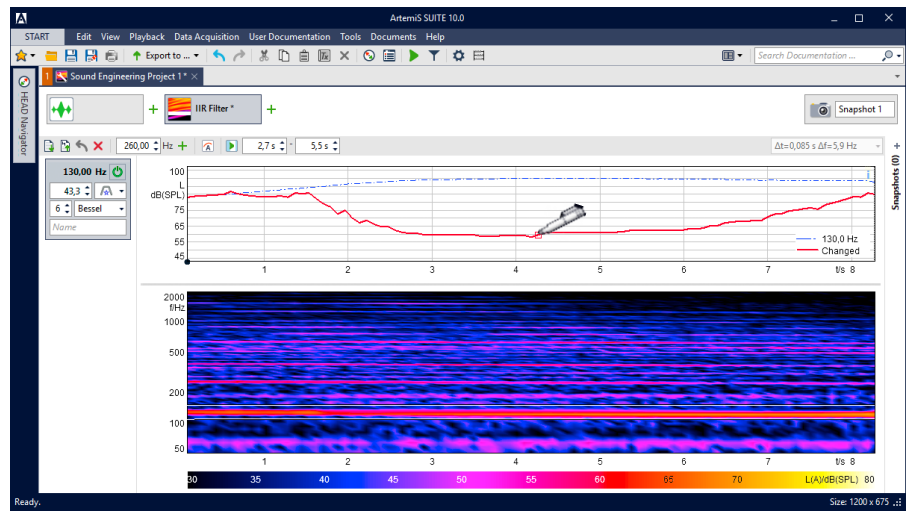
The core of the Sound Engineering Project are the processes (IIR and FIR filters, generators, and synthesis tools).

Their workflow resembles image processing, allowing users to manipulate sounds graphically in the diagram.

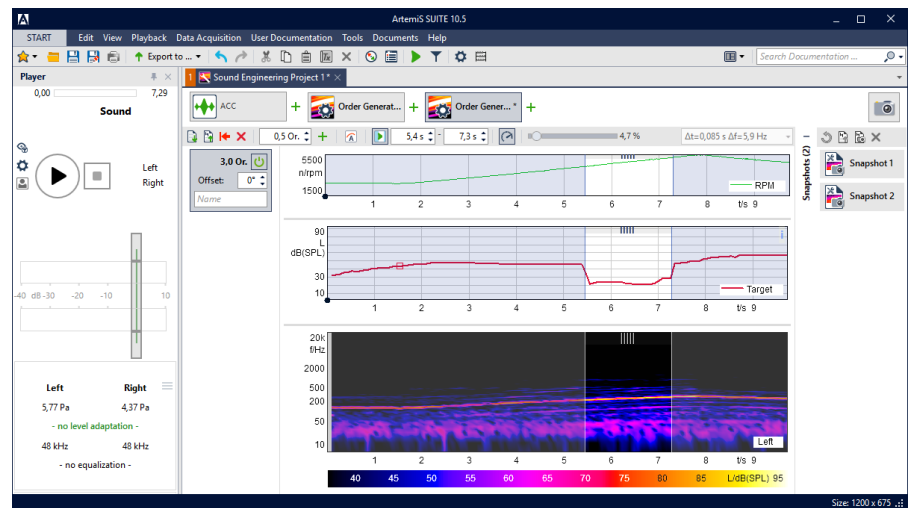
Any number of processes can be applied, modified, removed, changed, and saved as a sequence.

For RPM-based processes, the RPM vs. Time Diagram is available. Furthermore the A-weighting can be activated or deactivated.

