

National Quantum Computing Centre

Annual Report **2026**

Building the UK **quantum computing** ecosystem



03
Executive summary



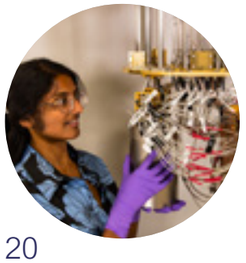
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Executive summary

Building on successes of the first decade of the National Quantum Technologies Programme, the International Year of Quantum in 2025, and the launch of the UK Industrial Strategy, 2026 has been a year of renewed energy for both the National Programme and the NQCC.



Chris McDonald, Minister of State (Minister for Science, Innovation and Investment) visited NQCC in September 2026.

Looking across international programmes, I have seen a shift in public policy over the past 12 months, with growing emphasis on applications and user adoption. Industry is similarly pivoting from supply to demand in quantum technologies. The NQCC has long championed use cases and applications, but as the technology scales, error rates improve and hybrid classical-quantum workflows mature, we are seeing a clear step change in commercial and research engagement with quantum computing and its potential utility.

The NQCC's **SparQ** user engagement programme continues to go from strength to strength, with new users from an expanding range of UK institutions and new channels opened for industry partners. I was delighted that colleagues at the University of Kent hosted a community event showcasing the breadth of research supported through **SparQ** Access.

Quantum Missions supporting long-term growth

User adoption and application-led values are central pillars of the UK Quantum Missions. 2026 has been an intensive year working with government and UKRI colleagues to turn the Quantum Computing Mission 1 (QM1) from ambition into commitment and action. In March, we hosted the then Chancellor of the Exchequer and Secretary of State at the NQCC to announce the Mission plans and £2bn government investment in quantum technologies. Later in the year, Chris McDonald, Minister of State for Science, Innovation and Investment, also visited the NQCC.

The ProQure programme has established a new model for government to drive research, scaling and user adoption. QM1 extends beyond ProQure, with UKRI funding calls advancing applications, algorithm development, supply chain engagement and hybrid workflows. Alongside traditional research funding, the government is using Innovate UK contracts for innovation to seed sector revenue, whilst building the technical assurance needed for large-scale government procurement over the coming decade.

Anchoring quantum start-ups in the UK, attracting inward investment and enabling access to state-of-the-art technology are key drivers of ProQure. Alongside this work, the NQCC will collaborate closely with the National Physical Laboratory to provide Innovate UK with technical assurance as ProQure moves into deployment next year.

Strategic focus on infrastructure

The ProQure programme follows on from our three-year quantum computing testbed initiative, which established a unique UK capability, hosting seven commercial quantum computers across five qubit modalities. Throughout 2026, NQCC researchers and colleagues from the University of Edinburgh's Quantum Software Lab have been testing these platforms at device, system and application levels, assessing their capabilities and informing future roadmaps and scaling decisions.

Testbed operations and benchmarking have been a major focus this year, verifying machine performance against target specifications while exploring user experience and access models. This work is establishing a blueprint for future on-premises hardware, operational requirements, cyber security and user access. Combined with new insights from ProQure, it positions the UK strongly as quantum computing becomes part of wider high-performance and supercomputing services.

While infrastructure and testbeds are vital, skills and ingenuity will ultimately drive the UK quantum industry and its supply chains. I am grateful to the entire NQCC team for their contribution throughout 2026 and delighted to see our sponsored PhD programme, hackathons and placement initiatives thriving. The UK is a great place to build both a quantum company and a research programme.

Dr Michael Cuthbert
Director, NQCC

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Technology highlights
Build. Host. Utilise.
Quantum readiness and SparQ
NQCC: Organisation and people
Looking ahead
Reports and publications

NQCC: Impact at a glance

The National Quantum Computing Centre (NQCC) is the UK's national laboratory for quantum computing. We are building, testing and hosting first-generation quantum computers, and collaborating on innovative and diverse solutions to address the key challenge of scaling. We work across the entire quantum computing stack, encompassing hardware, software and user applications, and are responsible for evolving the UK's quantum computing technology roadmap.

We seek to be a trusted authority in quantum computing while remaining accountable for delivering value for money to the UK through scientific, economic and societal impact.



144+
organisations in collaboration with NQCC



Industrial strategy
collaboration across all IS-8 sectors



116+
ideas supported through NQCC letters of support

Increased technology maturity
Technology Readiness Level (TRL) moved up two levels on average across projects where it was recorded

167
scientific publications attributed to NQCC researchers and collaborators

£23.8m
further funding after NQCC initial support





11+
intellectual property protection (patents, licences, copyright)

96+
jobs created in external organisations

11+
policy reports with contribution from NQCC



Business impact
(inward investment, co-location and industrial value creation)

NQCC in 2026: Building capability, accelerating adoption and connecting the quantum ecosystem



2026 has been a year of significant progress for NQCC, as the UK's quantum computing ecosystem continues to drive from research and experimentation towards wider application and user adoption.

Throughout the year, NQCC has strengthened the infrastructure, expertise and partnerships needed to support this transition. From expanding access to quantum computing platforms and advancing research, to supporting industry use cases, developing skills and bringing communities together, NQCC's work has focused on building a connected national capability for quantum computing.

In 2026, NQCC continues to advance its in-house R&D of open-architecture quantum computing systems across trapped-ion, superconducting and neutral-atom modalities, while building strategic partnerships and developing skills to strengthen the UK's quantum computing capability. This work is complemented by progress on NQCC-funded quantum computing testbed systems delivered in partnership with Innovate UK, alongside collaborative R&D projects that further accelerate the development of the UK's quantum computing ecosystem.

In parallel, NQCC continues to build its track record as a trusted source of informed, independent advice to government, funders and key sectors on how best to realise the potential of quantum computing.

By bringing together a diverse range of quantum computing platforms, the testbed programme has positioned the NQCC as a global leader in quantum technology evaluation. The initiative has drawn significant national and international attention, highlighting the NQCC's early thought leadership in this space.





The NQCC held an Industry Network meeting in April 2026 to drive wider adoption within the UK.

Technology highlights

Bringing together expertise across the entire quantum computing stack, NQCC is advancing quantum computing through research and development and collaboration.

As part of an ambitious programme, NQCC focuses on providing critical national infrastructure to develop and host multiple modalities, building strategic partnerships to explore use cases, and developing quantum applications to support ecosystem readiness.

