Acoustics & Vibration @ METAS

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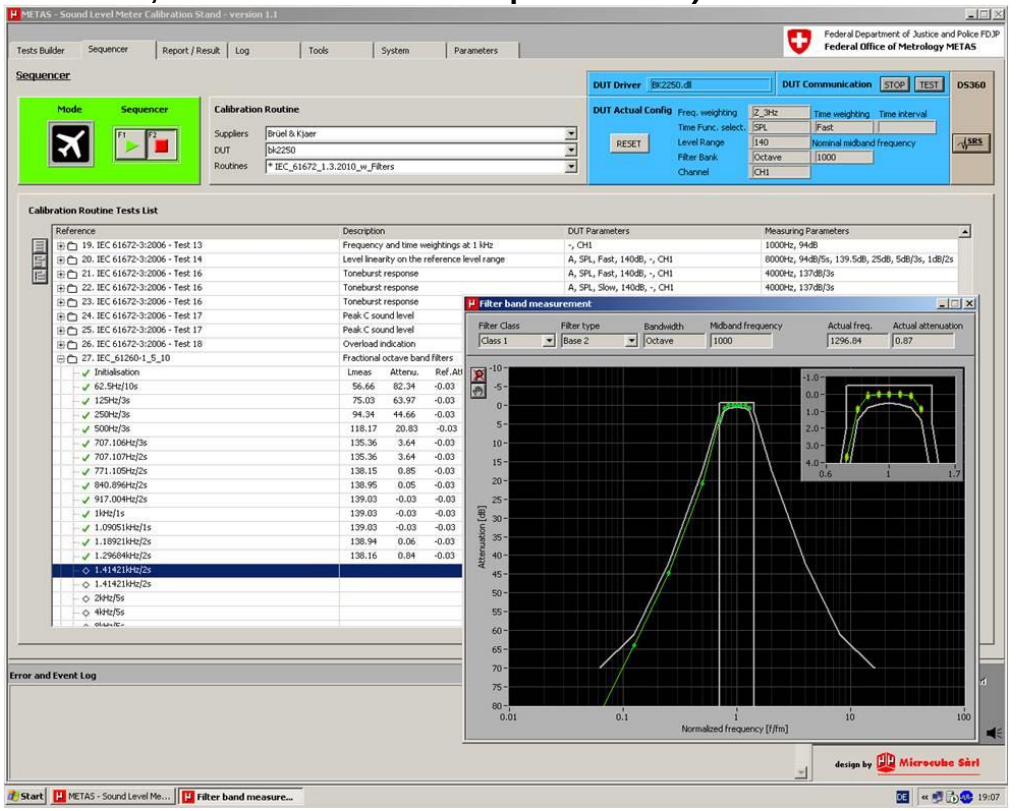
Mission

- METAS is the National Metrology Institute of Switzerland
- Its primary purpose aims to ensure measurements which are correct and in compliance with the law serving the protection of man and environment.
- It provides (or conveys) the necessary metrological infrastructure and competence required by the Swiss economy, research, administration and society
  - Provide internationally recognized units at an adequate level of accuracy
  - Carry out the necessary scientific and technical investigations
  - Develop state of the art measurement techniques
  - Perform research projects to contribute to significant improvements of metrology in all its disciplines
- ***The acoustics & vibration laboratory does just that...***
  ... in its respective technical area

