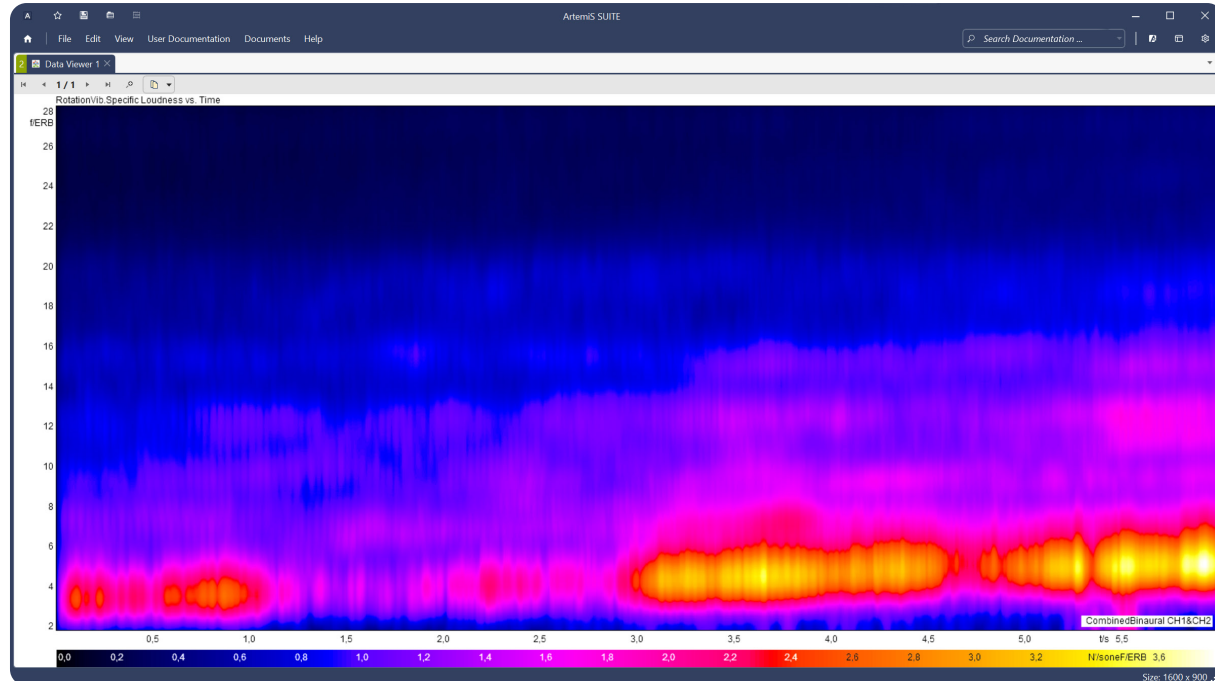




ArtemiS SUITE
Signal Processing

Code 51101

ASP 101 Psychoacoustics - Basic Analysis

Psychoacoustics - Basic Analysis of ArtemiS SUITE provides a range of psychoacoustic analyses, standards, and methods for the analytical description of perceived sound quality.

OVERVIEW

ASP 101 Psychoacoustics - Basic Analysis

Code 51101

Psychoacoustics - Basic Analysis provides psychoacoustic parameters for analyses that take into account the specific characteristics of human hearing.

ArtemiS SUITE provides further options (ASPs) including psychoacoustic analyses:

- › ASP 102 (Psychoacoustics - Basic Analysis) vs. Control Channel
- › ASP 103 (Psychoacoustics - Advanced Analysis)
- › ASP 104 (Psychoacoustics - Advanced Analysis vs. Control Channel)

ASP 101 and ASP 102 provide the following standards and methods:

- › DIN 45631, DIN 45631/A1, DIN 45681, DIN 45692
- › ISO 532-1, ISO 532-3, ISO/TS 20065, ANSI S3.4-2007
- › ECMA-418-1, ECMA-74 (Annex D)
- › Aures, von Bismarck

ASP 103 and ASP 104 provide the following standards and methods:

- › DIN 38455
- › ECMA-418-2, ECMA-74 (Annex F)

KEY FEATURES

Available analyses:

- › Loudness vs. Time
- › Specific Loudness
- › Specific Loudness vs. Time
- › Sharpness vs. Time
- › Specific Sharpness
- › Tonality
- › Tonality vs. Time
- › Tone-to-Noise Ratio
- › Tone-to-Noise Ratio vs. Time
- › Specific Prominence Ratio
- › Specific Prominence Ratio vs. Time

ASP 101 can be used in Pool Projects (APR 010 is required), Automation Projects (APR 050 is required), Standardized Test Projects (APR 220 is required), and Metric Projects (APR 570 is required).

