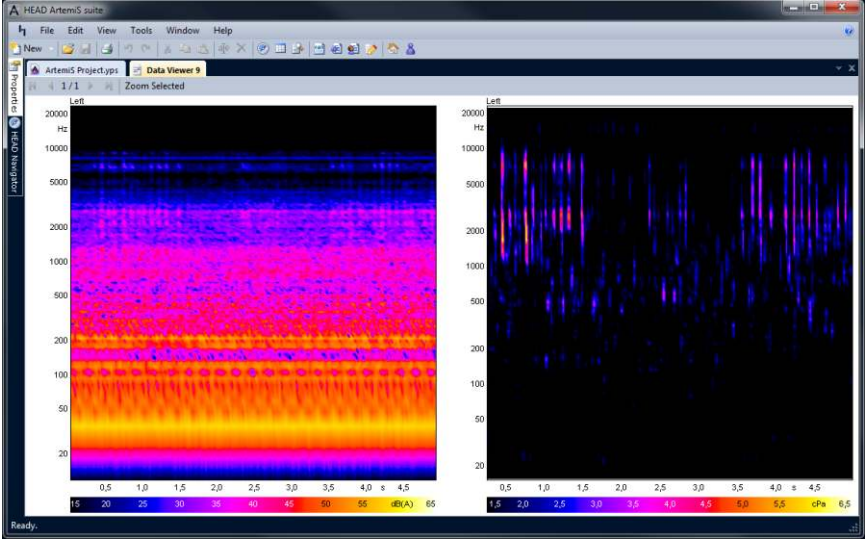


**DATA SHEET**

**ArtemiS SUITE Adv. Psychoacoustics Module (Code 5016)**

ArtemiS SUITE module for special acoustic evaluation



**Overview**

The Adv. Psychoacoustics Module includes the psychoacoustic roughness analysis, based on a hearing model, and the analysis Relative Approach, which are modeled after the special characteristics of subjective human signal processing. In addition to the analyses included in the Adv. Psychoacoustics Module of the ArtemiS SUITE, ArtemiS 12 provides the analyses of the Adv. Psychoacoustics Module (ATP 06).

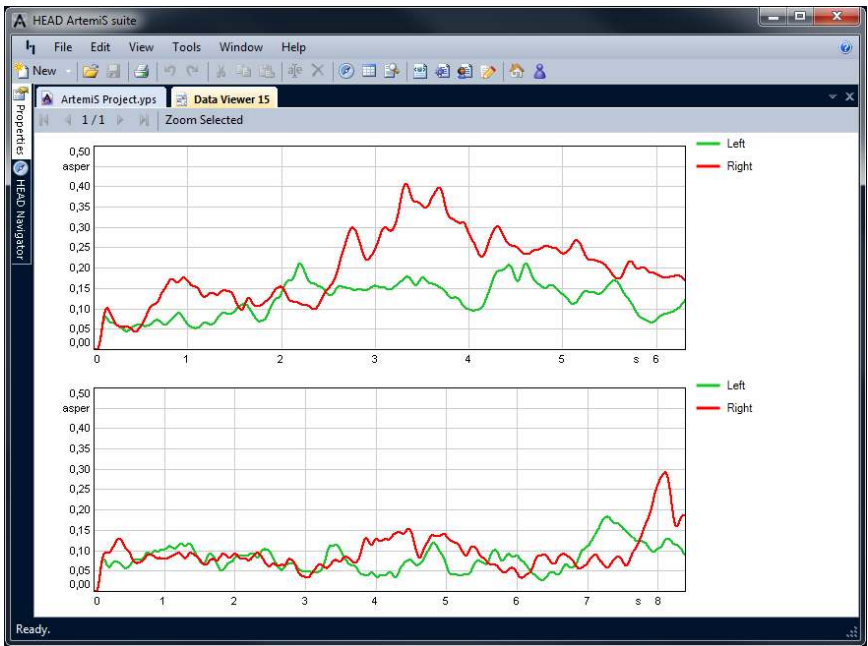
**Features**

- Expansion module of the ArtemiS SUITE for the objectivation of subjective sound perception with the analyses:
  - Hearing Model: Roughness vs. time
  - Relative Approach 2D
  - Relative Approach 3D
- The hearing model is based on the physiology of the human hearing and allows special analysis functions in the frequency domain, where time and frequency resolution correspond to those of human hearing.
- The Relative Approach Analysis is based on the hearing model and performs a timefrequency analysis of signal level curves in order to comply with the characteristics of human hearing. It reacts to rapid changing temporal and spectral structures in signals and excellently correlates with the pattern detection capabilities of human hearing.
- In comparison, the Relative Approach analysis exhibits the

sound component conspicuous to the human hearing much more clearly than the FFT analysis (upper left diagram; left diagram: FFT vs. time, right diagram: Relative Approach)

**Requirements**

- ArtemiS SUITE Basic Framework (Code 5000)
- ArtemiS SUITE Basic Analysis Module (Code 5001)



The diagrams exhibit the results of the roughness analysis based on the hearing model. The sound perceived as rougher is shown in the upper diagram and the sound perceived as less rough in the lower diagram. The difference between the human roughness perception is mapped by the analysis contained in ASM 16 very well.