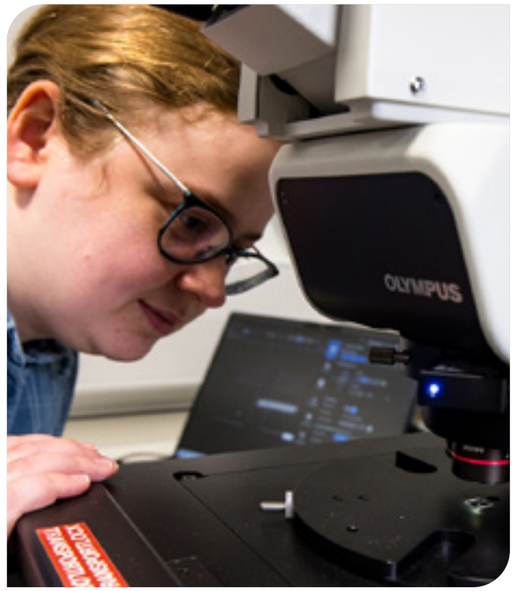
Superconducting circuits quantum computing R&D at NQCC

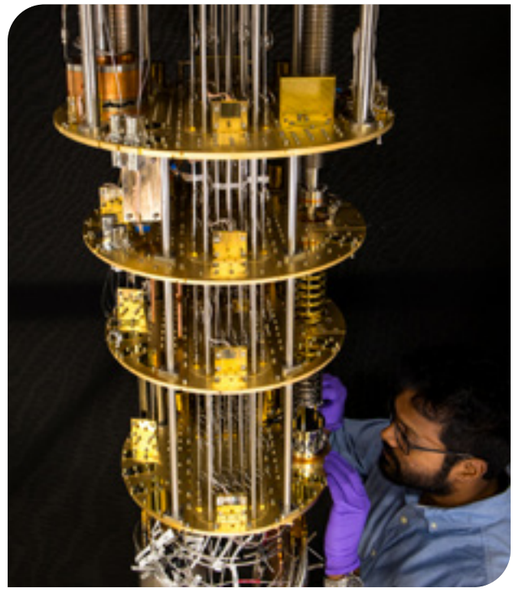
The team at NQCC works to understand and remove bottlenecks on the path towards universal fault-tolerant superconducting quantum computers. The team focuses on building capability and deep expertise by utilising open-architecture systems engineering principles. It addresses scaling challenges by integrating mature supply chain components as 'first customers' and leveraging collaborators' expertise.

Over the past four years, we have successfully established the foundations of a superconducting quantum computing capability from the ground up. This year, the team has upgraded its commercial qubit chipset and demonstrated qubit performance and control. The team is currently working with a 9-qubit system and has successfully demonstrated two-qubit operations on some qubit pairs. The team is also trialling novel solutions to scale up systems and has now procured high-density wiring solutions, as well as control systems for large qubit systems.

In the past twelve months, the superconducting circuits team at NQCC completed two collaborative projects funded by Innovate UK. The first focused on cryogenic readout technology, through which the team gained significant knowledge and expertise regarding the technology's performance, maturity and scalability. This has enabled a more informed assessment of its potential role in future superconducting quantum computing architectures.

The second project involved integrating quantum error correction (QEC) technology with an NQCC testbed, providing valuable insight into the challenges associated with conducting QEC experiments and integrating QEC technologies with quantum computers.





Above and above right: Superconducting circuit quantum computing researchers working at the NQCC lab.

Collaborations

Academic and national labs collaborations

Nb Tri-Layer Fabrication Resonator wafer fabrication

Cleanroom access for NQCC fabrication

SC flip-chip 3D integration
- Joint design and fabrication
- Feedback to flip chip process from mK measurements

Inputs to workpackage

Inputs to workpackage

Quantum computing industry and supply chain collaborations

QEC-RO: On-chip readout

HERMES: Real-time QEC

QC-SOAR: Optical readout
Optical readout of SC quibits using a transducer array

Cryogenic system capacity
Extract and model cryogenic performance of scaled systems

Programmes

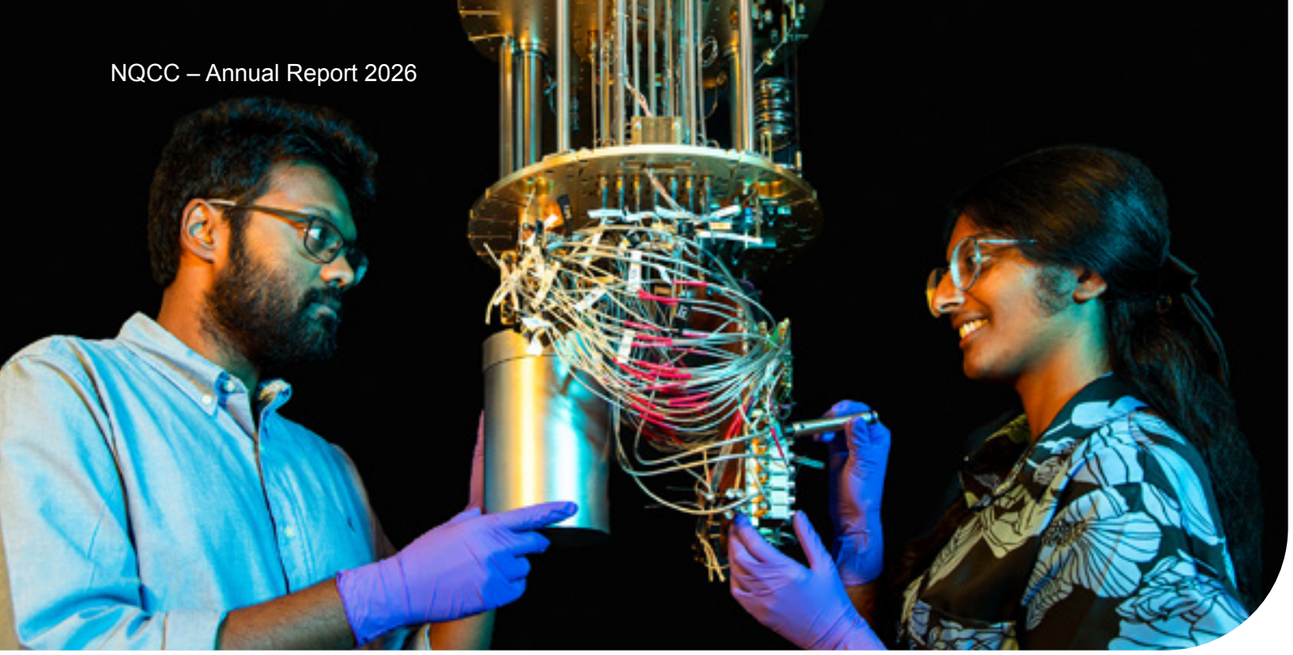
PhD projects:

Nb tri-layer qubits

Compact QLA arrays

Modular QEC architecture

Pulsed TLS detection



QEC Readout Testbed – SEEQC's scalable digital QEC ready qubit readout chip integrated with Rigetti's Novera QPU

Organisations involved: SEEQC, Rigetti, NQCC, Quantum Design Oxford, University of Edinburgh, Cambridge Consultants

This project, funded by, Innovate UK, marked a major milestone towards real-time quantum error correction, eliminating the need for bulky analogue readout chains and removing a major barrier to system scalability.

This is the first instance of SEEQC integrating its proprietary solution with a third-party QPU, while simultaneously improving readout performance. Rigetti and SEEQC have worked closely together to optimise the integration of their technologies into the NQCC system. This included the development of custom PCB and packaging solutions to improve signal integrity between the Novera QPU and the JDPD circuitry, resulting in single-qubit performance of 99.6% readout fidelity in under 400ns.

