Advanced audio analysis with Akulap / Audio Precision

1 Introduction

During the last years psycho-acoustic parameters moved from scientific research to practical world. These parameter like loudness, tonality, sharpness etc. have a much better correlation to the human ear than classical parameter like dBA

Typical applications

- Fan noise, from small air coolers to wind generators
- Engine noise
- Push or rotating buttons
- Compressor noise
- Closing door noise
- etc.

Typical industrial areas

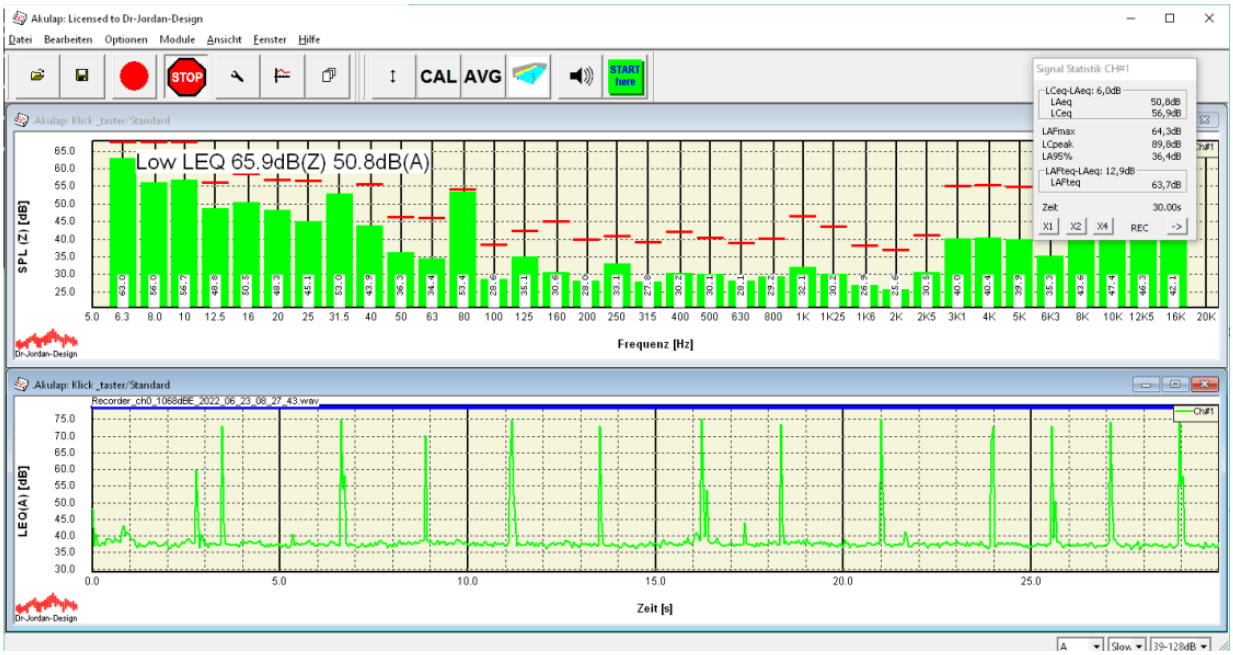
- Automotive NVH
- Aviation
- PC/Notebook manufacturer (e.g. fans, rotating disks, keypads)
- Home cinema equipment (e.g. fan noise for beamers)
- Household equipment, dishwashers, air condition etc

2 Akulap

Akulap is a PC/windows based analysis suite from Dr-Jordan-Design.

