



MATHMET

Sharing best practices in MU training

17 – 18 May 2022



MATHMET



Skills workshop

Sharing best practices in MU training (Marc-Olivier André, METAS)

The session aims at an exchange and discussion on best practices drawn from the project participant teaching experience.

15:00 Brief introduction (Marc-Olivier André, METAS)

15:05 Task 2.2 representatives present 2-3 slides on their best practices and lessons learnt (positive and negative)

- What makes the presenter's course unique? Didactical or pedagogical highlights, theory vs. hands-on, specific exercises ideally tailored to meet the need, etc.?
- "Lessons learnt" and top 3 improvements derived from them
- Tricks and tips
- What would the presenter aspire/dream to implement?
- Open discussion

16:00 Break

16:10 Presentations continued

16:30 General discussion (All)

16:45 Wrap-Up and Conclusions (Marc-Olivier André, METAS)



Skills workshop

Presenting order

15:05	CEM	Maria del Mar Pérez
	GUM	Jacek Puchalski
	INRiM	Francesca Romana Pennecchi
	IPQ	João Alves e Sousa
	DAM	Cord Müller
	LNE	Séverine Demeyer
	METAS	Marc-Olivier André
	NPL	Peter Harris
16:00	BREAK	
16:10	NSAI	Paul Hetherington
	PTB	Katy Klauenberg
	SMD	Thierry Caebergs
	UKN	Philipp Möhrke



Idea or dream yet to fulfill

CEM Maria del Mar Pérez

Main message

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Please write the appropriate names

Take home message

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What makes the course unique

Experience from Central Office of Measures (GUM) - POLAND (Jacek Puchalski)

What makes the presenter's course unique?

- In order to make the training more attractive, make a special presentation (.pptx), attach a video, attach fragments of JCGM documents,
- It is unique that we refer to very short mentions of history for example about famous mathematician, statistician like Fisher, Bayes, Gauss- normal distribution, Gosset – concerning the Student's t-distribution

"Lessons learnt" and top 3 improvements derived from them

- the convolution of two rectangular distribution – the k factor less than 2
- CLT Theorem the same standard deviation – k-factor equal 2
- *t*-Student distribution k factor greater than 2 (the number of degree of freedom less than 30)

The presenter should know the level of listeners – perhaps the level of skills in statistics mathematics, physics is enough. There are many internet pages and also video recordings on YouTube about statistics regarding some theory.



Lessons learnt

Experience from Central Office of Measures (GUM) - POLAND (Jacek Puchalski)

Tricks and tips

- In contrast, in MU trainings, uncertainty should be redefined Including standard and expanded uncertainty
- Use VIM and VIML terms, use the same notification, symbols
- Lectures should not contain evidence-claims – they can be found in other sources
- Analysis of measurement results and formulas for the expected value, standard uncertainty from the sample , standard uncertainty of the mean (from population), the law of propagation of uncertainty and the law of propagation of probability density distributions (PDF)for calculations without linearization of the equation of measurement, expanded uncertainty
- Apply examples from the simplest to the more complex (Guide JCGM 100 101 etc.).
- Apply script templates from Excel for selected for selected uncertainty budget examples
- Compare with results of MATLAB scripts for propagation of distribution
- Due to the nature of statistics, statistical mathematics, apply the resulting reasoning step by step – draw conclusions, e.g. with CLT- to be applied in the uncertainty budget



Tricks and tips

Experience from Central Office of Measures (GUM) - POLAND (Jacek Puchalski)

Tricks and tips continued

- Recommend interesting pages, e.g. timetables, you can learn from wikipedia, about Bayesian approach
- In order to broaden your knowledge, take a look at the available JCGM GUM guides, BIPM pages, Metrology articles, YouTube videos confront the content of pages, e.g. Wikipedia.
- Provide materials from the training in the form of presentations, more extended documents

With caution when implementing formulas from unknown sources – no one is perfect and some bad formulas can be found

what would the presenter aspire/dream to implement?

- We dream of having a database of all possible measurement equations / uncertainty budget to demonstrate the results of coverage interval
- Build a database of as many measurement equations as possible using as many inverted cumulative distribution functions (CDF) as possible to simulate various statistical distributions

to demonstrate the results of determination of coverage interval