Shaping the future metrology infrastructure: Experiences and impact from the European Metrology Networks

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www.euramet.org
https://www.euramet.org/european-metrology-networks

Content

- Background
- Concept of European Metrology Networks
- EMNs in EURAMET eV
- EMNs in the European Partnership for Metrology
- Stakeholder engagement, cooperation and projects
- More areas to cover?
- Challenges, problems

Background

A “Coordination Study” commissioned in 2016:

- Unexploited opportunities for more coordination
- Define European level strategies for further coordination
- Stronger links to high level stakeholders
- Create a framework for NMIs/DIs to specialise and develop according to their needs and ambitions

Networks, as part of EURAMET eV

European Metrology Networks

Objective: To create sustainable structures in areas of strategic importance for the future of European metrology.

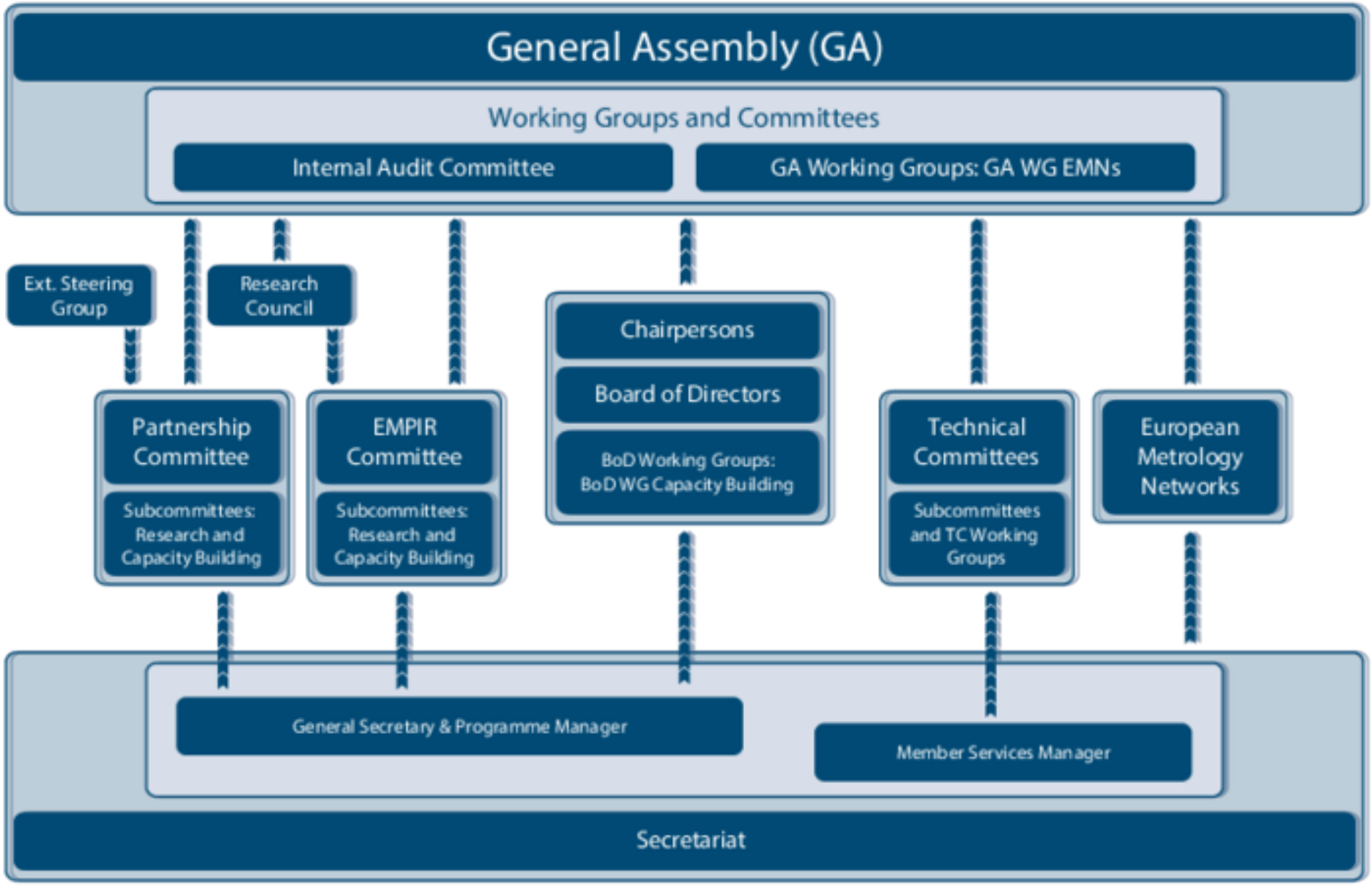
The Networks…

- cover an area of major strategic importance, with a **European dimension**;
- establish close links with a wider **stakeholder community**; including cooperation with other partnerships;
- strive for **scientific excellence**;
- develop and coordinate a **common metrology strategy & infrastructure** to support innovation, public policy, & regulation.

CLIMATE AND OCEAN OBSERVATION
ENERGY GASES
QUANTUM TECHNOLOGIES
SMART ELECTRICITY GRIDS
TRACE LAB MED
ADVANCED MANUFACTURING
RADIATION PROTECTION
CLEAN ENERGY
SAFE AND SUSTAINABLE FOOD
SMART NORTH
POLLUTION MONITORING
MATHMET

Approved EMNs

#	Title	Chair
1	Advanced Manufacturing	Fernando Araju de Castro (NPL)
2	Clean Energy	João Alves e Sousa (IPQ)
3	Climate and Ocean Observation	Celine Pascale (METAS)
4	Energy Gases	Annarita Baldan (VSL)
5	Mathematics and Statistics	Francesca Pennecchi (INRiM)
