NPL
National Physical Laboratory

Timekeeping fit for the future

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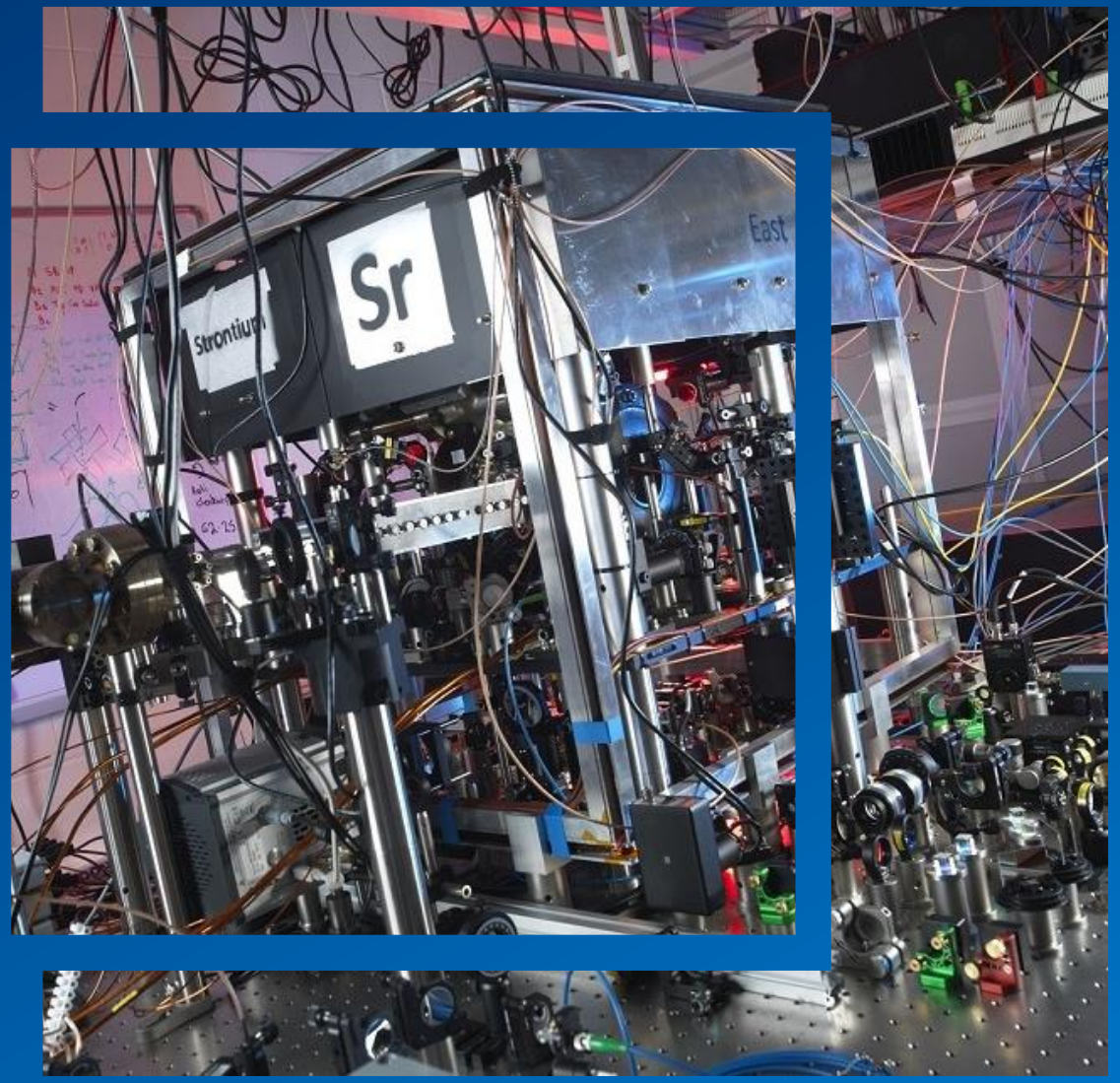
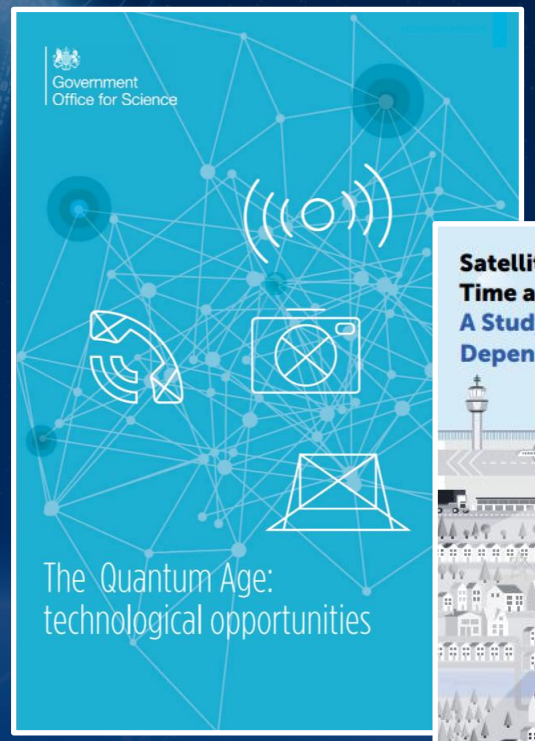
Head of Science, Time & Frequency

