TECHNISCHE UNIVERSITÄT DRESDEN

EAR RESEARCH CENTER DRESDEN

Universitätsklinikum Carl Gustav Carus
DIE DRESDNER.

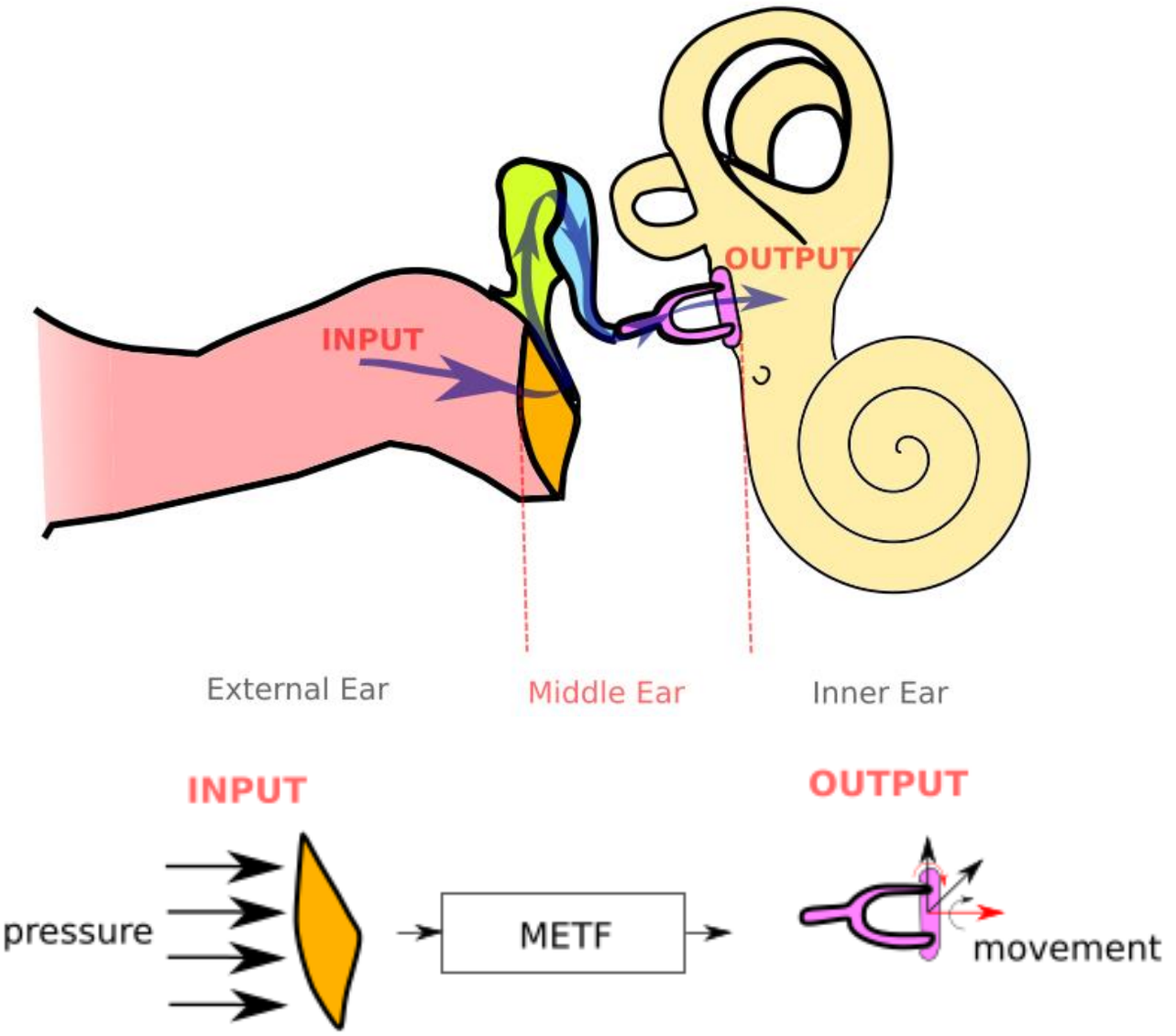
Klinik und Poliklinik für HNO-Heilkunde,
Kopf- und Hals-Chirurgie

Methods and reference data for middle ear transfer functions

Hannover, 18.11.2019;

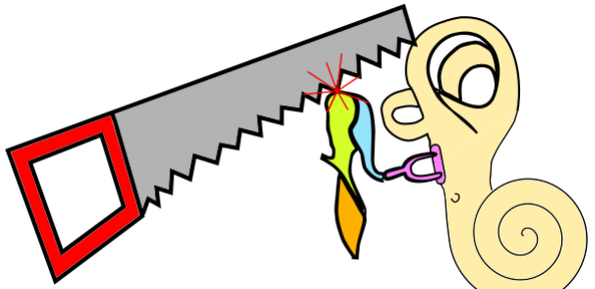
Martin Koch, T. Moritz Eßinger, Hannes Maier, Ingo Roeder, Marcus Neudert, Thomas Zahnert, Matthias Bornitz

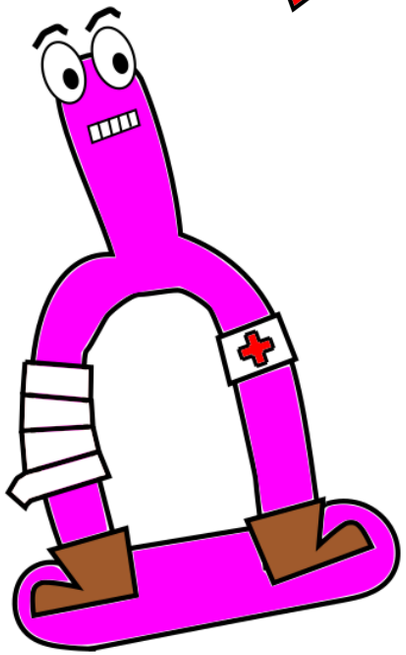
TB characterization with Middle Ear Transfer Function

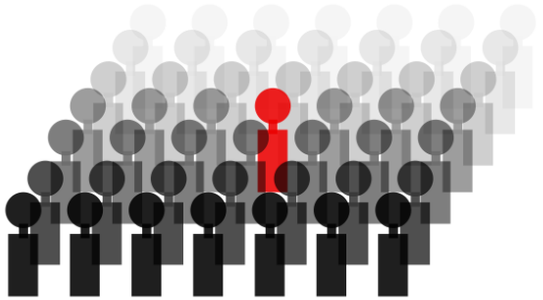


TB Temporal Bone (TB) experiments core element for Middle Ear Research

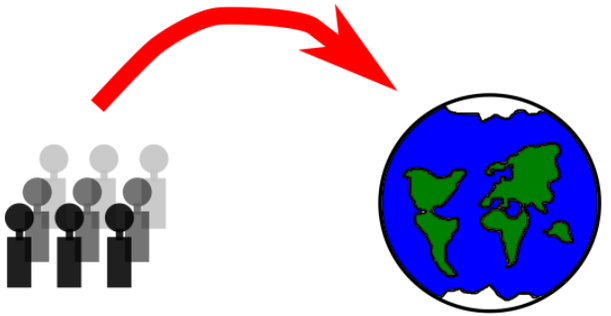
- Requirements for TB verification:

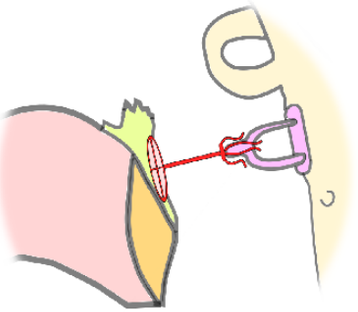


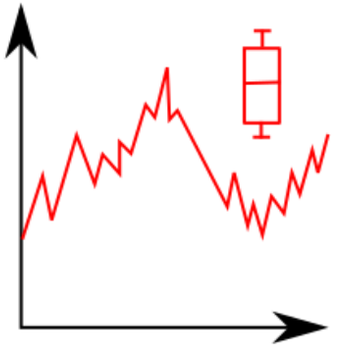




- Further possible applications of METF statistics:







Established METF-Standard:

- ASTM F2504-05 Standard Practice for Describing System Output of Implantable Middle Ear
  Based on Rosowski J.J, Chien W., Ravicz M.E., Merchant S.N. 2007: Testing a Method for Quantifying the Output of Implantable Middle Ear Hearing Devices. Audiol Neurootol; 12:265--276. URL: http://dx.doi.org/10.1159/000101474

→ Provision of valuable, practical and easy applicable METF mean and range for comparison purposes and as an exclusion criteria

- **Practical application shows criteria to be too strict**
  Morse R.P., Mitchel-Innes A., Prokopiou A.N., Irving R.M., Begg P.A. 2019: Inappropriate Use of the „Rosowski Criteria“ and „Modified Rosowski Criteria“ for Assessing the Normal Function of Human Temporal Bones. Audiol. Neurootol. 2019;24(1):20-24. doi: 10.1159/000495131.

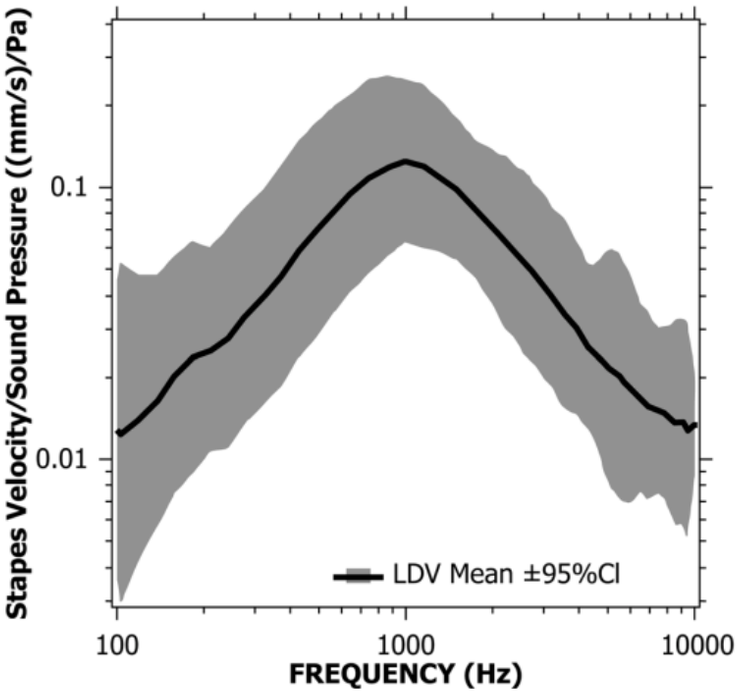
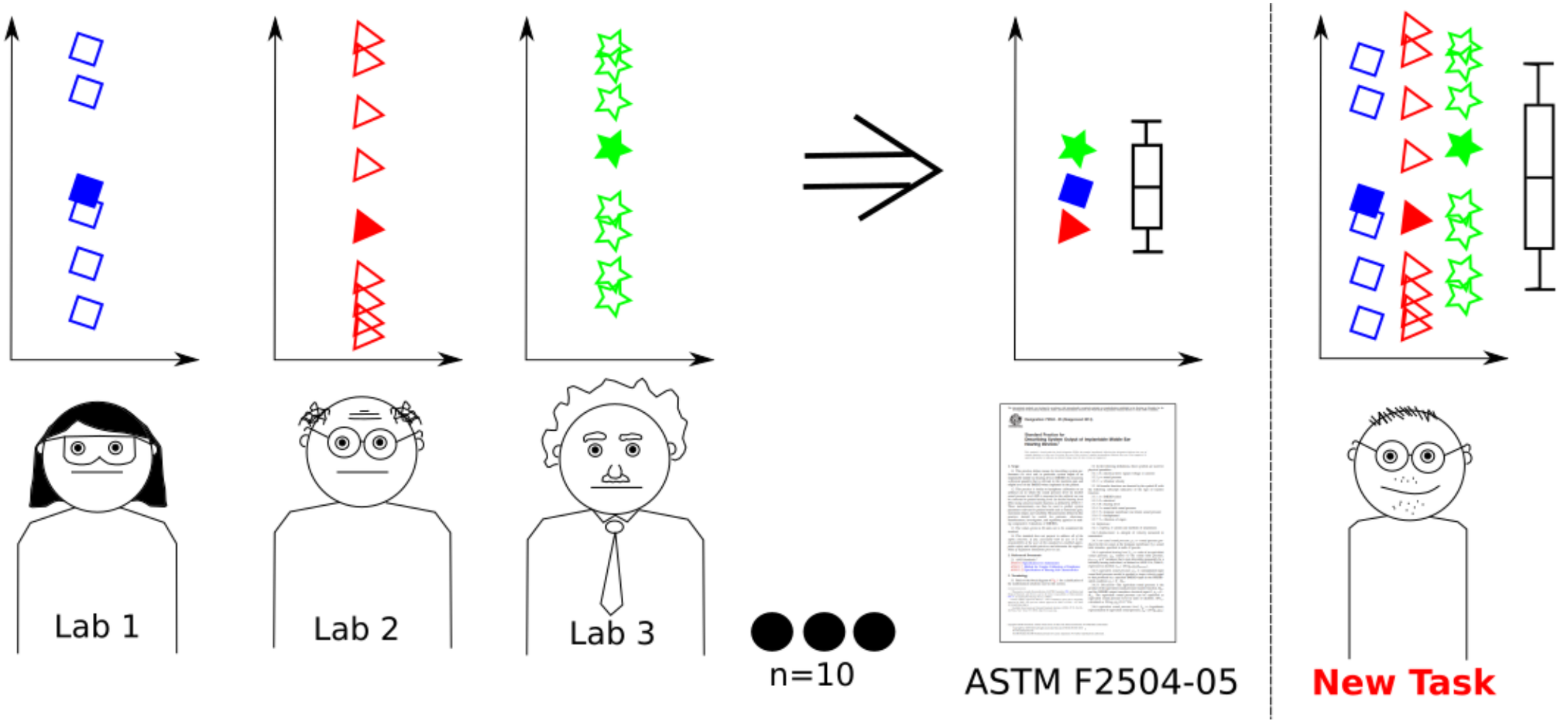


TABLE 1 Mean and Estimated 95 % Confidence Interval from Ten Published Studies of Stapes Velocity in Temporal Bones Including Nine LDV Studies (4-12) and One Study of Round-Window Displacement (13)[A]

NOTE 1—The means from each study were averaged to produce the mean of the group. The 95 % confidence interval is estimated by assuming that the standard deviation of the ten means is the standard error mean of the population.