APPLICATIONS

- › Simulation of human perception using appropriate analyses
- › Improvement of product sound quality
- › Evaluation of environmental noise

OVERVIEW ASP 101 – ASP 104

PSYCHOACOUSTICS - BASIC ANALYSIS (ASP 101)

- › Loudness vs. Time
- › Specific Loudness
- › Specific Loudness vs. Time
- › Sharpness vs. Time
- › Specific Sharpness
- › Tonality
- › Tonality vs. Time
- › Tone-to-Noise Ratio
- › Tone-to-Noise Ratio vs. Time
- › Specific Prominence Ratio
- › Specific Prominence Ratio vs. Time

PSYCHOACOUSTICS - BASIC ANALYSIS VS. CONTROL CHANNEL (ASP 102)

- › Analyses from ASP 101 as a function of control channels

PSYCHOACOUSTICS - ADVANCED ANALYSIS (ASP 103)

- › Loudness (Hearing Model) vs. Time
- › Specific Loudness (Hearing Model)
- › Specific Loudness (Hearing Model) vs. Time
- › Tonality (Hearing Model) vs. Time
- › Specific Tonality (Hearing Model)
- › Specific Tonality (Hearing Model) vs. Time
- › Tonality Frequency (Hearing Model) vs. Time
- › Roughness (Hearing Model) vs. Time
- › Specific Roughness (Hearing Model)
- › Specific Roughness (Hearing Model) vs. Time
- › Impulsiveness (Hearing Model) vs. Time
- › Specific Impulsiveness (Hearing Model)
- › Specific Impulsiveness (Hearing Model) vs. Time
- › Spectrum (Hearing Model) vs. Time
- › Fluctuation Strength (Hearing Model) vs. Time

- › Specific Fluctuation Strength (Hearing Model)
- › Specific Fluctuation Strength (Hearing Model) vs. Time
- › Relative Approach 2D
- › Relative Approach 3D

PSYCHOACOUSTICS - ADVANCED ANALYSIS VS. CONTROL CHANNEL (ASP 104)

- › Analyses from ASP 103 as a function of control channels

STANDARDS AND CALCULATION METHODS

- › Loudness
 - › DIN 45631 (1991), DIN 45631/A1 (2010)
 - › ISO 532-1 (2017), ISO 532-3 (2023)
 - › ANSI S3.4-2007 (FFT) / (FFT / 3rd Oct)
- › Sharpness
 - › Aures
 - › von Bismarck
 - › DIN 45692 (2009)
 - › DIN 45631/A1 (2010)
 - › ISO 532-1 (2017), ISO 532-3 (2023)
 - › ANSI S3.4-2007 (FFT) / (FFT / 3rd Oct)
- › Tonality
 - › DIN 45681 (2006)
 - › ISO/TS 20065 (2022)
- › Specific Prominence Ratio
 - › ECMA-418-1 (3rd) (2024)
 - › ECMA-74 (8th) (2003) / (9th) (2005)
- › Tone-to-Noise Ratio
 - › ECMA-418-1 (2nd) (2022) / (3rd) (2024)
 - › ECMA-74 (9th) (2005)
- › Tonality (Hearing Model)
 - › ECMA-74 (15th) (2018) / (17th) (2019)
 - › ECMA-418-2 (1st) (2020) / (2nd) (2022) / (3rd-4th) (2025)
- › Loudness (Hearing Model)
 - › ECMA-418-2 (2nd) (2022) / (3rd-4th) (2025)
- › Roughness (Hearing Model)
 - › DIN 38455 (2024)
 - › ECMA-418-2 (1st) (2020) / (2nd) (2022) / (3rd-4th) (2025)
- › Fluctuation Strength (Hearing Model)
 - › ECMA-418-2 (4th) (2025)



