NPL
National Physical Laboratory

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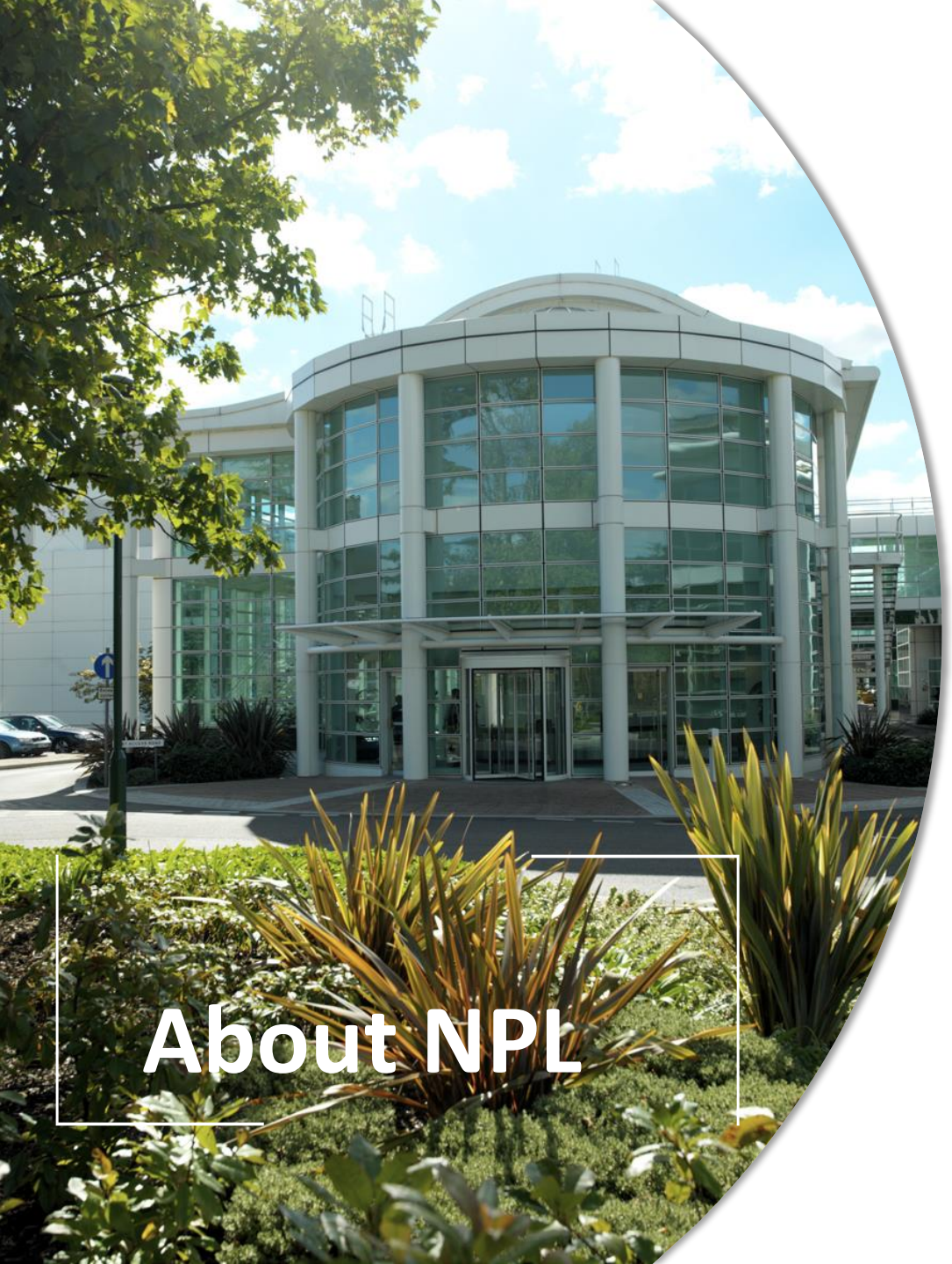
Introduction to NPL