The demonstration of fast, high-fidelity qubit readout performance, on par with current state-of-the-art conventional readout results, addresses a critical technical bottleneck in qubit readout. This establishes a clear pathway for scaling systems to support the UK government's target of one million quantum operations (MegaQuOp) by 2028.

NQCC has played a key role in externally validating the technology's performance and adaptability through direct integration into its infrastructure, demonstrating its practical viability in a real-world operational setting. This builds on prior experience, as a similar validation exercise was successfully completed with NQCC under the SEEQC-NVIDIA project in September 2025. Quantum computing system developers will benefit from this chip-level implementation.

Quantum information is highly fragile, making rapid error detection, readout and processing essential to prevent errors accumulating in a quantum system. This is a key challenge across all qubit modalities. Building on a successful previous collaboration, this project extends efforts to develop technologies that support scalable quantum error correction.

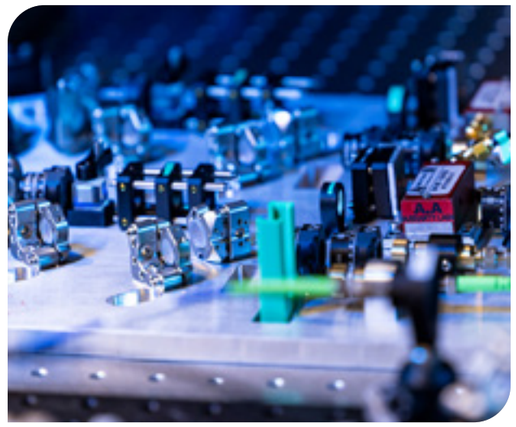
Phase-sensitive characterisation of a quantum frequency converter by spectral interferometry

Authors: Olszewski, Mateusz J; Alexander, Kasper Hecht; Woodley, Michael T M; Murphy, Leah R; Mosley, Peter J; Davis, Alex O C.*
ArXiv, February 2026; https://doi.org/10.48550/arxiv.2602.06796
*Alex Davies is recipient of NQCC funded Fellowship.

This paper presents and experimentally demonstrates a method for characterising quantum frequency converters, devices that change the colour (frequency) of light while preserving its quantum state. The authors introduce a technique called two-tone tomography, which uses a two-frequency optical probe and spectral interferometry to measure both the amplitude and phase response of a frequency conversion device.

The technique was demonstrated using a quantum frequency conversion system based on Bragg-scattering four-wave mixing in photonic crystal fibre. The researchers showed that the method can reconstruct the device's complex spectral transfer function (also known as the Green's function), providing a more complete description of its behaviour than conversion efficiency measurements alone.

Quantum computers and quantum networks often need to connect components that operate at different wavelengths, such as quantum memories, photon sources and communication channels. Quantum frequency conversion provides a way to translate quantum signals between these wavelengths while preserving quantum information. Improved characterisation techniques such as the one presented here can help optimise and validate these interfaces.

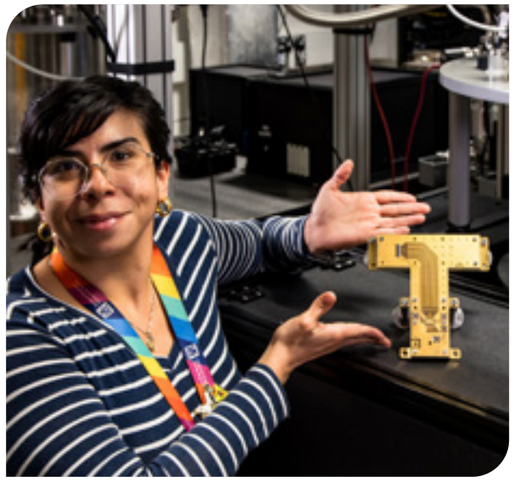


As a proof of principle, the team successfully measured the spectral phase associated with known dispersion intentionally introduced into the system and recovered values consistent with theoretical predictions. The work shows that the method can reveal how light propagates through different parts of a frequency conversion module and can be applied to a wide range of quantum frequency conversion platforms.



Trapped-ion quantum computing R&D at NQCC

Our trapped-ion team is working to deliver open architecture trapped-ion systems at scale. After trapping the first ions, the team is working towards demonstrating 2Q gate capabilities on the optically-driven Sr system and the microwave-driven Ca systems and system integration to run benchmarking on the internal system developed. The team's blueprint will be shared with stakeholders to enable a shared view of progress towards MQuOp Ion Trap System, identify scaling challenges and identify areas of NQCC can contribute to development.



Programmes

PhD projects:

Quantum network switch based on single ion control

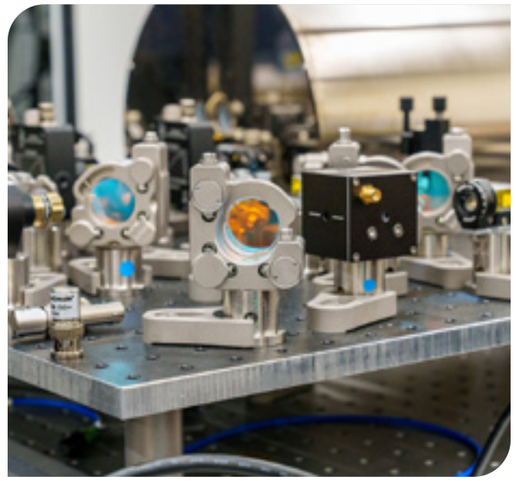
One-wire quantum computing

Robust quantum control for quantum error correction

STFC schemes:

1 STFC Graduate student

1 STFC Industrial Placement student



Highlight:
Design and implementation of a modular laser system for AMO experiments

Organisation of Authors: NQCC

NQCC researchers published the design, implementation and characterisation of a modular laser system for atomic, molecular and optical (AMO) experiments. The system comprises laser distribution, laser control and laser stabilisation modules housed within a 19-inch rack and a dedicated locking station, supporting 13 wavelengths from 375 nm to 1092 nm.

The modular platform was implemented across three laser systems for calcium and strontium trapped-ion experiments. The design uses precision-manufactured optical boards to reduce alignment degrees of freedom and incorporates fibre-coupled laser delivery, frequency stabilisation and independent control of laser frequency and amplitude.

Measured performance included laser delivery efficiencies from source to ion trap of 21-28%, laser linewidths below 500 kHz, polarisation extinction ratios of at least 40 dB, free-running power stability with coefficient of variation below 1%, and optical frequency tuning ranges greater than ±50 MHz.

A key design feature is the use of custom-machined optical boards and dowel-pin alignment, which substantially reduces alignment complexity compared with conventional optical-table implementations.

A reduction of approximately 70% in alignment degrees of freedom relative to a comparable tabletop setup is reported.

