Update on the activities in the Joint Committee for Guides in Metrology regarding the GUM and VIM

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Eurachem Workshop - Uncertainty from sampling and analysis for accredited laboratories, Berlin (D), 19-20 November 2019

Overview

- Revision of the GUM
- Development of VIM4
- Developing and using measurement models (JCGM 103)
- A New Perspective on the GUM
- Examples

Revision of the GUM

- Back in 2014, a Committee Draft has been circulated
- Much positive feedback and criticism received
- Document was perceived to provide no gain in comparison to JCGM 100:2008 (GUM:1995 with minor revisions) . . .
- . . . and associated with a substantial effort for its implementation
- Explicit request for retaining GUM:1995 alongside the “new GUM” from major NMIs
- WG1 decided to cease the further development of the document

What was achieved?

- Alignment with Supplement 1 with respect to type A evaluations
- More attention to using the law of propagation of uncertainty and the normal/t distribution beyond the cases for which it is demonstrably valid
- Type A and type B evaluations on the same (Bayesian) footing

What was not achieved?

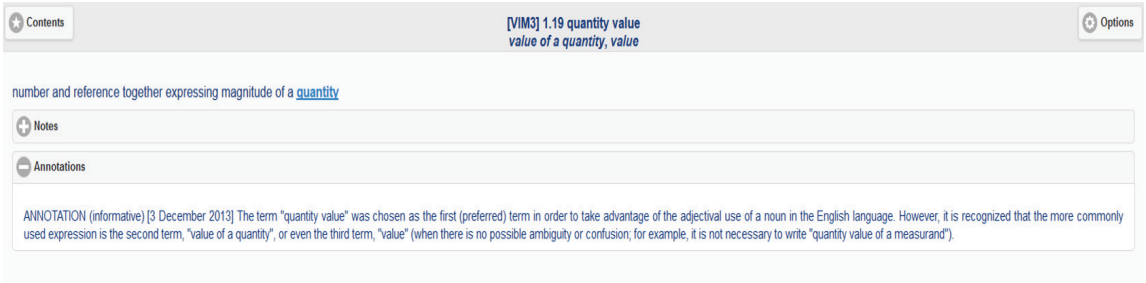
- No satisfactory solution was presented for the case of $n = 2$ or $n = 3$ observations (the t distribution has an infinite variance)
- Readership felt that validating the GUF was an extra burden, especially because it relies on using the Monte Carlo method
- Necessity to put the methods for evaluating standard uncertainty on the same footing was neither well communicated nor well appreciated
- Paying sufficient attention to the inheritance and successes of JCGM 100 (GUM:1995)

Experiences with the current VIM3

- Viewed as the ultimate reference for terminology in metrology
- Language perceived as difficult
- Concept diagrams not readily understandable
- Insufficient support for nominal properties

Annotations to VIM3

Adds further explanation to terms and definitions



Features of the VIM4

- Simplified language
- No concept diagrams
- Electronic (searchable) format
- VIM3 Annotations incorporated (currently 65 available)
- New chapter on nominal properties
- Separate entries for general quantity and individual quantity?
- Definitions of measurement, metrology

JCGM 103 – Developing and using measurement models

- Guidance document for developing and using measurement models
- Elaborates the first steps in any uncertainty evaluation, constructing the measurement model
- Broadens the understanding of measurement model, to include also statistical models (as used in, e.g., reference material production and the evaluation of interlaboratory comparisons)
- Three steps
  - Specification of the measurand
  - Modelling the measurement principle (→ “basic model”)
  - Elaboration of the basic model to include effects arising from the measurement

JCGM 103 – Developing and using measurement models

- Originally projected as Supplement 3 to the GUM
- Document makes connection to JCGM 100, JCGM 101 and JCGM 102
- Guidance on statistical models more in the spirit of a showcase, rather than directive
- Publication anticipated for 2020

Why a New Perspective to the GUM?