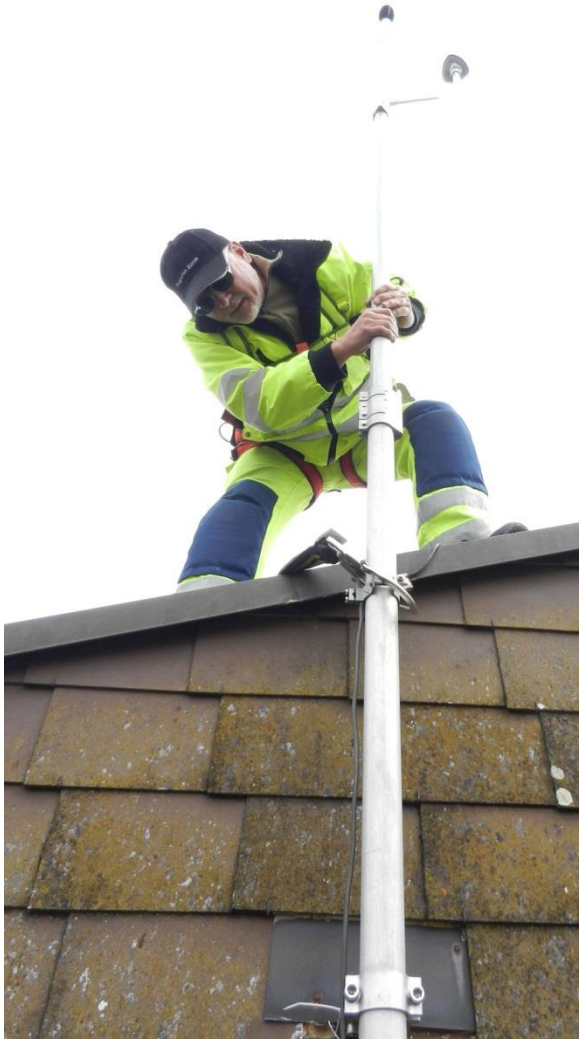
Service-oriented infrastructure

- The acoustics laboratory of METAS is in charge of the verification of **sound level meters** and sound analyzers
  - Close to 100 different types have a valid type approval
  - There are currently 716 instruments verified bi-annually
  - Current standards (IEC 61672, IEC 61260 and previous) are implemented

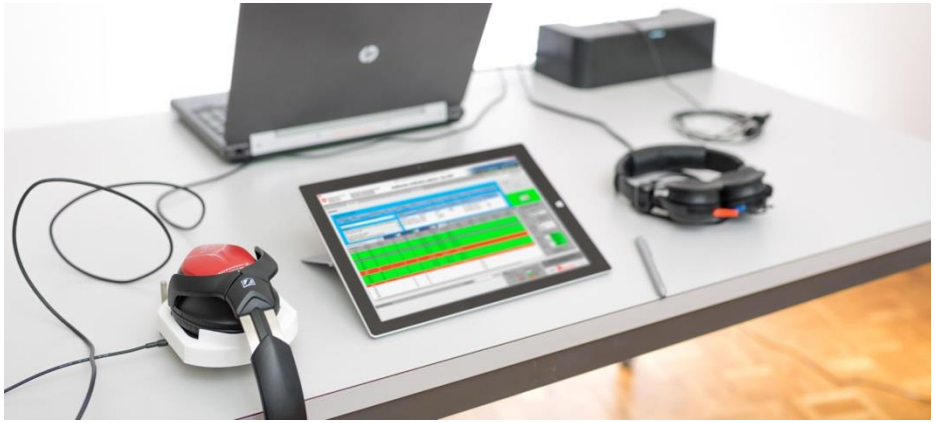


Stationary noise monitoring systems...

