

Title: Support for a European Metrology Network on Quantum Technologies

Abstract

Quantum physics is a key knowledge source for industry and European R&D programmes (such as the EC Quantum Flagship) are helping to bring about European leadership in this field. Quantum technologies (QT) is emerging as a fundamental technology, and number of devices are already being developed and integrated into products by European industry. Thus, it is becoming increasingly important for industry to have access to contact and reference points for their QT metrological requirements. The European Metrology Network for Quantum Technologies (EMN-Q) was established to coordinate and promote QT research activities and the related metrology. EMN-Q aims to address future stakeholder requirements for QT, including those from the European Quantum Flagship and standards development organisations (SDO). However, support is needed to kick-start and develop key aspects of the EMN-Q so that maximum impact can be achieved. This includes developing contacts with stakeholders, a Strategic Research Agenda (SRA) and a knowledge-sharing programme in order to promote the uptake of EMN-Q results.

Keywords

Quantum Technologies (QT), European Metrology Network for Quantum Technologies (EMN-Q), EC Quantum Flagship, Strategic Research Agenda (SRA)

Background

Standardisation is one of the key elements for the commercial success of any new technology, especially at the beginning of its development. Therefore, globally accepted standards are needed to facilitate the growth and development of the QT. However, in order to certify the compliance of commercial QT devices to such standards, it is necessary to develop the corresponding metrological infrastructure.

To maximise the impact of QT metrology research, a strategic plan and significant coordination both at European and global levels is required. It is fundamental for NMIs to decide how and where they should focus their limited resources, as no single NMI has the expertise and the resources to tackle all or even a significant fraction of the most critical priorities without collaboration. Without coordination, there is a strong likelihood of unnecessary duplications, with NMIs (nationally and/or regionally) potentially independently choosing to focus efforts on the same challenges and consequentially neglecting others. Therefore, EURAMET has formally established the EMN-Q in order to create close links to the stakeholder community, to develop and implement an SRA 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 EMN-Q in its initial tasks.

One of the most relevant roles of the EMN-Q in the different technological fields of QT (e.g. quantum photonics, quantum clocks, quantum electronics), will be to support the metrological community in its response to stakeholders needs. In turn stakeholders will acquire confidence that their metrological needs will be addressed by a long-term and coherent approach, improving the present situation where short-term projects are based on 'ad-hoc' needs. However, such a long-term and coherent approach requires stakeholder input and the development of an SRA and roadmaps for QT in order to support the coordination of national and international research programmes. To strength the industrial uptakes of QT, it is necessary to ensure the quality of QT products and their acceptance, through standardisation and certification processes; for this process EMN-Q will act as an important contact point between stakeholders and NMIs.

As well as consulting with stakeholders to define their QT needs, a knowledge transfer programme is needed for the dissemination and uptake of the EMN-Q results by stakeholders. As stakeholders are diverse this should include a range of events and training activities, as well as a web-based platform that serves as a single

point of contact for stakeholders, providing easy access to QT results and relevant NMI services (e.g. calibrations), and offering a service desk to answer their metrological questions.

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 and promote regular, constructive dialogue between stakeholders (quantum industry and representatives of European and national research programmes) and the EMN-Q. This includes:
 - the creation of a stakeholder advisory board inside EMN-Q,
 - the creation of EMN-Q contact groups as stable liaisons with EU and national research programmes (in particular the EU flagship on quantum technologies).
2. To develop an SRA addressing the following issues: (i) identify the metrological research needs of quantum technologies (ii) address the metrological requests emerging from quantum industries (iii) promote the development of emerging member states in quantum technologies. The overall objective of the SRA is to develop a plan for a joint and sustainable European metrology research infrastructure for quantum technologies via the coordination and smart specialisation of capabilities.
3. To develop a knowledge-sharing programme in order to promote the dissemination and uptake of EMN-Q results based on:
 - a web-based platform to facilitate interactions with stakeholders. The platform should include easy access to a wide range of quantum technology metrology data and a service desk for stakeholders to submit questions and requests for further information.
 - a range of regularly hosted activities, such as the exchange of personnel between organisations, metrology workshops, stakeholder events and training courses.
4. To promote and contribute to the standardisation and certification processes for quantum technologies. This should include establishing regular and constructive dialogue between relevant standards development organisations (SDO) and the EMN-Q, so that the needs of SDO can be accommodated.

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.