Prof. Gareth Hinds

Senior NPL Fellow, National Physical Laboratory

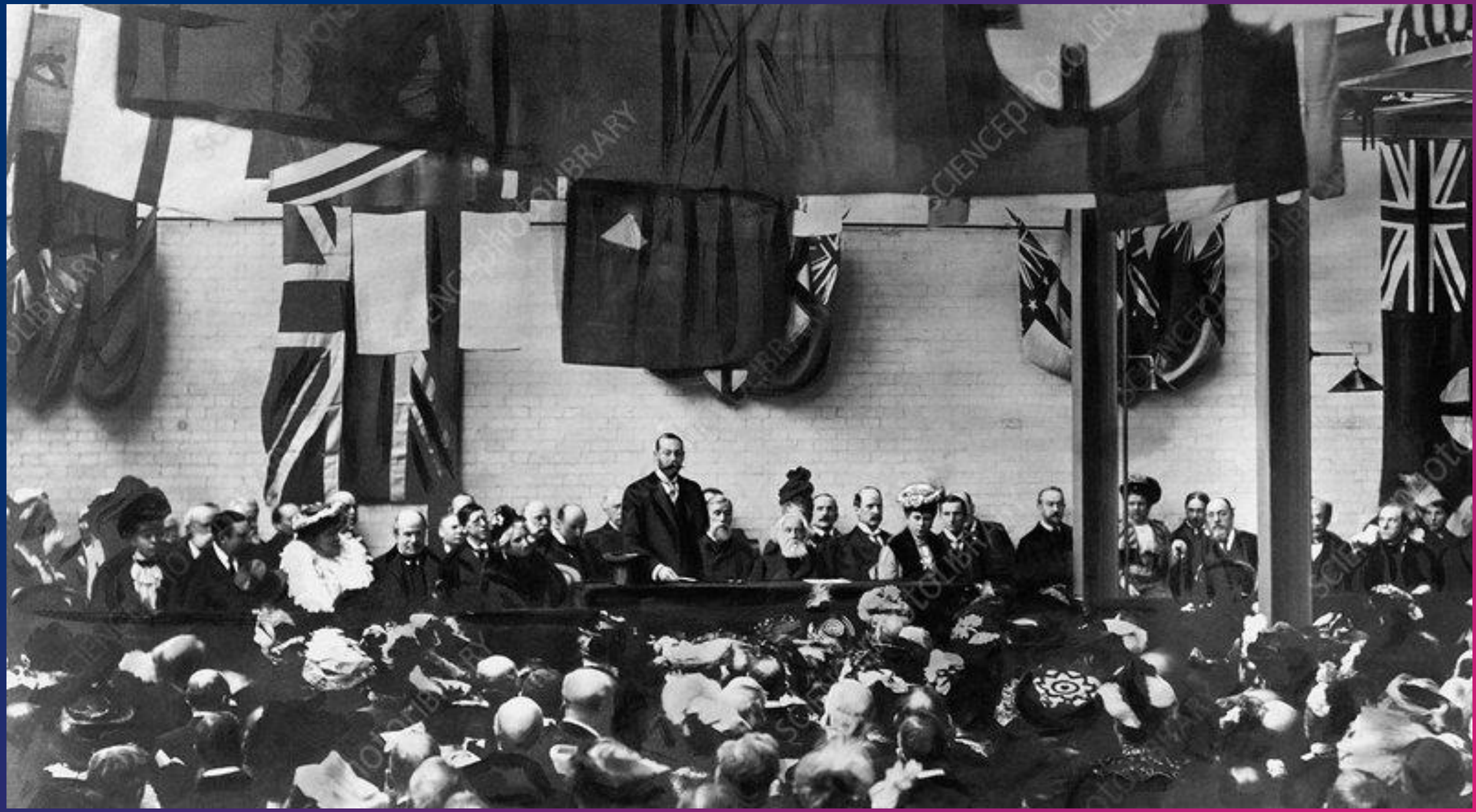


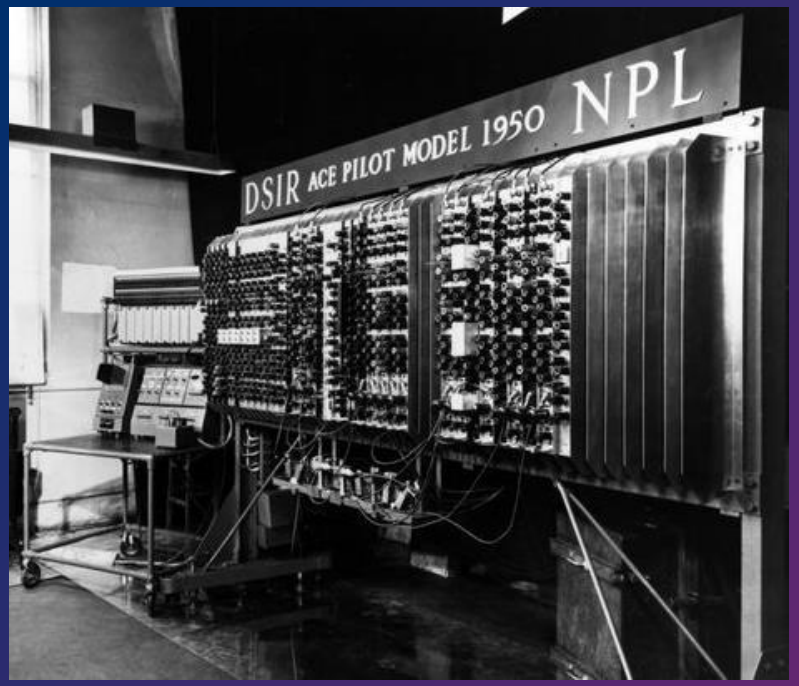
About NPL

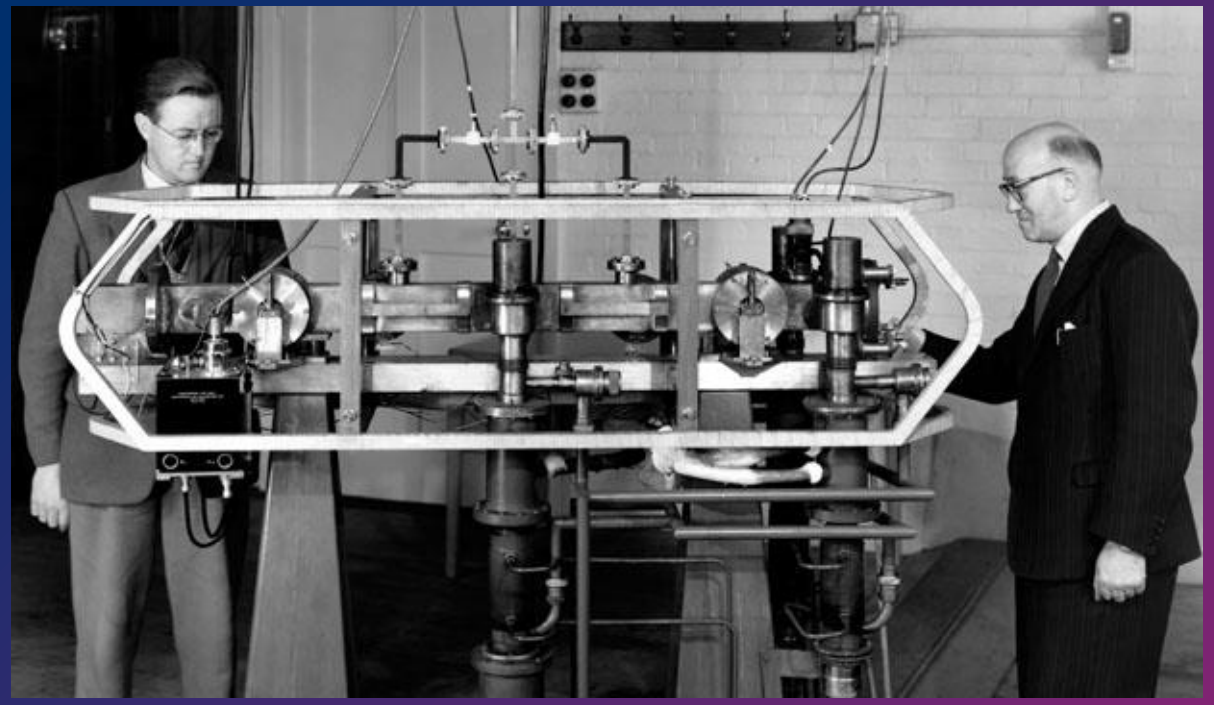
- UK's **National Metrology Institute** founded in 1900
- Provides the measurement capability that underpins UK prosperity and quality of life
- Public Corporation and PSRE owned by DSIT