6	Pollution Monitoring	Nathalie Guigues (LNE)
7	Quantum Technologies	Ivo Degiovanni (INRiM)
8	Radiation Protection	Annette Röttger (PTB)
9	Safe and Sustainable Food	Andrea Rossi (INRiM)
10	Smart Electricity Grids	Stefano Lodetti (NPL)
11	Traceability in Laboratory Medicine	Vincent Delatour (LNE)
12	Smart Specialisation in Northern Europe	Martti Heinonen (VTT)


General Assembly (GA)
Working Groups and Committees
Internal Audit Committee
GA Working Groups: GA WG EMNs
Ext. Steering Group
Research Council
Partnership Committee
Subcommittees: Research and Capacity Building
EMPIR Committee
Subcommittees: Research and Capacity Building
Chairpersons
Board of Directors
BoD Working Groups: BoD WG Capacity Building
Technical Committees
Subcommittees and TC Working Groups
European Metrology Networks
General Secretary & Programme Manager
Member Services Manager
Secretariat

EMNs in the Metrology Partnership

Article 2

Objectives of the Metrology Partnership

1. The Metrology Partnership shall contribute to the implementation of Regulation (EU) 2021/695, and in particular Article 3 thereof.

2. Without prejudice to paragraph 1, the Metrology Partnership shall, through the involvement and commitment of partners in designing and implementing an annual work programme as referred to in Article 7, pursue the following general objectives:

(a) to develop a sustainable, excellent and coordinated metrology system at European level, thereby helping to bridge the investment gap between Europe and its global competitors;

(b) to ensure that state-of-the-art metrology capabilities are widely taken up by innovators in their ecosystems and beyond;

(c) to increase the impact of metrology on societal challenges in relation to the implementation of policies, standards and regulations, inter alia in the digital, economic, industrial and environmental areas, in order to make them fit for purpose.