Audio Inputs can be

- Real-time Audio Input via Windows Audio /Direct X, WASAPI, ASIO
- Audio files from recordings .wav or MP3 files



Akulap covers the following parameters (and many more)

- All **classical** parameter according to IEC61672-1 (SPL in dB ,LAEQ, LCEQ etc).
- Room and building acoustics
- 1/3 octave analysis and High resolution FFT
- Loudness in Sone **DIN 45631/A1 ISO 532-1**
- Specific Loudness
- Loudness time-invariant **ISO 532B** (classical Zwicker Model)
- Sharpness **DIN 45692**
- Tonal components **DIN 45681**
- Tonal analysis for wind turbines **IEC61400-11**
- Roughness (Daniel & Weber)
- Impulsiveness
- Modulation analysis AM/FM
- **GMW18141 and GMW14155**: Laboratory Evaluation of Mechanical Sounds Produced by Electrical Switches. This procedure describes a laboratory method for evaluating component sound quality metrics for automotive customer actuated switches. It is applicable for any physical switches used by vehicle occupants to actuate specific functions, such as toggle switches, push buttons, rockers, etc.
- **ECMA 418-1 Annex B** ITT equipment Part 1 (prominent discrete tones)

Analysis views

- Table
- HTML / PDF report
- 2D plot
- Spectrogram
- 3D (real-time rendering)

3 Complexity

These advanced parameters require a deep knowledge of psycho-acoustic models and signal theory. In addition, the computational effort is large. But CPUs sold today can handle this.

4 Usage

However, in contrast to implementation, the usage is very easy and requires the following steps

- Perform an audio recording
- Select the area of interest graphically
- Perform the required advanced analysis

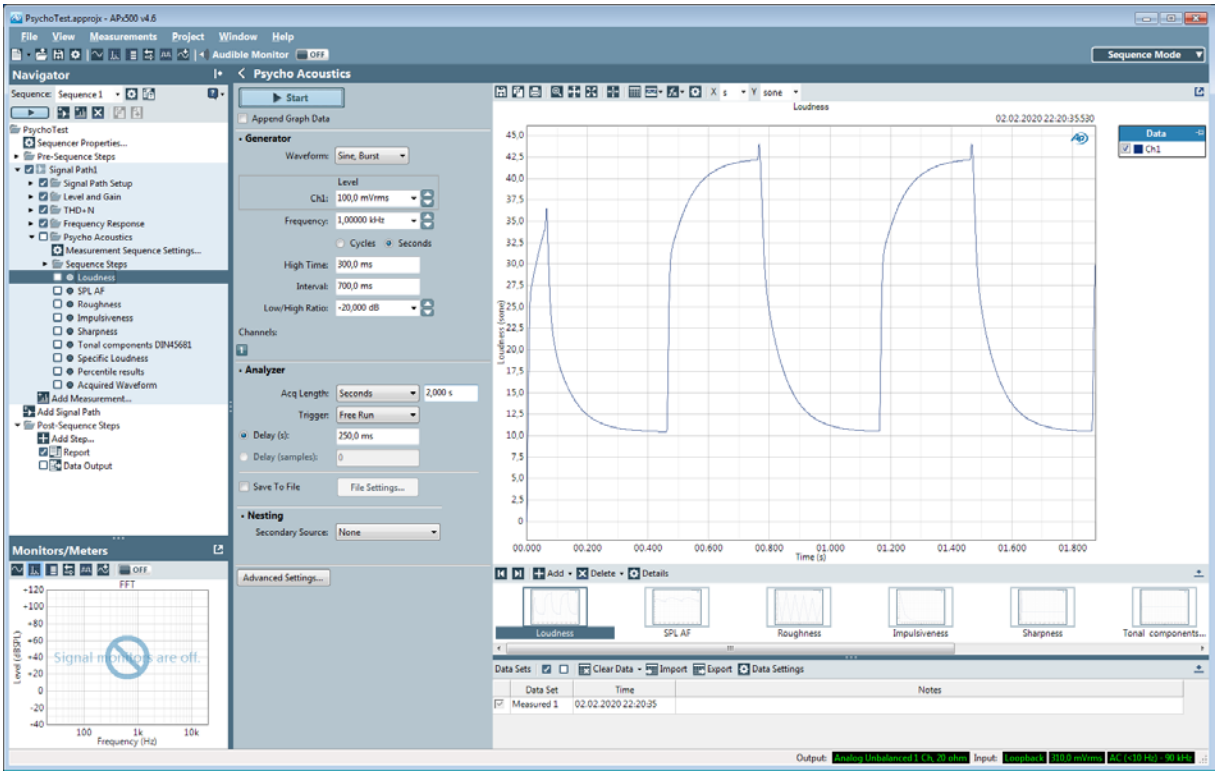
Analysis can be done automatically from e.g. .wav files
It can be integrated in other frameworks e.g. **Audio Precision**, MATLAB, ASIO