... are measured on-site using a mobile system

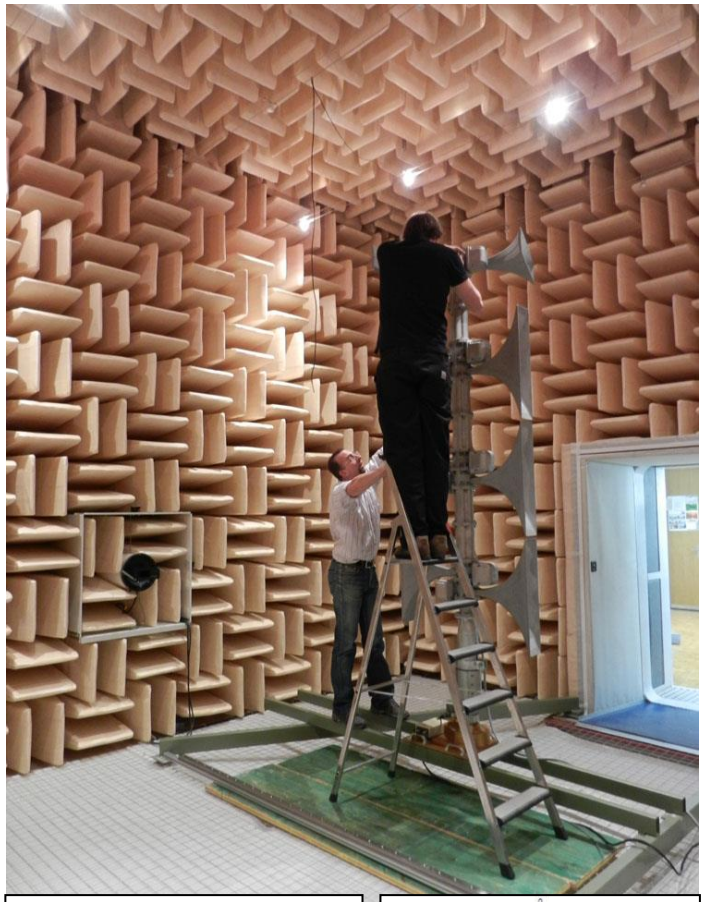


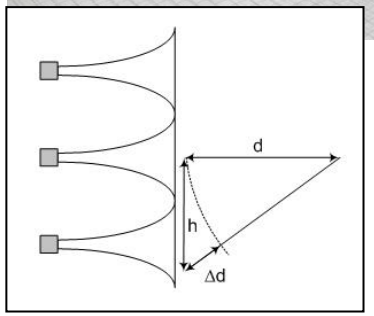
Audiometer verification

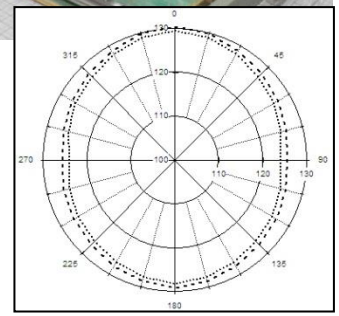


- 92 different types
- >1200 instruments verified annually
- using mobile equipment on-site

Freefield-facilities...
...(anechoic and semi-anechoic)