- Current structure is unbalanced in that it considers JCGM 100 as the base document
- JCGM 100 was until the appearance of Supplement 1 (2008) the ultimate reference for evaluating and expressing measurement uncertainty
- Current “gold standard” has been the Monte Carlo method (JCGM 101 and 102) since then
- Supplements are perceived as annexes to JCGM 100, which is contradicted in their motivation and scope

Trends

- Acknowledgement of the limitations of the current JCGM 100:2008
- Will to preserve a legacy (GUM:1995, classical statistics)
- Increasing use of the Monte Carlo method, but still by a (small) minority
- Increasing need for uncertainty evaluations for multiple measurands
- Interest in Bayesian methods, but their adoption still in an infant state

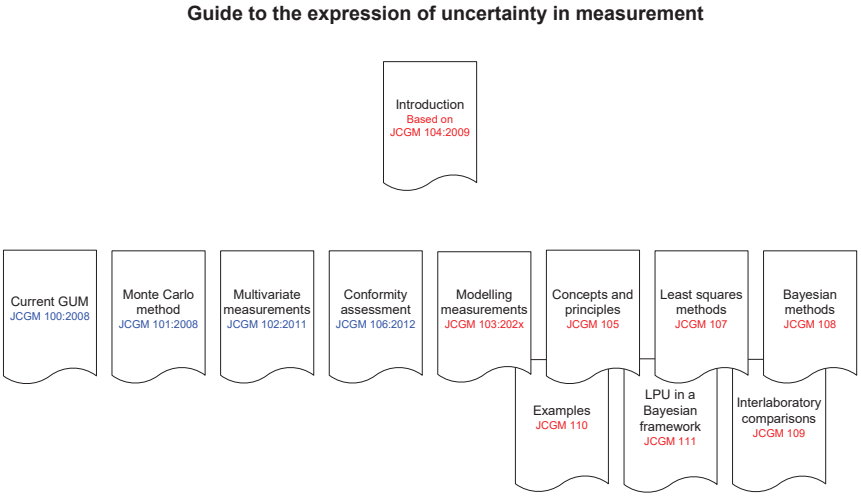
What does the new perspective provide?

- A more flexible structure, by considering all documents as constituent parts of a suite
- Easy to add parts to the suite
- All documents branded under a common banner
- Elimination of the document type “Supplement to the GUM”
- Preservation of the legacy of GUM:1995 readily accommodated

Outline of the new perspective

- Coherent suite of documents covering different methods and applications at different levels of complexity
- Introductory document outlining basic processes and guides the reader to specific part(s)
- Specific parts differing in assumptions and statistical complexity
- Suite can address scientific challenges and day-to-day routine at the same time

Proposed document structure



Rewrite of the Introduction (JCGM 104)

- Provides an “entry-level” introduction to measurement uncertainty and suite of documents
- Minimum set of principles
- Explains that different problems require different methods for uncertainty evaluation
- Overview of the application documents
- Guides readers to the relevant document(s) for their problem

Examples

- Not withstanding available guidance, most people take up examples more readily
- Continued need for further examples . . .
- . . . covering different applications, statistical approaches etc.
- JCGM WG1 made a request to Euramet for a project for developing examples (see poster on 17NRM05 – EMUE)

JCGM 110 – Examples

- First draft circulated in 2014
- Main comment was lack of coverage of applications, methods
- Choice to be made whether document will include examples beyond currently available guidance
- Project 17NRM05 will provide substantial input

Concluding remarks

- Work on the new vocabulary (VIM4) is well underway and extends metrology to qualitative properties
- Revision of the GUM (JCGM 100) ceased because of a lack of support
- A New Perspective to the GUM developed to facilitate the coexistence of methods, without a hierarchy
- New guidance document to appear soon about modelling measurements
- Substantial work ongoing on further examples demonstrating good practice in evaluating measurement uncertainty

Acknowledgement

Special thanks to Walter Bich (convenor WG1) and Chuck Ehrlich (convenor WG2) and the membership of the working groups for their assistance in preparing this overview.

The opinions expressed in this paper are those of the author and do not necessarily reflect the views of the JCGM WG1 and WG2 (working groups 1 and 2 of the Joint Committee for Guides in Metrology).