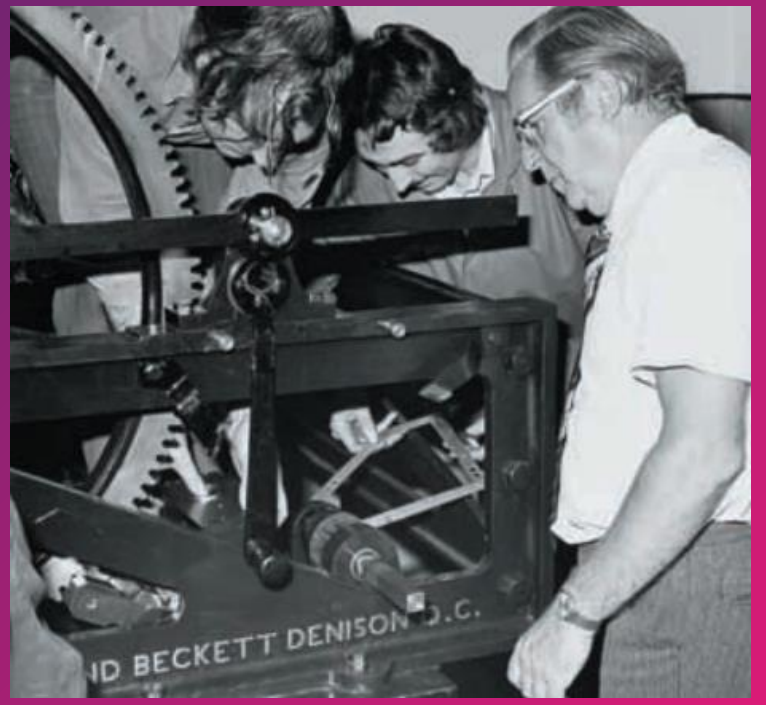
Department for Science, Innovation & Technology

- 1400+ staff
  200+ visiting researchers
- Provides independent & impartial advice to government, the public and private sector
- World-leading breadth & depth of science, engineering & metrology expertise
  Huddersfield, Cambridge, Glasgow, Guildford, Solihull and Teddington