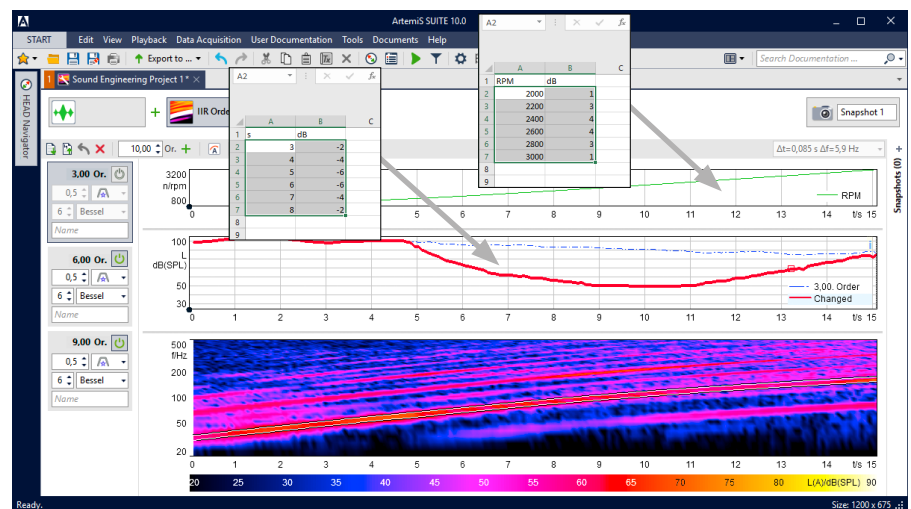
- Time-variant FIR filters (Eraser / Brush)
  - Universal filter for removing or emphasizing sound components
  - Graphical creation of multiple filter tools in the spectrogram (Eraser)
  - Defining Target Levels and Minimum Levels for attenuation and amplification (Brush)
  - Manually adjustable size (frequency and time range) for each filter
  - Addition of suitable noise signals in partial areas of the spectrogram to compensate for attenuated areas
- Time-dependent IIR filters
  - Manipulation of sounds or very narrow-band sound components
  - Manual (e.g. graphic) modification of the level course of a frequency component
  - Copying of modified level courses for use with other filters
- RPM-dependent IIR order filters
  - Manipulation of RPM-dependent sounds (orders) by means of time-dependent IIR filters based on a reference quantity
  - Manual (e.g. graphic) modification of the level course of an order component
  - Copying of modified level courses for use with other filters



In the Level vs. Time diagram, the original level curve is shown as a blue line (when present) and the curve modified by filtering as a red line. With the pencil cursor, the red line can be partially or entirely re-drawn at any time.



The level course can be drawn with the mouse in the Level vs. Time diagram and added or replaced in the corresponding signal. Additionally when applicable, the RPM course of the selected reference quantity channel can be displayed as RPM vs. Time diagram.



Values can be copied directly or via drag and drop from Microsoft Excel or from HDF files into the RPM vs. Time or Level vs. Time diagram in order to use them for amplifying or attenuating the existing level course.

- Creation of new orders or order curves (determining the target order)
  - Based on order analysis and re-synthesis
  - Manual editing of the synthetical orders
  - Manual (e.g. graphic) modification of the level course of an order component
  - Copying of order curves for use with other filters
  - Background attenuation
- Generating of new orders without pulse information (Order Generator)
  - RPM-based sine generator
  - Adjustable phase offset
  - Manual (e.g. graphic) modification of the level course of an order component
  - Copying of order curves for use with other filters
  - Background attenuation

### Snapshot functionality

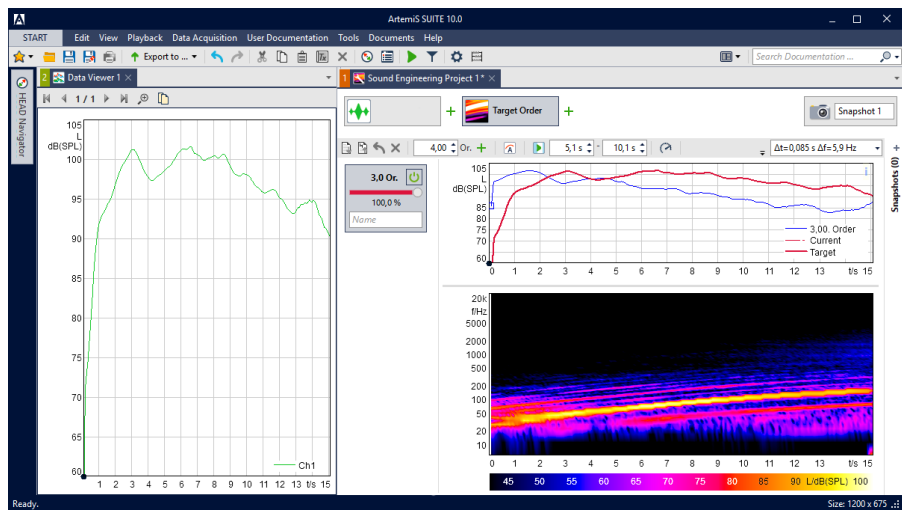
The snapshot function allows the user to save and restore sequences with all changes at any time.