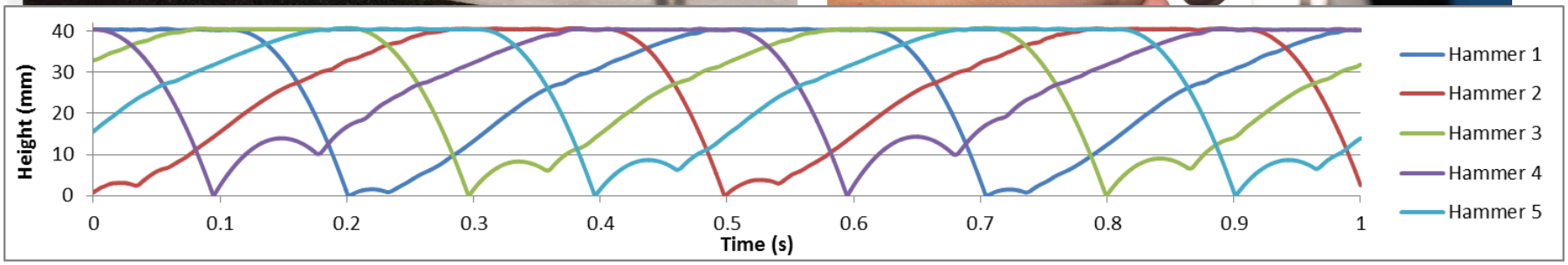


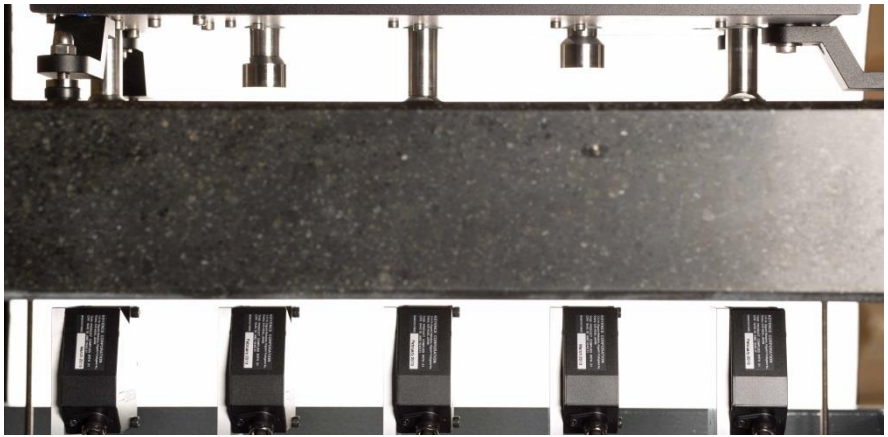


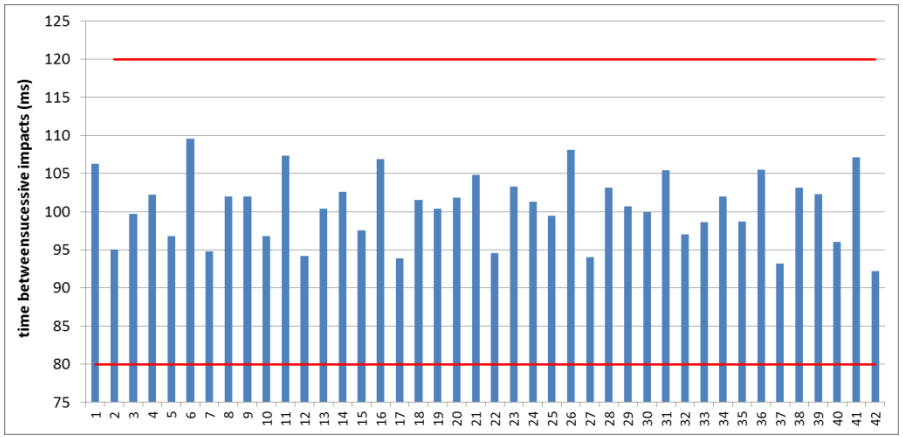


- microphone calibration (comparison)
- sound level meter calibration
- source characterisation (e.g. sirens)