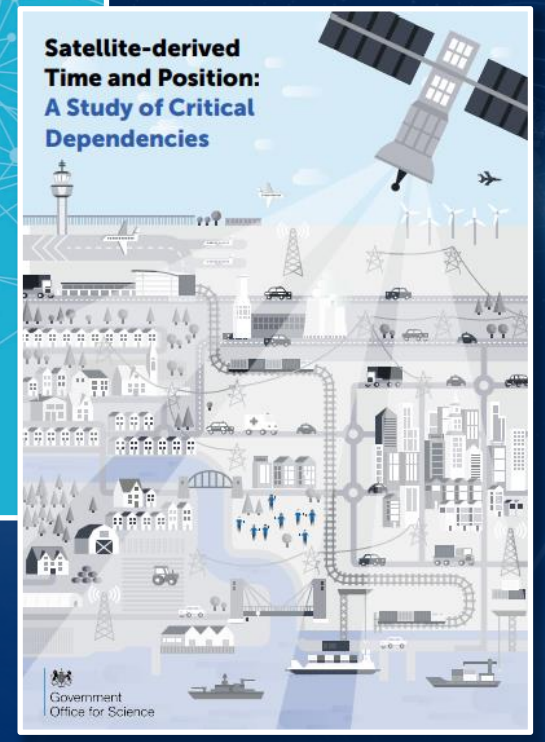


The invisible utility

Dependency on timing signals from global navigation satellite systems (GNSS)

- Easy to access and free to use
- Widely used by many critical sectors
- Weak and therefore vulnerable to disruption
- Any breach or failure could cost the UK economy more than £1 billion / day





UTC(NPL) – the UK time scale

The UK reference for time and frequency for more than 30 years, providing signals traceable to Coordinated Universal Time (UTC)

MSF radio time signal
Dedicated time and standard-frequency broadcast

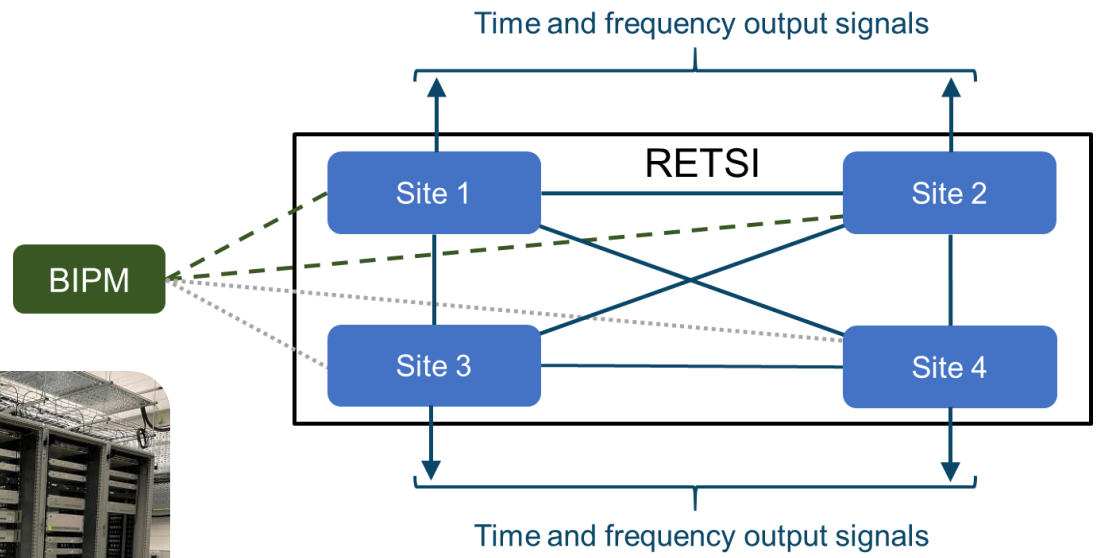
Internet time service
NTP servers operated by NPL & others

