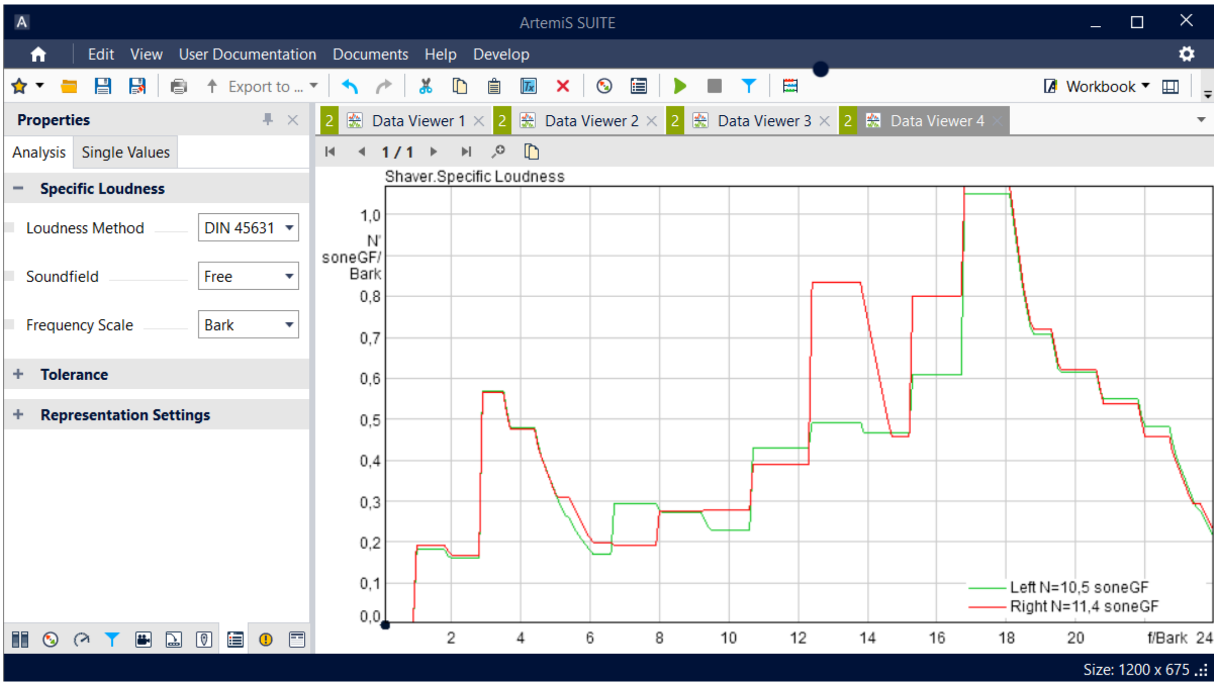
HEAD acoustics

DATA SHEET



ArtemiS SUITE
Signal Processing

Code 51101

ASP 101 Psychoacoustics - Basic Analysis

Psychoacoustics - Basic Analysis of ArtemiS SUITE provides a range of psychoacoustic analyses and single values for analytical description of perceived sound quality.

OVERVIEW

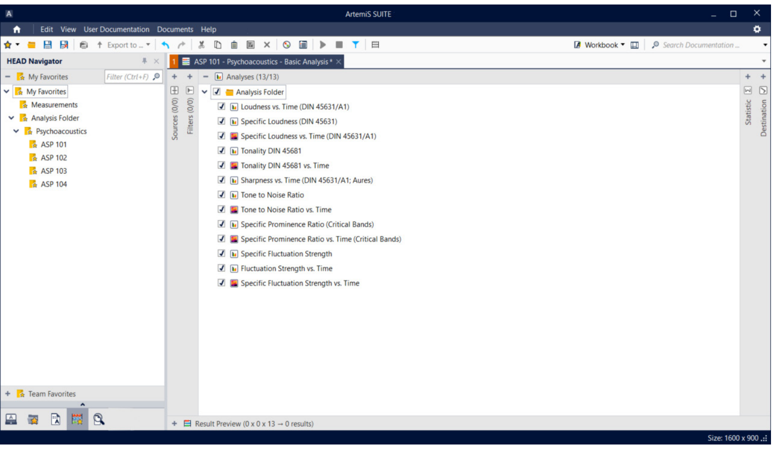
ASP 101 Psychoacoustics - Basic Analysis

Code 51101

Psychoacoustics - Basic Analysis (ASP 101) provides various psychoacoustic parameters which enable the data analysis under consideration of the specifics of the human hearing.