- Direct acoustic and visual comparison of different modifications

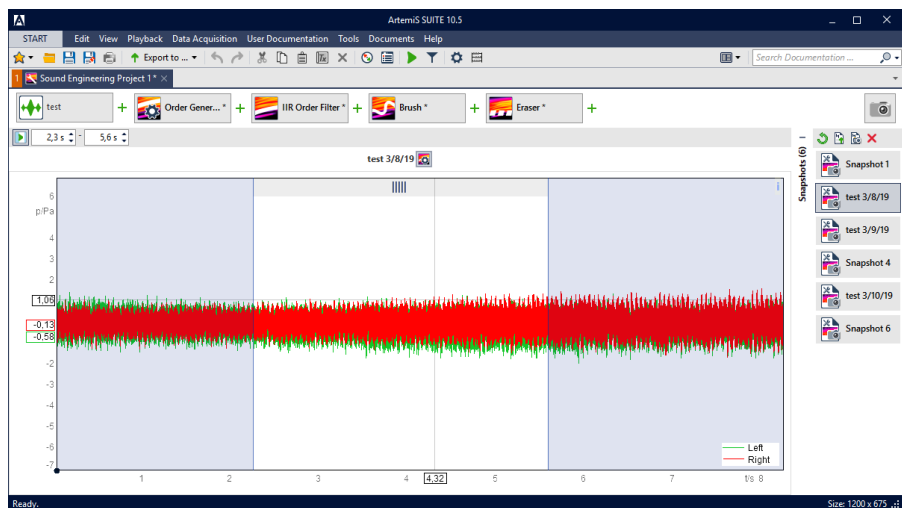
### Interactive processing

The interactive workflow consisting of several consecutive steps offers many advantages:

- By proceeding step by step, a structured and thus faster workflow is greatly facilitated
- The graphical workflow inspired by image processing ensures easy operation
- The immediate acoustic and visual feedback allows you to verify the results of your manipulations immediately
- Since sequences can be saved and played back at any time, you can interactively identify even subtle, minimal differences via direct A/B comparisons



The configured course of the target order or the order generator, or the differences between the edited and the original course of the IIR order or IIR frequency can be saved and re-used. When loaded into a filter from a process, edits the corresponding part of the signal.



The current state of all active and inactive processes (complete processing sequences) can be saved as Snapshot. The Snapshots will be visualized as tile in the Snapshots bar.