Frequency, Hz	Mean Value, mm/s/Pa	Upper Limit, mm/s/Pa	Lower Limit, mm/s/Pa
125	0.015	0.048	0.004
250	0.030	0.074	0.012
500	0.073	0.180	0.029
1000	0.125	0.250	0.062
2000	0.071	0.138	0.037
3000	0.043	0.094	0.020
4000	0.029	0.060	0.014
6000	0.018	0.047	0.007

Statistical Data Analysis in ASTM F2504-05



Collaborating Research Groups

Dresden –Technische Universität Dresden

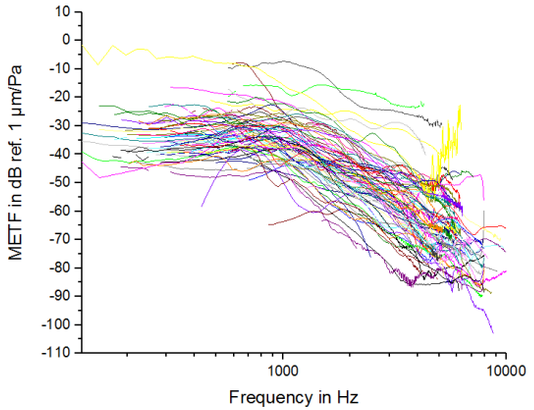
Hannover – Hannover Medical University Hannover

Zürich – University Hospital Zürich

Boston – Harvard Medical School

Project Plan

METF – Data – Collection



Methodology Questionnaire

ABCDEFGH ?
ABKDLAFJDKAJDKH
adklfjöalfjkakösdjf
ADFKADSGDHG
LAKDJFADLFJDAKLFJD
ADKFDLAJFDLKHAGKDHG
ADKFDLAJLDFHAGKHDAHG
slakdfjlsdkfjdlskjfddlsfj

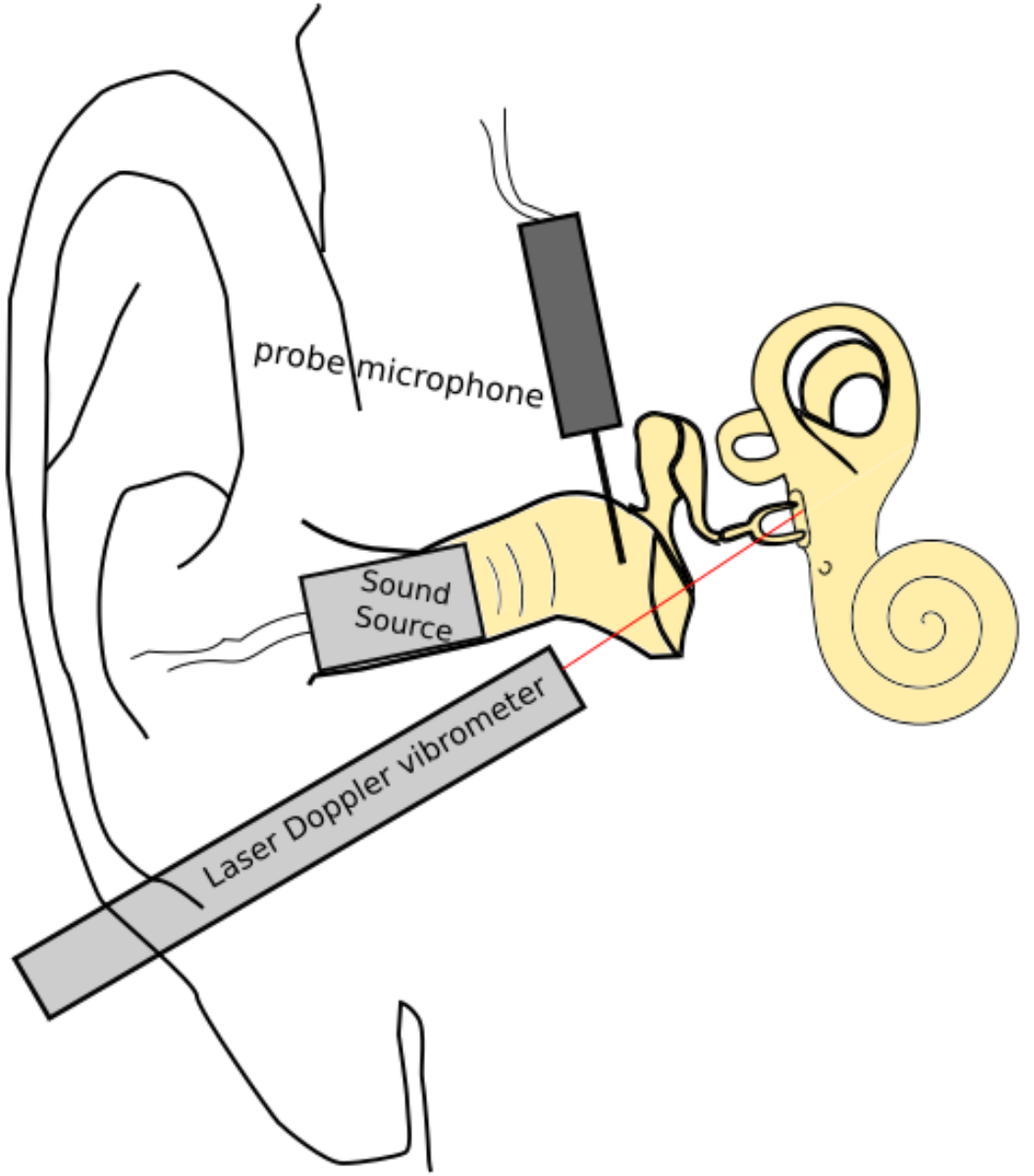
skaöfjösdlkjfaköjdföa
aödkfjöahgäashgkdshg
aökdhgöadhgdköhf
öadkfjöakdjföakdhgöh
öakdhfhökahgködhsg