## Analysis Pool

### Relative Approach 2D / Relative Approach 3D

Basis analysis:	1/n Octave (Filter) / 1/n Octave (FFT) / Hearing model / Loudness (FFT/HEAD)
Band Resolution:	Octave / 3rd Octave / 1/6 - 1/96 Octave
Spectral Weighting:	None / A / B / C / D / G / $W_d$ / $W_k$ / $W_n$ etc. Weighting
Overlap:	Selectable
Time Weighting (ms):	Selectable time constant for the calculation of the frequency pattern (F) and time pattern (T)
Variation Analysis:	Regression / Prominence 3D
Regressions Algorithm:	Time Pattern / Frequency Pattern / Frequency + Time Pattern
FFT Size:	FFT size can be specified separately for the frequency pattern (F) and time pattern (T)
Weighting:	The weighting factors for the adding of the results of the algorithms Frequency Pattern (F) and Time Pattern (T) can be adjusted
Cuts:	Extracting of 2D curves from the three dimensional spectrum (Cut Mode: First Abscissa / Second Abscissa / Free selectable cuts)

### Hearing Model: Roughness vs. Time

Resolution:	1/1 Bark / 1/2 Bark
Transient oscillation effects (display in diagram) can be suppressed	

**ATP 06 (Code 5016)**

**ArtemiS Advanced Psychoacoustic Module**

for special acoustic evaluation  
 ASM 16 (Code 5016) of the ArtemiS SUITE includes ATP 06.

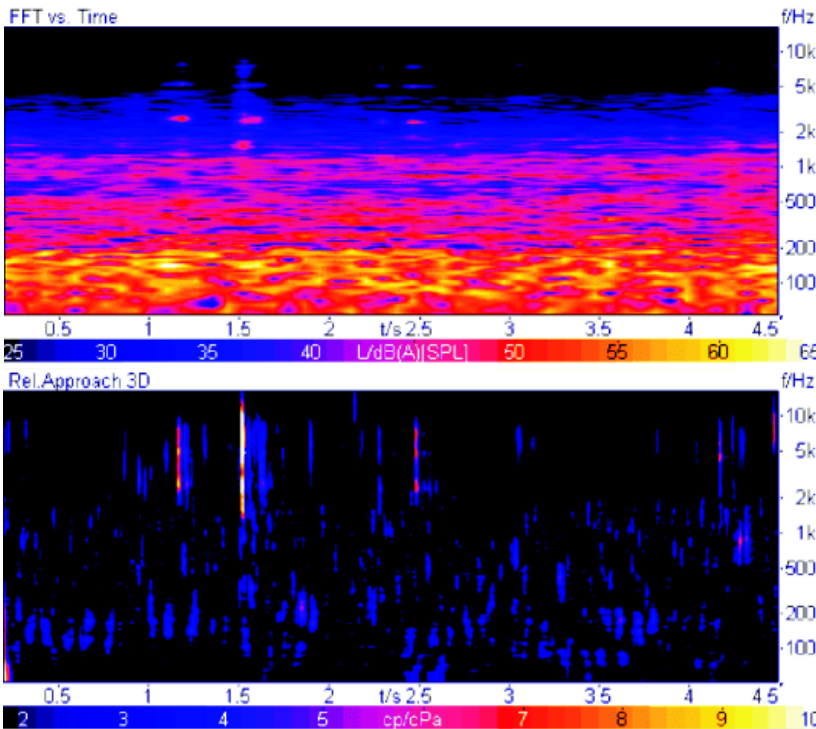
**Overview**

The ArtemiS Advanced Psychoacoustic Module includes the psychoacoustic analysis functions Hearing Model, Relative Approach, and HSA, which are modeled after the special characteristics of subjective human signal processing.

reacts to rapid changing temporal and spectral structures in signals and excellently correlates with the pattern detection capabilities of human hearing.

• **HSA** (High-resolution Spectral Analysis)

The HSA method is a special signal estimation algorithm, which improves the analysis of tonal components in a signal. This applies especially to short signal sections, where HSA has great advantages compared to conventional FFT analysis.



In the analysis of a car interior sound, the Relative Approach analysis (lower diagram) exhibits the disturbing sound component much more clearly than the FFT analysis (upper diagram).

