European Metrology
Programme for
Innovation and Research

Industrial innovation – Projects (Call 2017)

An overview of the funded projects from the Targeted Programme Industry.

The aim of these projects is to use cutting-edge measurement science to drive innovation in industry and facilitate new products.

The projects focus on new applications at the crossroads between different technologies to improve efficiency and effectiveness in high-tech industries and key industrial sectors, in order to ensure European industry remains globally competitive.

EURAMET e.V. - the European Association of National Metrology Institutes

Medical implants and MRI scanning: improving patient safety

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Procedures allowing medical implant manufacturers to demonstrate compliance with MRI safety regulations

In the EU alone, the market for medical implants is worth €3 billion. Of the 50 million European citizens carrying such devices, the majority will at some point receive an MRI scan (Magnetic Resonance Imaging). Due to MRI magnetic field and radio wave interactions with some implants, product compatibility is a key consideration for patient safety. However, current time-consuming compliance testing methods discourage manufacturers from creating new products for the implant market.

This project will develop the test methods needed to demonstrate implant compatibility with MRI scanning for improved patient safety. By improving models of human subjects with implants, and validation of computer modelling by comparison with test implant measurements, the project results will feed into new and existing international standards for MRI safety regulations. With an additional, simpler compliance-checking process for small implants (< 10 cm), many European manufacturers will benefit from the outcomes of this project.

Project 17IND01
Procedures allowing medical implant manufacturers to demonstrate compliance with MRI safety regulations
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A universal communications format for the Internet of Things

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Communication and validation of smart data in IoT-networks

The Internet of Things (IoT) is the common term for the fast-growing global network of wifi-enabled smart devices and computers. For the increasing number of networked measurement devices used in science and industry, reliable interoperability is a key issue: without a shared, universal communications format, incorrectly interpreted and unsecure digital data pose significant risks to users of measurement data.

This project will define a digital format for the secure transmission and unambiguous interpretation of measurement-related data used in science and technology; devices adopting the new communications protocol would, for example, have to employ International System (SI) units. Demonstration measurement systems will be set up to validate the new digital communication format, along with the development of secure digital calibration certificates for IoT-connected measurement devices. With guidelines developed from this project, international standards organisations and industry will be able to adopt a secure and reliable communications format in the Digital Age.

Project 17IND02
Communication and validation of smart data in IoT-networks
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Improving large volume measurements for industry

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Improving large-scale dimensional measurements for manufacturing

In sectors such as the aerospace and automotive industries, large volume components are manufactured, modified and assembled to create complex products. For the machine tools, industrial robots and inspection systems employed, various factors limit the accuracy of some laser-based spatial positioning systems; cheaper multi-camera systems are available but offer less accuracy. Effective response to device data requires a digitally networked production line: such in-line operations for manufacturing and inspection would create more efficient factories of the future.

This project will address the industrial need for more accurate large volume coordinate measurements. A demonstration laser-based position measurement system will exploit improved gas cell data and a new correction method for air refractive index variation. For multi-camera systems, calibration techniques will be made traceable to National Metrology Institute standards for greater accuracy. The project will also demonstrate the production efficiencies achievable with in-line component inspection. To encourage industry uptake, results will feed into guides and support for the updating of international standards.

Project 17IND03
Large Volume Metrology Applications
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Better temperature measurements for industry

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Enhancing process efficiency through improved temperature measurement

For many manufacturers, product quality and uniformity are critically dependent upon temperature. Accurate temperature measurement in industry, however, is still a challenge: errors from tens to hundreds of degrees Celsius are possible for processes such as welding, whilst thermometer accuracy can drift over time. For some existing thermometer types and newer optical fibre-based designs, there are few or no current methods to trace their calibration back to primary standards held by National Measurement Institutes (NMIs).

This project will improve the accuracy of a range of thermometer types used in manufacturing, as well as undertaking validation of in-situ references standards for combustion flame temperature measurement. For industrial processes where surface temperatures can reach the 1300 °C region, methods will be developed with target levels of uncertainty less than 3 °C, the measurements traceable to standards held by NMI laboratories. With better product uniformity resulting from improved temperature control, European manufacturers will be able to achieve greater efficiency through reduced wastage costs.