The systems were successfully integrated with trapped-ion platforms and demonstrated stable ion-trap operation, including a chain of five 88Sr+ ions in a microfabricated trap. The complete laser system was also transported between laboratories 160 km apart, with minimal realignment required after transport.

https://arxiv.org/pdf/2603.17697

Collaborations

Academia

Microwave-driven trapped-ion QC

Strategic partnership to accelerate Ca systems

Joint PhD student consultancy agreement

National Labs

Optically-driven trapped-ion QC

Strategic partnership to accelerate Sr system

BIST funding in place until March 2026

Industry

Interconnected trapped-ion QC

Technical support and evaluation

Quantum Missions: Pilot funding

Internal collaborations

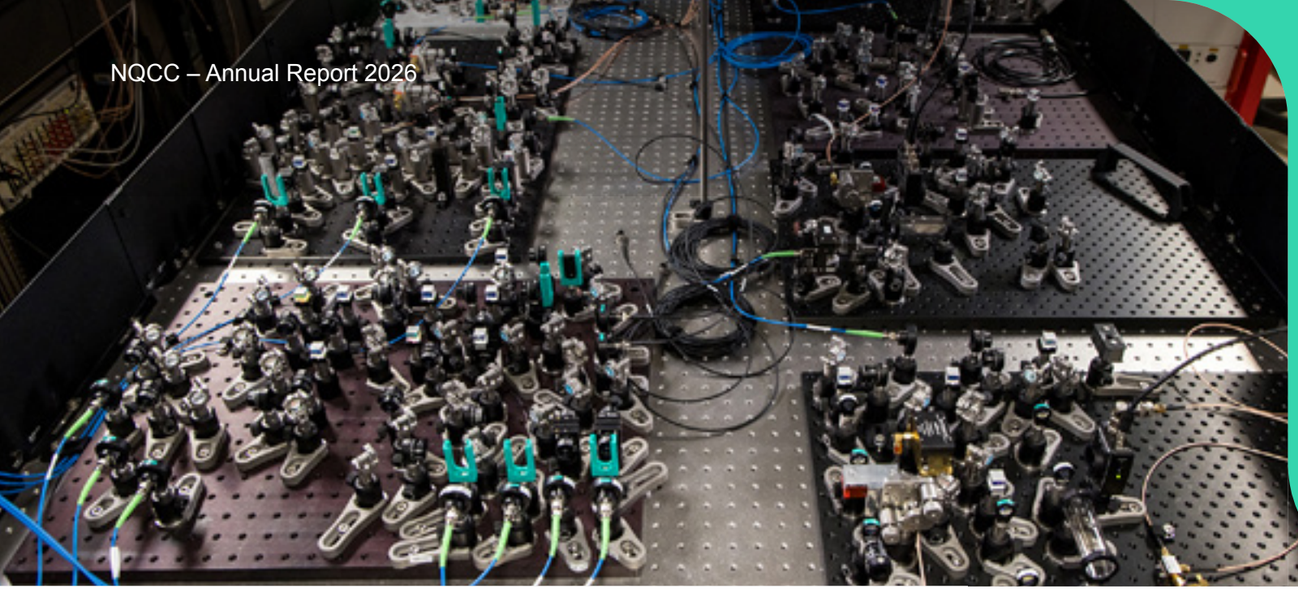
Applied Science Division

Interconnect

Cryogenics and Magnetics

Business and Innovation Directorate





Neutral atoms quantum computing lab at the NQCC.

Our modular approach to neutral atoms quantum computing combines engineering excellence, scalability and reproducibility, enabling us to build an open-architecture quantum computing platform. Through innovation, collaboration and skills development, we aim to advance the technology and help shape the future quantum workforce.

Neutral atoms quantum computing R&D at NQCC

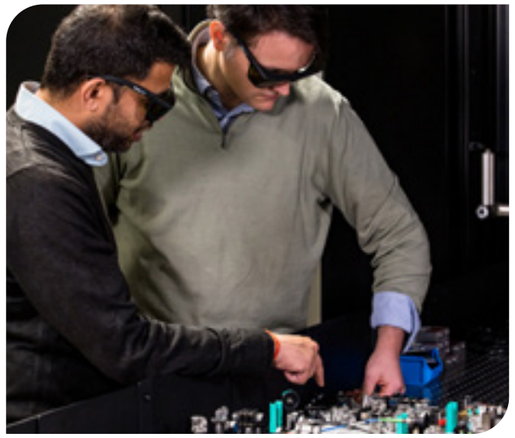
The Neutral Atoms team at NQCC was set up following a review of the developments in the field and the potential that it offers.

The new team built on relevant expertise and knowledge from NQCC in-house R&D teams to have an integrated systems engineering approach from the outset. It is similar in ethos in its aim to build an open architecture neutral atoms quantum computer, build expertise in NQCC in this modality and contribute to training and workforce development.

The team have adopted a modular approach to developing a neutral atoms-based quantum computer where the first-generation system has a modular laser delivery and generation two advancing with modular laser delivery system combined with modular QPU.

This approach has several advantages such as reproducibility of laser delivery, faster deployment, stability and modularity. The team have demonstrated atom trapping and site refilling as they progress towards their goal of demonstrating single and 2 qubit global gates.





Above and right: Neutral atoms quantum computing researchers working at the NQCC lab.

Collaborations

Internal collaboration

STFC Engineering

Science and Technology Facilities Council

Supply chain collaboration

Newbury Electronics

NewburyElectronics

Kingsview Optical

KingsviewOptical

Industry collaboration

Duality Quantum Photonics

DUALITY QUANTUM PHOTONICS

Programmes

PhD projects:

Error correction experiments

Error correction theory and decoders

3D arrays

Dual species error correction directorate



Quantum computing software and control systems

The NQCC has developed an end-to-end quantum integration platform 'KWON', which has supported our engagement with researchers, software developers and hardware providers across the quantum computing ecosystem.

The team have successfully established a mature software deployment infrastructure based on Kubernetes, embracing cloud-native and GitOps principles. This enables reproducible deployments, lays the groundwork for collaboration across research activities, and provides a scalable basis for future capability growth.

The open-source platform is expected to help facilitate interaction with hardware developed at NQCC with the aim of accelerating innovation. The modular nature of the platform enables independent engagement with communities operating at different layers of the quantum software stack, helping to accelerate collaboration, exploration and technology transfer.

NQCC delivered the Software Engineering Conference in May 2026, bringing together relevant Industry representatives, and NQCC partners to share progress on relevant software stack and future plans.







Software Engineering Conference in May 2026.

Industry representation at the Software Engineering Conference 2026

aegiq · AWE · CLASSIQ · Coherence Engine · FUJITSU · Infleqtion · IBM · JIJ · Microsoft · NPL · NVIDIA · OQC · ORCA COMPUTING · oxford ionics · QORO · QSL · QuantrolOx · QuEra · QUNASYS · river lane · TreQ

Highlight:
Examining QRMI as a unified interface for Quantum-HPC integration

Organisation of Authors: Alice & Bob, CINECA, HPC Gridware, IBM, Lawrence Livermore National Laboratory, NQCC, Oak Ridge National Laboratory, Pasqal, Qilimanjaro Quantum Tech, Rensselaer Polytechnic Institute, Siemens, STFC Hartree Centre

The work in this paper examined the Quantum Resource Management Interface (QRMI), a vendor-neutral software layer designed to integrate quantum computing resources into existing high performance computing (HPC) environments. This study evaluated QRMI across a wide range of workload management systems, including Slurm, PBS, LSF, Grid Engine, Kubernetes, and the Flux Framework, demonstrating that a common approach can be applied across diverse computing infrastructures.

