EMPIR Call 2019 – Networks

Selected Network Topic number: **SNT-w02**
Version: 1.0

Title: Support for a European Metrology Network on positioning, navigation, timing and geodesy

Abstract

Positioning, navigation, timing and geodesy (PNTG) are essential for classical construction surveying, time-synchronised financial transactions, and future georeferenced services e.g. autonomous driving. In addition, PNTG contributes to geodetic global spatial referencing and supports the most challenging issues in Earth Sciences, e.g. temporal evolution and the increase in global sea levels. However, the infrastructure behind all this relies on ensuring international and European collaboration and future developments in PNTG need the development of new, interdisciplinary approaches in gravimetry, time and frequency, and length metrology. Therefore, a European Metrology Network is needed to establish a core infrastructure for stakeholders in the field.

Keywords

Positioning, navigation, timing and geodesy (PNTG), gravimetry, time and frequency, large-scale dimensional metrology, surveying, length

Background

Accurate PNTG plays an ever-growing important role in modern life. Geodetic services are vital for ensuring the stability of dams, bridges, nuclear power plants, and the number of Global Navigation Satellite Systems (GNSS) receivers world-wide is estimated as 5 billion, of which 80 % are embedded in smartphones. Highlighting the importance of PNTG within Europe, the European Commission recently defined the level of accuracy required for business clocks in their regulation (EU) 2017/574, which supplements the Markets in Financial Instruments Directive 2004/39/EC. Further to this, European Directives 2009/31/EC, 2011/70/Euratom and 2011/92/EU define the need for accurate geodetic monitoring in order to assess and contain environmental and societal hazards, such as spent fuel and radioactive waste.

Within PNTG community, the link between the geodetic and the timing community has been well established through the International GNSS Service (IGS) and programmes such as Galileo. However, the recent improvement of time and frequency measurements, via optical clocks, has created new interdisciplinary challenges and needs for more collaboration. Current satellite-based links need to be supplemented by optical links, but in order to achieve this wide-scale coordination of upgrade timescales, infrastructure development, optical clock performance levels and an improvement in the understanding of geodetic and geophysical effects is needed.

Currently geodesy is supported by international societies, like the International Association of Geodesy (IAG), the International GNSS Service, and the European Plate Observing System (EPOS). However, there is currently no metrology network to support such geodetic societies in Europe. In contrast, traceability for time and frequency, dimensional, and mass metrology is coordinated at the European level by the EURAMET technical committees for length (TC-L), mass (TC- M), and time and frequency (TC-TF), and collaboration with the metrology community for gravimetry is supported by the IAG and BIPM Consultative Committee for Mass and Related Quantities (CCM). But despite these separate metrology links, there is currently no single network to bring together all PNTG stakeholders so that their metrological needs can be defined, prioritised and addressed.

How and where NMIs should focus limited resources to obtain maximum impact for society urgently requires a strategic plan and significant coordination both at European and global levels. No single NMI has the expertise or resource to tackle all or even a significant fraction of the most critical priorities without collaboration. Without coordination, there is a strong likelihood of unnecessary duplication, with NMIs (nationally and/or regionally) potentially independently choosing to focus efforts on the same challenge with

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consequential neglect of others. EURAMET is considering establishing a European Metrology Network to coordinate the European NMI response, to establish close links to the stakeholder community, to develop and implement a strategic agenda and establish a knowledge, technology transfer and promotion plan, to ensure an effective response is put in place. This SNT is intended to elaborate how a network could support EURAMET and to support that network in its initial tasks.

Objectives

Proposers should address the objectives stated below, which are mainly based on the PNT 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 / legal / regulatory / market constraints, but the reasons for this should be clearly stated in the protocol.

The JNP shall focus on developing a long term ongoing dialogue between the metrology community and relevant stakeholders. This dialogue should support the take-up of research outputs from the metrology community and the collection of needs from stakeholders to inform future research.

The specific objectives are:

1. To establish regular, constructive dialogue and liaison between the project and stakeholders in the fields of Positioning, navigation, timing and geodesy (PNTG), including relevant European and international societies and standards development organisations. This should include not only fostering existing liaisons, but also promoting new collaborations.
2. Using the feedback from stakeholders in Objective 1, to develop a web-based platform for PNTG. The platform should include easy access to European metrology capabilities, information of large structure measurements, and a service desk for stakeholders to submit questions and request further information. The platform should also be developed in a manner that allows it to be maintained by a future EMN.
3. To develop a Strategic Research Agenda (SRA) and roadmaps for PNTG metrology. This should take into account existing roadmaps for time & frequency, length and gravimetry metrology (e.g. EURAMET TC-L, TC-TF and TC-M) and the metrological needs of stakeholders, as well as the identification of research milestones.
4. Using the feedback from stakeholders in Objective 1, to set up a knowledge-sharing programme for PNTG stakeholders, in order to promote the dissemination and uptake of results, including those from previous, relevant EMRP and EMPIR projects. This should include a range of regularly hosted activities, such as the exchange of researchers between organisations, metrology workshops, stakeholder events and training courses.
5. To develop a plan for a joint and sustainable European metrology research infrastructure for PNTG via a European Metrology Network. The plan should be completed within 12 months of the start of the project and should (i) develop coordination and smart specialisation of capabilities (ii) align with other running initiatives and projects, (iii) promote the development of emerging member states, and (iv) consider how to extend collaboration to third countries.

The proposed activities shall be justified by clear reference to the measurement needs within strategic documents published by the relevant stakeholders. Proposers should establish the current state of the coordination in this area, and explain how their proposed project goes beyond this.

The proposed activities should not include those essential for the establishment and operation of the EMN. EMNs will be established and operated by the EURAMET members using their own national resources regardless of whether specific EMPIR proposals are funded. EMPIR funding is for specific tasks aimed at ensuring a proposed EMN will progress quickly towards its establishment and implementation and contribution to the objectives of the programme.

EURAMET expects the average EU Contribution for the selected JNPs in this TP to be 0.4 M€, and has defined an upper limit of 0.5 M€ for this project.

Potential Impact

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

You should detail how your JNP results are going to:

- Address the SNT objectives and deliver solutions to the documented needs,
- Provide a lasting improvement to coordination in the European metrological community and communication with their stakeholders beyond the lifetime of the project,

You should detail other impacts of your proposed JNP.

You should also detail how your approach to realising the objectives will further the aim of EMPIR 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

Time-scale

The project should be of up to 4 years duration.