Tapping machines



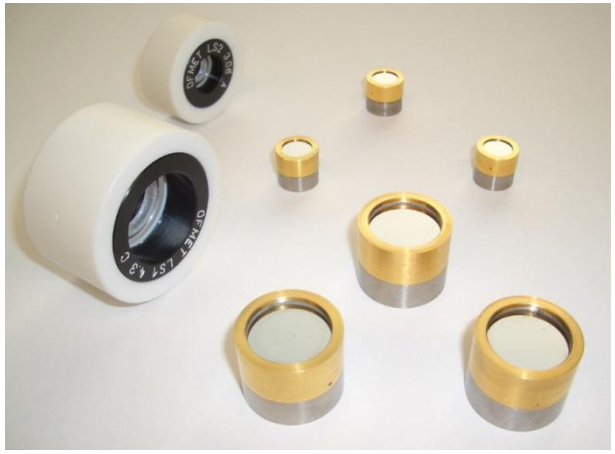


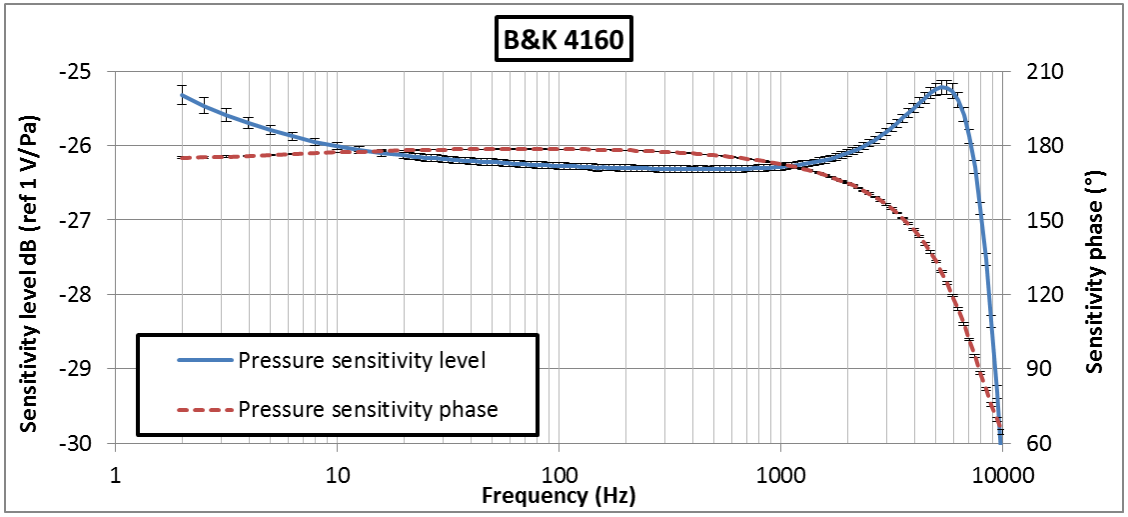


Calibration of sound calibrators

- METAS calibrates or verifies periodically 633 sound calibrators

Primary pressure calibration of LS1P and LS2P microphones by the reciprocity technique IEC 61094-2,





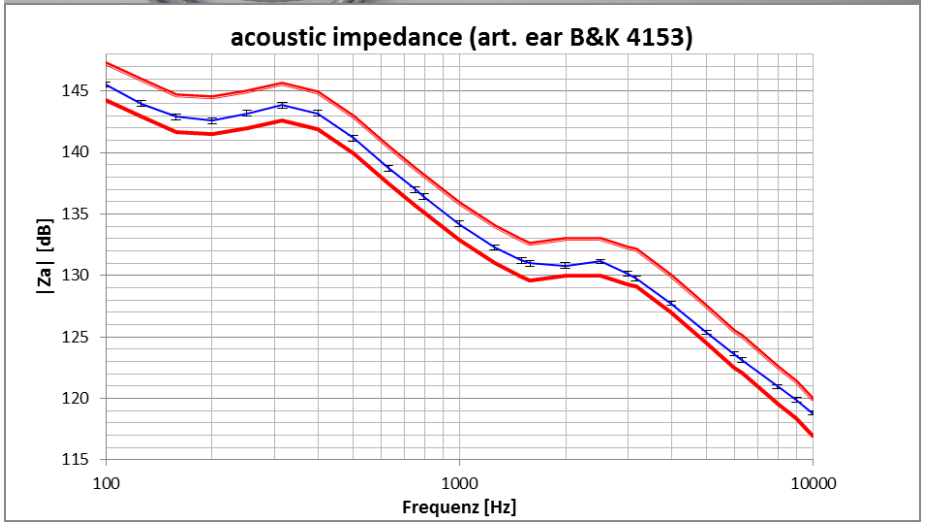
Uncertainties (k = 2):

Amplitude:
20 Hz – < 3 kHz < 0.05 dB
3 kHz – < 5 kHz < 0.08 dB
5 kHz – < 10 kHz < 0.1 dB

Phase:
1 kHz – < 2 kHz < 0.2°
2 kHz – < 4 kHz < 0.4°
4 kHz – < 7 kHz < 0.5°
7 kHz – < 10 kHz < 1°

