European Partnership on Metrology
Call 2022 – Digital Transformation, Health, Integrated European Metrology, Normative and Research Potential

Selected Research Topic number: **SRT-d08**
Version: 1.0

Title: Optimised procedures for legal metrology in the digital age

Abstract

EU legislation on legal metrology is one of the pillars of the single market for goods. Legal metrology is the application of legal requirements to measurements and measuring instruments and is used to promote public safety and fair trade. Legal metrology, together with quality assurance, is used to detect non-compliant measurements and measuring instruments. However, the correct balance between the cost and the quality of verification results is essential as overly stringent quality checks can hinder innovation, whereas the inability to detect non-compliant instruments can result in financial and reputational damage for businesses.

Recent developments in digital technologies mean that most measuring instruments can now be read remotely, and the transmission and storage of the data collected is both economically and technologically viable. Efficient analysis of such large data sets is also possible using artificial intelligence (AI), machine learning (ML) or deep learning. However, these new technologies are currently used outside the scope of legal metrology e.g. management of energy or water supplies. Such new technologies could provide legal metrology with more efficient methods for verification, but they first need to be rigorously analysed and validated so as not to jeopardise the trust placed in legal metrology by society.

Keywords

Quality assurance, conformity assessment, legal metrology, verification, artificial intelligence, machine learning, smart meter

Background to the Metrological Challenges

Legal metrology is used to provide society (e.g. consumers, industry and governments) with confidence in measurements and measuring instruments. However, it must also be proportional i.e. the measures must be necessary and suitable for public safety, protection of the environment, levying of taxes/duties and fair trade, whilst also addressing the trade-off between costs, (e.g. labour for dismounting and shipping the instruments to a verification authority, disruption to the use of the instrument, fees for the verification authority) versus benefits (i.e. confidence in the verification result and product safety).

The concept of accreditation was introduced the 1990s and paved the way for conformity assessment based on quality assurance of the production process, which typically involves a quick production check of every individual instrument and a more thorough check of a limited sample (MID module D), plus conformity assessment based on product verification, based on sampling (MID module F). This type of conformity assessment replaced the more costly and time consuming, traditional verification of every individual instrument in the production process. However, further efficiencies in the verification and conformity assessment process are needed.

The EC in their proposal for a strategy on standardisation has emphasised that "a climate neutral, resilient and circular economy cannot be delivered without European standards on testing methods, management systems or interoperability solutions". Research is needed to prepare such standards for the transition into the digital and green age. The verification of the measurement stability of devices used for the measurement of energy conversion and consumption is also vital for this transition.

Modern, digital technologies provide improved collection and transmission of data as well as more sophisticated analysis of large data sets. As a consequence, new methods and solutions for legal metrology and quality assurance are emerging. These new methods could be used to help governments and verification authorities to adhere to the principle of proportionality more efficiently, as well as allowing manufacturers and

utilities companies to increase the efficiency of their quality assurance. But before this can occur, the reliability and metrological value of these new methods needs to be convincingly demonstrated for legal metrology.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support digital transformation in legal metrology and the development of optimised procedures.

The specific objectives are

1. To develop reliable and accurate methods for at least 2 instrument categories defined in the Measuring Instruments Directive (MID) 2014/32/EU) for legal metrology. This should be done using (i) the collection of data from instruments using remote readings such as from smart meters, and (ii) subsequent analysis of the data using AI, ML or deep learning. The methods should also be optimised to minimise the cost and any disruptions to legal metrology, and where possible, avoid the use of personal data.
2. To determine the effect of redundancies and interdependencies in modern legal metrology applications and how they can be used to improve target measures (e.g. verification). This should include case studies for at least two instrument categories defined by the MID, in particular measurements with legally controlled instruments from a larger group, (e.g. a block of flats), as well as from individual consumers, (e.g. each flat within the block of flats).
3. To determine, using methods such as AI or ML, how production tests can be used to optimise MID conformity assessment according to modules D & F. Products whose behaviour deviates from standard product behaviour should be included in the analysis.
4. To produce test cases for the validation of the methods developed in Objectives 1-3. The test cases should include end user input and be used to produce end user guidance such as information on likely modes of failure. The test case must also provide stakeholders with a sufficient level of confidence, so as to enable them to carry out their own pilot studies.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain, standards and respective regulatory developing organisations (IEC, CENELEC, WELMEC, OIML TC3, OIML TC8, committees associated with the Measuring Instruments Directive (MID) 2014/32/EU) and end users (e.g. industry, governments, verification authorities and the energy sector).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies, and other European Partnerships is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EMPIR project 17IND02 SmartCom and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.7 M€ and has defined an upper limit of 2.4 M€ for this project.

EURAMET also expects the EU Contribution to the external funded beneficiaries to not exceed 35 % of the total EU Contribution across all selected projects in this TP.

Any industrial beneficiaries that will receive significant benefit from the results of the proposed project are expected to be beneficiaries without receiving funding or associated partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the ‘end user’ community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the ‘end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to industry, governments, verification authorities and the energy sector.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of the Partnership to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

Time-scale

The project should be of up to 3 years duration.