EURAMET
European Association of National Metrology Institutes

European Metrology Research Programme

New Technologies

An overview of the funded projects from the Targeted Programme New Technologies.

The aim of these projects is to support new scientific and technical developments with a suitable measurement infrastructure, stimulate technological innovation and improve the data needed for policy making and regulation.

Focus is placed on nanotechnology and other areas that require extra efforts to develop new measurement tools and methods, such as new materials, security, biotechnology, mathematics and ICT metrology.

New measurements for new electronics

Supporting the competitiveness of the European semiconductor industry

A revolution is occurring in the world of micro- and nano-electronics in terms of miniaturisation, power consumption and processing speed. New types of inorganic materials are being used in semiconductor materials, where silicon has always dominated, new 3D architectures are being employed in chip design and new electronics based on organic semiconductors are emerging.

The techniques used in the semiconductor industry need to be updated to ensure that they apply to these new technologies. This project will support this by developing and improving the methods for characterising the chemical and electrical properties of nanostructures.

No single technique can provide the traceability required, therefore this project will make accurate comparisons between a range of different techniques. By ensuring accurate measurement and reliable characterisation of material and device properties, this project will support the competitiveness of the European semiconductor industry.

Project NEW01
Traceable characterisation of nanostructured devices

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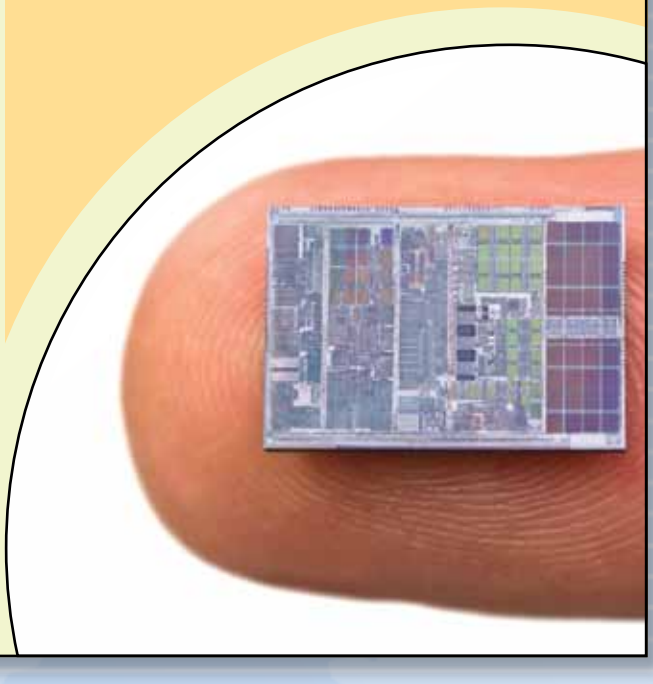
projects.npl.co.uk/NEW01-TReND



Improving Raman spectroscopy

Reliable identification at the nanoscale

Raman spectroscopy is a technique that uses scattered light to identify and map the distribution of chemicals and structures at the micro- or nanoscale. It is used by the pharmaceutical, healthcare, biotechnology, nanotechnology and forensic science sectors and is a fast and non-destructive method. However Raman spectroscopy is relatively new to measurement science and is not currently accepted by regulatory bodies for the approval of drugs, as the data it provides is not yet traceable.

This project will address the regulatory needs of Raman spectroscopy, by improving measurement reliability, establishing traceability to the SI Units mole and metre, and by developing reference samples. It will also provide measurement standards for spatial resolution, depth resolution and confocality; a specific request from device manufacturers.

The results of the project will improve the use of Raman spectroscopy for high resolution chemical and structural identification, with applications in experimental science, industry and healthcare.

Project NEW02
Metrology for Raman spectroscopy

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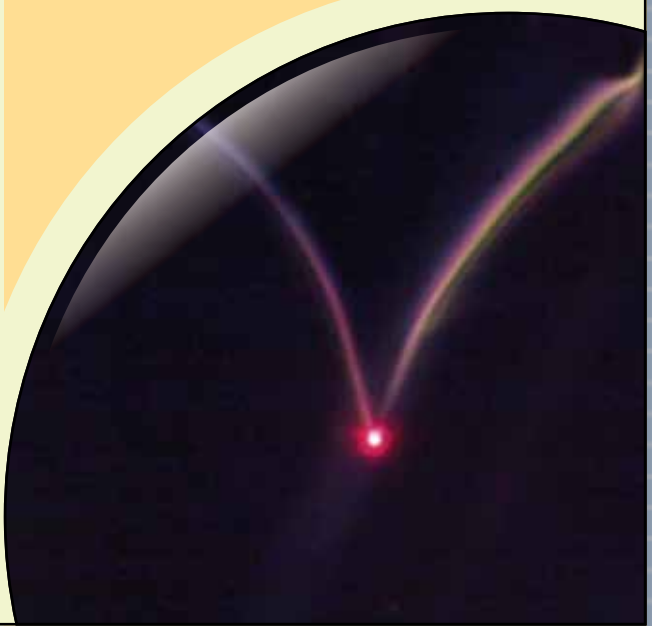

