Measurement Uncertainty Training workshop

Session 4
MU training for the community of legal bodies

17-18 May 2022

MU Training

MATHMET

Task 2.3.2: Development of a curriculum for a course on Measurement Uncertainty aimed at the community of legal bodies

Activity number	**Activity description**	**Partners (Lead in bold)**
A2.3.1 M1-M6	IMBiH, with help from IPQ, METAS, SMD and DAM, will contact stakeholders from the community of legal bodies, such as Technical Committees of WELMEC (the European Cooperation in Legal Metrology), to inform them about the current activity and to gather information about their current needs in the area of Measurement Uncertainty evaluation and training.	**IMBiH**, DAM**,** IPQ, METAS, SMD
A2.3.2 M7-M12	Based on the output of A2.3.1, IPQ, with help from IMBiH, METAS, SMD and DAM, will develop a curriculum for a course on Measurement Uncertainty aimed at the community of legal bodies, such as the Technical Committees of WELMEC.	**IPQ**, DAM, IMBiH, METAS, SMD

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The legal metrology community

- What is WELMEC
- What community do they serve
- How are they organized
  - Working groups (WG)
    - WG 2: Weights and Weighing Instruments
    - WG 6: Prepackages
    - WG 8: General Application of MID and NAWID
    - WG 10: Measuring Equipment for Liquids Other Than Water
    - WG 11: Gas and Electricity Meters
  - Relevant guides and standards
    - WG 6.9: Prepackages – Uncertainty of Measurement
    - OIML R87: Quantity of product in prepackages (Sampling)
    - EN 45501: Metrological aspects of non-automatic weighing instrument

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Points raised in meetings with the legal metrology community

- To have a better understanding of the general concept of measurement uncertainty, so that WELMEC Guides can be better used
- To develop a general measurement model, including as many influence quantities as possible, enabling to compute a combined measurement uncertainty that can be checked against legal tolerances. A possible support for the validation of procedures (packer)
- Fundamentals of measurement uncertainty evaluation
  - Identification of measurand and input quantities
  - Sources of uncertainty
  - Input PDFs
  - Expanded uncertainty
  - The applicability of the GUM

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Points raised after the meetings with the legal metrology community

- The point about s_T/\sqrt{n_T} is a very valid one, it should more thoroughly introduced in discussed in general
- The distinction between type A and B uncertainty should be improved, but it should be kept simple
- Many people confuse calibration vs. verification. Such documents should integrate this important distinction
- Giving an example of a certificate and how to read it is also fundamental
- Practical considerations on the equipment environment can also be quite useful in a document like this one

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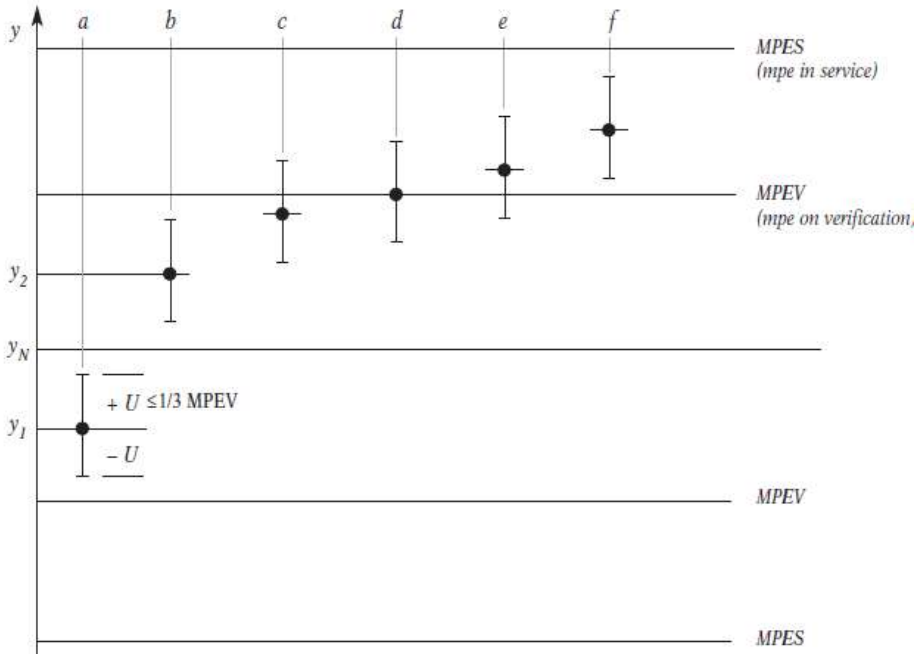
Important topics to be covered in MU training for this community

- Key concepts in metrology
  - Measurement and models
  - Error (traceability) and Uncertainty (quality of measurement)
  - Repeatability and Reproducibility (type A uncertainty)
  - Expanded uncertainty
- Maximum permissible error (determination, type approval vs. periodic verification)
  - $U(k = 2) \leq 1/3 \times MPEV$
- Conformity assessment
  - Acceptance interval vs. Tolerance interval
  - Grey areas
  - Simple procedures (JCGM 106?)
- Sampling



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Important topics to be covered in MU training for this community

- Application of the GUM
  - Measurement model
  - Sensitivity coefficients
  - Law of propagation of uncertainty
  - Measurement result
- Limits of applicability
- Case studies
  - Weighing instruments
  - Speedmeters
  - Breath analizers

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Open questions

- Conformity assessment (decision-making according to ISO/IEC 17025)
- Determination of MPE
- Use of statistical tools to better define MPE and verification periods
- Definition of a structure for the MU training course – tailored made
- “Everything must be made as simple as possible. But not simpler.”
  — **Albert Einstein**
- ….