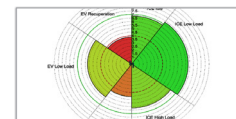
BINAURAL MEASUREMENT AND PLAYBACK



JURY TESTING SOFTWARE SQALA



SOUND QUALITY INDEX



DETAILS

Advantages of Psychoacoustic Analyses

Given that human hearing does not function like a linear measurement instrument, a simple level measure, such as dB(A), cannot adequately represent the auditory impression perceived by the listener. Like human hearing, psychoacoustic analyses focus on level differences, modulations, tonal components, roughness components, and other characteristics present in a sound. This reflects the cognitive signal processing that occurs during listening.

Listening tests form the foundation of psychoacoustic analyses development. As a pioneer in the development and application of psychoacoustic methods, we have been conducting extensive listening tests for several decades, with the results continuously incorporated into the ongoing development of these analyses. The results of the listening tests confirm the high validity of all our psychoacoustic analyses.

Loudness

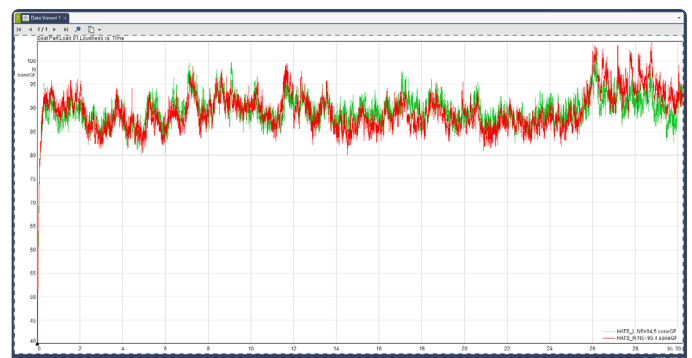
Loudness is the perceived magnitude of sound intensity. Since human loudness perception is frequency-dependent, sound events with the same level but different frequencies may evoke different loudness perceptions. The loudness scale therefore accounts for the fact that a sound perceived as twice as loud is also assigned twice the loudness value on the loudness scale, expressed in sones.

The calculation is based on the following standards:

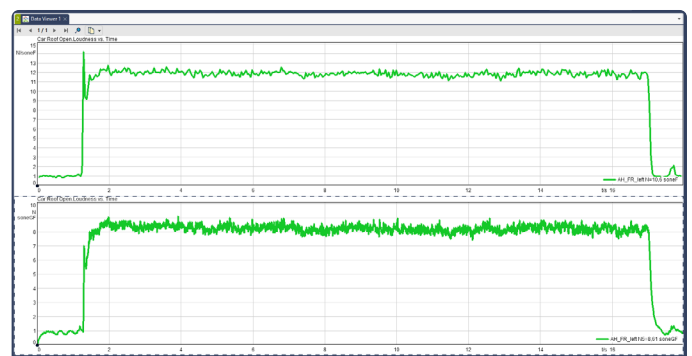
- › DIN 45631 (1991)
- › DIN 45631/A1 (2010)
- › ISO 532-1 (2017)
- › ISO 532-3 (2023)
- › ANSI S3.4-2007 (FFT)

The following analyses are available:

- › Loudness vs. Time
- › Specific Loudness
- › Specific Loudness vs. Time



Loudness vs. Time (ISO 532-1)



Loudness vs. Time (top: ANSI S3.4 2007 (FFT); bottom: ISO 532-1 (2017))

Sharpness

Sound signals with high-frequency spectral components are perceived as “sharp” or “shrill” by human hearing. The psychoacoustic quantity sharpness was introduced as a measure of this sensation. Sharpness is primarily determined by the center of gravity of the area under the spectral envelope. The further this center of gravity is shifted toward higher frequencies, the sharper the sound is perceived.

The Sharpness vs. Time analysis is based on the sound’s specific loudness distribution. The loudness standards listed above can be used for this analysis.