Project 17IND04
Enhancing process efficiency through improved temperature measurement 2
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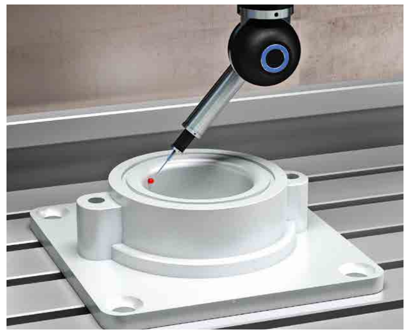
Industrial material surfaces – microprobes for in-line inspection



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Multifunctional ultrafast microprobes for on-the-machine measurements

For the production of materials and coatings used in modern technology, surface quality monitoring is key: high-value manufacturing requires accurate measurement of properties such as roughness, elasticity or contamination. As the demand for precision increases, tactile microprobes used to inspect components will need better characterisation. Furthermore, existing optical inspection techniques are inadequate for in-line use; microprobe-based systems, however, could be integrated into the production line to achieve fast and continuous quality control.

This project will develop tactile microprobes and their industrial use for material surface measurements. Probe tips will be developed for improved wear resistance and have their geometries characterised for better accuracy in various modes of use. By integrating such devices into the manufacturing process, in-line product inspection could be 30 times faster compared to off-line methods; production-line efficiency and waste reduction through improved quality control therefore delivers direct economic and environmental benefits. Industry users will also gain from the project results through good practice guides and training events.

Project 17IND05
Multifunctional ultrafast microprobes for on-the-machine measurements
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Europe's power supply: managing the smart grid

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Measurements for next-generation digital substation instrumentation

The electrical power industry is faced with significant technical challenges as generation from more widely distributed, and less predictable, renewable energy sources displaces fossil fuels. Outdated hardware is also being replaced with digital systems needed for so-called smart grids. By monitoring the modern power grid with greater accuracy, a better managed and more reliable electricity supply can be delivered to the consumer.

This project will develop the calibration methods needed for the new digital hardware used in networks for power transmission and distribution; greater accuracy will be achieved, with measurements traceable to primary standards held by National Measurement Institutes. Because synchronization and accurate measurement timings are critical for the operation of a smart grid, the project will also assess existing timestamping methods. To encourage uptake of the results from this project, both industry and standards organisations will be informed through workshop events, journal papers and good practice guides.

Project 17IND06
Metrology for the next-generation digital substation instrumentation
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Pressure and temperature sensors for gases and liquids

Development of measurement and calibration techniques for dynamic pressures and temperatures

From injection moulding to internal combustion engines, many technologies operate with gases and liquids that undergo dynamic changes in temperature and pressure. Measurement of such quantities can, however, be inaccurate: there is little assurance that sensors calibrated under static conditions will behave similarly in rapidly changing environments. With the development of calibration methods made traceable to primary standards held by National Measurement Institutes, better measurements would allow industry to improve product quality and manufacturing efficiency.

This project will develop traceable calibration methods for dynamic pressure and temperature sensors for use within industrial settings; associated measurement uncertainties will also be obtained. Computer simulations will also be developed to model sensor behaviour when exposed to a range of changing conditions and various media, with new sensor types also to be assessed for suitability of use. With best practice guidelines and workshops delivered by the project, results will also support international standards adopted by industry.

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Project 17IND07

Development of measurement and calibration techniques for dynamic pressures and temperatures

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CT Scans for product development

Enhancing the quality and efficiency of industrial CT measurements

Computed tomography (CT) scans are moving out of hospitals and into factories. Advances in the technique mean that it can increasingly be used to measure product dimensions and surface features. While industrial CT measurement remains time consuming and prone to considerable error, it can simultaneously evaluate both the complete inner and outer geometry of a sample without causing it any damage. This could substantially improve product development and quality control, but quicker and more accurate techniques are needed to provide practical CT scanning that can be integrated into production lines.

This project will significantly enhance the quality and efficiency of measurements performed using CT. By correcting geometry errors by 9 degrees of freedom and those originating in the X-ray tube and detector, the project will improve CT accuracy by a factor of 2^{-8}. It will also produce fast CT methods to reduce measurement time to a few minutes or less, greatly benefiting advanced manufacturing in areas such as the automotive, aerospace, and telecoms industries.