5 Audio precision APX Plug-in

Audio Precision offers a powerful framework - the APX software - for automatic audio measurements. This software supports the APx series and the new APX flex for ASIO compatible sound cards.

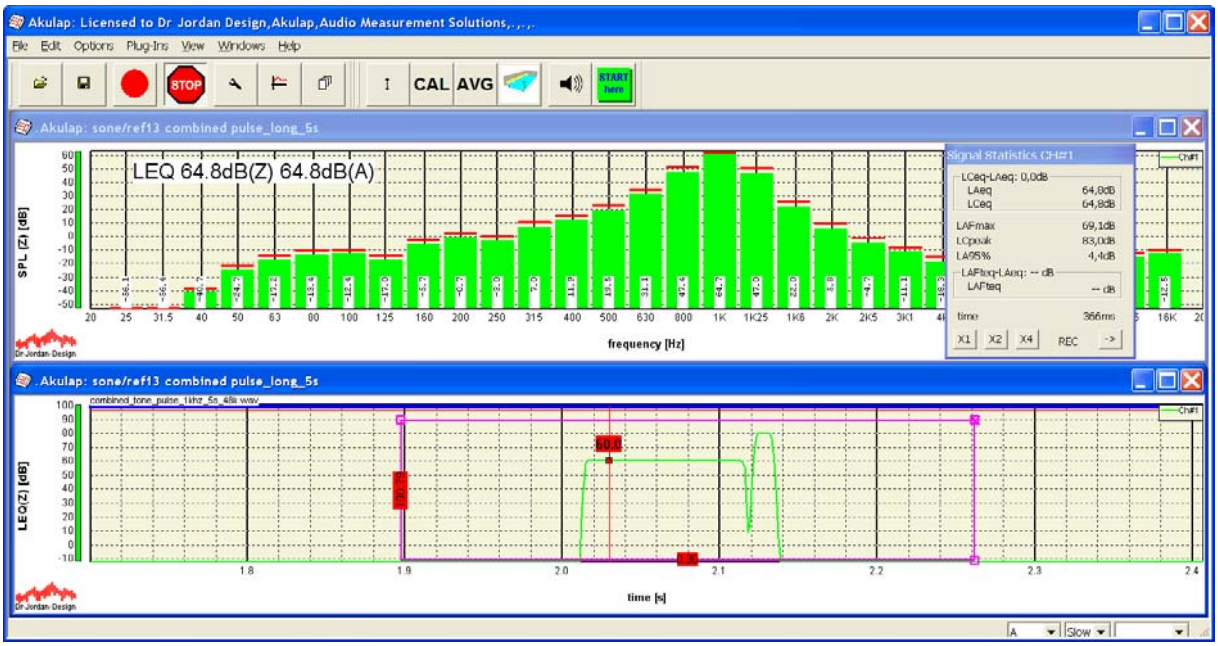
In addition to many built-in measurement functions, the plug-in interface in the 'Sequence Mode' of the APX software allows loading of extended functions.

Akulap includes a powerful psycho-acoustic model as a plug-in for the APX family, which calculates a wide range of psycho-acoustic parameters.
This plug-in fits seamlessly into the Sequence Mode, so that you can use all measurement functions and analysis of the APX software. The loudness calculation is done in the background with Akulap.