Based on this, sharpness can be calculated using one of the following three methods:

- › Aures
- › DIN 45692
- › von Bismarck

The following analyses are available:

- › Sharpness vs. Time
- › Specific Sharpness

Tonality

Sounds are perceived as tonal when they contain distinct tones or narrowband noise. Unwanted sounds with pronounced tonal components are perceived as more annoying than comparable sounds without tonal components. If a product or machine produces pronounced tonal components, this has a negative impact on perceived overall quality.

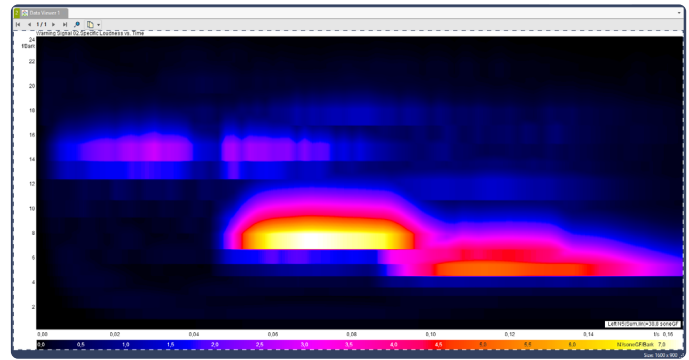
Tonality analyses are used to determine the perceived prominence of tonal components in sounds and are widely used in sound quality assessment, noise measurement, and product development.

The Tone-to-Noise Ratio is defined as the ratio of the power of a tone to the noise power within the critical band surrounding the tone.

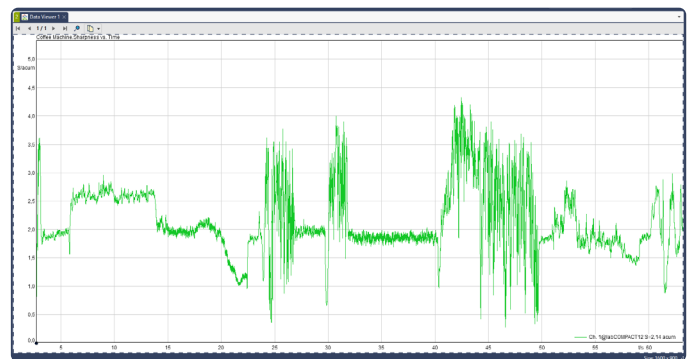
The Specific Prominence Ratio and Specific Prominence Ratio vs. Time analyses can be used to determine tonal components in a signal and display them numerically. When analyzing versus time, the algorithm is applied to each individual FFT versus time.

The following calculation methods are available:

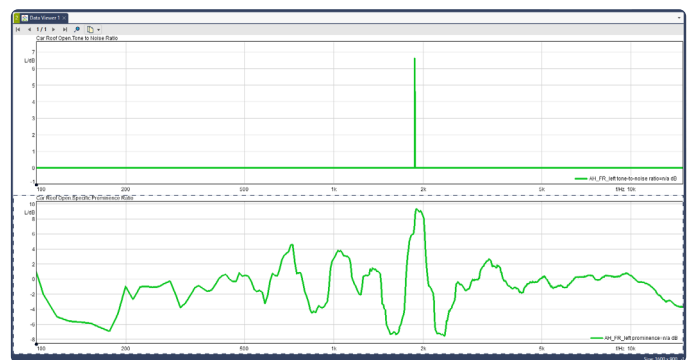
- › DIN 45681 (2006)
- › ISO/TS 20065 (2022)
- › ECMA-418-1 (2nd) (2022) / (3rd) (2024)
- › ECMA-74 (8th) (2003) / (9th) (2005)



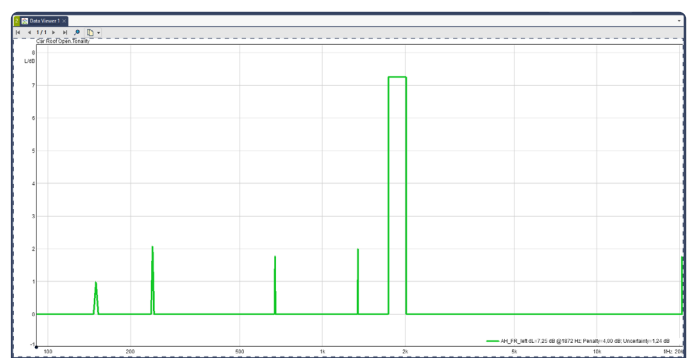
Specific Loudness vs. Time (ISO 532-1)