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Project 17IND08

Advanced Computed Tomography for dimensional and surface measurements in industry

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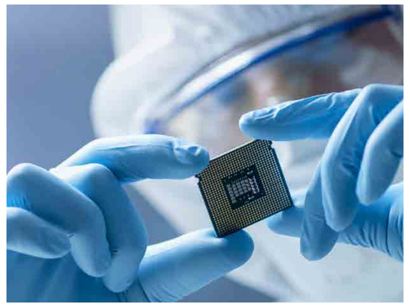
Avoiding Airborne Molecular Contamination

Accurately measuring Airborne Molecular Contamination in the semiconductor production process

European semiconductor sales amount to approximately €32 billion per year, representing 10 % of the global share. Progress is driven by the ability to operate at increasingly smaller scales and with greater complexity. A key challenge facing the industry is production loss due to Airborne Molecular Contamination (AMC) in the form of vapours and aerosols, which can corrode metal surfaces and form contamination layers during microscale manufacturing processes. Existing monitoring instrumentation is often deficient, and since 1997 there have been 24 major production losses due to AMC, each with a value of up to €80 million.

This project will develop new spectroscopic techniques and reference materials to measure priority AMCs (HCl and NH_3) at lower concentrations (<1 nmol/mol) and faster rates (<1 minute), than is currently possible. It will also investigate typical AMC monitoring scenarios and improve system robustness and transportability. By developing techniques for timely and reliable AMC detection, this project will enable semiconductor manufacturers to make corrective actions before production yields are affected.



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Project 17IND09

Metrology for Airborne Molecular Contaminants II

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A second life for Lithium-ion batteries

Measuring the residual capacity of Li-ion batteries used in electric vehicles

With the rise of electric vehicles (EVs) on Europe's roads, there will be a growing need to repurpose the Lithium-ion (Li-ion) batteries powering them. Li-ion batteries lose their capacity with increasing age and use, eventually reaching a point when they are no longer suitable for EVs. Most could be salvaged as 'second use' batteries for less demanding applications such as electricity grid reserve power. However, this requires accurate measurement of their residual capacity and current methods are too slow or too imprecise to be economically viable.

This project will address the speed and reliability of the Li-ion battery characterisation by establishing a process for determining residual capacity, using impedance. As impedance can be measured rapidly and provides information about the internal condition of a battery, the feasibility of its use to predict sudden premature death of Li-ion batteries will also be explored. This will pave the way for a vibrant second use battery market, contributing towards Europe's renewable energy and climate change goals.

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Project 17IND10

Quality assessment of electric vehicle Li ion batteries for second use applications

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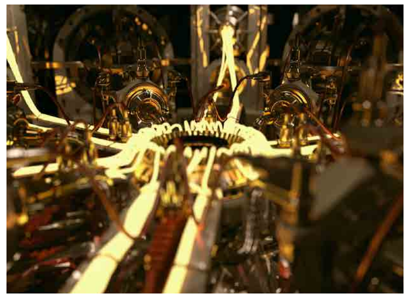
Measuring materials at extreme temperatures

Supporting robust measurement of thermophysical properties in solid materials

Many industries run their operations at very high temperatures (up to 3000 °C) to increase efficiency and reduce emissions. Accurate knowledge of materials that can function reliably at these extreme temperatures, for example in shuttle re-entry, gas turbine blades, and nuclear fission reactors, is therefore essential. Although it's possible to measure thermophysical properties (thermal diffusivity, spectral emissivity, specific heat, and fusion temperature) of solid materials up to 3000 °C, neither reference facilities nor materials exist for higher than 1500 °C. As a result, measurements made above this temperature have no traceable accuracy or consistency.

This project will establish new methods for characterising the thermophysical properties of any solid material up to 3000 °C, and launch a network of reference facilities and materials available to industry. By supporting reliable measurement practices, this project will improve the understanding of high-temperature materials and enable industries such as the aeronautics and energy sectors to develop novel and innovative materials.