The paper shows that QRMI enables quantum processors to be managed as first-class computing resources, alongside traditional CPUs and GPUs. By providing standardised interfaces for resource discovery, scheduling, execution, and monitoring, QRMI reduces the need for application developers and HPC operators to work directly with vendor-specific quantum technologies.

A key contribution of the work is the identification of common integration patterns that can be reused across multiple workload managers. The study reports that quantum resources can be incorporated into established HPC scheduling and workflow systems without major modifications to existing infrastructure, supporting a more portable and scalable approach to quantum-HPC integration.

The research also highlighted important challenges that must be addressed as quantum computing matures, including dynamic quantum resource availability, coordination between quantum and classical workloads, and efficient scheduling of hybrid workflows. By analysing these challenges across several production-grade workload managers, the paper provides practical guidance for future development of quantum-enabled HPC systems.

In parallel to the research, QRMI has been deployed and evaluated across several international HPC and quantum computing environments including development systems at the STFC Hartree Centre. NQCC has initiated integration of its API with QRMI to support future access to both on-premises and cloud-based quantum resources.

https://arxiv.org/abs/2607.19591

Quantum applications and algorithms

Alongside developing open architecture quantum computing systems, our team of researchers are building expertise to solve real-world problems exploiting the unique potential that quantum computers offer and are an integral part of NQCC's SparQ programme.

Working closely with industry and academic partners, NQCC researchers are focusing on identifying problems that can be solved and the areas where quantum computing provides a computational advantage. They are also building knowledge and expertise in algorithms development, benchmarking and verification that will help solve complex problems.

A significant highlight for the team has been the technical evaluation of the NQCC testbeds across five different modalities that required the development of benchmarks and test regimes for the systems alongside exploring potential application areas. This work has strengthened the team's capability to assess quantum computing systems and has provided a clearer understanding of how computational problems may be mapped across different quantum modalities according to their respective capabilities and limitations.

Additionally, the activity has enhanced the team's understanding of the evolving quantum applications landscape and the development pathways towards fault-tolerant quantum computing. The experience gained has established a stronger foundation for the independent evaluation of quantum technologies and their prospective use cases and this knowledge and expertise will position the team to support a wider range of activities including supporting Innovate UK in appraising technical progress and milestones of successful ProQure projects. NQCC's application team is also supporting several Proof-of-Concept projects that NQCC funds to help industry and other partners explore application of quantum computing in their journey to be 'quantum ready'.

Working together with partners at QSL, significant progress has also been made in areas such as quantum chemistry, quantum optimisation, building software libraries for quantum simulation as well as quantum cryptography.

Highlight:

Resource-efficient quantum algorithms for selected Hamiltonian subspace diagonalisation

Organisation of Authors: NQCC

This paper lays out a method to perform accurate quantum chemistry calculations using significantly fewer quantum resources than existing quantum subspace-diagonalization methods, while remaining practical for current noisy quantum hardware (NISQ devices).

The paper introduces two new quantum chemistry algorithms based on the Configuration Interaction Matrix (CIM) framework; CIM-QSCI (Configuration Interaction Matrix Quantum Selected Configuration Interaction) and CIM-QSHCI (Configuration Interaction Matrix Quantum Selected Heat-Bath Configuration Interaction). These methods are designed for quantum-selected Hamiltonian subspace diagonalization and are formulated in the first-quantized CIM representation rather than the second-quantized Fock-space representation used by previous QSCI and SQD approaches.

The authors conclude that CIM-QSCI and CIM-QSHCI provide a resource-efficient framework for quantum-selected subspace diagonalization by combining the CIM representation with approximate quantum evolution and classical subspace diagonalization. While the proposed methods do not surpass state-of-the-art classical HCI, they extend the capabilities of quantum-selected configuration interaction algorithms and demonstrate that accurate molecular simulations can be achieved using substantially reduced quantum resources. Future work is identified as improving determinant-selection strategies, reducing preprocessing costs, and further enhancing quantum sampling and error mitigation.

https://pubs.acs.org/jctcce/article/22/15/7642/5235635/Resource-Efficient-Quantum-Algorithms-for-Selected



Turning innovation into real-world applications

A central part of NQCC's work is creating pathways for quantum computing to move from technical exploration towards practical applications.

The NQCC funds collaborative projects with partners across industry and the research community to solve technology challenges and realise the benefits of quantum computers for social and economic development. Through our **SparQ** programme, we engage with research institutions, companies, and government organisations to explore the potential of emerging quantum computers for tackling real-world applications.

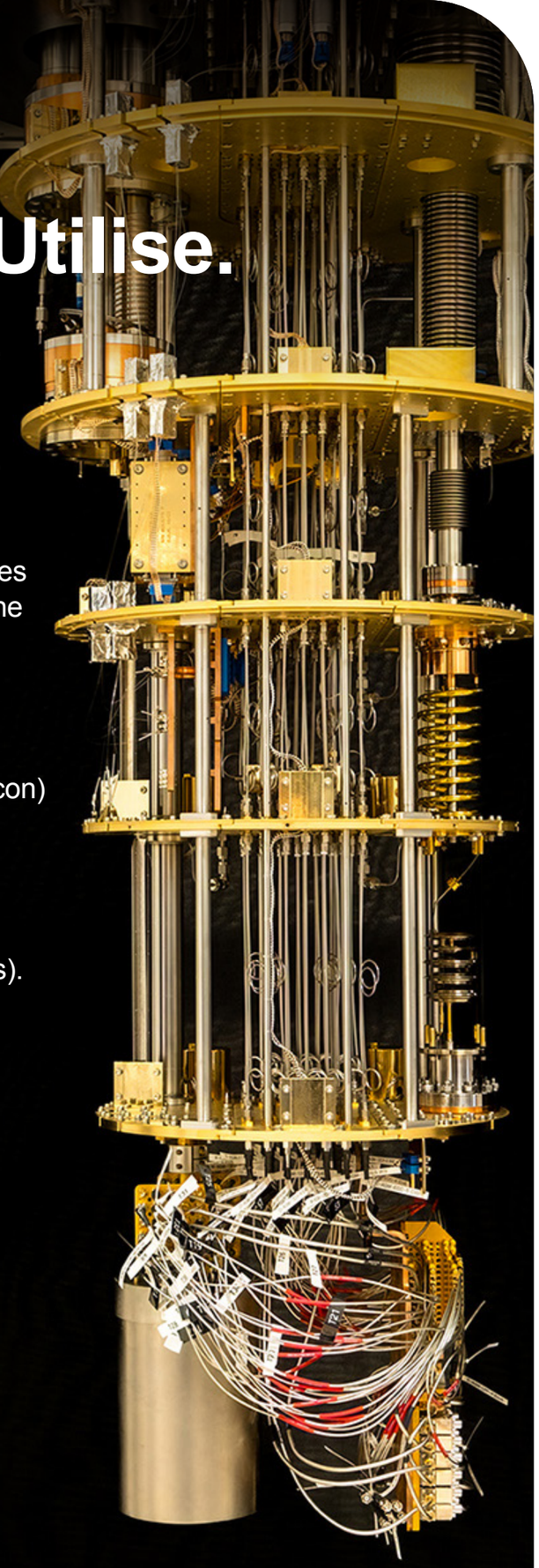


Highlight:

NQCC SparQ Proof-of-Concept Call 2026: Showcasing the next wave of quantum innovation in the UK

The NQCC's 2026 **SparQ** Proof-of-Concept Call is funding 13 projects to explore how quantum computing can address real-world challenges across the UK's public, private and charitable sectors. Co-delivered with STFC, the programme builds on the success of the 2025 call, supporting business-led collaboration to translate quantum innovation into practical, commercially relevant applications. This year's projects will investigate opportunities in areas including telecommunications, corrosion simulation, logistics and energy optimisation. By connecting organisations with quantum technologies and specialist expertise, the programme aims to strengthen the UK's quantum readiness, accelerate early adoption and unlock the wider economic and societal benefits of quantum computing.

- Significantly expanded the PoC call this year and added PoC+ projects to support further development and drive towards commercialisation.
- Highest response rate for the 2026 POC/POC+ call to date, with the number of applications increased by 44%.



Build. Host. Utilise.

UKRI invested £30 million to fund the development of 7 prototype quantum computers (testbeds) by companies across the most promising modalities in 2024. Co-delivered with Innovate UK, the testbeds were successfully commissioned in 2025, with companies choosing to deploy their systems at the NQCC facilities at Harwell Campus.

- Aegiq (photonics)
- Infleqtion UK (neutral atoms)
- Quantum Motion (spin qubits in silicon)
- QuEra UK (neutral atoms)
- ORCA Computing (photonics)
- Oxford Ionics, an IonQ company (trapped ions)
- Rigetti UK (superconducting circuits).

Quantum Computing Testbed Initiative

The Quantum Computing Testbed Initiative (QCTI) was designed from the outset to comprise two phases: the first focused on testbed development and deployment – co-delivered by the NQCC and Innovate UK – whilst the second phase involves performance evaluation and utilisation, led by the NQCC in partnership with the Quantum Software Lab at Quantum Software Lab, University of Edinburgh.

It's the combination of cutting-edge tech development twinned with rigorous test and validation that has become the hallmark of the programme's value – de-risking technology development and future investment. The role of the NQCC has been to act as a first customer. Besides the technical impact the funding enabled, the NQCC testbed project also provided a successful testcase that has enabled a much larger government investment through the ProQure programme delivered through Innovate UK in close partnership with NQCC.

Quantum Computing Testbed Initiative: Impact

£1.5bn+

private investment raised by lead companies awarded test bed funding in 2025/2026

£7m+

further funding following testbed award for the lead companies

4

providers reporting change to higher TRL level, with two reaching TRL 7 and 8

48

high skilled jobs created in companies

10

intellectual property reported (copyrights or patents)

Business impacts

(business expansion, entry to new markets, product maturity, increased investment)

HPC-Quantum integration

High performance computing at NQCC enables developers and partners to access HPC alongside quantum computing resources. NQCC is working towards increasing usage of its high-performance computing cluster, QUASAR, alongside integration into the NQCC's KWON system.

QUASAR has enabled simulations as well as hybrid workflows, and the team has established close collaboration on Quantum Resource Management Interface (QRMI) with STFC Hartree, US national labs and industry partners. Work done so far has enabled the team to accelerate towards quantum-hybrid workflows using QUASAR with both cloud-hosted and on-premise quantum computers and implementing remote solutions to selected partners for technical testing of systems at NQCC.



Access to quantum computers

The NQCC's '**SparQ** Access' provides access to assured quantum computing systems across a range of modalities for academia and industry users to explore solutions to problems using quantum hardware. The initiative is part of the NQCC's 'SparQ' programme, which aims to support the pathway to quantum readiness by building knowledge and expertise in applications discovery and developing the UK quantum computing user community.

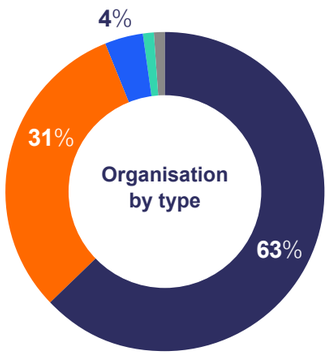
Statistics for access*

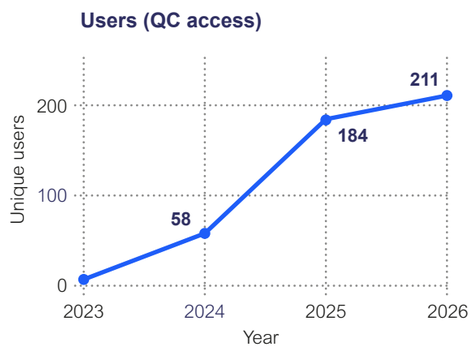
387
number of unique users

76
organisations
(users of QC access)