3. When implementing the general objectives set out in paragraph 2, the Metrology Partnership shall pursue the following specific objectives:

(a) to develop, by 2030, new research capabilities which are built within the framework of new European metrology networks and which perform in terms of calibration and measurement capabilities at least equally to the leading metrology institutes outside the Participating States;

(b) to support, by 2030, sales of new innovative products and services through the use and adoption of the new metrology capabilities in key emerging and enabling technologies;

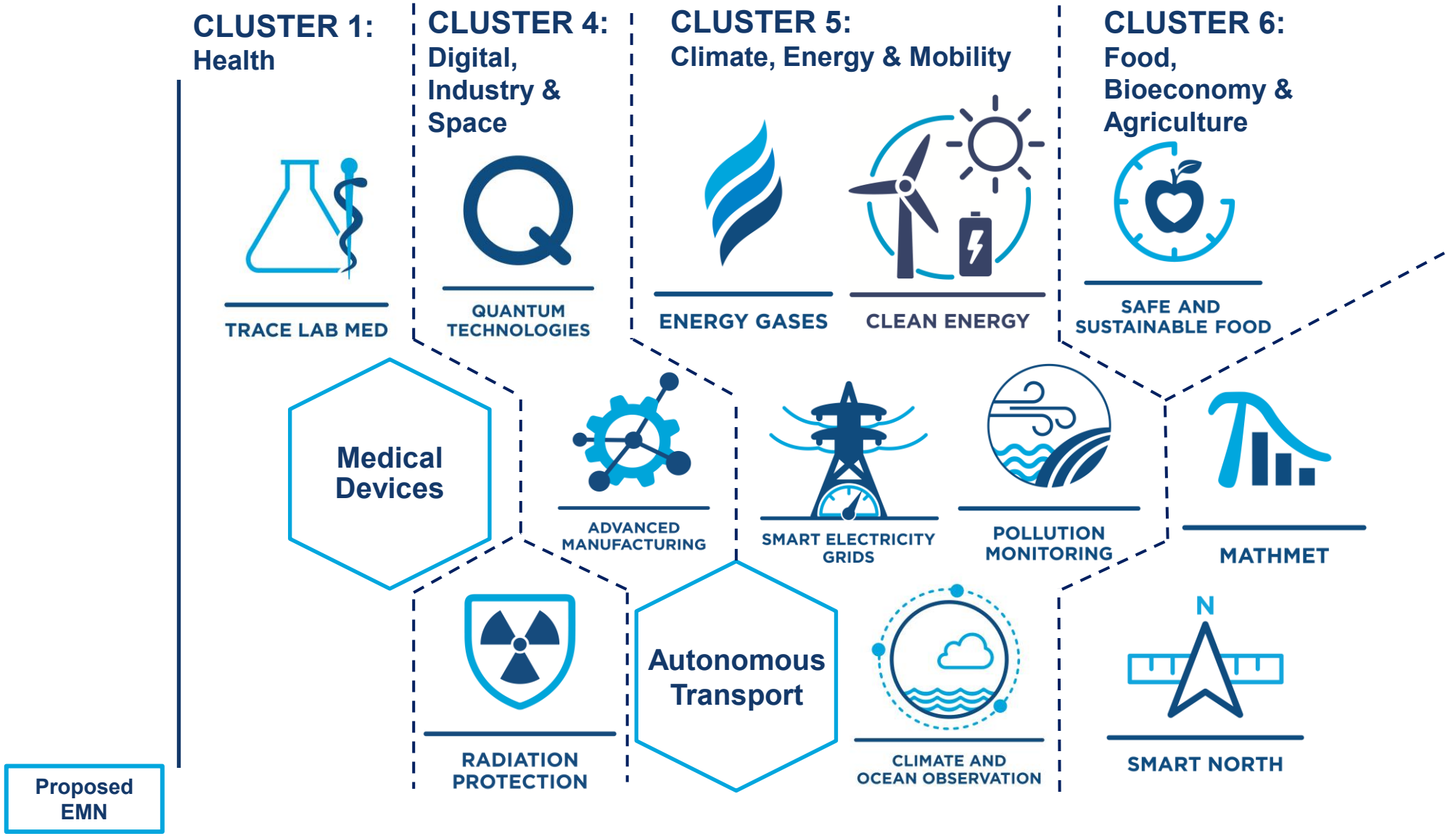
(c) to contribute to the creation and diffusion of high-quality new knowledge, competences and skills across the Union in the context of lifelong learning and with a view to achieving societal transformation, including through enhancing capability for innovation;

(d) to contribute fully and effectively, by 2030, to the design and implementation of specific standards and regulations that underpin public policies addressing societal, economic and environmental challenges;

(e) to unleash the potential of metrology among end-users, including SMEs and industrial stakeholders, as an instrument which contributes to the achievement of the Union goals for the digital and green transitions.