NPL*Time*®
Delivered over fibre to the financial sector

National Timing Centre (NTC) programme

Design and implement a new, more resilient, geographically distributed time scale for the UK

Resilient Enhanced Time Scale Infrastructure (RETSI)



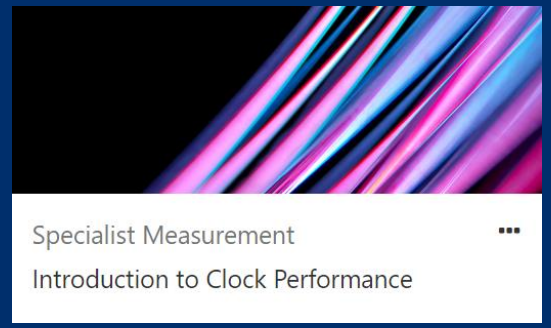
National Timing Centre (NTC) programme

Provide innovation opportunities for UK companies through access to time and frequency signals, expertise and funding

UKRI Innovate UK
University of Surrey
University of Strathclyde
Cranfield University
TELEHOUSE

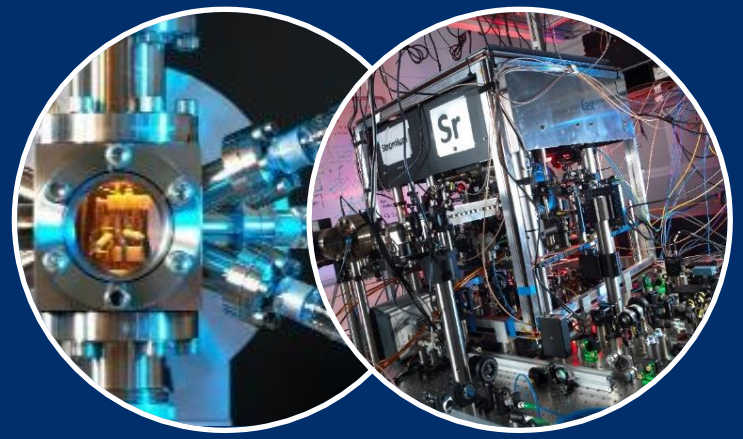
National Timing Centre (NTC) programme

https://elearning.npl.co.uk



Provide training opportunities to address the skills gap in time and frequency

Redefinition of the second



- Next-generation optical atomic clocks are now outperforming caesium fountain primary frequency standards
- International roadmap for a redefinition of the second prepared by the Consultative Committee for Time and Frequency (CCTF)

2020:
- CCTF task group formed

CGPM 2022:
- Validated roadmap
- Different options for redefinition

CGPM 2026:
- Redefinition option proposed
- Mandatory criteria achievable by 2029

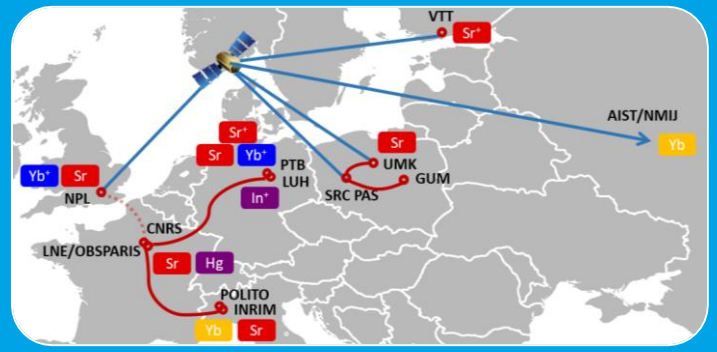
CGPM 2030:
- Redefinition

CGPM 2034:
(backup scenario)

Progress towards redefinition

Testing the international consistency of optical clocks

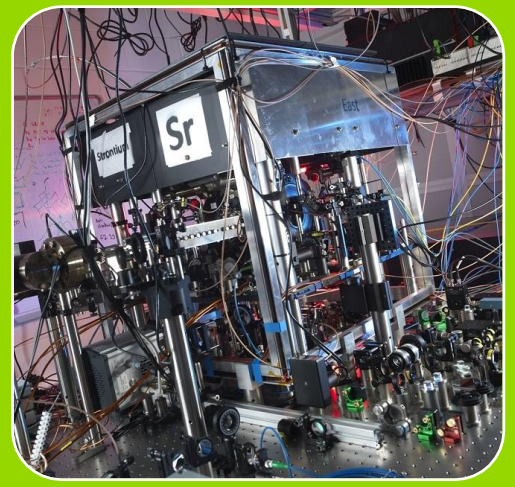
Coordination of the largest optical clock comparison ever performed (11 clocks in 7 countries)



