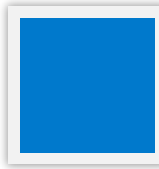
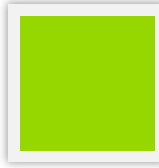


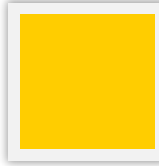
# About NPL



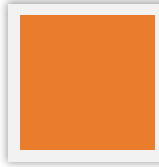
UK's National Measurement Institute founded in 1900



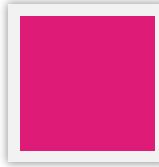
Public Corporation owned by Dept for Science, Innovation & Technology



1200+ staff, 200+ visiting researchers



Independent & Impartial advice



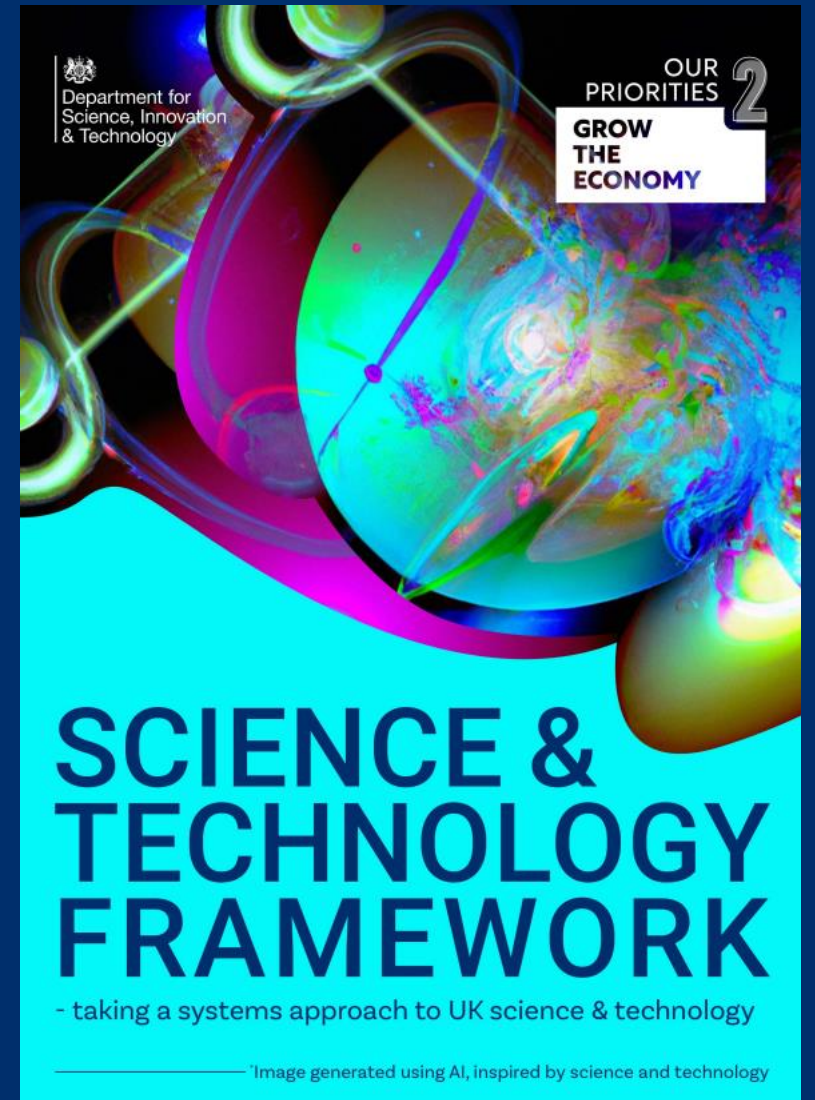
World-leading breadth and depth of metrology expertise



Department for  
Science, Innovation  
& Technology

# 5 Critical Technologies

- **Artificial Intelligence (AI)** – machines that perform tasks normally performed by human intelligence, especially when the machines learn from data how to do those tasks.
- **Engineering biology** – the application of rigorous engineering principles to the design of biological systems.
- **Future telecommunications** - evolutions of the infrastructure for digitised data and communications.
- **Semiconductors** – a class of electronic materials with unique properties that sit at the heart of the devices and technology we use every day.
- **Quantum technologies** – devices and systems which rely on quantum mechanics, to provide capabilities that ‘classical’ machines cannot.