In-kind contributions from NMIs includes work related to EMN, but also TC

Relevance of EMNs in Horizon Europe clusters



Coordinating Technology Infrastructures for Metrology in Quantum

EMN-Q enables its members being front-runners in developing a metrology infrastructure for Q-technologies in Europe:

- Fundamental enabler to deploy quantum technology
  - Metrology contributes e.g. Characterisations of cryogenic components for quantum computing
- Framework Partnership Agreement Qu-Test (an EU19M€ project ~2027) developing a service catalogue (>100 services) to support scaling up the European quantum industry
- Event during Danish Presidency of the Council of the EU

RTI – Summit 2025: A Research and Technology Infrastructures Ecosystem for Breakthrough Science and Innovation; 21 – 24 October 2025

FPA Qu-Test "Supporting industry through testing and experimentation"

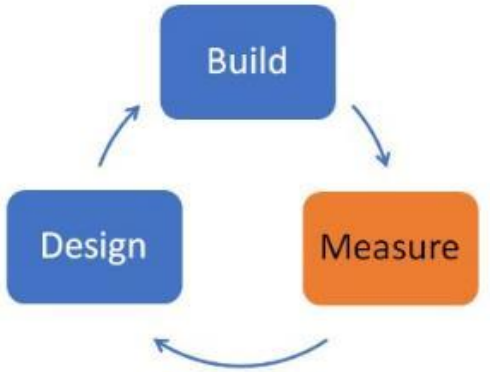
Three technical areas (testbeds):