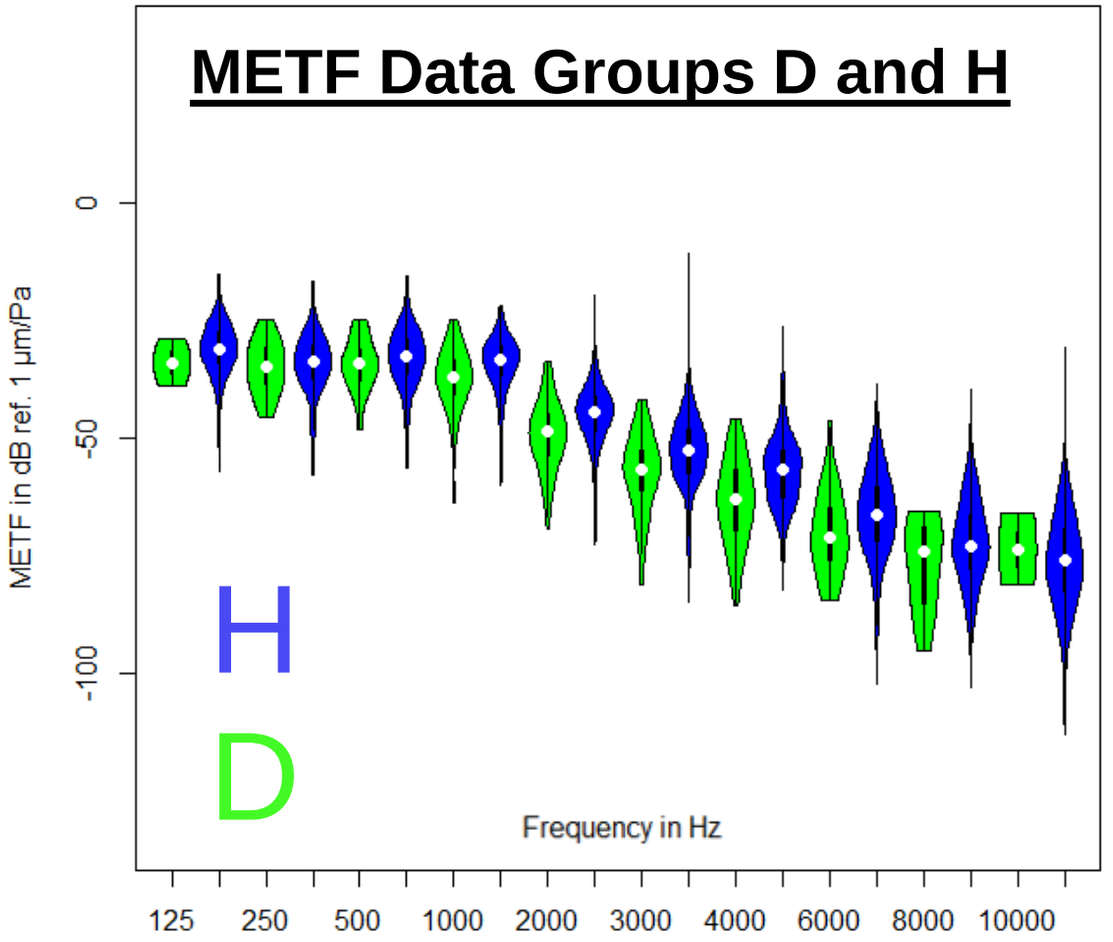
Open Source Data Repository

Data Analysis and Publication

Methodology Questionnaire

- Measurement Setup
- Temporal Bone Preparation
- Data acquisition and preprocessing

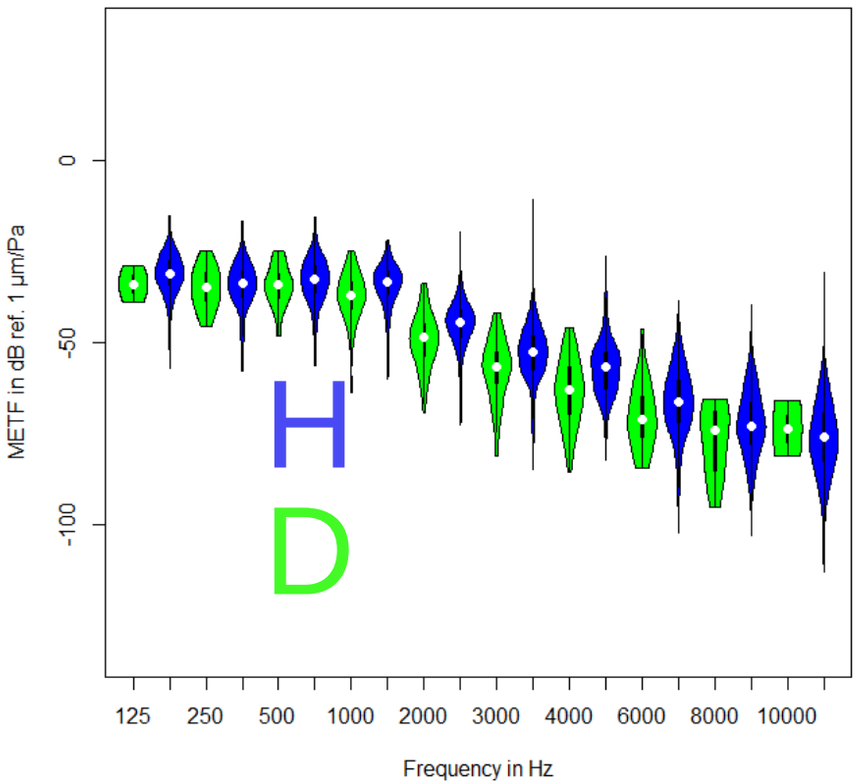




F in Hz	125	250	500	1k	2k	3k	4k	6k	8k	10k
n DD	4	26	55	63	63	63	62	44	12	2
n H	193	248	248	248	248	248	248	244	218	208

- Sample Size D n=63; H n=248
- Lognormally distribution
- Excitation D multisinus, H audiol.freq.
- D without; H with angle correction
- Signal quality criteria D coherence, H SNR