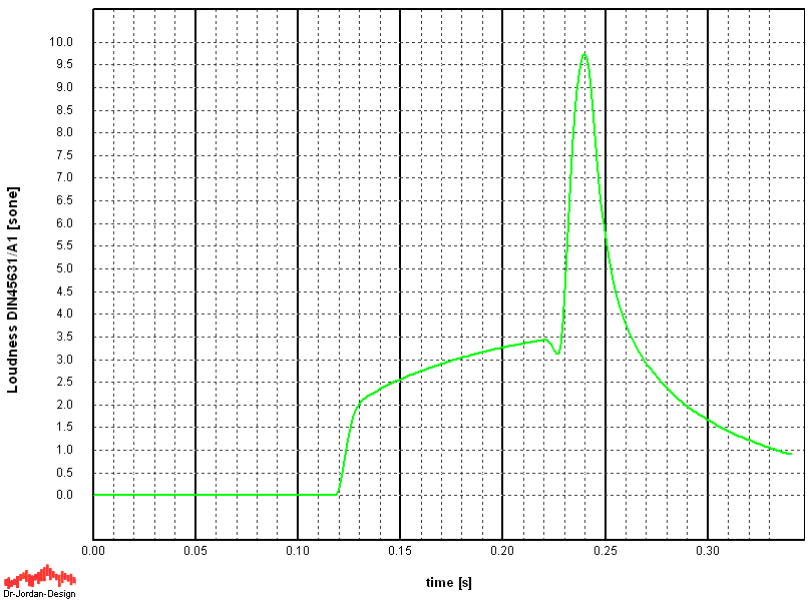


6 Examples

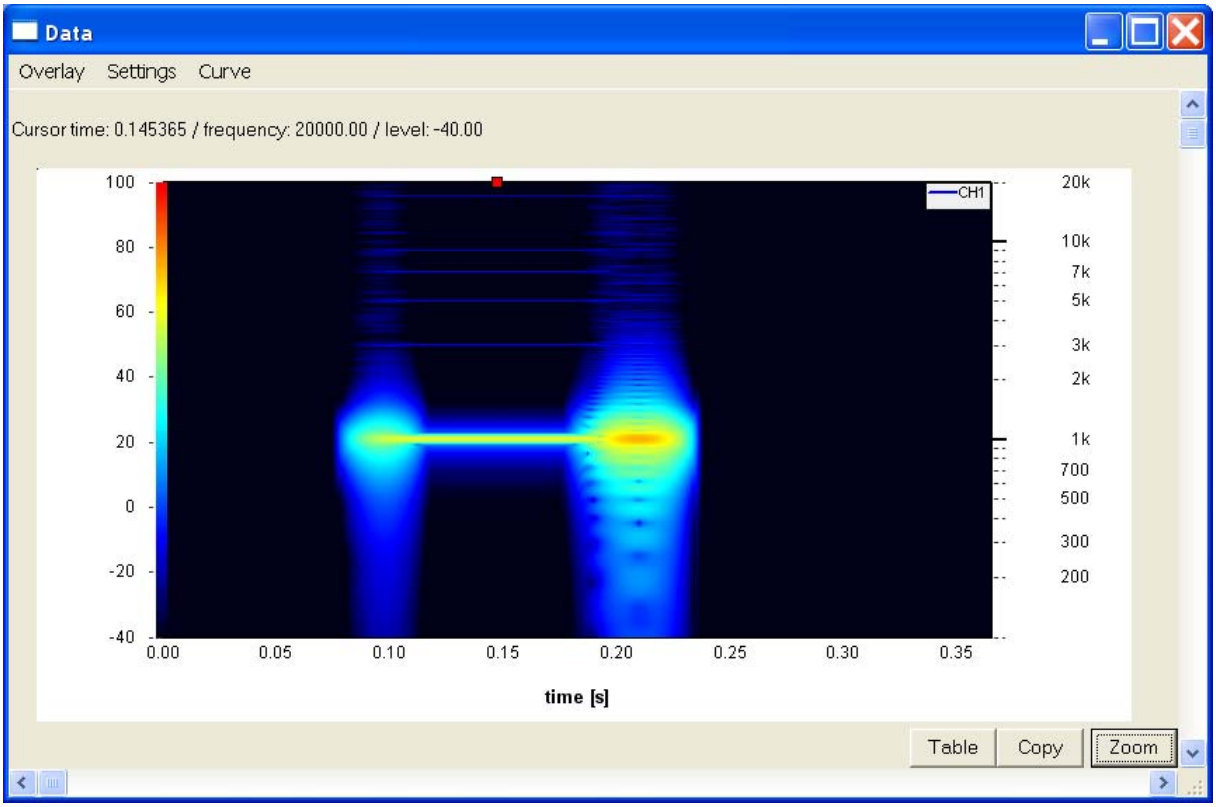
Selection of a recorded audio signal. In this case it is the reference combined sine burst from ISO532-1.
The test signal contains two 1khz tone bursts. It starts with a 100ms burst at 60dB, continues with a pause of 5ms and continues with a burst of 10ms with a level of 80db.