Quantum Computing

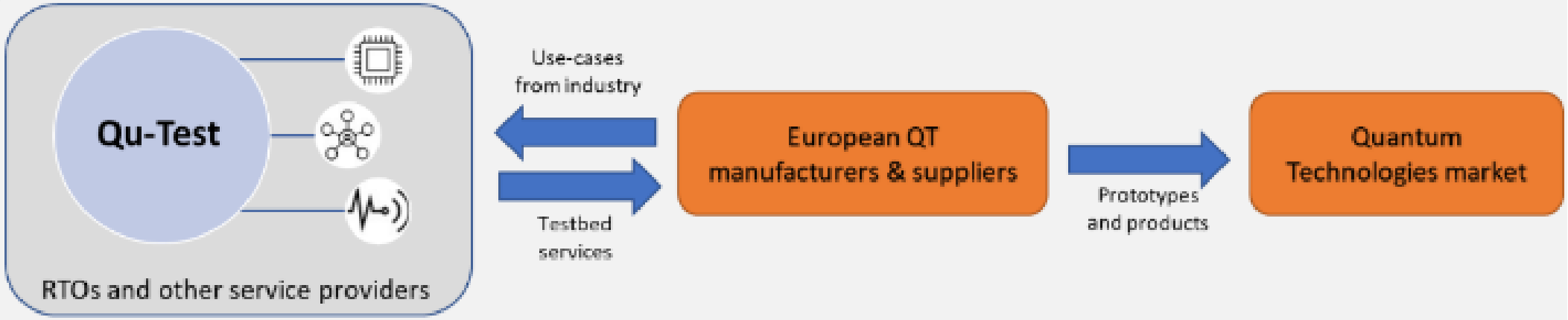
Quantum Communication

Quantum Sensing

Quantum devices engineering



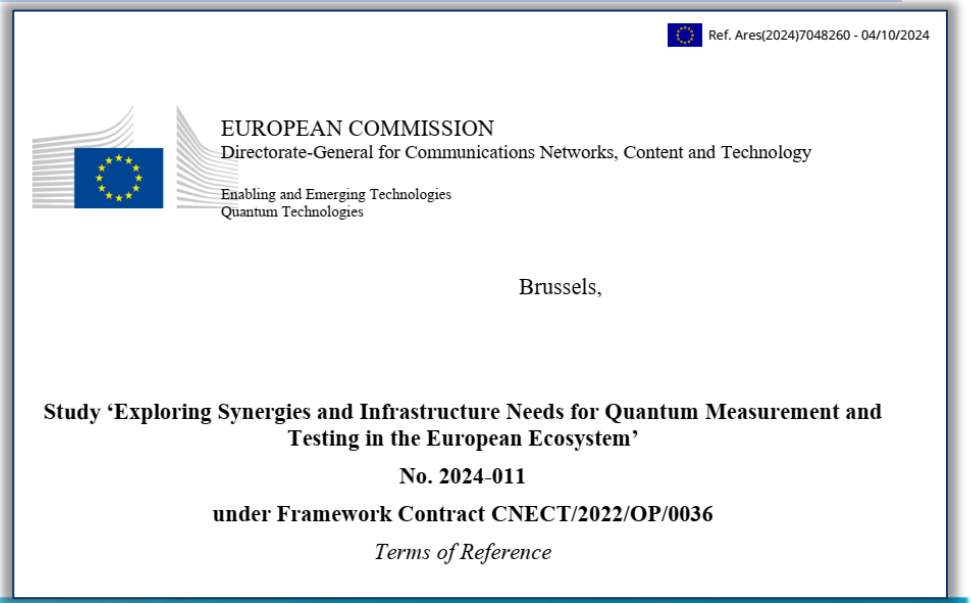
Testbed operation



Initiative “EuroQMTI”

- EuroQMTI can build upon existing European institutions active in QT:
  - National Metrology Institutes
  - Academic institutes
  - Research and Technology Organisations (RTOs)
  - Standards Development Organisations (SDOs)
- Cooperation as successor / continuation of FPA ‘Qu-Test’

A consortium led by ICF is performing the EuroQMTI study



Ref. Ares(2024)7048260 - 04/10/2024

EUROPEAN COMMISSION
Directorate-General for Communications Networks, Content and Technology

Enabling and Emerging Technologies
Quantum Technologies

Brussels,

Study ‘Exploring Synergies and Infrastructure Needs for Quantum Measurement and Testing in the European Ecosystem’

No. 2024-011

under Framework Contract CNECT/2022/OP/0036

Terms of Reference

Supporting the deployment of Quantum Tech with standards

- European Standardization Roadmap on Quantum Technologies on Quantum Technologies by CEN-CENELEC
- Establishment of a new JTC at CEN-CENELEC creating a “home” in standardisation for the European quantum industry.
- The Standardisation roadmap also informed ISO/IEC JTC 3 that has the scope of “Standardization in the field of quantum technologies”

EMN Quantum is engaged with the following standardisation stakeholders:

Trustworthy virtual experiments and digital twins

www.vidit.ptb.de

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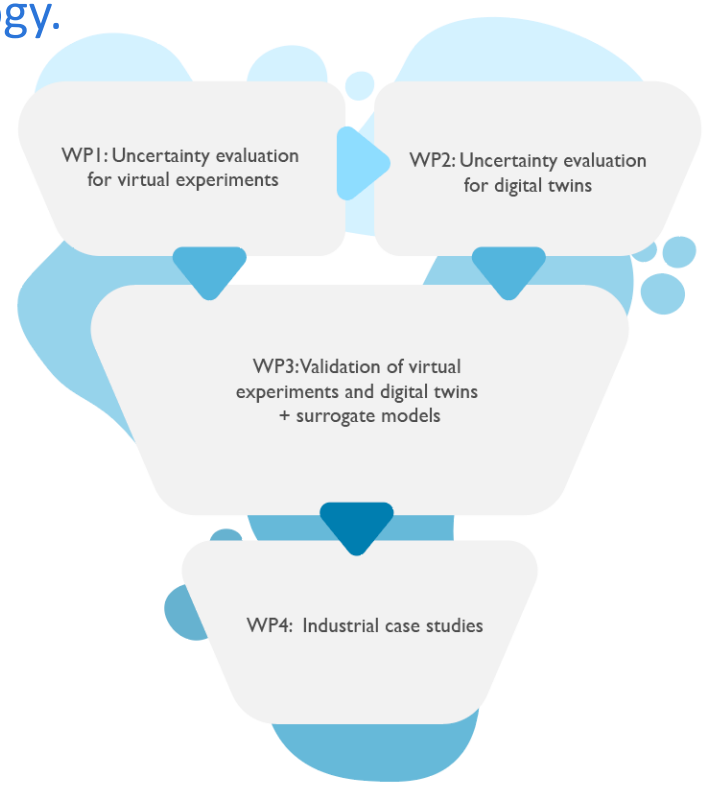
Aim of the project:

To develop methods and tools that enable ensuring the **reliability and trustworthiness** of **virtual experiments** and **digital twins** in metrology.



Objectives:

- To derive **traceability** in metrological applications, where virtual experiments/digital twins are used
- To provide **validation procedures** for metrology systems with embedded virtual experiments/digital twins
- To ensure the **transferability** of the developed methods in **industrial applications**

Trustworthy virtual experiments and digital twins

www.vidit.ptb.de

EURAMET

Coordinate measurement

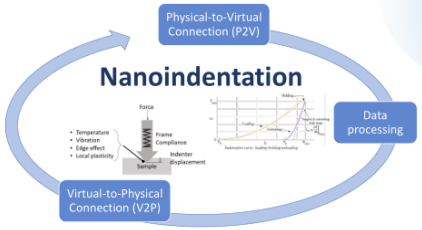
Mahr

DUI Dutch United Instruments

Contactless form measurement

GEOMNIA
3D METROLOGY ENGINEERING AND SOFTWARE SOLUTIONS

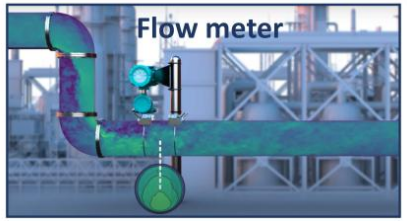
Nanoindentation measurement



Industrial case studies

EMERSON

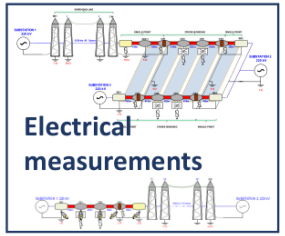
KROHNE
measure the facts



Flow measurement

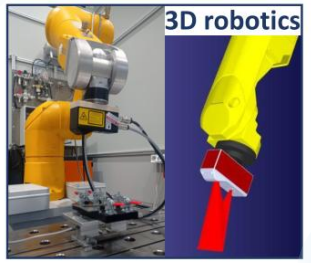
Endress+Hauser
People for Process Automation