EURAMET.AUV.A-K5 **AFRIMETS.AUV.A-S1**

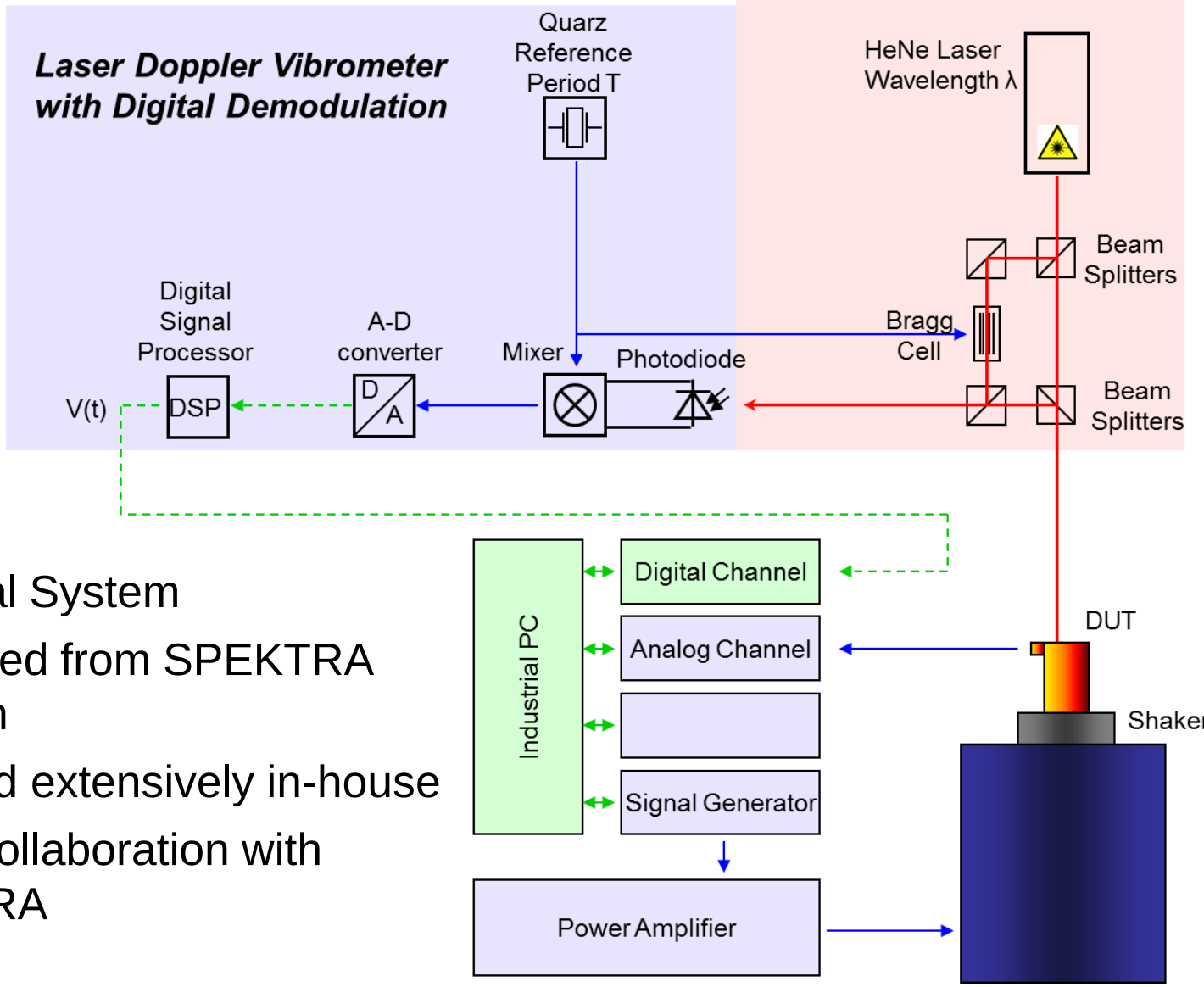
Calibration of artificial ears



Expertise to be further extended:

EMPIR JRP h22: "*Metrology for modern hearing assessment and protecting public health from emerging noise sources*"

Primary vibration calibration - ISO 16063-11



Commercial System

- purchased from SPEKTRA Dresden
- validated extensively in-house
- and in collaboration with SPEKTRA

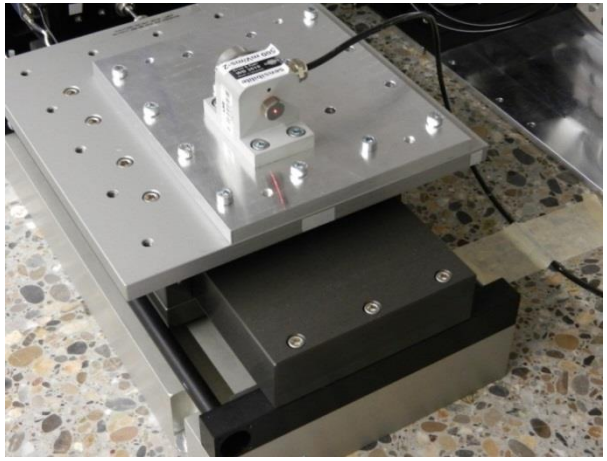
Primary vibration calibration - ISO 16063-11