Lab Effect between Groups D and H

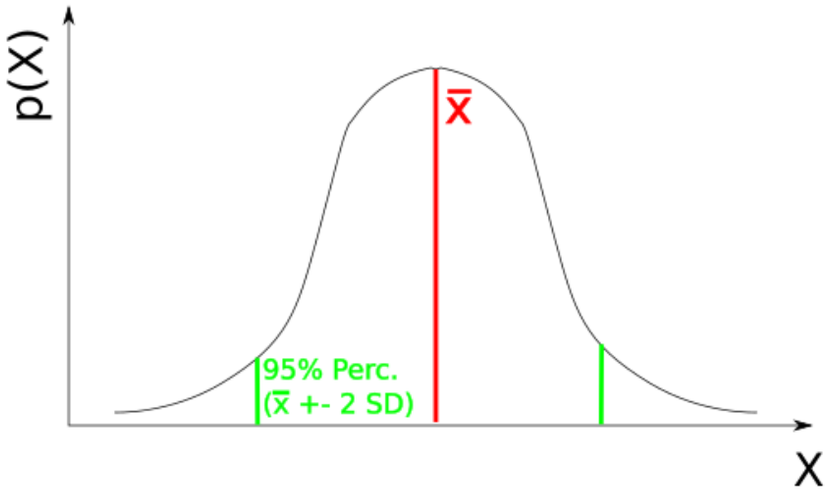


Welsh unpaired T-Test

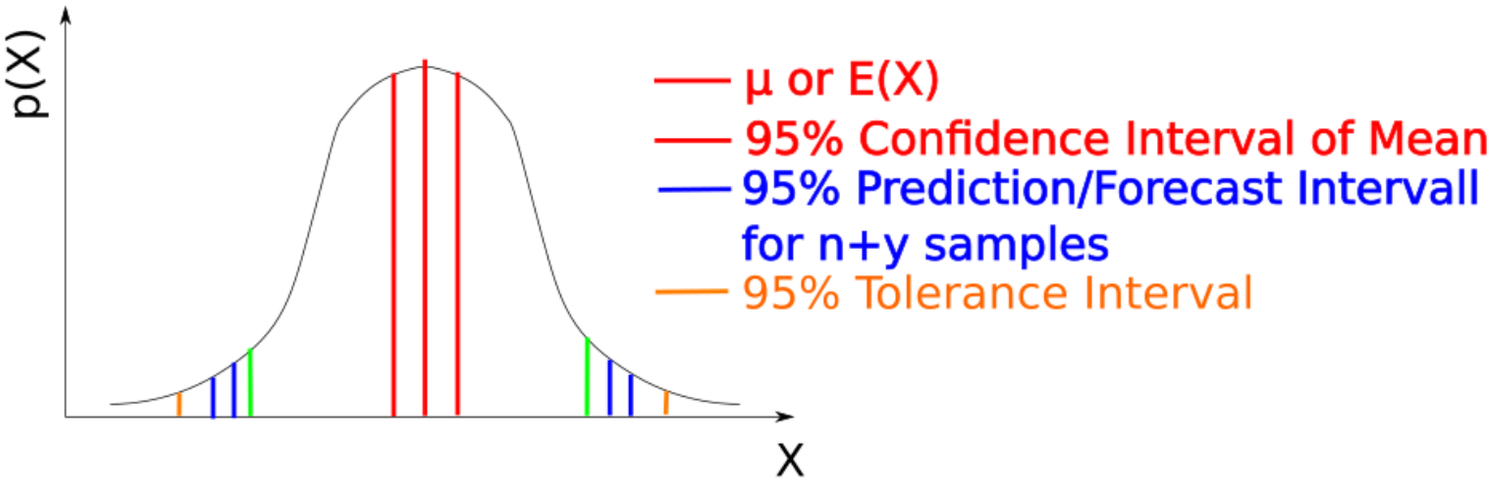
F in Hz	125	250	500	1k	2k	3k	4k	6k	8k	10k
p-value	0.31	0.62	0.124	2e-3	2e-4	2e-4	6e-7	0.007	0.12	0.77
Diff mean H-DD dB	2.8	0.7	0.6	2.9	4.0	4.5	5.8	4.0	4.8	-2.8
95% CI min dB	-9	-3	-3	-5	-6	-7	-9	-7	-11	-88
95% CI max dB	+4	+2	+0.4	-1	-2	-2	-4	-1	+1.5	+94