Recently hosted transportable optical clocks from Japan and Germany

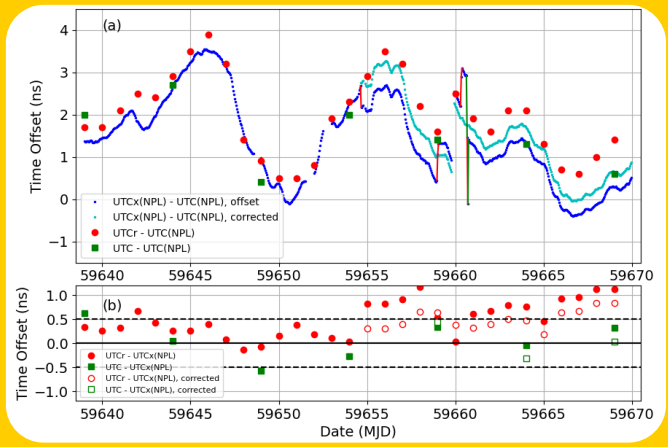
Optical clocks contributing to International Atomic Time (TAI)

Major milestone reached in March 2023 with data from our strontium optical lattice clock providing the first UK optical steer of TAI



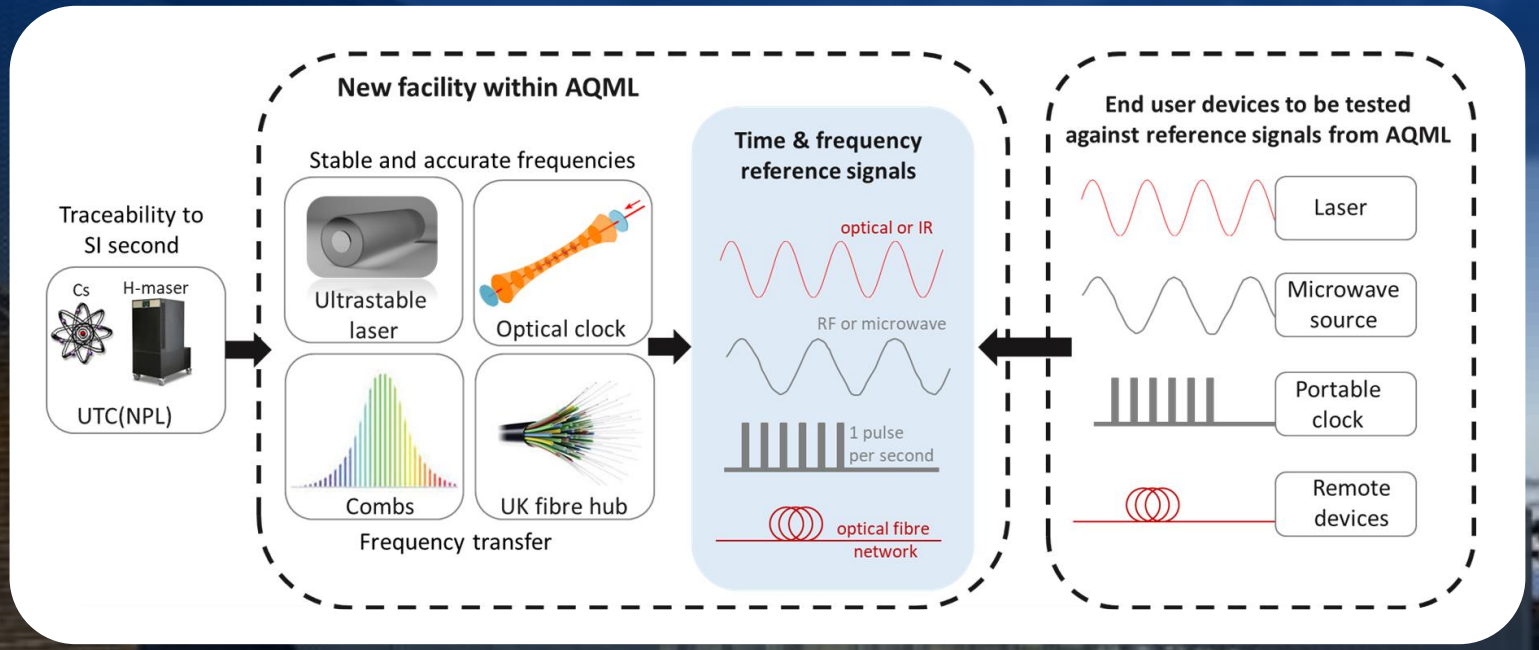
Optical clocks being used to steer national time scales

