

# **European Partnership on Metrology Decision (EU) 2021/2084**

## **FINANCIAL FRAMEWORK PARTNERSHIP AGREEMENT 2021/METROLOGY/01**

**European Partnership on Metrology ANNUAL REPORT  
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## Publishable Summary

The European Partnership on Metrology was established in 2021 by twenty-three participating countries and the European Union, utilising Article 185 of the European Treaty. It follows on from the European Metrology Programme on Innovation and Research (EMPIR) which held its last call for Joint Research Projects in 2020. EURAMET - the European Association of National Metrology Institutes - is the body responsible for the implementation of European Partnership on Metrology. The decision of the European Parliament and of the Council on the participation of the Union in the European Partnership on Metrology jointly undertaken by several Member States (COM(2021)0089 – C9-0083/2021 – 2021/0049(COD)) was adopted in November 2021. The legislation was published in the Official Journal at the end of November 2021 and entered into force on 1 December 2021.

The core activity of European Partnership on Metrology consists of funding multi-partner transnational joint research projects to advance metrology and its applications. In view of the concentrated capacities in metrology, the core part of European Partnership on Metrology is executed by National Metrology Institutes and Designated Institutes assigned by the participating states.

The key differences between the European Metrology Programme for Innovation and Research (EMPIR) and the European Partnership on Metrology are the reformation of the co-funding scheme as well as the closer collaboration among other partnerships within the Horizon Europe.

The year 2023 saw the completion of the third annual call and selection process. The two-stage process for joint research projects commenced with a call for ideas, followed by a call for proposals against the selected ideas. EURAMET launched the first stage of this call requesting ideas addressing metrology needs underpinning industrial competitiveness and research potential in January, with Stage 1 closing in February. The ideas received were prioritised by EURAMET in April, and the preparatory work for second stage dedicated call completed in June. The Stage 2 call was published & launched in June and closed at the beginning of October, addressing 56 topics which had been distilled from the best of the ideas received in Stage 1. For each of the topics published a supporting document was provided identifying the need or opportunity, the scientific objectives and potential impact.

The proposals received were checked for eligibility and then subject to independent expert evaluation at European level culminating in a Review Conference (at which the referees meet a representative of the proposing consortia). This was held at the end of November face to face and involved 93 referees, the representative for each proposal in the respective Target Programme Fundamental Metrology or Normative or Industry or Research Potential or Capacity Building Coordination and the EURAMET Management Support Unit that runs the programme. A few days later the Partnership Committee formally endorsed the recommendations of the independent referees without change.

The referees deemed 13 of the 15 Fundamental Metrology proposals, 18 out of 23 Metrology for Industry proposals, 10 out of 11 Metrology for Pre- and Co-normative Research proposals, 3 out of 5 Research Potential proposals, and the Capacity Building Coordination proposal of suitable quality for support. Considering the budget restrictions, the Partnership Committee decided to fund the top 8 of the Fundamental Metrology projects, top 14 of the Metrology for Industry projects, top 5 of the Metrology for Pre- and Co-normative Research projects, top 3 of the Research Potential projects and the Coordination and Support Action on Capacity Building Coordination. These proposals were sent for ethics screening with a view to being funded. An independent observer attended the Review Conference and gave both a positive report and some suggestions for improving the process. The projects sent for ethics review cover:

For the Fundamental Metrology:

1. Photonic and quantum sensors for practical integrated primary thermometry
2. Controlled confinement to reduce the inaccuracy of clocks based on optical lattices
3. High-accuracy ion-based optical clocks
4. Fundamental physical metrology with cold molecules

5. Advanced quantum technology for metrology of electrical currents
6. Fundamental protein metrology to support the definition of measurands, analytical targets, and their associated measurement uncertainty
7. Quantum anomalous Hall effect materials and devices for metrology
8. Metrology for superconducting qubits

For the Industry Programme:

1. Electric energy and supply reliability
2. Manufacturing of commutable calibrators and quality control materials for standardisation and post-market surveillance of IVD<sup>1</sup> tests
3. RF<sup>2</sup> key quantities for 6G<sup>3</sup> development
4. Metrology for static and dynamic characterisation of supercapacitors
5. Flow measurement traceability for hydrogen in gas networks
6. Metrology for electric vehicle charging systems
7. Radon metrology: Sensor networks for big buildings and future cities
8. Traceable machine vision systems for digital industrial applications
9. Metrology for green maritime shipping: Emission control through traceable measurements and machine learning approach
10. On-wafer microwave metrology for future industrial applications
11. Thermometry with embedded SI<sup>4</sup> traceability for industrial applications
12. Application of digital metrological twins for emerging measurement technology in advanced manufacturing
13. Metrology for food safety in the circular economy: targeted and screening methods for contaminants in food and recycled packaging
14. Multidimensional optical diffusion for the measurement of appearance

For the Capacity Building Coordination Programme:

1. Capacity building coordination (2023)

For the Normative Programme:

1. Support for standardisation of sample-by-sample waveform uncertainty computation
2. Standardised measurements of surface functionalities on nanoparticles
3. Standardisation of bioaerosol monitoring for air quality and climate modelling
4. Normating colour-centre-based quantum sensing technology towards industrial application and standards
5. Advanced detail sensitivity monitoring by new concepts to improve the reliability of safety relevant products using industrial computed tomography

For the Research Potential Programme:

1. Wideband AC<sup>5</sup> quantum traceability
2. Establishing European traceability for medical measuring devices through liquid absorbance filters

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<sup>1</sup> In vitro diagnostics

<sup>2</sup> Radio frequency

<sup>3</sup> A future technical standard of a sixth-generation technology for wireless communications

<sup>4</sup> The International System of Units

<sup>5</sup> Alternating Current

3. Metrology for standardised moisture content measurements in plant-origin bulk materials in support of International and European food safety and trade

Formal notification including outcome, evaluation marks, ranking and the comments of the independent referees and ethics reviewers will be sent to the proposers in 2024. The list of selected projects along with the names of the referees and some basic statistics will appear on the EURAMET website on the formal announcement dates.

Highlights on progress towards Technical Sovereignty of Europe (as in the Biannual Monitoring Report 2024)

#### Technological

*Improving self-calibrating photodiode standards for environmental monitoring and European industry.*

Photodiodes have a broad range of applications across industry, environmental monitoring, and medicine. As photonics and optics systems evolve to become more miniaturised and integrated, new cost-effective standards for photodiodes are required. These standards are particularly relevant to detectors for the ultraviolet (UV) range, which are used in healthcare and Earth observation but suffer from a lack of stability. The Metrology Partnership project '[Self-calibrating photodiodes for UV and exploitation of induced junction technology](#)', builds on a previous EMPIR project, which created an 'NMI-on-a-chip', ideal for miniature, integrated or remote systems as they are self-calibrating. The project will improve on this work by developing new 3D simulation models of photodiode-based Predictable Quantum Efficient Detectors (PQED) to improve quantum yield predictions and improve uncertainty, test PQEDs as built-in references across a range of applications and develop improved photodiodes in the UV range. The outcomes of the project will help to ensure accuracy for photonics and optics systems, even for those that are difficult to access in-situ. This will increase confidence in the industries, environmental monitoring and medical applications which utilise them and enable further miniaturisation, opening new applications for the future.

#### Economic

*Extending accessibility to low-cost medical imaging in Europe*

Magnetic resonance imaging (MRI) is used help identify conditions ranging from damaged ligaments to cancer. Around 40 million MRI scans are performed each year in the EU, but the size and cost of scanners means that not all European citizens have equal access to this form of medical diagnosis. 'Low-field MRI' is a portable form of the standard MRI scanner, opening opportunities to provide treatment at a patient's locality. However, these machines currently lack metrological traceability and the accredited documentation blueprints of hardware and software required by the EU's Medical Device Regulation. The project '[Affordable low-field MRI reference system](#)' will design, develop, and characterise a mobile, low-cost, low-field MRI system. For the first time, multiple low-field low-cost open-source magnetic resonance (MR) scanners will be built at different sites and evaluated. All information to build, operate and maintain these scanners will be made publicly available including model-based image reconstruction approaches optimised for low-field MRI fulfilling the requirements of the Medical Device Regulation. This will result in an easier approval route for similar low-field MR systems developed by companies, resulting in cost savings for public healthcare systems.

#### International positioning

*Metrology Partnership project on passive radiative cooling technologies collaborates with SPACECOOL in Japan*

The Metrology Partnership project '[Metrological framework for passive radiative cooling technologies](#)' is working to develop a metrological framework to classify and compare Passive Radiative Cooling (PRC) materials. These materials provide an emerging technology that can cool to sub-ambient temperatures even in direct sunlight, and could be an efficient alternative to conventional systems, saving up to 80 % of cooling-related electricity. SPACECOOL INC in Japan

has developed PRC material known as SPACECOOL film. The company will provide the material and will collaborate with the consortium towards the development of characterisation methods, demonstration tests and life cycle assessments for PRC materials. The project will create protocols and best-practice guides for in-field testing and assess material performance under a variety of real-world conditions. This will help drive innovation in PRC technology, producing more energy-efficient cooling to meet rising needs.

More highlights and details of the running and completed EMPIR & Partnership projects are available from the EURAMET website [www.euramet.org](http://www.euramet.org).

The EMPIR and European Partnership on Metrology are good examples of European Joint Programming - pooling national research efforts in order to make better use of Europe's precious public R&D resources to tackle common European challenges more effectively. The first stage of the call selects research areas where the stakeholder need is clear, and the metrology community have the appropriate resources to make a significant impact. The second stage is a competition where the best proposals (in terms of scientific excellence and potential impact) are chosen by independent referees. The result is collaborative European projects where critical mass is brought to bear on clear objectives, with agreed project plans and enhanced stakeholder engagement. All the participants abide by the European level independent evaluation, clearly demonstrating the true "European Research Area" nature of the programmes.