Nanomaterials in biological environments

Supporting nanotechnology with physical, chemical and optical characterisation

Companies are increasingly using nanoscale materials and structures to overcome technical challenges and currently such materials can be found in over 1300 commercial products, from medical devices to cosmetics. However, there is concern over their widespread use.

Nanomaterials pose a potential risk to human health as their properties change when they interact with biological systems, which alter their functionality and behaviour. For example, nanomaterials may become coated with proteins, which could influence how they interact with cells, or they could enter the bloodstream after being inhaled. However, these properties could also be put to good use, for example by coating nanomaterials with therapeutic proteins.

This project will develop methods to characterise the physical, chemical and optical properties of nanomaterials in biological environments. It will develop a series of nanoparticle reference materials which will then be used to validate measurement methods and techniques for the benefits of the nanotechnology industry.

Project NEW03
Chemical and optical characterisation of nanomaterials in biological systems

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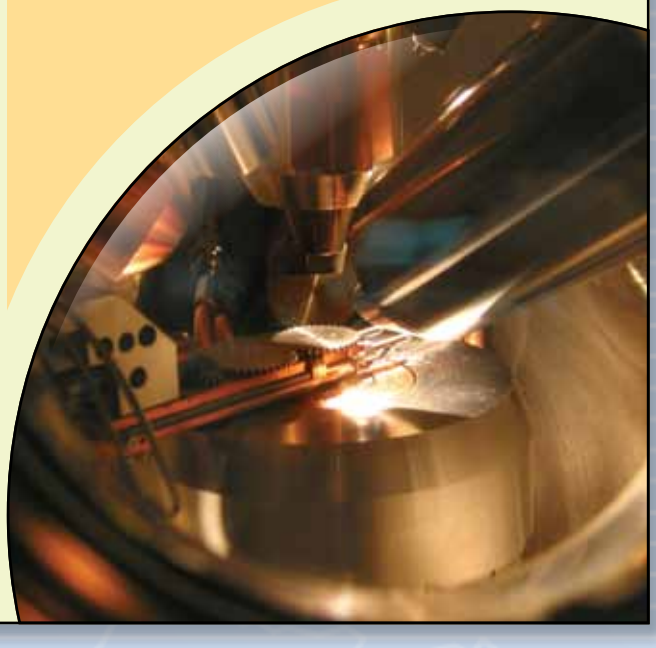

Evaluating uncertainty

Better measurement uncertainty analysis

The evaluation of uncertainty in measurement is fundamental to measurement science. Without it results cannot be compared, and unreliable uncertainty evaluations can have huge negative economic, health and environmental impacts.

The Guide to Uncertainty in Measurement (GUM) contains existing approaches to uncertainty evaluation, but these may not be appropriate for modern applications such as biochemical and nanoscale measurements.

This project will develop new approaches to measurement uncertainty evaluation and enable their consistent application. It will focus on three areas where new uncertainty analysis methods are needed: 1) inverse and regression problems, 2) computationally expensive model functions, 3) conformity assessment and reliable decision making. These new analysis methods will improve product testing, safety regulations, medical diagnosis and drug testing, and will provide input for future revisions of the GUM.

Project NEW04:
Novel mathematical and statistical approaches to uncertainty evaluation

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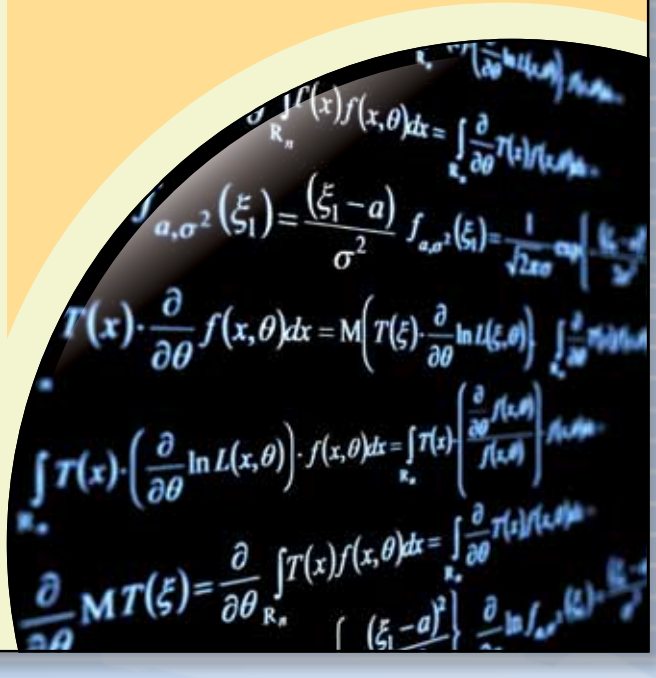