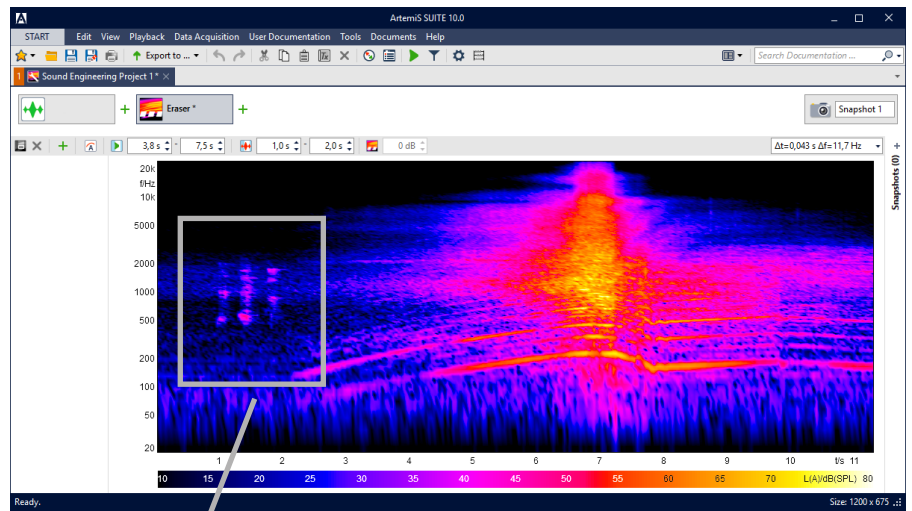
# Sound Engineering Project Examples

## 1<sup>st</sup> example (Eraser)

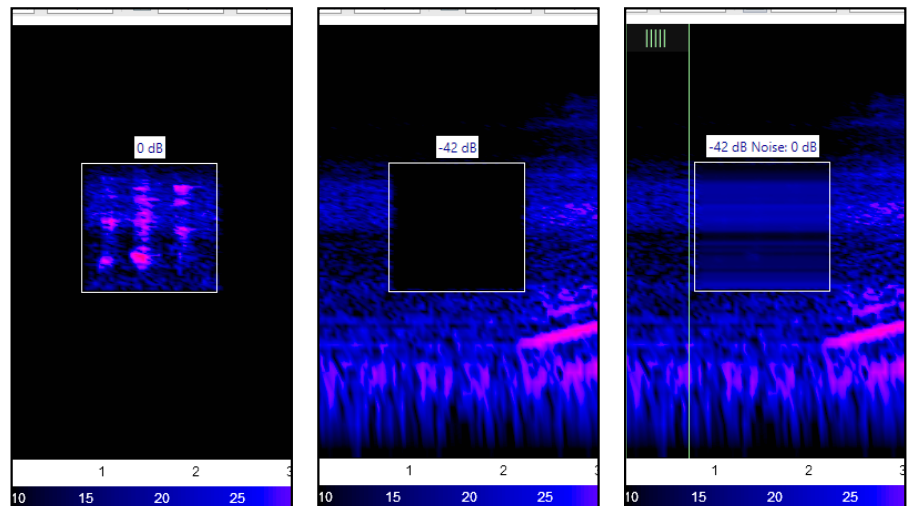
The Eraser can be used to define time frequency areas in the FFT vs. Time spectrogram, whose level shall be increased or attenuated individually.

The position and the limits of the area can be adjusted via the mouse whereby even non-rectangular shapes are possible. The amplification or attenuation for the chosen area can be set e.g. via the mouse wheel.

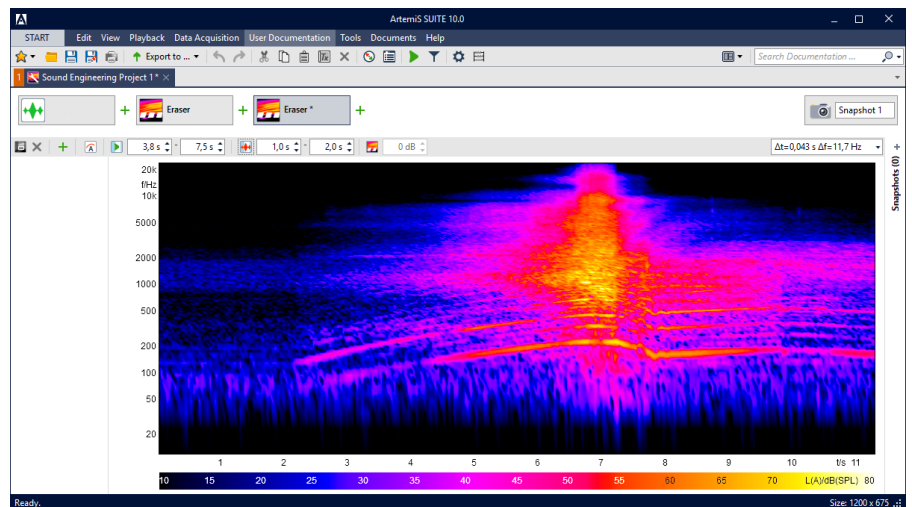
In addition, noise components from another position in the spectrogram can also be inserted into this area to achieve a more realistic overall result.



1<sup>st</sup> example: A disturbing noise fragment is to be removed from the sound event.



With the Eraser, the disturbing noise is identified by reducing the levels of the surrounding frequency and time ranges (left figure). Then the disturbing noise fragment is removed by reducing its level by 42 dB (middle figure), and the resulting acoustic “gap” is filled with uniform noise (right figure).



The disturbing noise fragment has been removed from the sound event, and the resulting “gap” that would otherwise irritate the listener has been filled with uniform noise.

# Sound Engineering Project Examples

## 2<sup>nd</sup> example (Brush)

By means of the Brush, users can intuitively „draw“ in an FFT vs. Time spectrogram known from the handling of graphical software.

This allows to select the focused acoustical signal components very easily, and to increase or decrease them individually. For comfortable operation different settings can be used, e.g.:

- the option „Minimum Level“ secures that signal parts with a lower level are not changed
- the option „Target Level“ allows signal parts to be attenuated respectively amplified to a specified value

The optical changes will then be converted into appropriate filters so that the users are able to get immediate feedback in the Player.

Additionally users can insert noise parts from another position in the spectrogram into these areas to create a more realistic overall result.