Statistic Ranges

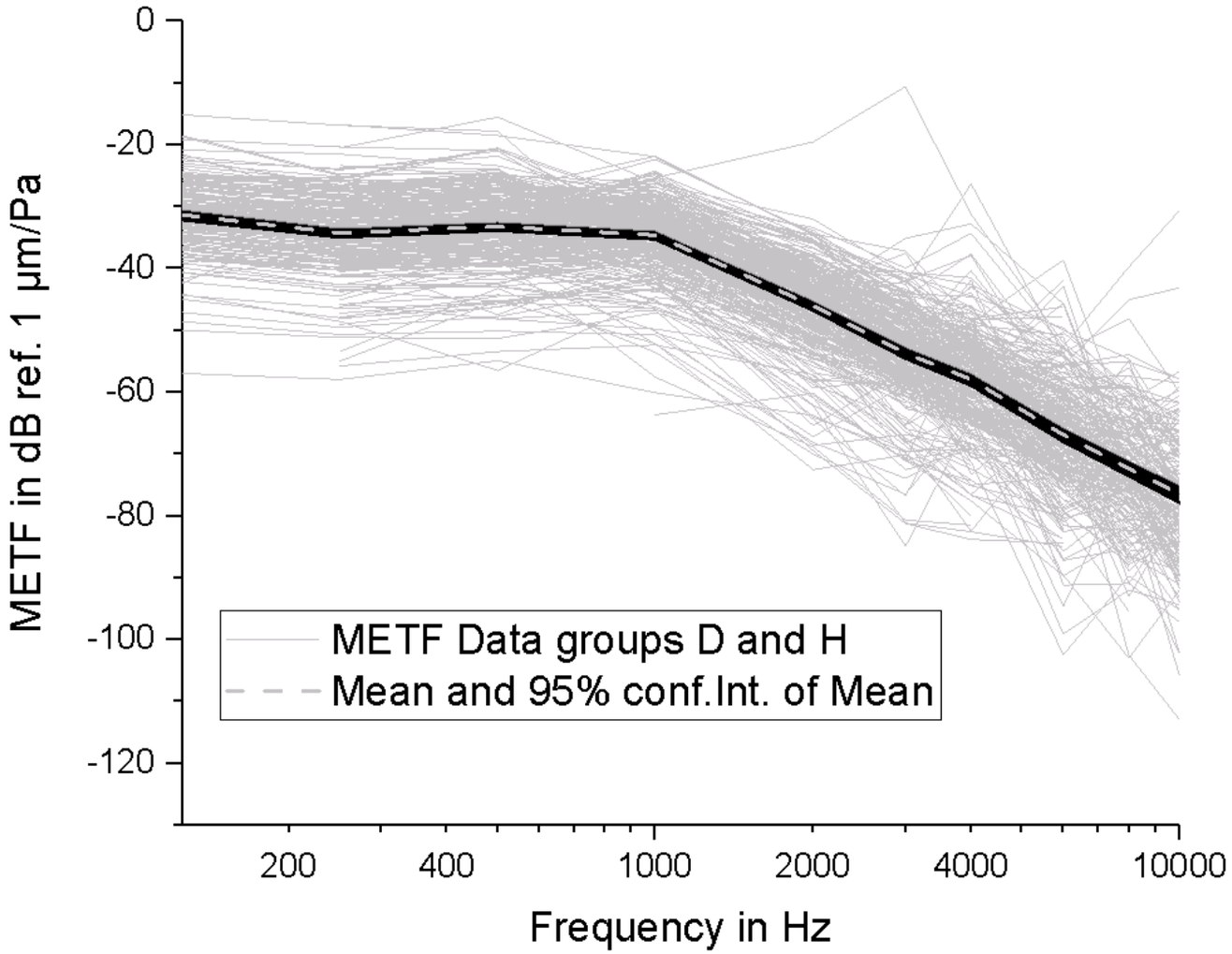
Descriptive Statistics



Predictive Statistics

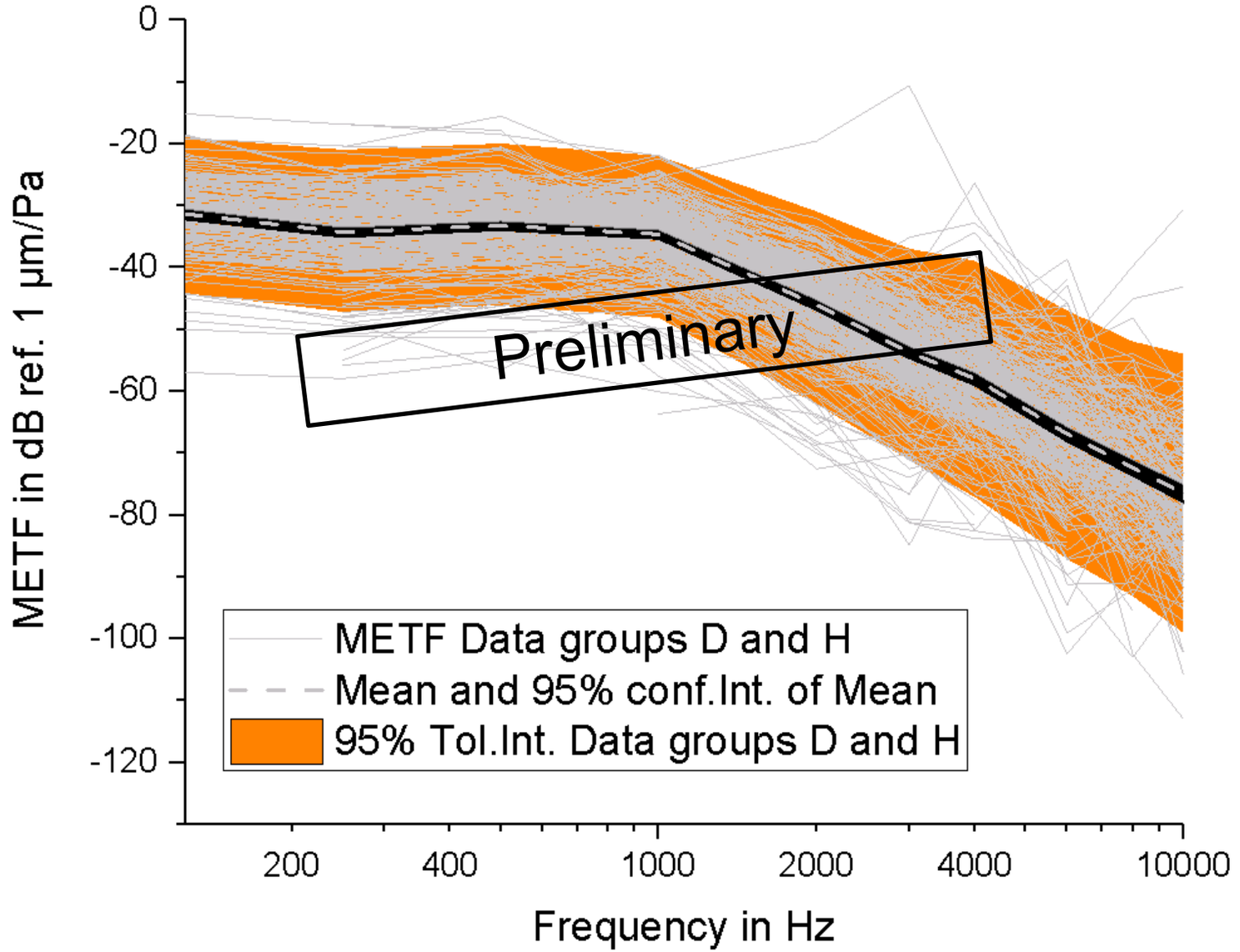


Data Analysis Groups D and H: Confidence Interval of Mean



- Range of Conf.Int. 2-3 dB

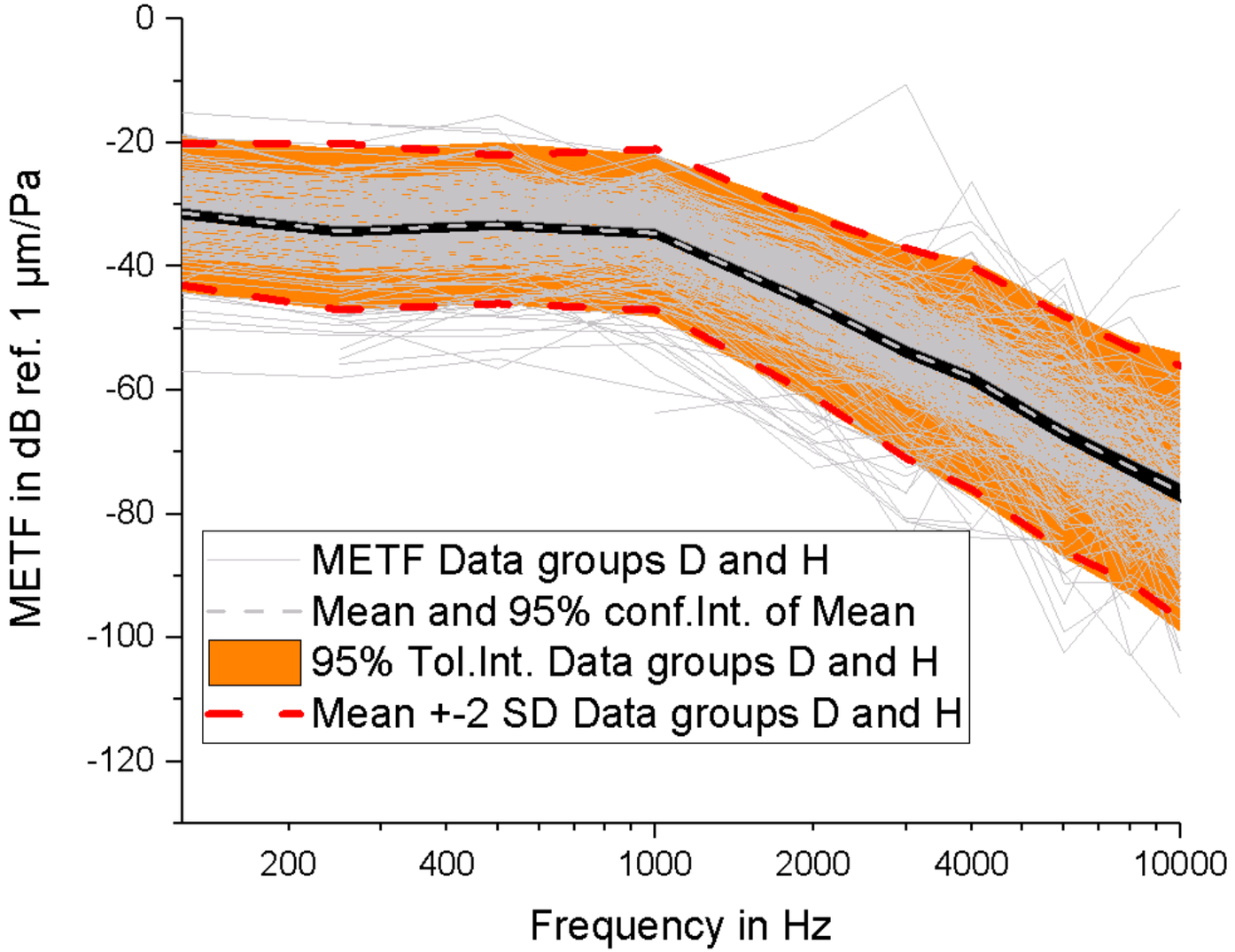
Data Analysis Groups D and H: Tolerance Interval