Exploiting nano-object properties

Getting nano products to market

Nano-objects such as carbon nanotubes can be used to improve products such as high strength concrete. However, to do this we need to be able to measure the mechanical properties of the nano-objects in order to fully exploit their novel features. The small size of nano-objects makes conventional measurement difficult, however atomic force microscopy can be used as it can visualise objects with very high resolution and measure physical properties.

This project will develop measurement traceability for the mechanical properties of nano-objects such as nanoparticles, nanowires, nanoscale structures and composite materials through the development of test samples and techniques, as well as improved instruments.

The improved reliability of measurements, and the ability to quantify properties such as the range of size of nano-objects with smaller uncertainty, will help improve products. Furthermore, the ability to identify new physical properties in a much more precise and systematic way should result in faster product development and quicker routes to market.

Project NEW05
Traceable measurement of mechanical properties of nano-objects

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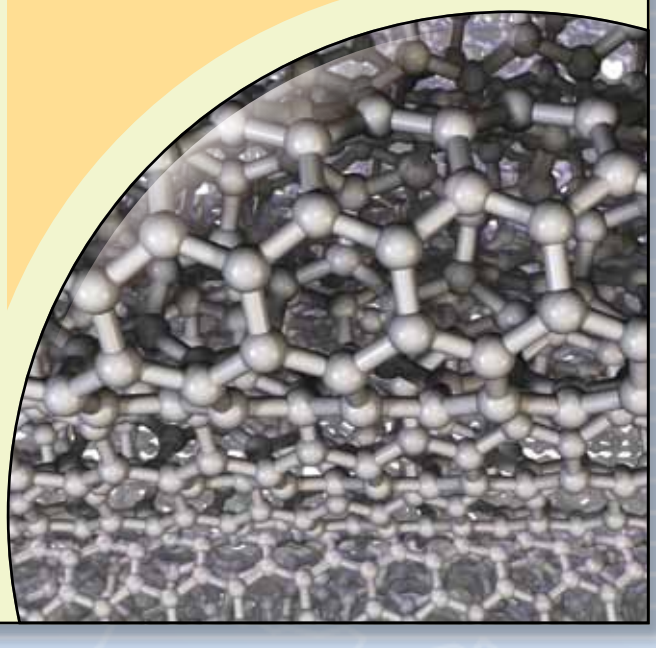

Computers in coordinate metrology

Building trust in measurement software

Information and Computing Technology (ICT) dominates all aspects of business and much of our daily lives, and plays a large role in many areas of measurement. Traceability, measurement standards and quality systems all demand the demonstration of computational links that are fit for purpose, but testing is difficult without knowing whether software is producing accurate results in the first place.

This project will use mathematics, numerical analysis and state of the art computer technology to validate software and develop new technologies to deliver traceability to measurements requiring intensive computing. It will ensure the trustworthiness and fitness for purpose of measurement software and enhance consumer confidence in metrology products.

Internet based services will be used to validate software at the point of use and industrial partners, Hexagon, Mitutoyo, Werth and Zeiss, will deliver the new systems to thousands of users, changing the traceability landscape for computation in coordinate metrology.

Project NEW06
Traceability for Computationally-Intensive Metrology

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Measurement for homeland security

Improving microwave and terahertz scanners for security

Remote sensing techniques that use terahertz and millimetre waves can provide unique insights into material properties. Traditionally used in scientific applications like radio astronomy, they are now used in security applications such as personnel scanners and spectrometers for the detection of illegal or hazardous substances.

Despite the commercialisation of microwave and terahertz technologies, the properties and performance of scanners and spectrometers remain difficult to measure. In addition, there is currently a lack of traceability of terahertz measurements and measurements often differ depending on the instruments used.

This project will develop measurement traceability for sources and detectors for sub-mm and THz frequencies. It will also help to get the best performance out of devices at the lowest possible radiation levels and quantify human exposure to sub-mm waves, which is needed to comply with safety limits and future regulations.