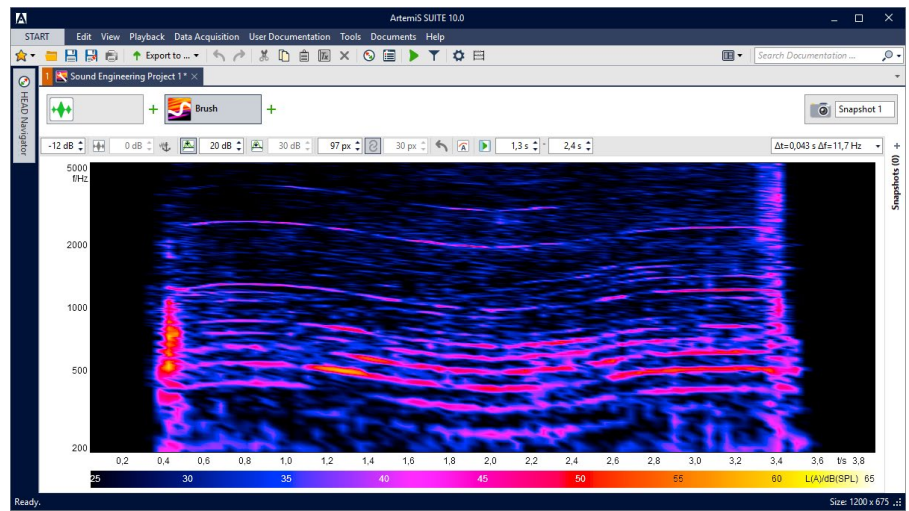
## File requirements

The Sound Engineering Project allows the user to process one- or two-channel files with a length of up to five minutes.

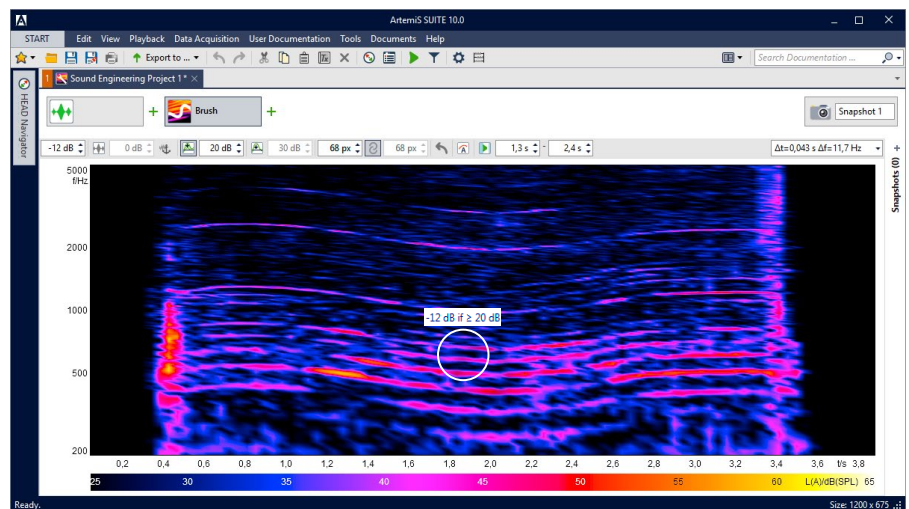
## HEAD Performance Analyzer

Using the Sound Engineering Project requires a powerful computer and graphics card.

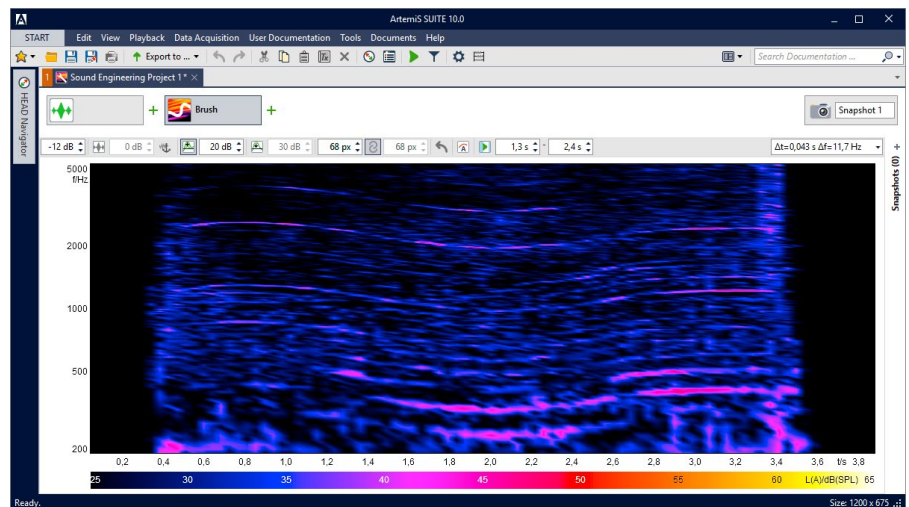
With the HEAD Performance Analyzer, the user can easily and safely check whether a computer meets the requirements for running the Sound Engineering Project. The HEAD Performance Analyzer can be downloaded free of charge from the Download Center on the HEAD acoustics web site.