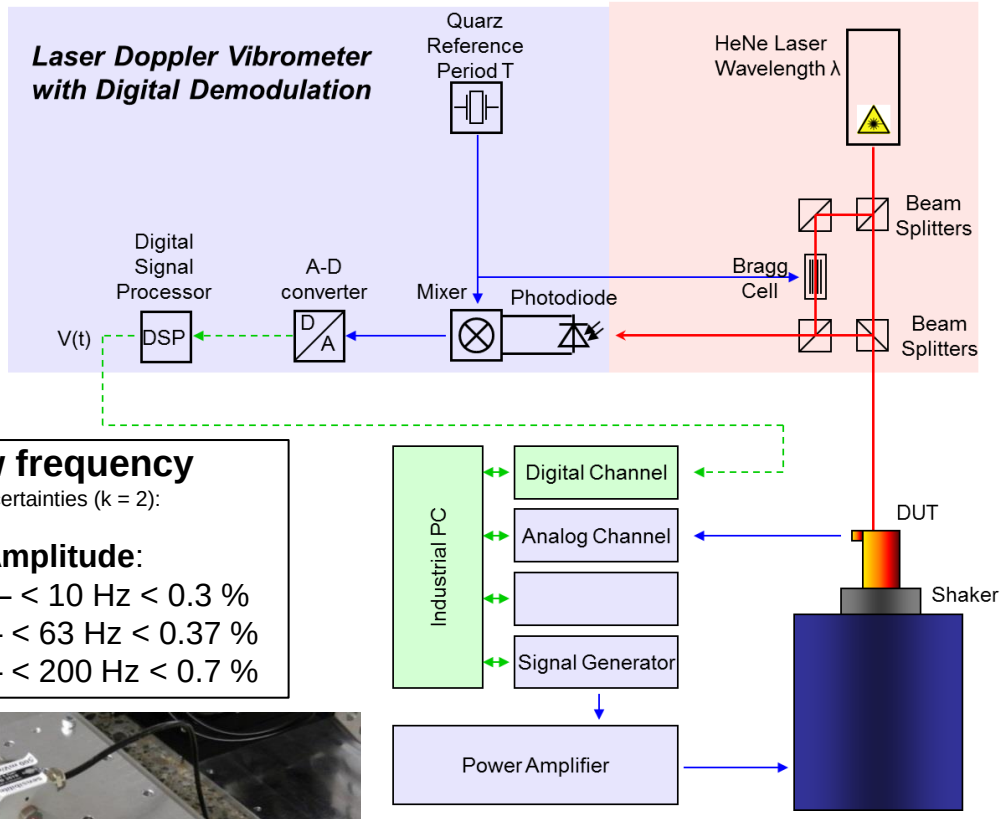
High frequency
Uncertainties (k = 2):

Amplitude:
10 Hz – < 5 kHz < 0.25 %
5 kHz – < 7 kHz < 0.70 %
7 kHz – < 10 kHz < 1.8 %

Low frequency
Uncertainties (k = 2):

Amplitude:
0.2 Hz – < 10 Hz < 0.3 %
10 Hz – < 63 Hz < 0.37 %
63 Hz – < 200 Hz < 0.7 %