DSIR ACE PILOT MODEL 1950 NPL





125 years of impact

NPL National Physical Laboratory

People

Creating positive impact for people’s lives

Prosperity

Working with industry to grow the UK economy

Planet

Using science to make changes for our changing planet

125 years of impact

4,500 businesses

1 million employees

£188bn turnover

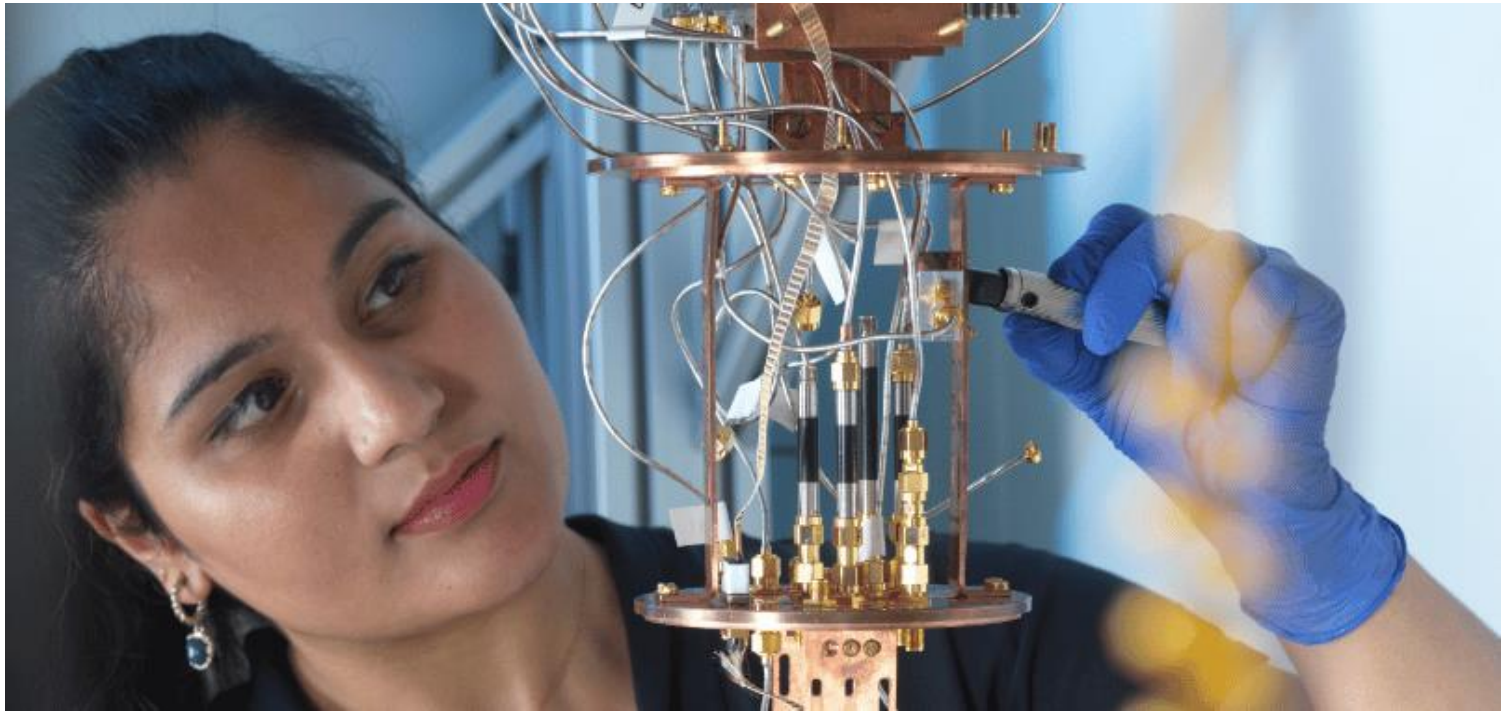
74,000 organisations

190 UKAS accredited labs

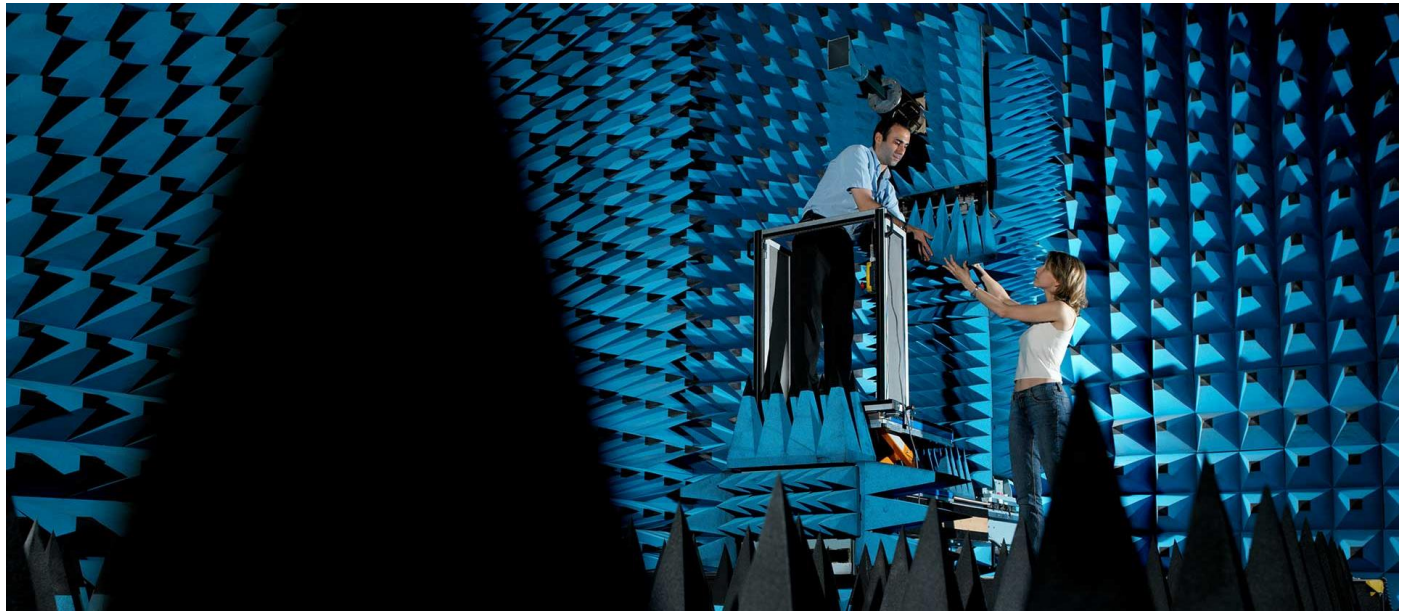
400 measurement services

The UK spends **£58bn** each year on making measurements

with **6.3%** of the UK workforce in occupations that involve taking measurements




NPL
Instruments



WORLD METROLOGY DAY

20 MAY 2025

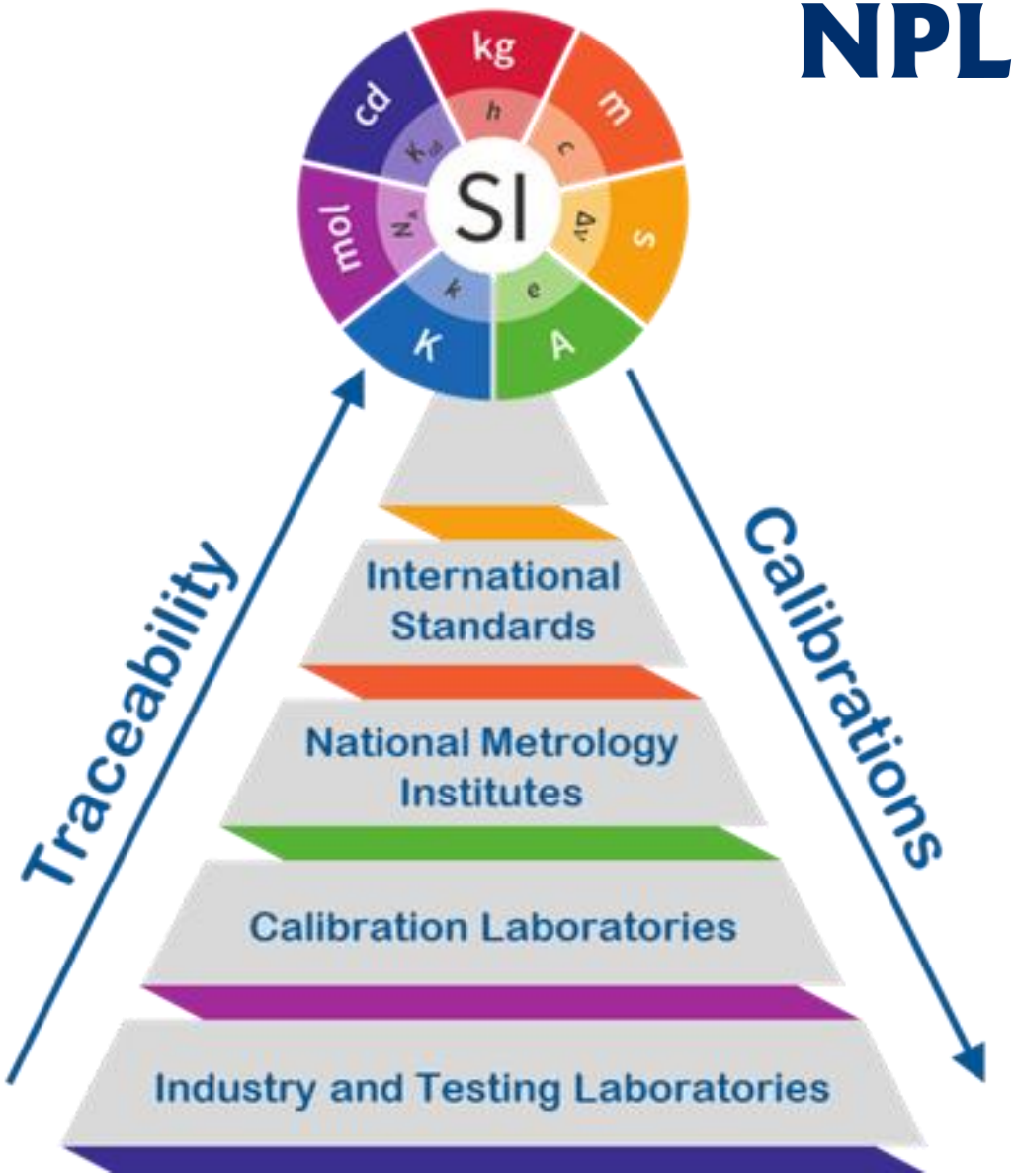
150 years of the Metre Convention

Measurements for all times, for all people

BIPM 150 | OIML 70 | In support of the World Metrology Day 2025 unesco | 2024 - 2033 International Decade of Sciences for Sustainable Development

worldmetrologyday.org

NPL



Why is materials metrology important?

Dr Andrew Pollard

Principal Scientist in Advanced Materials, National Physical Laboratory

Why are materials important?