# Example **innovation** challenges

- Resilient timing
- Sovereign quantum capability
- Secure communications
- Trusted emissions monitoring
- Early diagnosis and treatment of priority diseases
- Trustable climate and earth information
- Trusted autonomy
- Technology for clean growth

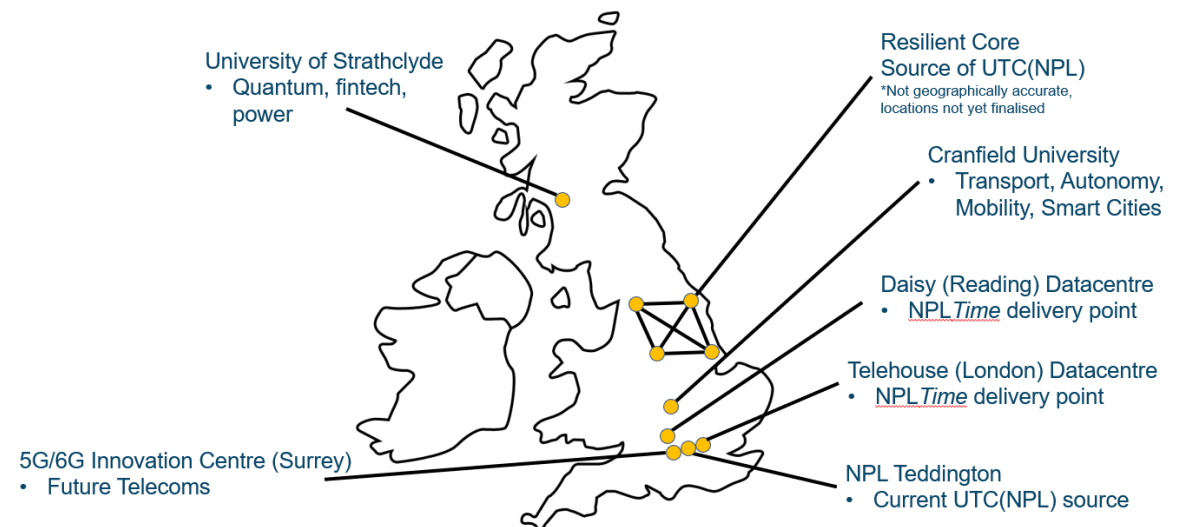
# National Timing Centre Programme



Funded by UKRI's Strategic Priorities Fund and delivered with Innovate UK as a partner, the 5-year programme aims to support multiple industries – from the electricity networks and finance, to broadcast, telecoms and aerospace. The programme is developing the UK's timing capability to improve security and resilience, communication and implementation of new technologies across the country.

- **Resilience - £17.3m**
  - Resilient enhanced timescale infrastructure
- **Innovation - £9.5m**
  - Innovation calls (Innovate UK) - £6.7m
  - Nodes
- **Skills - £3.5m**
  - Training blueprint
  - E-courses, degree modules, secondments, studentships, apprenticeships

## Innovation node locations available to industry in the 2022 Innovate UK innovation competition



# UK Telecoms Laboratory



UK Telecoms Lab



**UKTL activities will enable industry to raise & maintain security and resilience of UK's telecoms networks to world leading standards**



Vendor diversification	Security research	Security testing
Supporting incumbents and new vendors to build secure, interoperable solutions, ensuring security concerns do not become a barrier to entry into operator networks.	Discovering and examining new and emerging vulnerabilities in telecoms and related systems or equipment, to help the sector and the UK's national security.	Raising the bar on the security of the UK's telecoms live networks currently deployed and their supply chains, through independent testing of equipment and network functions.
<b>Skills</b>		

  
Department for  
Science, Innovation  
& Technology

  
National Cyber  
Security Centre  
a part of GCHQ

# NPL Quantum Programme

**Building quantum measurement expertise, facilities and infrastructure, supporting innovation across the UK**

- **Longstanding quantum research programme:** computing, sensing, communications, security, timing and metrology
- **Home to 100+ scientists Quantum scientists**, and are developing the quantum skills base training apprentices, graduates & PhDs
- Convene and collaborate to support the UK's growing quantum tech sector
- **NPL's Quantum Test and Evaluation Programme** supports industry by addressing the barriers to innovation and accelerating the commercialisation of quantum technologies.