ArtemiS SUITE offers further options for psychoacoustic analysis:
ASP 102 (Psychoacoustics - Basic Analysis vs. Control Channel),
ASP 103 (Psychoacoustics - Advanced Analysis),
ASP 104 (Psychoacoustics - Advanced Analysis vs. Control Channel)

› ASP 101 and 102 provide the standards and methods: DIN 45631/A1, ISO 532-1, 532-3, ANSI S3.4-2007, DIN 45681, Aures, von Bismarck, DIN 45692
› ASP 103 and 104 provide the standards: DIN 38455, ECMA 418-2 (1st Edition) / (2nd Edition), ECMA 74 (15th Edition) / (17th Edition)



KEY FEATURES

ASP 101 provides several analyses:
› Loudness vs. Time
› Specific Loudness
› Specific Loudness vs. Time
› Sharpness vs. Time
› Tonality DIN 45681
› Tonality DIN 45681 vs. Time
› Tone to Noise Ratio
› Tone to Noise Ratio vs. Time
› Specific Prominence Ratio
› Specific Prominence Ratio vs. Time
› Fluctuation Strength vs. Time
› Specific Fluctuation Strength
› Specific Fluctuation Strength vs. Time

Available standards and methods:
› DIN 45631/A1, ISO 532-1, 532-3, ANSI S3.4-2007 (FFT) / (FFT/3rd Oct)
› DIN 45681
› Aures, von Bismarck, DIN 45692

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

APPLICATIONS

› Simulating human perception with suitable analyses
› Improving the sound quality of products
› 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
- Tonality DIN 45681
- Tonality DIN 45681 vs. Time
- Tone to Noise Ratio
- Tone to Noise Ratio vs. Time
- Specific Prominence Ratio
- Specific Prominence Ratio vs. Time
- Fluctuation Strength vs. Time
- Specific Fluctuation Strength
- Specific Fluctuation Strength vs. Time

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 (Hearing Model) Frequency 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
- Relative Approach 2D
- Relative Approach 3D

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

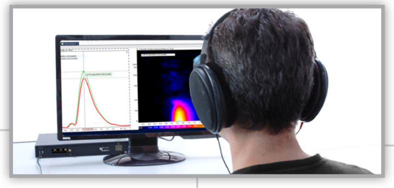
- Loudness vs. RPM
- Specific Loudness vs. RPM
- Sharpness vs. RPM
- Tonality DIN 45681 vs. RPM
- Tone to Noise Ratio vs. RPM
- Specific Prominence Ratio vs. RPM
- Fluctuation Strength vs. RPM
- Specific Fluctuation Strength vs. RPM

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

- Loudness (Hearing Model) vs. RPM
- Specific Loudness (Hearing Model) vs. RPM
- Tonality (Hearing Model) vs. RPM
- Specific Tonality (Hearing Model) vs. RPM
- Tonality (Hearing Model) Frequency vs. RPM
- Roughness (Hearing Model) vs. RPM
- Specific Roughness (Hearing Model) vs. RPM
- Impulsiveness (Hearing Model) vs. RPM
- Specific Impulsiveness (Hearing Model) vs. RPM

STANDARDS

- Loudness
  - DIN 45631/A1
  - ISO 532-1, ISO 532-3
  - ANSI S3.4-2007 (FFT) / (FFT/3rd Oct)
- Sharpness
  - Aures
  - Von Bismarck
  - DIN 45692
  - DIN 45631/A1
  - ISO 532-1, ISO 532-3
  - ANSI S3.4-2007 (FFT) / (FFT/3rd Oct)
- Tonality
  - DIN 45681
- Loudness (Hearing Model)
  - ECMA 418-2 (2nd)
- Roughness (Hearing Model)
  - DIN 38455
  - ECMA 418-2 (1st) / (2nd)
- Tonality (Hearing Model)
  - ECMA 74 (15th) / (17th)
  - ECMA 418-2 (1st) / (2nd)