Credit: tomsguide.com

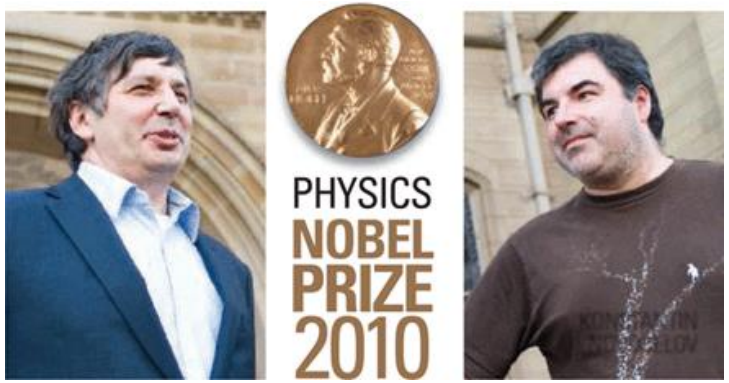
Credit: wastepackgroup.co.uk

Credit: BBC

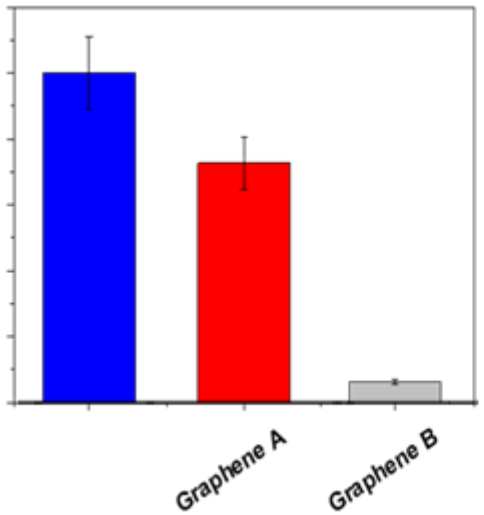
Credit: midlandheart.org.uk

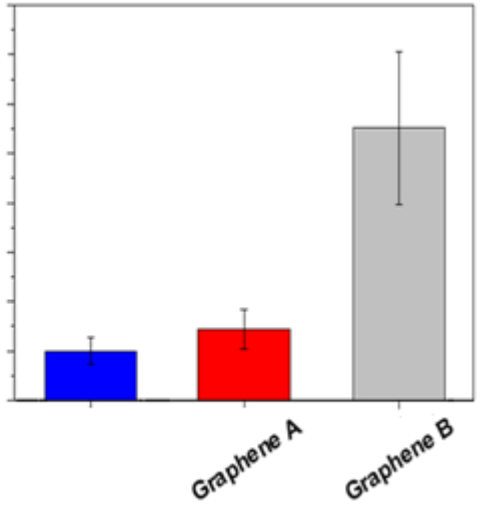
- Materials innovation businesses contribute an estimated **£45 billion** each year to the UK economy.

From Nobel Prize to industry



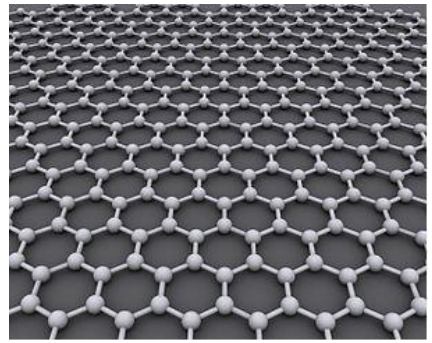
MANCHESTER 1824
The University of Manchester

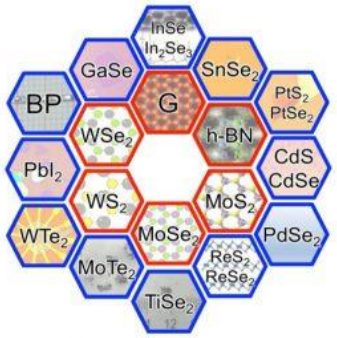




Brennan *et al.* App. Surf. Sci. **403** 403-412 (2017)

What is this stuff?!

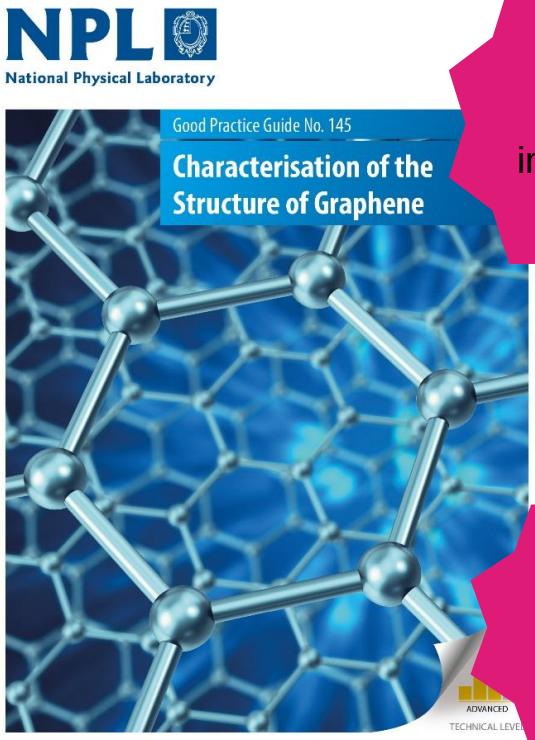




Credit: Nanyang Technical University

www.graphenea.com
www.appliedgraphenematerials.com
DerHexer, Wikimedia Commons, CC-by-sa 4.0
www.davidkelly.me

Applying metrology to solve industry challenges



£60M private investment

Staff Growth 2× to 11×

Future Challenges: Quality Control at Scale

Reducing up to 30% of costs

Radiotherapy: Shaping Patient Dose Accuracy

Dr Ana Lourenço

Principal Scientist in Radiotherapy and Radiation Dosimetry, National Physical Laboratory

1 in 2 of us will face cancer in our lifetime

50% of cancer patients rely on radiotherapy - it amounts to just 5% of the NHS cancer budget