**NPL** 

  
UK NATIONAL  
QUANTUM  
TECHNOLOGIES  
PROGRAMME



**Technology Secretary, Michelle Donelan MP (right) with NPL's Professor Olga Kazakova (left) when visiting NPL's AQML**

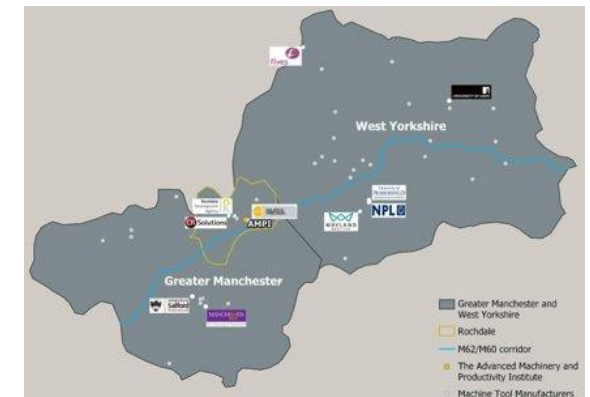
A £22.6m UKRI SIPF grant over 5 years brings together 10 partners across West Yorkshire & Greater Manchester

- 7 new jobs created at the Institute, c.20 at HEI's
- 660 new direct jobs across region
- 530 indirect jobs across region
- >40 companies across region participating

AMPI is an industry led initiative that will stimulate and support rapid growth of the UK's advanced machinery and robotics sector.

- A £2bn UK export capacity will be created within 10 years establishing over 30,000 high value manufacturing sector jobs.

## Strength in Places Fund





## **Businesses accessing our unique capabilities\***

NPL helps innovative UK businesses at all stages of their journey, from start-up to scale up to access its world leading expertise and facilities through a variety of business support schemes which currently includes:

- Analysis for Innovators, A4I (partnership with Innovate UK)
- Measurement for Recovery, M4R
- Measurement for Business, M4B





650+  
exploratory  
discussions  
with experts



360  
collaborative  
bids submitted



270  
R&D  
projects  
funded



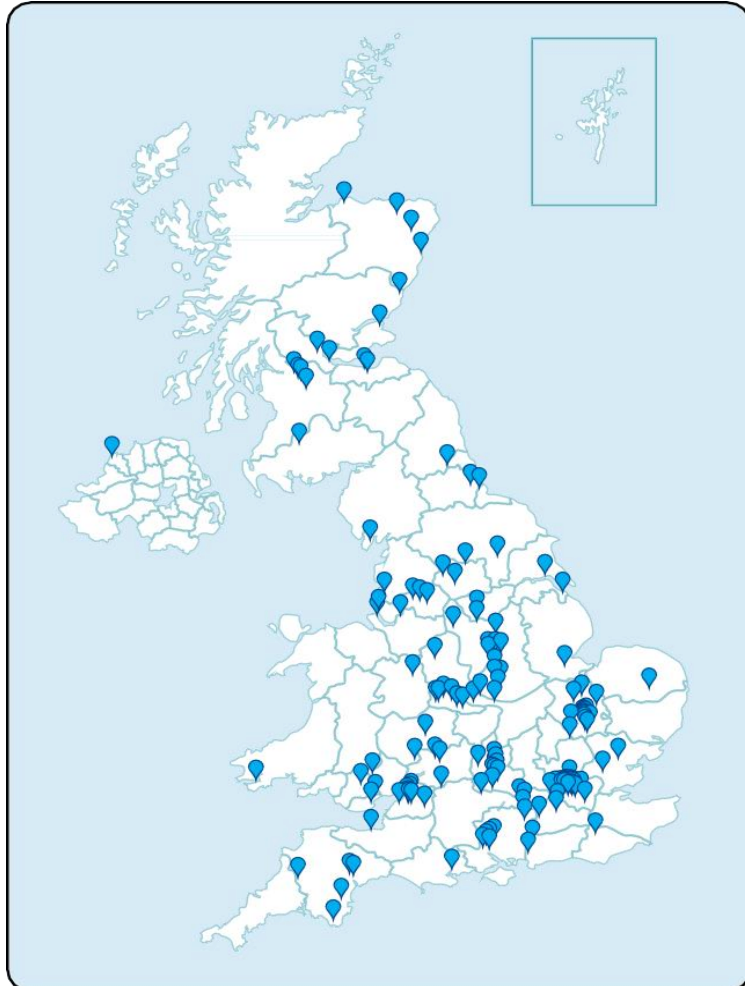
Innovate  
UK



# Analysis for Innovators

Analysis of participants feedback shows:

- **87%** of companies believe their **commercial opportunity has greatly or moderately increased** as a result of their A4I project
- **51%** of participants expect to **introduce either a new product, service or process** within a year of an A4I project
- **82%** of companies expect to see a **financial benefit** from their A4I project
- Companies say **83%** of projects **would not have gone ahead or would have gone ahead on a smaller scale** without A4I



\*Data is from rounds 1-6



National Engineering  
Laboratory



Science and  
Technology  
Facilities Council

Newton Gateway  
to Mathematics



ADVANCED SUSTAINABLE MANUFACTURING TECHNOLOGIES  
TECHNOLOGICAL MANUFACTURING CAPACITY

# Measurement for Recovery (M4R)



Created and led by NPL, M4R brings together the UK's top measurement science experts and specialist laboratory facilities to address problems for UK companies with new approaches, to help drive growth and recovery with up to 20 days support and advice at no charge.



The programme was conceived to support UK industry in its recovery from COVID-19 with access to cutting-edge R&D, expertise and facilities to help solve analysis or measurement problems that couldn't be resolved using standard technologies and techniques.



The idea was to help boost productivity and competitiveness in UK industry, unleashing innovation and making the UK a great place to work and do business.



National Engineering Laboratory

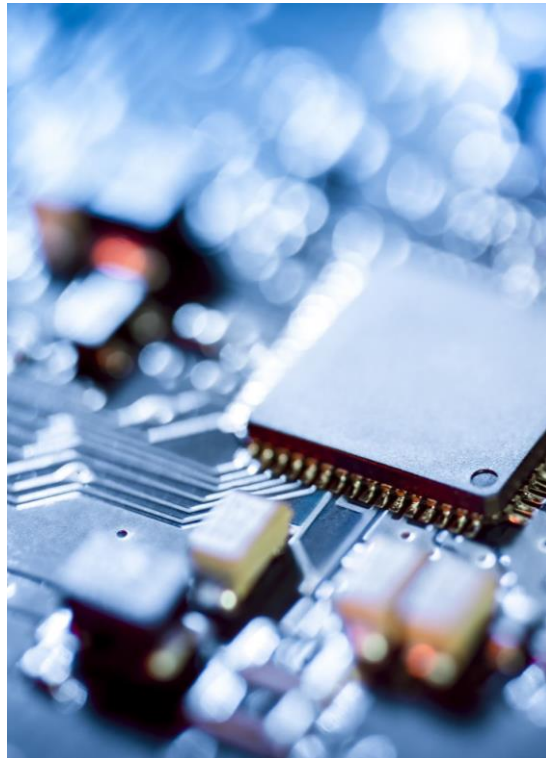
# Measurement for Business (M4B)

Launched 2023.

It is open to UK SMEs with a product or service in development. It offers access to NPL's expertise to support SMEs to solve measurement problems and accelerate the product or service getting to market.

It is currently open to applications from:

- SMEs from the Energy Sector
- SMEs from the Greater Manchester & Yorkshire region



NPL's contribution to economic growth is channeled through **regularly supported firms**

“**Supported**” with measurement services or R&D in collaboration with NPL

“**Regularly Supported Firms**” are supported for at least 5 of the past 6 years

**RSFs** see net-additional increase in labour productivity:

£37.5m in extra wages

£338m benefits to the UK economy

# Metrology Research Roadmaps



The NPL Metrology Research Roadmaps outline our research agenda covering the next ten years. They will guide the development of specific research programmes, both within and across disciplines, as we seek to answer current scientific questions and reduce scientific and measurement uncertainties.