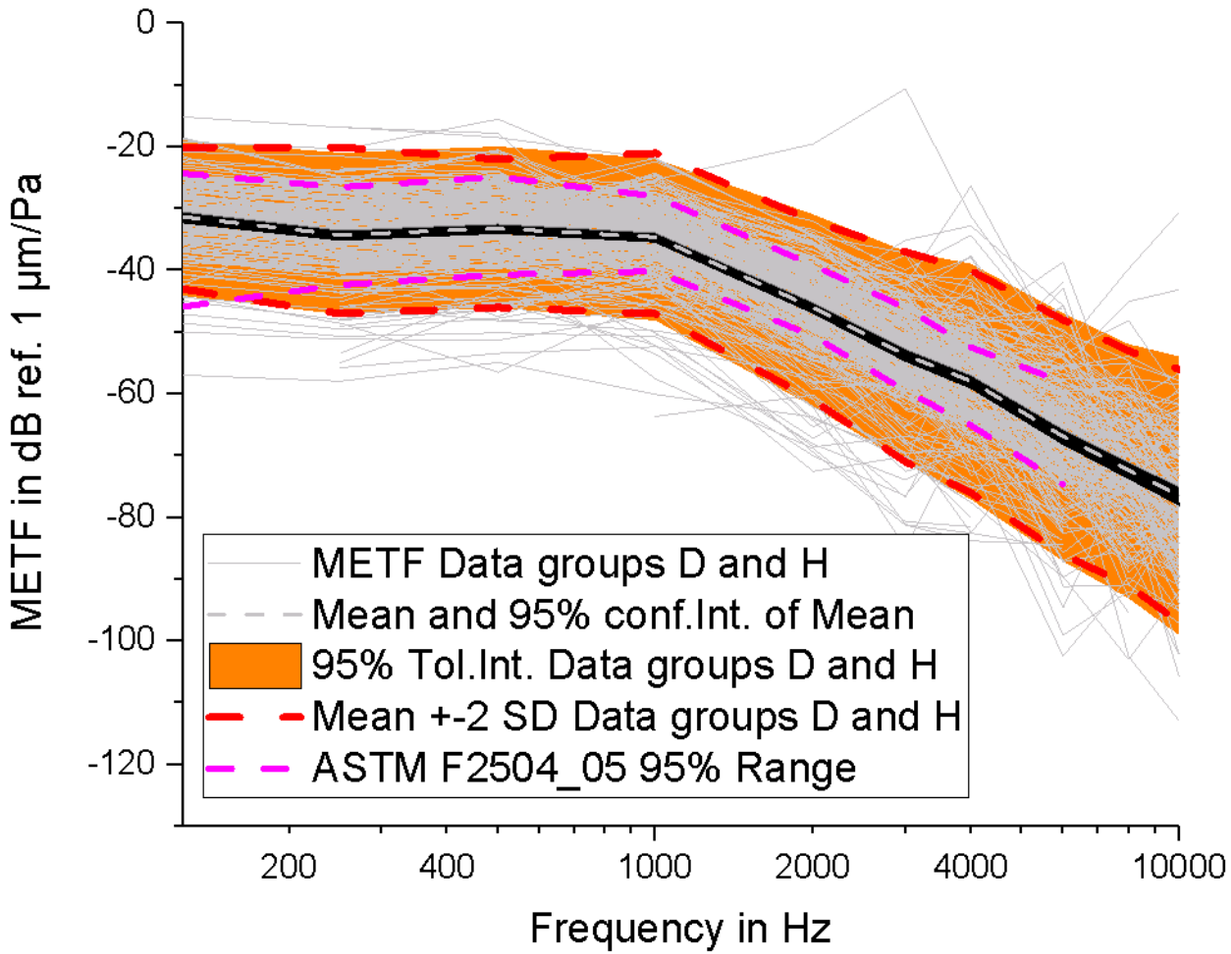
- Range of Tol. Int. 25-40 dB

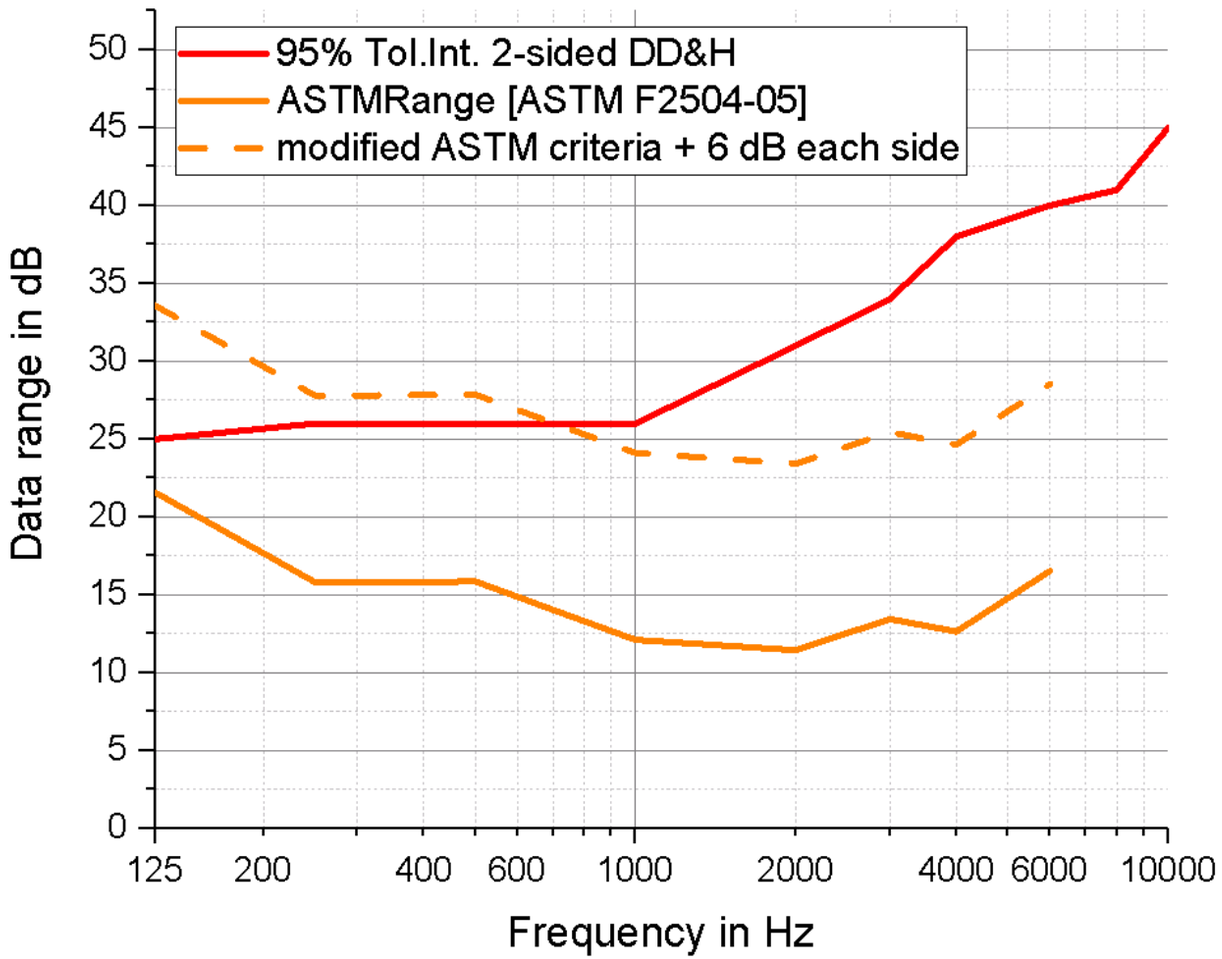
F in Hz	Mean	95% Tol.Int. Min	95% Tol.Int. Max
125	-31	-46	-16
250	-34	-49	-19
500	-33	-47	-19
1000	-35	-48	-21
2000	-46	-62	-29
3000	-54	-72	-35
4000	-58	-77	-38
6000	-67	-87	-46
8000	-72	-93	-52
10k	-76	-99	-54

Data Analysis Groups D and H: Statistical Ranges Comparison

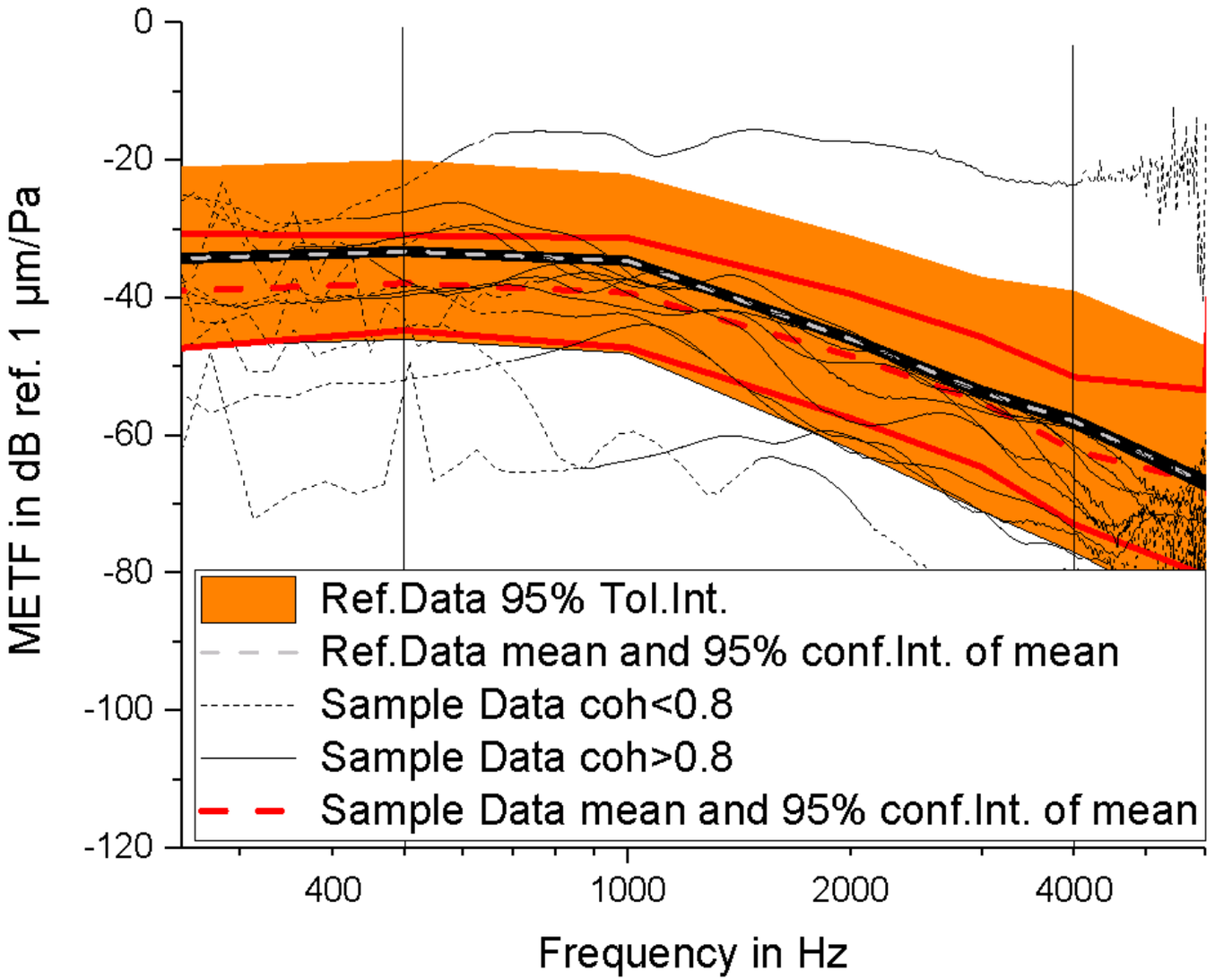


Data Analysis Groups D and H: Statistical Ranges Comparison





Example Application of Reference Data Set



Conclusion and Prospective Outcome

- METF statistics of international research group as reference data set
- Possibility of validation and assessment of new TB studies mean and sample values
- Insight about reasons for Lab Effect and advice for minimizing effect
- Online Data Repository for Re-Calculations

Thank You

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Digital Presentation

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