1913: NPL measured radiation based on simple methods

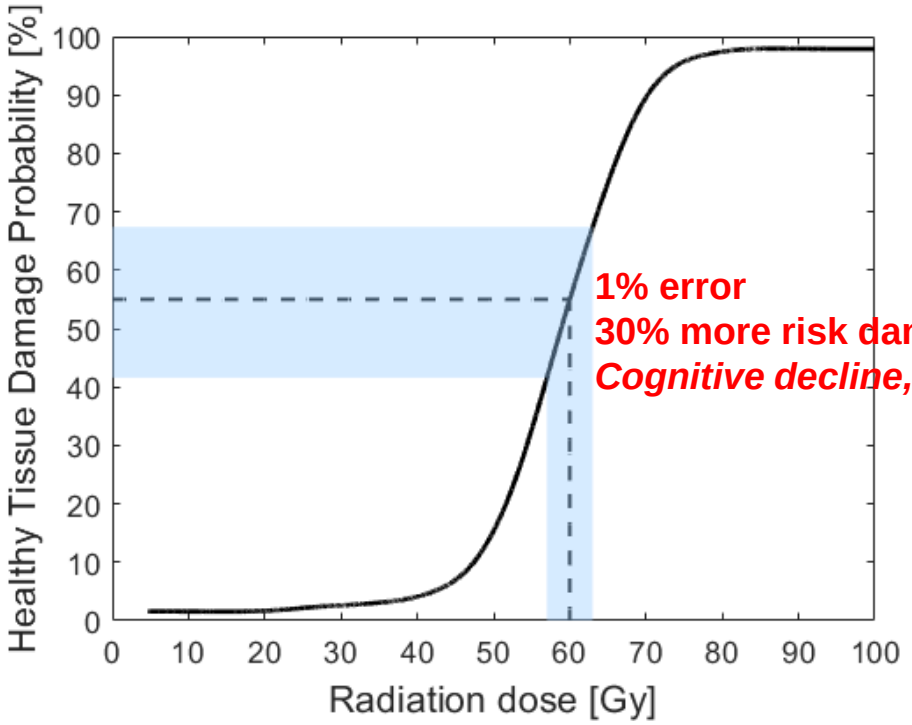
Effective, safe cancer care, with better outcomes, starts with the right radiation dose

Trusted, world-leading **MEASUREMENT** makes it possible

In 1988, NPL launches the **world's first** calibration service for absorbed radiation dose

Why radiation dose accuracy matters?

Small error in the radiation dose can lead to harmful consequences



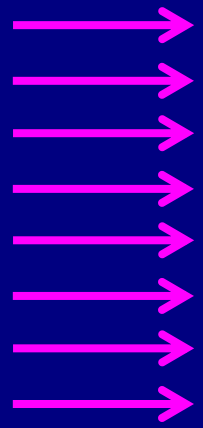
All NHS radiotherapy centres rely on NPL for **safer, more accurate cancer treatments.** Every patient, receives the right dose.

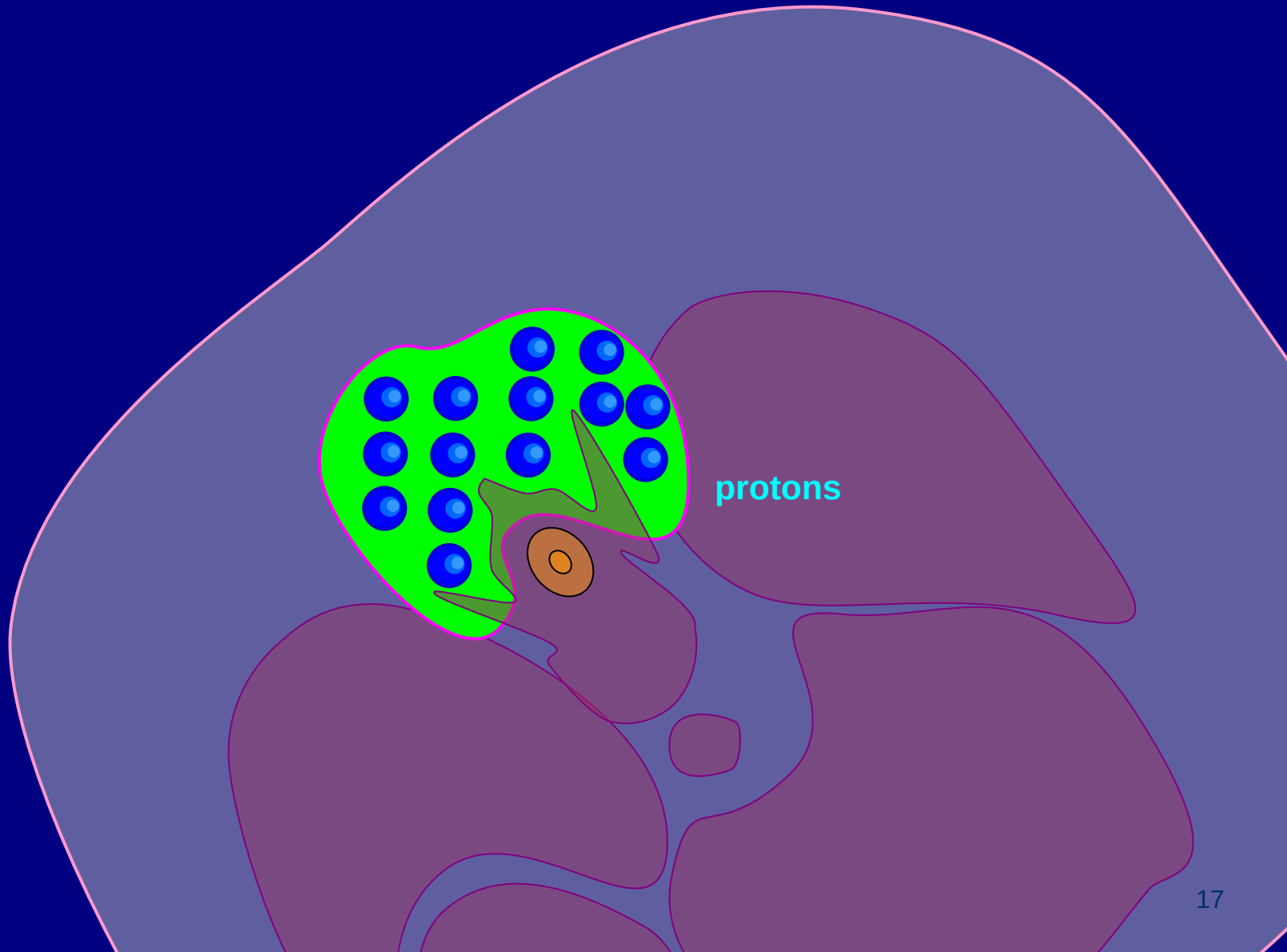
NPL verifies the entire radiotherapy workflow through independent audits – essential for clinical trials