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Project 17IND11

Industrial process optimisation through improved metrology of thermophysical properties

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Supporting the digitalisation of factories

Building calibration capabilities for advanced, digital-only industrial sensors

Factories of the future will use Industrial Internet of Things (IIOT) environments: networks of devices and machine-learning algorithms that can automate decision-making and manage production. Advanced digital-only sensors that can measure dynamic, time-dependent qualities such as acceleration, force, and pressure, and pre-process collected data are quickly becoming the de facto standard in the IIOT. It is vital for manufacturing processes that such digital sensors measuring dynamic qualities are accurate and well-calibrated. However, the high-level calibration services currently offered by National Measurement Institutes (NMIs) are still focussed on analogue, rather than digital, outputs.

This project will develop calibration methods for advanced digital-only industrial sensors, including those with internal pre-processing capabilities. It will also establish the infrastructure and software needed to take account of measurement uncertainty and quality together with measurement data, and synchronise data flow in sensor networks. This will help NMI facilities to become digital ready, and enable European factories of the future to be competitive with their global counterparts.

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Project 17IND12

Metrology for the Factory of the Future

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Saving water with smart meters

Characterising water meters in real-world conditions to improve their accuracy

Growing pollution levels and depleting resources mean that the World's water increasingly needs to be conserved. In urban areas around Europe, this is aided by water meters. Germany alone has 45 million water meters installed, and across the whole of Europe they represent a production value of almost €1 billion. It's expected that smart meters will help to accelerate uptake further, giving consumers convenient access to leakage detection and information about their water usage. However, achieving the sensitivity required for these devices remains a challenge and there is an outstanding need to characterise meters in real-world environments.

This project will assess domestic water meters under realistic operation conditions, including typical water qualities (suspended particles, hardness, and pH), dynamic load changes, and general wear and tear. This will improve the accuracy of water consumption measurements and extend meter life, establishing their economic viability. In doing so, this should save consumers' money and ultimately contribute to Europe's pressing need to decrease its water consumption.


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Project 17IND13

Metrology for real-world domestic water metering

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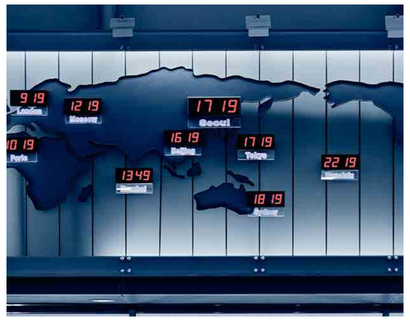
Precise time and frequency

Developing a new time transfer technique for industrial applications

From telecommunication operators building 5G, to self-driving cars and air pollution monitoring stations, there is a growing need for networks that reliably distribute accurate time and frequency. One of the highest performing dissemination systems is the White Rabbit Precision Time Protocol (PTP-WR). By employing fibre-optic links, PTP-WR avoids many of the issues associated with current radio and broadcasting time and frequency sharing schemes, such as the Global Navigation Satellite System which is vulnerable to spoofing, hacking, and disturbance from space weather. However, the system is not yet resilient enough for extensive industry take-up, and there remains a lack of adequate calibration techniques.

This project will establish methods and devices for PTP-WR that ensure time and frequency are precisely matched across diverse sites and networks. In offering reliable and high-performing time transfer which is continuously calibrated to Coordinated Universal Time (UTC), this project will enable leading-edge industrial applications that depend on time, such as mobile e-commerce and smart power grids.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Project 17IND14

Precision Time for Industry

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Europe's National Measurement Institutes working together

The majority of European countries have a National Measurement Institute (NMI) that ensures national measurement standards are consistent and comparable to international standards. They also investigate new and improved ways to measure, in response to the changing demands of the world. It makes sense for these NMIs to collaborate with one another, and the European Association of National Metrology Institutes (EURAMET) is the body that coordinates collaborative activities in Europe.

The European Metrology Programme for Innovation and Research (EMPIR) follows on from the successful European Metrology Research Programme (EMRP), both implemented by EURAMET. The programmes are jointly funded by the participating countries and the European Union and have a joint budget of over 1000 M€ for calls between 2009 and 2020. The programmes facilitate the formation of joint research projects between different NMIs and other organisations, including businesses, industry and universities. This accelerates innovation in areas where shared resources and decision-making processes are desirable because of economic factors and the distribution of expertise across countries or industrial sectors.

EURAMET wants to involve European industry and universities at all stages of the programme, from proposing Potential Research Topics to hosting researchers funded by grants to accelerate the adoption of the outputs of the projects.

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