22
different QPUs provided

*Correct as of 2 September 2026





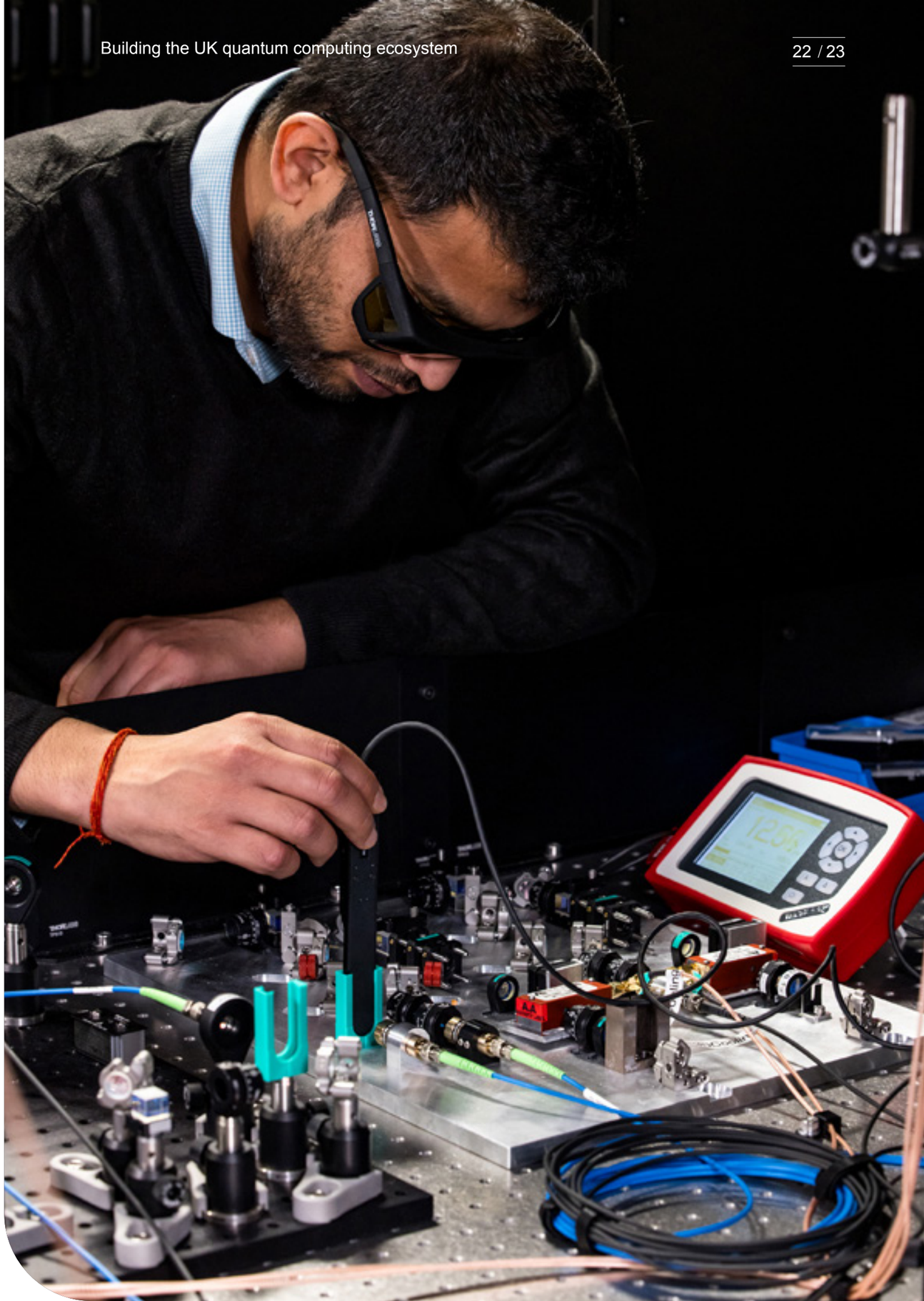
Highlight:
Quantum generative diffusion model for real-world time series

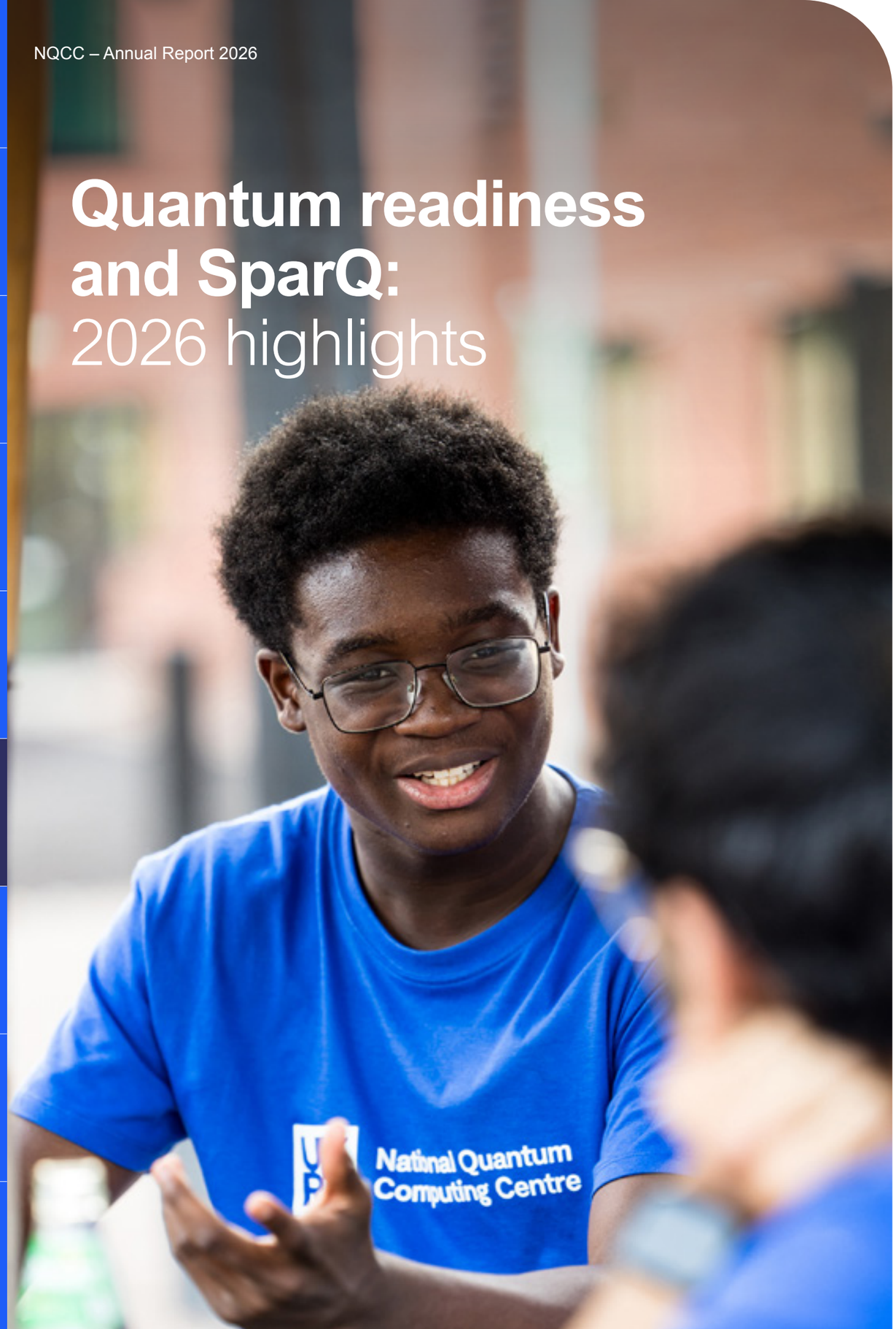
Organisation of Authors: Kingston University London, University of Florence, Florence, Brunel University of London

The paper introduces QDiffusion-TS, a hybrid quantum-classical diffusion model for time-series generation. Using financial datasets, the authors report that the approach reproduces real data distributions more accurately than a classical diffusion baseline, reduces Wasserstein distance by approximately 44%, improves downstream forecasting performance by up to 71% when used for data augmentation, and achieves these results with substantially fewer trainable parameters. The model was additionally validated on the IQM Emerald quantum processor, access to which was provided by NQCC, where hardware performance remained consistent with the simulated quantum implementation.