NPL ensures **new techniques are delivered** to patients **safely**

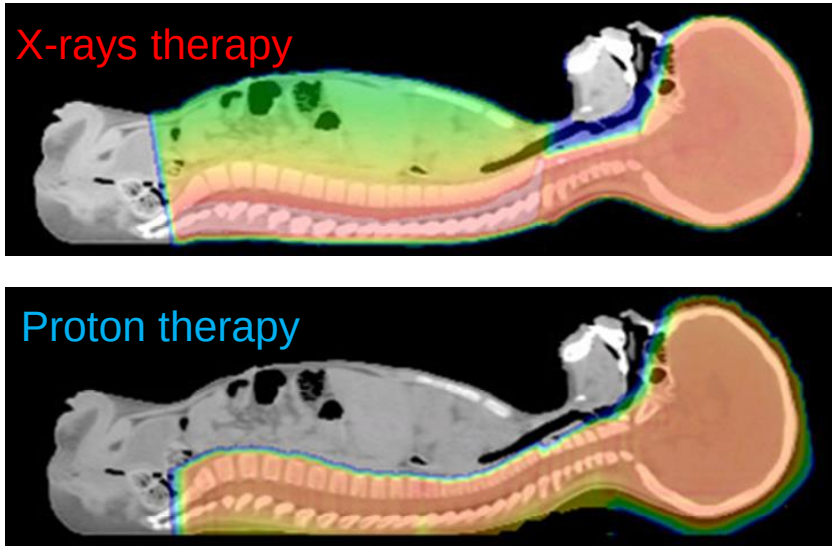
Radiotherapy: high-energy X-rays vs protons

Radiation beam

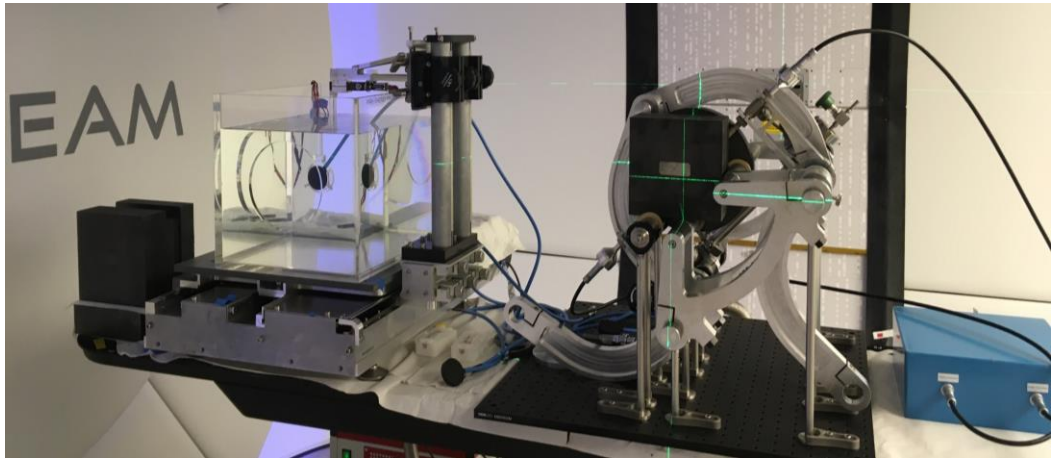




A clinical example
pediatric medulloblastoma patient



NPL **world's 1st dedicated measurement standard** for proton radiotherapy in the 1st high-energy NHS proton radiotherapy centre



NPL

An ultra-fast cancer treatment that could **cure cancer in 1 week**

NPL introduces absolute dosimetry for FLASH proton beams

28 Mar 2023

Calibration team National Physical Laboratory researchers have built a primary-standard proton calorimeter and used it to perform dosimetry of FLASH proton beams at Cincinnati Children's Hospital in the USA. (Courtesy: NPL)

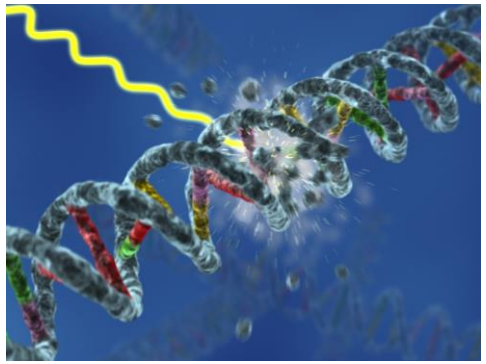
Metrologists enable radiation therapy. These experts in measurement science develop measurement standards and calibrate detectors used in radiotherapy clinics, and when new treatment modalities such as FLASH proton radiotherapy are introduced, they establish accurate dosimetry for those systems.

As detailed in *Nature Scientific Reports*, metrologists at the National Physical Laboratory

By 2040, cancer cases in the UK are expected to rise by one third - reaching over 500,000 new cases each year

Personalised cancer care

Science to understand how different patients respond to radiation

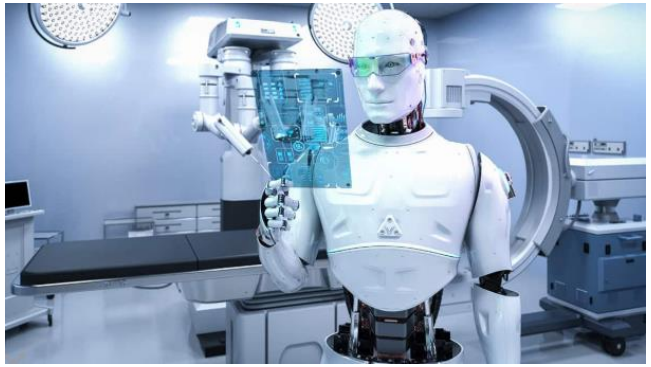


Accelerating adoption of advanced treatments

Standards that make it safe

Artificial Intelligence

Explainable and trusted validation



Right patient. Right treatment. Right time. Right dose.

Professor Josephine Bunch

NPL Fellow in Biomolecular Analysis, National Physical Laboratory

And for the next 150 years?