**Features**

- Hearing Model spectrum vs. time
- Hearing Model Impulsiveness vs. time
- Hearing Model Roughness vs. Zeit
- Hearing Model Spec. Impulsiveness
- Hearing Model Spec. Roughness
- Hearing Model Spec. Impulsiveness vs. time
- Hearing Model Spec. Roughness vs. time
- Relative Approach 2D
- Relative Approach 3D
- High-resolution Spectral Analysis (HSA)
- HSA vs. time
- HSA vs. rpm

**Applications**

- Objectivation of subjective sound perception
- Sound Quality

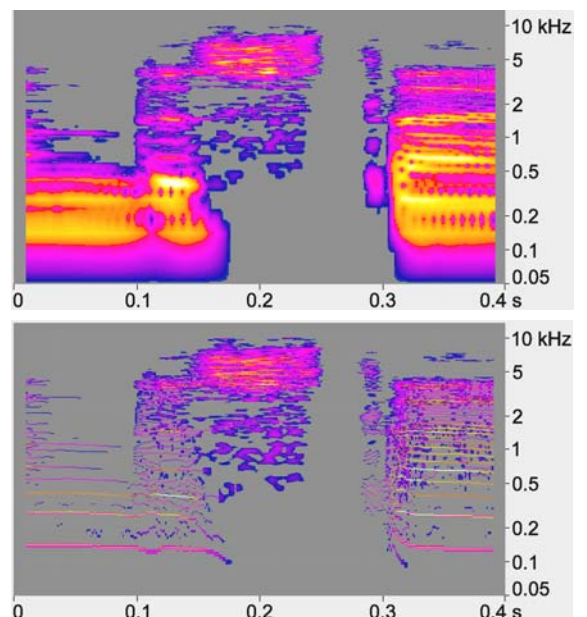
**Specifics**

• **Hearing Model**

The hearing model is based on the physiology of the human hearing and allows special analysis functions in the frequency domain, where time and frequency resolution correspond to those of human hearing.

• **Relative Approach**

The Relative Approach Analysis is based on the hearing model and performs a time-frequency analysis of signal level curves in order to comply with the characteristics of human hearing. It



In comparison with an FFT analysis (upper diagram) the Hearing Model analysis (lower diagram) exhibits the temporal modifications of the frequencies more clearly and shows the level of the base frequencies and the harmonics abundantly clear

## Technical data

### Hearing Model

Range:	1 - 14000 Hz
Resolution (bandwidth):	0,1 - 1
Frequency scale:	Bark / $\frac{1}{2}$ Bark / $\frac{1}{3}$ Bark / $\frac{1}{5}$ Bark / Lin/Log
Band pass:	1st - 5th order
Low pass:	Off / 1st - 5th order
Spectral Weighting:	none / A / B / C / D Weighting
Calculation of the envelope:	Hilbert Transformation / Half wave rect. / Full wave rect.
Band pass shape:	asymmetric
Low pass frequency:	1 - 5000 Hz

### Hearing Model Impulsiveness vs. time

### Hearing Model Spec. Impulsiveness / Hearing Model Spec. Impulsiveness vs. time

Frequency scale:	Hz / Bark
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### Hearing Model Roughness vs. time

Resolution:	1/1 Bark / 1/2 Bark
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### Hearing Model Spec. Roughness / Hearing Model Spec. Roughness vs. time

Frequency scale:	Hz / Bark
Resolution:	1/1 Bark / 1/2 Bark

### Relative Approach 2D /Relative Approach 3D

Base Analysis:	1/n octave (Filter) / 1/n octave (FFT) / Hearing Model / Loudness (FFT/HEAD)
Spectral Weighting:	none / A / B / C / D / G / $W_d$ / $W_k$ / $W_h$ etc. Weighting
Variation analysis:	Regression / Prominence 3D
Reg. algorithm.:	Frequency Pattern / Time Pattern / Freq. + Time Pattern

### 1/n Octave (Filter)

Band resolution:	Octave / 3rd Octave - 96th Octave
Time Weighting:	0,1 - 50 ms

### 1/n Octave (FFT) / Loudness (FFT/HEAD)

FFT Size:	$2^8$ - $2^{16}$
Overlap:	0 - 99.9 %

### HSA / HSA vs. time/ HSA vs. rpm

#### HSA

Window size:	$16 - 2^{16}$
Increase of frequency resolution with HSA compared to FFT:	1 - 16
Window Function:	Rectangle / Hanning / Hamming / Blackman / Bartlet / Kaiser-Bessel 8 - 16 / Flat-top / Gauss 8, 16, 32
Spectral Weighting:	none / A / B / C / D G / $W_d$ / $W_k$ / $W_h$ etc. Weighting / Equal Loudness
Iterations:	0 - 500

#### Order Limit

Order Limit:	On / Off
Range (Order):	0.1 - 1000

#### Advance

Overlap:	0 - 99.9 %
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The functionality of the ArtemiS Advanced Psychoacoustics Module (ATP 06) is extended by the ArtemiS Signature Analysis Module (ATP 03). Further information you will find in the data sheet of ATP 03.