- The redefined kilogram
- The redefined kelvin
- Redefinition of the second
- Digital metrology
- Medical physics
- Net zero environmental metrology
- Net zero technology metrology
- Advanced manufacturing and productivity
- Biometrology and molecular imaging
- Quantum electrical metrology
- Quantum clocks, sensors and communications
- Quantum computing

Theme	Sub-theme	Time					
		2021	2023	2025	2027	2029	2031
Energy generation	Wind	High-speed Digital Image Correlation (DIC) for turbine blade composites; ultrasonic methods for piling	Validated noise abatement methods for offshore wind construction	Validation of low noise construction (blue piling, floating wind); validation of <i>in situ</i> DIC methods	ISO standards for NDT of composites; validated methods for cumulative ocean noise effects with uncertainty	Traceability in recycled composites; ISO standard high-speed DIC; ocean noise mapping for GES	Liquid composite moulding digital twin; validated methods for estimating effect of noise on ecosystems
	Nuclear	Establish NMI role for SMR, AMR & fusion programmes; ASCC test protocol	UKAEA support for fusion research; ASCC environmental variables analysis	R&D for SMR challenges; ISO standard on ASCC testing	Tools for lifetime prediction in storage of nuclear waste	Online SMR monitoring services and standards; R&D for AMR/Gen-IV	Integration of lifetime prediction and monitoring tools
	Carbon Capture, Utilisation and Storage (CCUS)	First methods & PRMs for impurities in CO <sub>2</sub> ; literature review on corrosion test methods	Test facility for solvent degradation; corrosion test capability; UK BAT amine/nitrosamine measurements	PRMs; sampling good practice & QA; draft standard corrosion test method	CMCs for impurities in CO <sub>2</sub> ; AMPP standard corrosion test; CO <sub>2</sub> loss quantification standard	ISO standard on testing CCUS solvents; industry specifications for material selection	ISO standard on QA of CO <sub>2</sub> in CCUS; integration of lifetime prediction and monitoring tools
Energy storage & distribution	Hydrogen	Fuel cell & electrolyser validation & modelling; PRMs for H <sub>2</sub> /Natural gas blends; humidity in H <sub>2</sub> ; H <sub>2</sub> permeation in composites	Impact of impurities on fuel cells; PRMs; modelling apps; ISO 14687 UKAS accreditation; humidity calibration in H <sub>2</sub>	Draft standard fuel cell & electrolyser test methods; PRMs for 100% H <sub>2</sub> in gas grid; humidity calibration at elevated pressure; LH <sub>2</sub> mechanical testing	ISO & IEC standards; high power fuel cell & electrolyser stacks; humidity traceability in H <sub>2</sub> ; H <sub>2</sub> leak quantification methods	Inline quality control in fuel cell & electrolyser manufacturing; 700 bar H <sub>2</sub> sampling rig; CMCs for humidity measurement	Next gen tech; hybridisation; systems; annual PT scheme for H <sub>2</sub> ; stable multi-component PRMs at ISO 14687 purity threshold
	Batteries	Standard test protocols; modelling tools, <i>in situ</i> & operando diagnostic techniques	Inline quality control in manufacturing; module testing; modelling apps	Draft standard test methods; pack testing; traceable fibre-optic thermometry	IEC standards for performance & lifetime; BMS; measurement methods for next generation materials	Systems modelling; standard methods for electrode composition determination	Next gen tech; hybridisation; system management; multi-modal techniques for electrode composition
	Electricity Grid	Measurement needs for stable integration of net zero renewables ensuring inertia, system strength and low disturbance	New inertia reference method; SS algorithms; early warning methods for non-synchronous oscillations	Inertia test beds, site & instrument verification; NSO protection; traceable condition monitoring via thermal imaging	Commercial protection solutions; data analytics to assure grid power quality for mixed-source electricity	<i>In situ</i> condition monitoring through traceable thermal imaging	
Energy consumption	Power Electronics	Intercomparison of insulation resistance testing methods in damp environments	Methods to assess power electronics reliability	Internationally agreed test method for insulation resistance in condensing environments	Internationally agreed test protocol for reliability assessment of protective coatings in power electronics	Method for complex reliability test cycles	Integrate data driven diagnostic methods to reliability test measurements
	Electric Machines & Drives	Open circuit measurement uncertainties < 1% for NdFeB/SmCo magnets in electric motors	Magnetic measurements under simulated operational conditions (high temp, mechanical stress)	AC loss techniques to assess soft magnetic materials at 10-50 kHz & under mechanical stress	Internationally agreed magnetic measurements during operation (up to 155 °C and non-standard geometries)	Methods under complex conditions (temp, stress, non-sinusoidal waveforms)	Accreditation under combined operational conditions (target combined U of 3-10%)



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