EDF



Electrical measurement

red eléctrica



AERnnova

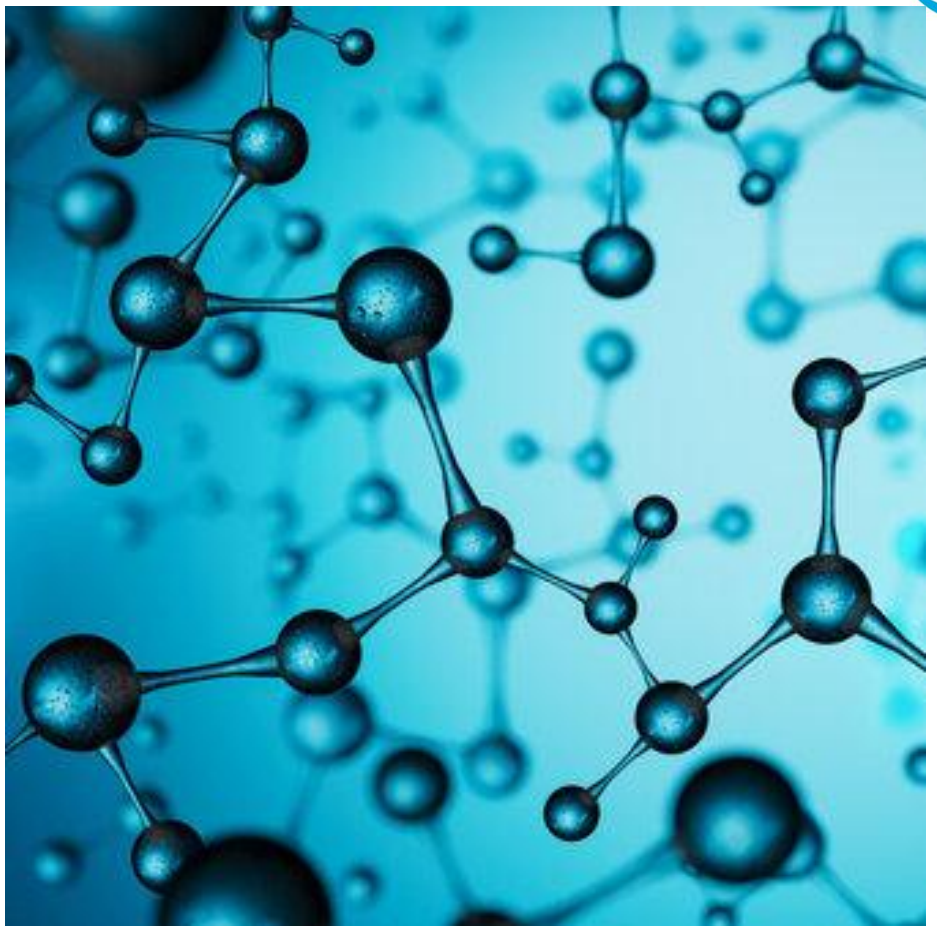
Robotic 3D scanning system

Advanced Materials Open Consultation

21 November 2025 online workshop

Autonomous Driving Open Consultation

In the week 22-28 January 2026 online workshop



ADVANCED MANUFACTURING

Power grids of tomorrow need better observability

- Grids → once-in-a-generation transformation
- Stability under threat
- New-generation "**grid-forming**" inverters
- To provide stability & prevent black-outs in a 100% renewable scenario
- Can we **trust** them to keep the lights on?

GRID FORM

Metrology for grid-forming converters to stabilize future power grids

24GRD08 [2025-2028]

coordinator: RISE (Sweden)

- ✓ Performance testing procedures
- ✓ EU testing facilities in place
- ✓ Capability for onsite verification
- ✓ Interoperability of grid-forming inverters
- ✓ Stability and reliability of the grid

SMART ELECTRICITY GRIDS

Metrology for reliable grid data analytics (24DIT05)

1 June 2025 – 31 May 2028

- Aim: Develop a metrological framework to test and validate grid data analysis methods

- This involves:
  - Quantification of data quality of measurement data
  - Generation of simulated data to complement measurement
  - Extensive testing of algorithms incl. AI/ML-based methods

- Targeted grid phenomena:
  - frequency deviations
  - sub-synchronous oscillations
  - power quality disturbances
  - grid asset faults
  - congestion forecasting

METROLOGY PARTNERSHIP

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Challenges, problems, future development…

Possible new EMNs: Autonomous Driving, Medical Devices, …?

Comms4Net, support for communication/impact

Further/stronger links to high level initiatives (Other partnerships, DGs in EU, Joint Research Centre, etc)

Consolidation of EMN landscape, will be a key element in the future metrology infrastructure in Europe

Resources in NMI/DIs vs results/impact

Capacity Building, Knowledge Transfer, keeping all member countries on board