Experimental prototype of optically steered UTC(NPL) demonstrated in March 2022



Directly compared with a similar prototype time scale in Paris

Advanced Quantum Metrology Laboratory (AQML)

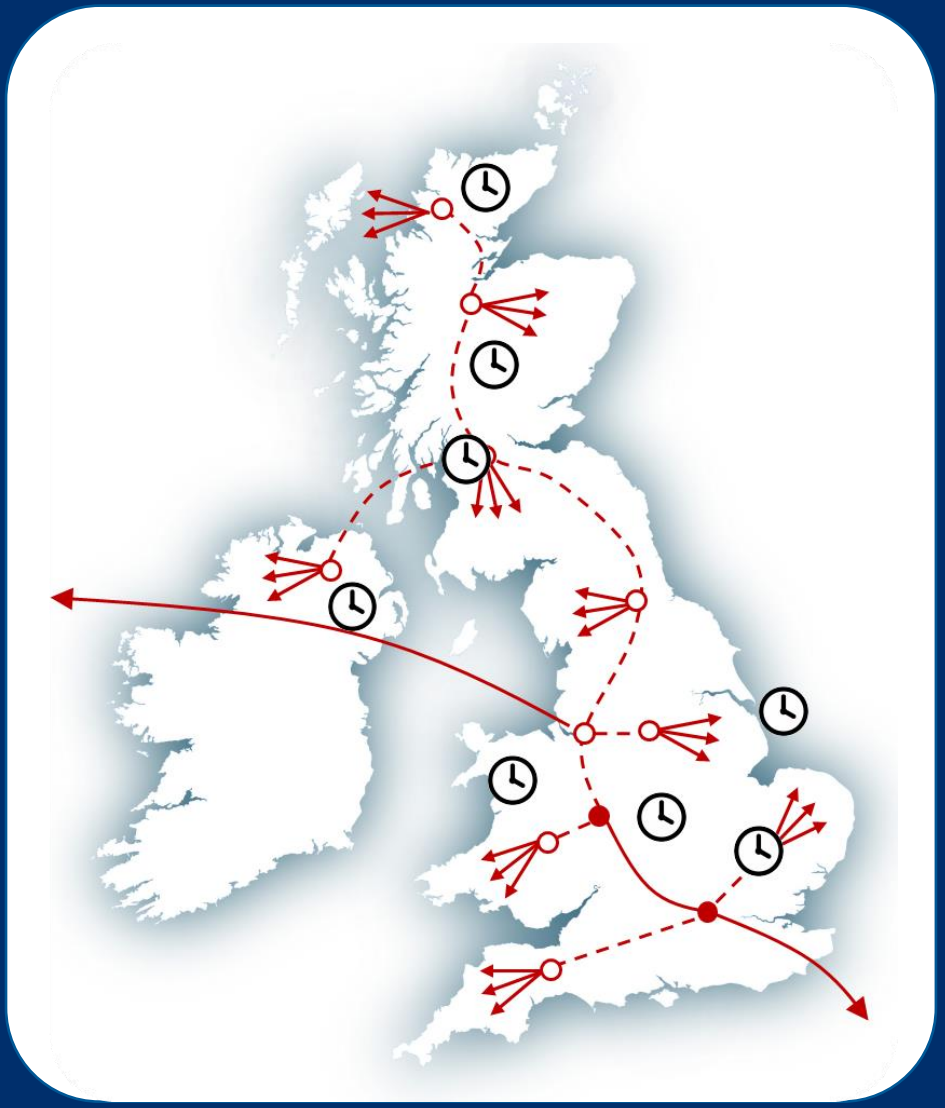


- Collaborative innovation space with access to state-of-the-art frequency references
- End user access in designated laboratory space within the AQML, or remotely via optical fibres
  - Demonstrator link to the University of Birmingham

Eliminating reliance on GNSS for timing

Time and frequency signals that users can trust

Whoever they are, wherever they are



Kick-starting UK innovation in technologies that underpin our increasingly connected world

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