ARTEMIS SUITE PROJECTS

- Pool Project (APR 010)
- Automation Project (APR 050)
- Standardized Test Project (APR 220)
- Metric Project (APR 570)

Additional solutions from HEAD acoustics

JURY TESTING SOFTWARE SQALA

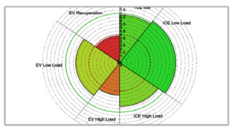
- Jury Testing - SQala Basic (APR 500)
- Jury Testing - SQala Net (APR 501)
- Jury Testing - SQala Server (APR 501)

BINAURAL MEASUREMENT AND PLAYBACK

- Artificial heads HMS V, HSU
- HEAD*lab* systems
- Mobile frontend SQuadriga III, ...
- ...

SOUND QUALITY INDEX

- Metric Project (APR 570)



DETAILS

Loudness

Loudness is the sensation value for the human perception of loudness. Since the loudness perception of the human auditory system is dependent on frequency, sound events with the same level but different frequency do not always evoke the same loudness perception in humans. Therefore, the loudness scale is characterized by the fact that a sound that is perceived as twice as loud also has a sone value that is twice as high on the loudness scale.

LOUDNESS VS. TIME

Loudness vs. Time provides several standards:

› DIN 45631/A1
› ISO 532-1
› ISO 532-3
› ANSI S3.4 2007 (FFT)
› ANSI S3.4 2007 (FFT) / (3rd Octave)

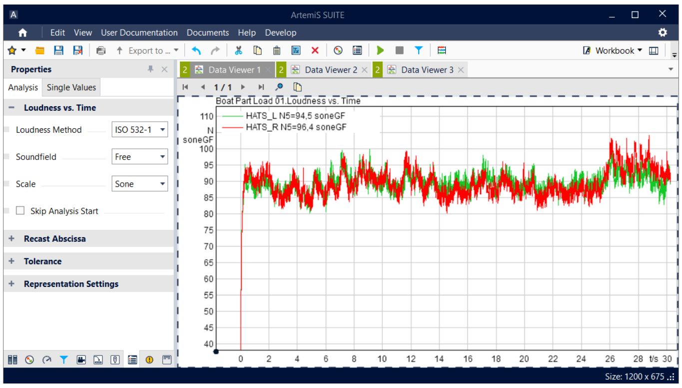
DIN 45631/A1 extends the standard DIN 45631, which includes a method to determine the loudness of time-variant noises.

The ISO 532-1 standard is based on the calculation rule described in DIN 45631/A1. The standard takes variable signals into better account in contrast to other standards, which are more suitable for stationary signals, for example. 532-3 provides a particularly higher time resolution at higher frequencies and an especially excellent frequency resolution at lower frequencies.

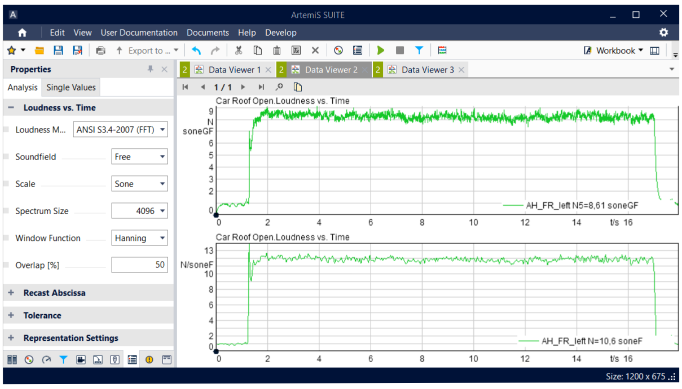
ANSI S3.4-2007 (FFT) and ANSI S3.4-2007 (FFT/3rd octave) are the ideal standards for examining the loudness of stationary signals.