Sharpness vs. Time (DIN 45631/A1)



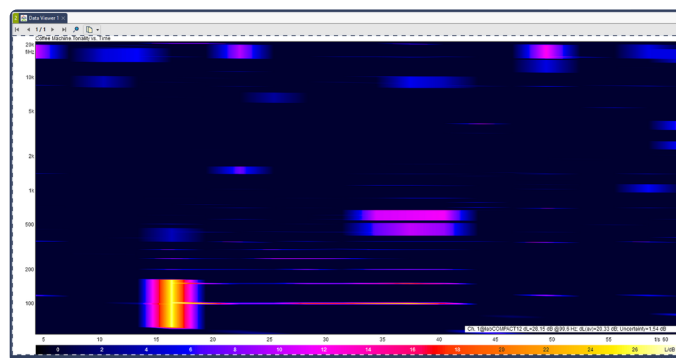
Tone-to-Noise Ratio (top) and Specific Prominence (bottom)



Tonality (ISO/TS 20065)

The following analyses are available:

- › Tonality
- › Tonality vs. Time
- › Tone-to-Noise Ratio
- › Tone-to-Noise Ratio vs. Time
- › Specific Prominence Ratio
- › Specific Prominence Ratio vs. Time



Tonality vs. Time (ISO/TS 20065)

LICENSES AND OPTIONAL FEATURES

General Requirements

Code	Product Name	Description
50000	APR 000 APR Framework	Basis of ArtemiS SUITE
51101	ASP 101 Psychoacoustics - Basic Analysis	Psychoacoustic analyses, standards, and methods for the analytical characterization of perceived sound quality
At least one of the core projects of ArtemiS SUITE—Pool Project, Automation Project, or Standardized Test Project—or the Metric Project is required and must be licensed.		

Optional Features

Code	Product Name	Description
50010	APR 010 Pool Project	Central project of ArtemiS SUITE: interactive workflow, ease of use, and data processing based on the cross-product logic
50050	APR 050 Automation Project	Central project of ArtemiS SUITE: one-time definition of the processing steps, followed by automated and repeated execution for all subsequent data
50220	APR 220 Standardized Test Project	Central element of ArtemiS SUITE: display of filtered, analyzed, and statistically processed input signals in an individual Report
50570	APR 570 Metric Project	Creation of quality metrics by correlating listening test results with acoustic signal analyses
51102	ASP 102 Psychoacoustics - Basic Analysis vs. Control Channel	Analyses from ASP 101 as a function of control channels
51103	ASP 103 Psychoacoustics - Advanced Analysis	Advanced psychoacoustic analyses, standards, and methods based on the Sottek Hearing Model for the characterization of psychoacoustic effects and fundamental auditory perceptions of human hearing
51104	ASP 104 Psychoacoustics - Advanced Analysis vs. Control Channel	Analyses from ASP 103 as a function of control channels

LICENSES AND OPTIONAL FEATURES

Optional Features

Code	Product Name	Description
51107	ASP 107 Spectral Audio Feature Analysis	Analyses for the detailed characterization of spectral features and the quantitative description of the acoustic properties of signals
51108	ASP 108 Spectral Audio Feature Analysis vs. Control Channel	Analyses from ASP 107 as a function of control channels

5097	ASX 07 Local Processing Service (API)	ASX programming interface: execution of Automation Projects, for example, in End-of-Line processes, based on automation specifications (calculation jobs); ArtemiS SUITE does not need to be installed
5092	ASX 02 Data Processing and Representation API	ASX programming interface: automated or interactive control of Pool Projects and Automation Projects, including the execution of Reports, exports, and other tasks from within your software; ArtemiS SUITE must be installed

Further modules of ArtemiS SUITE (see ArtemiS SUITE Overview data sheet)



Contact Information

Ebertstraße 30a
52134 Herzogenrath, Germany
Phone: +49 2407 577-0
E-Mail: sales@head-acoustics.com
Website: www.head-acoustics.com