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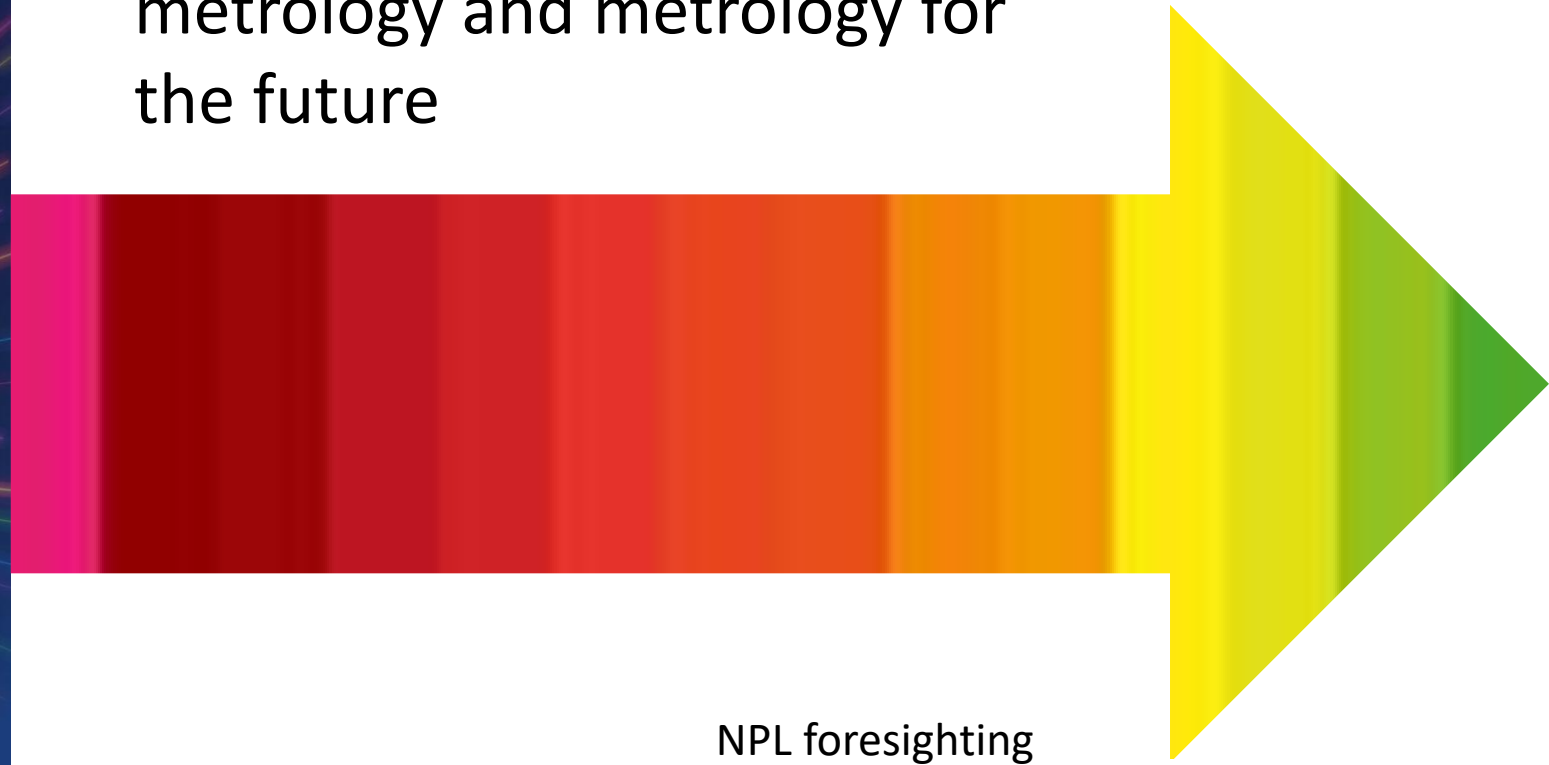
Developing the future of metrology and metrology for the future

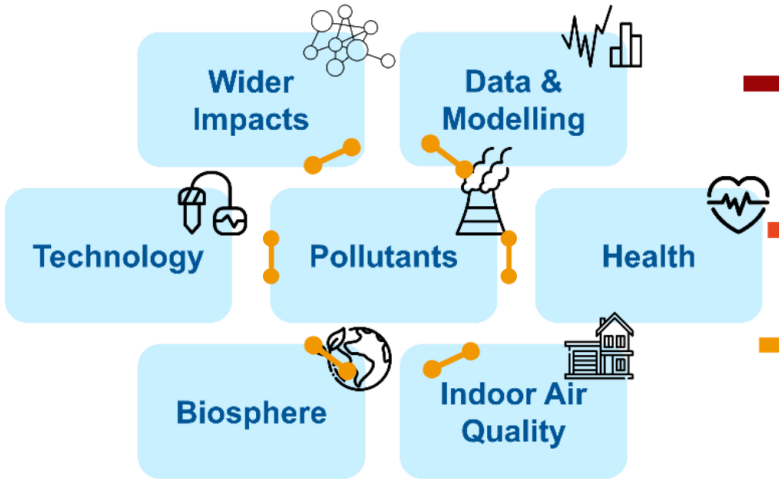


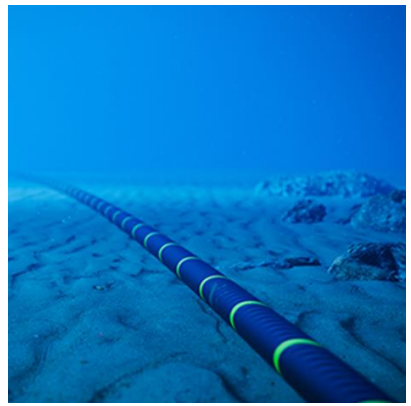
NPL foresighting

Built environment | Energy | Food production | Healthcare | Manufacturing | Transport

Developing the future of metrology and metrology for the future

- New approaches to tackle highly complex and interconnected systems
- New approaches to uncertainty calculation
- Improved SI-traceable methods
- Trusted AI





Developing the future of metrology and metrology for the future

- New approaches to tackle highly complex and interconnected systems
- New approaches to uncertainty calculation
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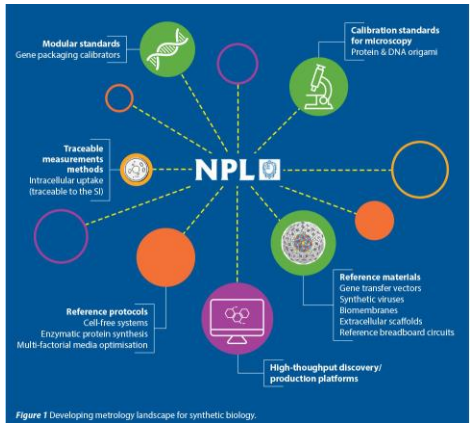
Unified measurements in the future will reduce uncertainties, save money and save lives



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Q&A

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