SPECIFIC LOUDNESS, SPECIFIC LOUDNESS VS. TIME

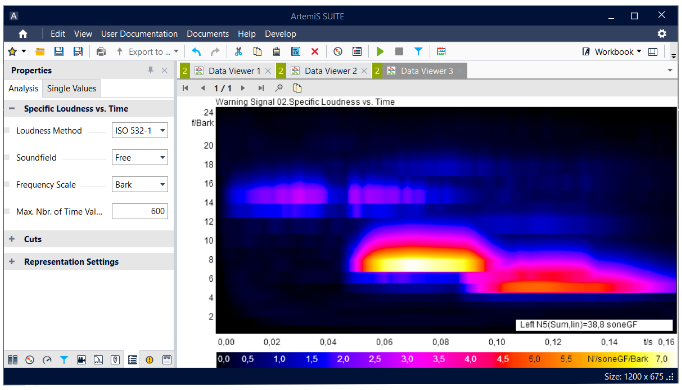
The analyses Specific Loudness and Specific Loudness vs. Time calculate the distribution of loudness of the input signal (versus time) across the critical bands. The standards correspond to those of the Loudness vs. Time analysis.



Loudness vs. Time (ISO 532-1)



Loudness vs. Time (ANSI S3.4 2007 (FFT))



Specific Loudness vs. Time (ISO 532-1)

Sharpness

Sound signals whose spectral components are mainly located in the high frequency range are perceived as "sharp" or "shrill" by human hearing. As a measure for this impression, the sharpness parameter has been introduced. The decisive factor for sharpness is the balance point of the area below the envelope of the spectrum. The farther this point is shifted towards high frequencies the sharper is the acoustic impression of a sound.

SHARPNESS VS. TIME

The calculation of the Sharpness vs. Time analysis is based upon the specific loudness distribution of the sound. Several standards are available:

- DIN 45631/A1
- ISO 532-1
- ISO 532-3
- ANSI S3.4 2007 (FFT)
- ANSI S3.4 2007 (FFT/3rd Octave)

Coming from that, the sharpness can be calculated using one of these methods:

- Aures
- DIN 45692
- von Bismarck

The von Bismarck calculation method is based on the distribution of the specific loudness throughout the critical band rate. The procedure refers to sounds of equal loudness, meaning that the influence of the absolute loudness upon sharpness is not taken into consideration. The Aures calculation method takes the influence of loudness into account, too. In DIN 45692, a method for the calculation of the sharpness is standardized which is similar to the one developed by von Bismarck.

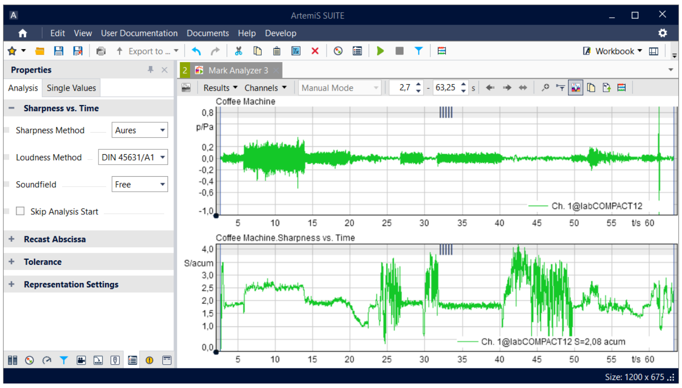
Tonality

Sounds are perceived as tonal if they contain distinct individual tones or narrow-band noise. Undesired tonal noise is perceived as more annoying than comparable noise without tonal components. If a product or machine causes tonal noise components, this will have a negative effect on the perceived overall quality.

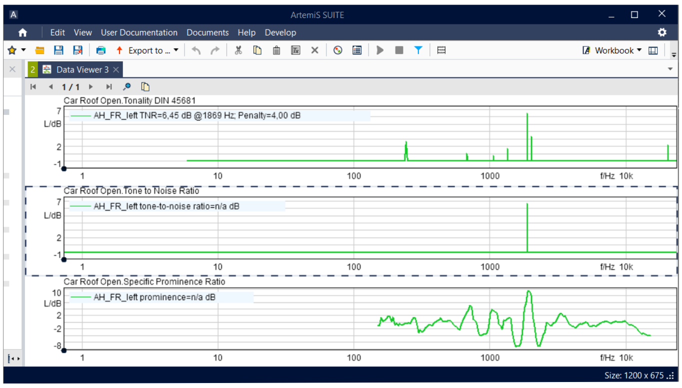
TONALITY DIN 45681,
TONALITY DIN 45681 VS. TIME

The analyses Tonality DIN 45681 and Tonality DIN 45681 vs. Time can be used for the determination of tonal components of noises and for the determination of a tone adjustment for the assessment of noise immissions.