Project NEW07
Microwave and terahertz metrology for homeland security

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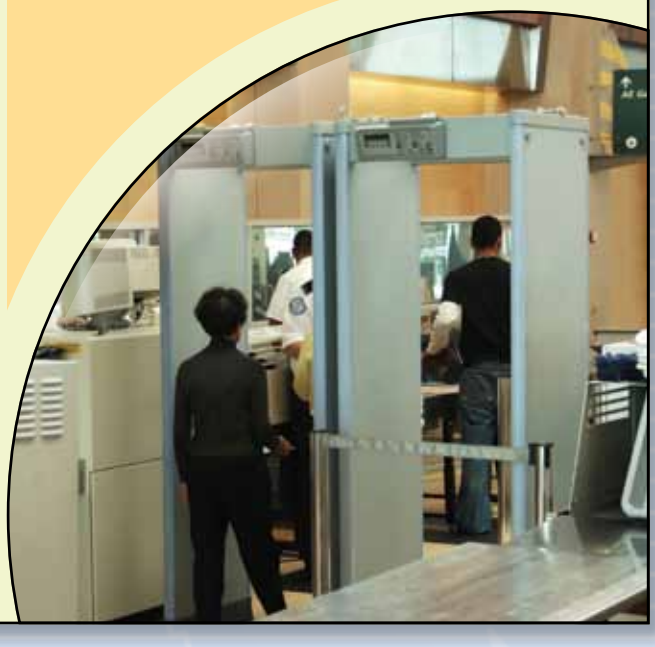

Supporting nano-electro-mechanical devices

Innovative measurements for future technologies

Industry demands increasing complexity, speed and performance from devices, as well as a reduction in size. Nano-electro-mechanical systems (NEMS) devices integrate electrical or mechanical functionality at the nanoscale level and are a key disruptive technology that could potentially provide solutions to a range of technological barriers, from electronics and computing, to physical and biological sensors.

As the dimensions of devices are reduced, new technologies and approaches are needed, however NEMS has not yet been exploited to meet these needs.

This project will develop precise and traceable measurements of physical parameters such as mass, force, displacement and temperature, as well as single photon and single molecule measurement, at the nanoscale level. It will also investigate new materials such as graphene and piezoelectrics to develop high performance NEMS.

Project NEW08
Metrology with/for NEMS

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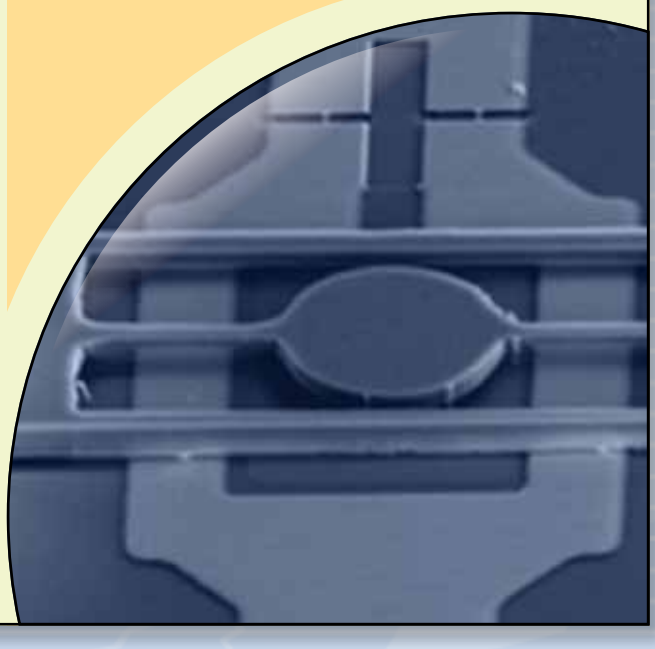

Reliable measurements for functional materials

Efficiency in transport, power generation and solid state cooling

The automotive, energy, and medical industries all require high temperature functional materials to increase efficiency. New solid-state cooling techniques are currently being developed for computer chips and for domestic refrigeration using electrocaloric materials, however these are not yet supported by reliable measurements.

This project will develop reliable, accurate and traceable measurements of electro-thermal-mechanical coupling at high temperatures in order to support new functional material technologies, such as electrocaloric materials and the products that use them.

The project will lead to the development of new technologies for more efficient and reliable transport and power generation, for example, through piezoelectric control of fuel flow in aero-engines and high temperature sensing and integrity monitoring in steam facilities. It will also enable new solid state cooling technologies to reduce greenhouse gas emissions from refrigeration and enable faster electronics thorough on-chip thermal management.

Project NEW09
Metrology of electro-thermal coupling for new functional materials technology

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projects.npl.co.uk/METCO

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.

EURAMET has implemented the European Metrology Research Programme (EMRP), a project programme organised by 22 NMIs and supported by the European Union, which will have a value of over 400 M€. The EMRP facilitates 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.

Full details can be found at: **www.euramet.org**

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