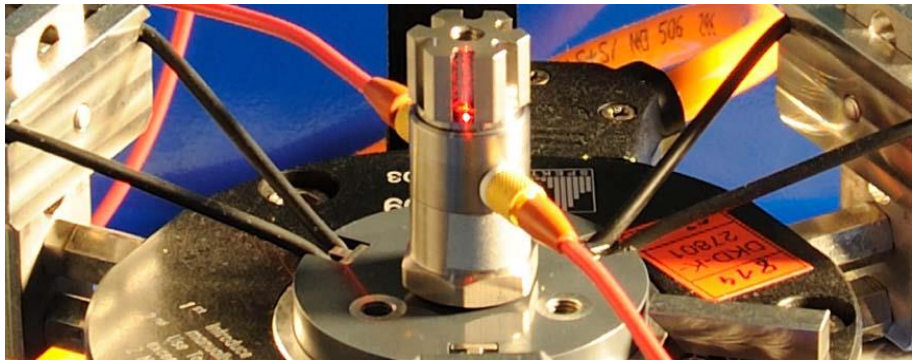
EURAMET.AUV.V-K1.2

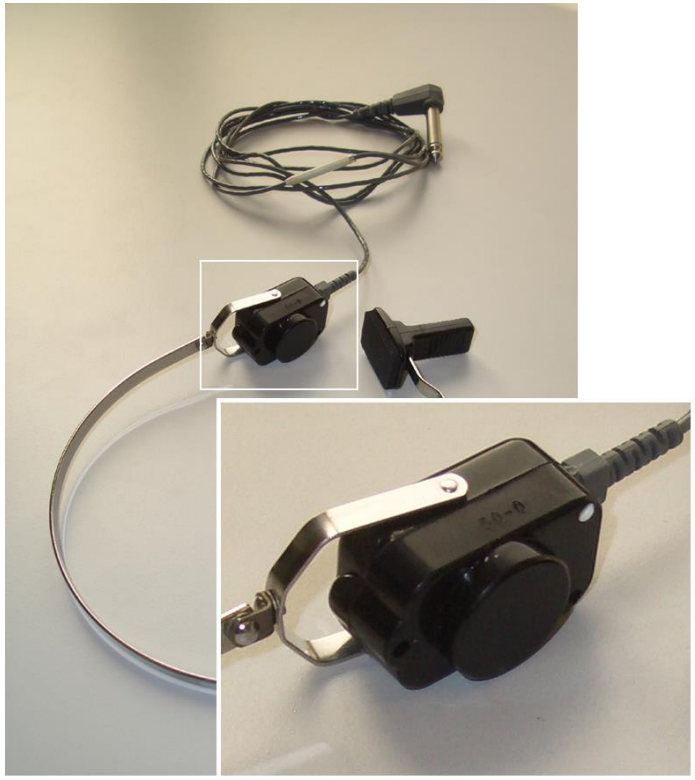
CCAUV.V-K2

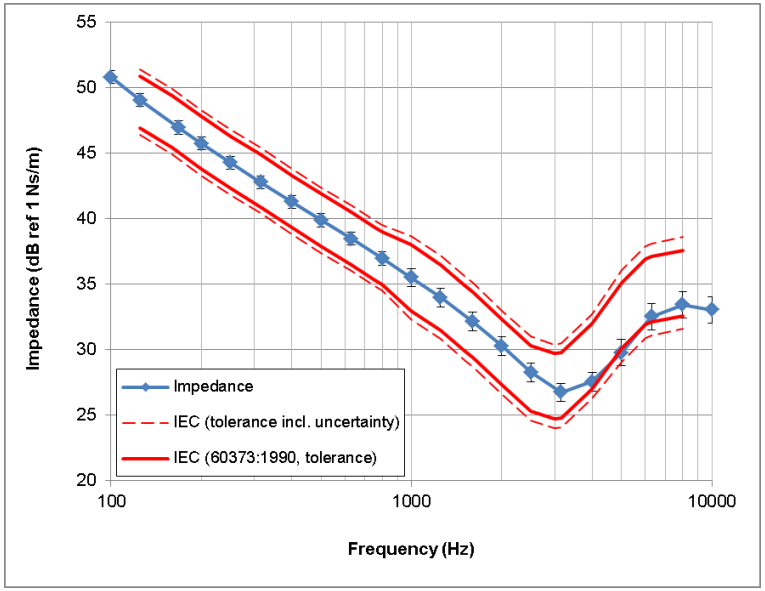
EURAMET.AUV.V-K2

CCAUV.V-K3

Impedance head calibration







Hof & Zwahlen Meas. Sci. Technol. 23, 125102, 2012

On the measurement of the mechanical impedance of artificial mastoids

Conclusion

- The METAS acoustics and vibration laboratory provides a wide range of services within the context of legal metrology (verification) as well as industrial metrology (calibrations)
- In order to achieve the required level of quality, METAS maintains its references at the current state of the art
- METAS investigates and quantifies effects limiting its measurement uncertainty
- It carries out research projects to overcome technical limitations and contribute to the progress of metrology

Thank you very much for your attention