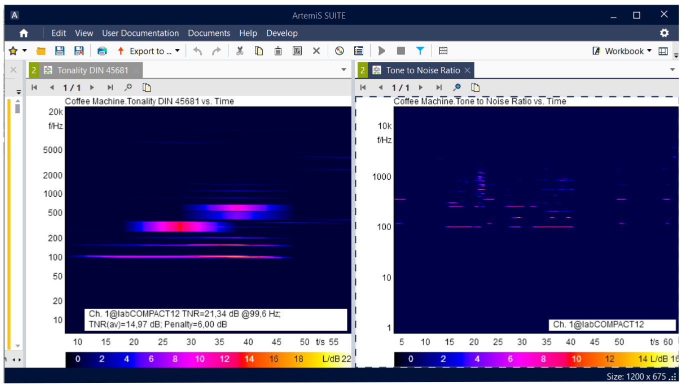
Therefore, DIN 45681 defines a method for the automatic determination of tones and tone groups from narrow band spec-



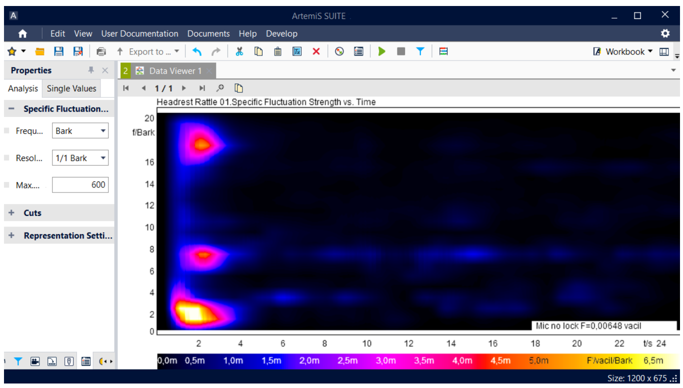
Sharpness vs. Time (DIN 45631/A1)



Tonality DIN 45681, Tone to Noise Ratio, Specific Prominence Ratio



Tonality DIN 45681 vs. Time, Tone to Noise Ratio vs. Time



Specific Fluctuation Strength vs. Time tra. Similar to the Tone to Noise Ratio anayses, the difference between the tone level and the level of the noise signal in the surrounding critical band is determined whereby an additional frequency-dependent occlusion measure is accounted for.

TONE TO NOISE RATIO, TONE TO NOISE RATIO VS. TIME

Tone to Noise Ratio is defined as the power of a tone compared to the noise power of the critical band surrounding the tone. The analyses Tone to Noise Ratio and Tone to Noise Ratio vs. Time enable users to find tonal components of a signal and to present them as numeric values.

SPECIFIC PROMINENCE RATIO, SPECIFIC PROMINENCE RATIO VS. TIME

The analyses Specific Prominence and Specific Prominence vs. Time can be used for the identification of tonal components in a signal and their numerical representation. In the analysis versus time, the algorithm is applied to each individual FFT versus time.

Fluctuation Strength vs. Time, Specific Fluctuation Strength, Specific Fluctuation Strength vs. Time

The Fluctuation Strength analyses map the human impression of amplitude modulations up to frequencies of about 25 Hz to a linear scale. The calculation of the fluctuation strength is derived from the calculation of the Roughness (Hearing Model) analyses (ASP 103 or ASP 104 are required).

Required: APR Framework (Code 50000)
and/or: HEAD System Integration and Extension (ASX) programming interfaces

Advantages of psychoacoustic analyses

As the human hearing does not work like a linear measurement device, a simple representation of the level, e.g., dB(A), of a signal cannot capture the impression perceived by a listener. Just like humans, psychoacoustic analyses concentrate on the pattern level differences, modulations, tonal components, roughness components, etc., found in a sound. This corresponds to cognitive signal processing during listening.

Listening tests are the basis for the development of psychoacoustic analyses. As a pioneer in the development and application of psychoacoustic methods, HEAD acoustics has continuously performed extensive listening tests for several decades, the evaluations of which are permanently incorporated into the further development of the analyses. The results of the listening tests confirm the high validity of all psychoacoustic analyses provided by HEAD acoustics.

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