2<sup>nd</sup> example (Brush): Using the Brush tool, several interfering signal parts are to be removed from the sound event.



By means of the cursor, users are able to „draw“ in the spectrogram to remove any interfering signal part quickly and precisely with an attenuation of 25 dB. The Minimum Level set to 15 dB prevents all signal parts below this specified value to be changed.



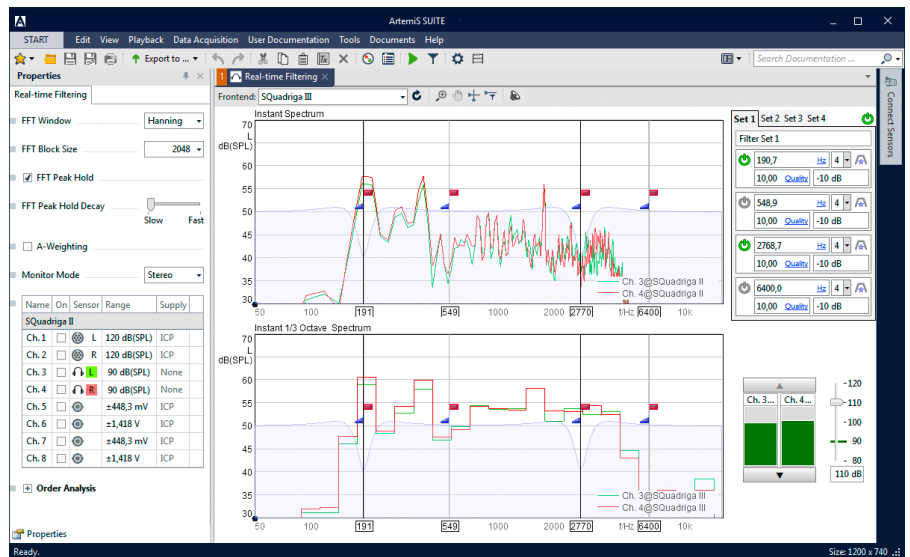
All interfering signal parts are removed from the sound event. After this, the new signal can be exported and be used for listening tests and much more.

## Real-time Filtering

With the Real-time Filtering binaural signals can be analyzed online. For users, a comfortable and intuitive parametrization of suitable filters becomes available that can be processed on the front end directly.

A SQuadriga is required as the front end. With this system, real-time filtering can be performed in a mobile setup, e.g. while driving in a vehicle, and thus in a real-life environment. This and the possibility to modify sound signals in real time allow more authentic assessment results and significant time-saving compared to a laboratory environment.

- Individual real-time filters: all-pass, low-pass, high-pass, band-stop, band-pass, parametric band-pass, parametric low-pass and parametric high-pass (each real-time filter can also be used as a tracking filter to attenuate or amplify individual orders)
- Signal control via Instant Spectrum, Instant 1/3 Octave Spectrum and Instant Order Spectrum (if RPM data is recorded)



The online analysis settings provide the so-called Instant Spectrum and the Instant 1/3 Octave Spectrum. Users can easily and comfortably switch between four independent sets of each four freely parameterizable 4<sup>th</sup> order filters.



Example configuration for real-time filtering of a binaural signal recorded with an HMS IV artificial head and SQuadriga III. The real-time filters are turned on and off directly with the RC X.1 remote control.

## Scope of Supply (ASM 19)

- License file:  
ArtemiS SUITE Sound Engineering Module (Code 5019)

## Requirements (ASM 19)

- ArtemiS SUITE Basic Framework (Code 5000)

## Requirements (Sound Engineering Project)

- Powerful computer
  - Powerful graphics card supporting DirectX 11
- ⇒ If you have questions regarding the special requirements to be met by the computer and the graphics card, please contact your HEAD acoustics representatives

## Recommended (Sound Engineering Project)

- ArtemiS SUITE Basic Analysis Module (Code 5001)

## Requirements (Real-time Filtering)

- SQuadriga III (Code 3324) Mobile recording and playback system (as of firmware 1.3) or
- SQuadriga II (Code 3320) Mobile recording and playback system (as of firmware 2.0)
- Binaural sensors (e.g., HMS IV), standard microphones or accelerometers
- Closed headphone

## Optional (Real-time Filtering)

- RC X.1 (Code 9850) Remote control for connecting to a PC

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