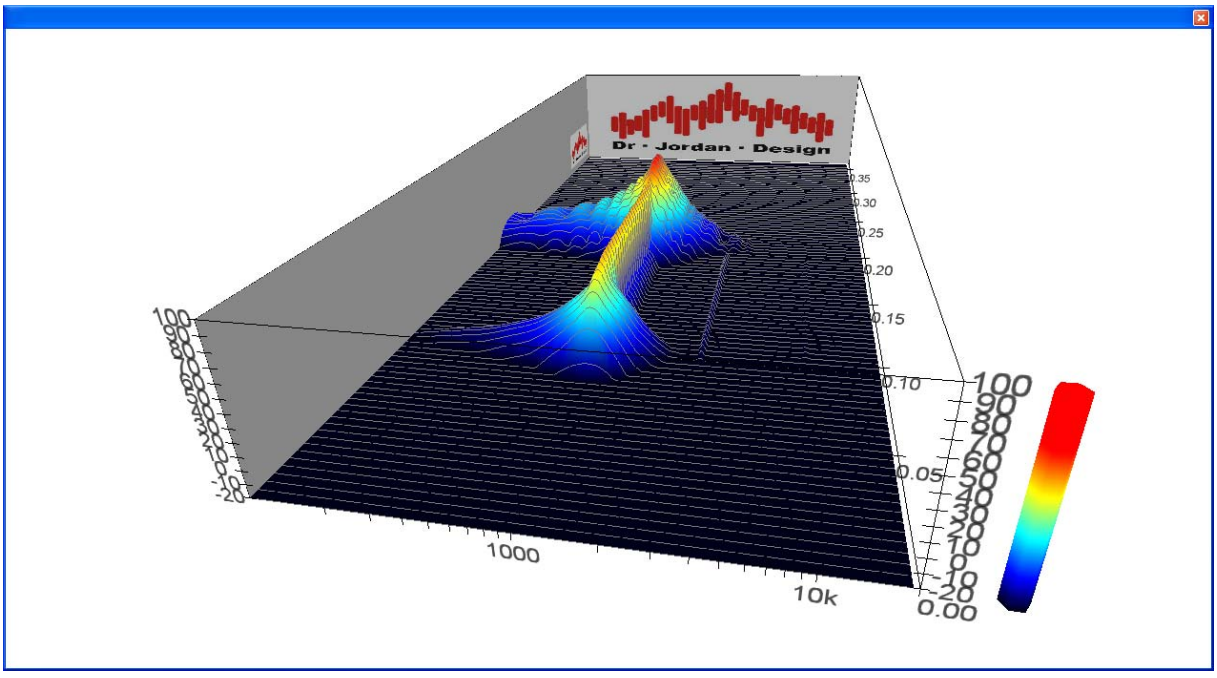


Time-variant loudness DIN45631/A1 of the selection



Spectrogram and 3D plot of the same signal and selection





Interactive Prominence Ratio calculation according to ECMA418-1