Authors conclude that quantum-enhanced architectures can match or exceed the performance of classical generative models while using fewer trainable parameters, and provide a practical framework for hybrid quantum-classical generative modelling of time-series data.

https://arxiv.org/pdf/2606.27561





Quantum readiness and SparQ: 2026 highlights

The NQCC's ambition is to enable the UK as a quantum-ready economy, prepared to take full advantage of the benefits quantum computing can offer. Bringing together the entire quantum computing community, NQCC has been accelerating quantum readiness through user engagement, skills and learning and outreach activities. NQCC's flagship programme **SparQ** drives applications development, assists with responsible adoption, supports skills development, and provides opportunities for networking and collaboration for quantum readiness.

SparQ Access

The NQCC's 'SparQ Access' provides access to assured quantum computing resources across a range of modalities to explore solutions to problems using quantum hardware.

In 2026, NQCC launched a dedicated **SparQ Access Industry Channel**, providing free trial access to quantum computing resources for early-stage use case discovery and evaluation. This aims to support organisations in progressing their quantum computing journey, enabling them to explore, validate, and develop practical applications of quantum computing in support of future business objectives.

While organisations with existing quantum computing experience or well-defined use cases are likely to derive the greatest immediate benefit from the channel, the long-term ambition is to support a broader range of industry engagement.

Key outcomes:

- New Industry channel launched facilitating UK company access to QC resource
- Strong response to EOI
- Academic channel goes from strength-to-strength, now have 29 UK universities participating – an increase of 71% on this time last year
- 114 academic allocations awarded since start of channel.

Highlight:
SparQ Access Showcase 2026



The NQCC launched the **SparQ** Access Showcase, a new community event bringing together academic users from across the **SparQ** Access programme. The first Showcase was held in collaboration with the University of Kent's Quantum Applications Research Centre (QuARC). Over two days, the Showcase provided an opportunity to share research enabled by **SparQ** Access, exchanged ideas and experiences, and connected with peers working across a wide range of disciplines and projects, which helped to strengthen the growing community around quantum computing.

Sectoral engagement

In 2026, the NQCC continued engaging with UK industry to identify high-value applications for quantum computing, understand adoption challenges and accelerate progress towards a quantum-ready economy. Activities focused on sectors including finance, healthcare and pharmaceuticals, defence, transportation and energy, exploring opportunities in optimisation, machine learning, simulation and cybersecurity.

Highlight:
Quantum computing in energy

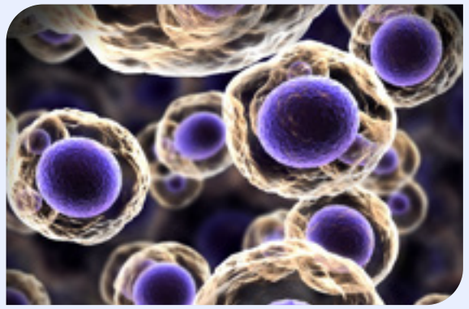
The Unit Commitment Problem is one of the energy sector's most complex and economically significant optimisation challenges, involving the scheduling of generation assets to meet electricity demand at the lowest possible cost while maintaining system reliability and managing emissions.

JIJ Inc. and ORCA Computing, in collaboration with bp and the NQCC, released a white paper demonstrating that hybrid quantum-classical optimisation is moving closer to commercial relevance for this most complex operational challenges for the energy sector.

Read the article: https://www.j-ij.com/en/news/20260610



Highlight:
Quantum Computing in Healthcare and Pharma – Signals from the Sector



Quantum for healthcare sits within the UK's Modern Industrial Strategy (IS-8) at the meeting point of two of its eight growth-driving sectors – Life Sciences and Digital & Technologies, where quantum is a named frontier technology, backed by the £2 billion of government investment. Through ProQure, the UK's new quantum procurement programme, the government is developing a pathway to procure quantum capability and not only fund research: a signal of demand that helps pull innovation towards real-world use. Alongside world-leading biomedical sensing capabilities, and a maturing applications ecosystem anchored at Harwell, the UK is well placed to lead the next phase of this conversation.

Read the blog at: https://www.nqcc.ac.uk/blogs/quantum-computing-in-healthcare-and-pharma-signals-from-the-sector/

NQCC is now providing dedicated support across 5 strategically important sectors.

Strategic partnerships and collaborations

Quantum Software Lab

Launched in April 2023 and led by Professor Elham Kashefi, the NQCC's Chief Scientist, the Quantum Software Lab (QSL) is a strategic partnership between the NQCC and the University of Edinburgh. It plays a central role in co-designing quantum software, with a core focus on practical applications, verification, and benchmarking.

QSL contributes to SparQ, the NQCC's user engagement programme that supports applications discovery, skills development, and provides opportunities for networking across the ecosystem, and to the NQCC's testbed initiative. Researchers at QSL in partnership with industry professionals and NQCC's applications engineers are transforming existing computational challenges into research problems that can be tackled using quantum technology.



The QSL celebrated its 3rd anniversary, as part of the Quantum Fringe 2026

QSL highlights

70+
quantum researchers

18+
partners

250+
QSL publications



QCi3 Hub

NQCC's strategic partnership with the former Quantum Computing and Simulation (QCS) Hub continues with signing of a memorandum of understanding with the new QCi3 Hub, to work together to advance the field of quantum computing for the benefit of the UK and unlock the advantages for wider society.

Both the QCi3 Hub and the NQCC are part of the National Quantum Technologies Programme (NQTP). Hence, the synergies within core areas of work will help accelerate development and performance of UK quantum computing efforts.

During 2026, collaboration with universities, technology companies, government, national laboratories and international organisations created new routes for knowledge exchange, research and access to advanced computing resources.

Google Quantum AI

Through a joint collaboration, the NQCC and Google Quantum AI expanded UK researchers' access to Google's Willow processor. Launched in December 2025, the initiative was designed to support UK-led research projects exploring applications that could help accelerate progress toward useful quantum advantage. The first selected project, led by researchers at King's College London and ENS Paris, is exploring how quantum computing techniques could contribute to understanding complex quantum dynamics inspired by neural systems – opening exciting new possibilities at the intersection of quantum computing and computational neuroscience.



The research team is collaborating closely with experts from Google Quantum AI, while the NQCC is providing technical expertise and support throughout the project to help maximise scientific impact.



Japan's National Institute of Advanced Industrial Science and Technology (AIST)

The NQCC and AIST, through its Global Research and Development Centre for Business by Quantum-AI Technology (G-QuAT), signed a Memorandum of Understanding (MoU) to strengthen international collaboration in quantum computing science and technology. This partnership establishes a framework for long-term cooperation between the UK and Japan in key areas such as joint research, the exchange of knowledge and expertise, and the organisation of collaborative activities, including workshops, seminars, and symposia.



EY

The 2026 Quantum Business Readiness Report by EY was launched in in collaboration with the NQCC. The report findings reflect what we're hearing across the ecosystem: strong awareness, but a need for clearer pathways to practical adoption. At the NQCC, we're working with industry, government and academia to accelerate readiness – supporting skills development, enabling access to emerging capabilities, and fostering collaboration across the UK ecosystem. Building capability through partnerships and early engagement will be key to turning interest into impact. Now is the time for organisations to engage, collaborate, and prepare thoughtfully for long-term, scalable quantum advantage.

Digital Catapult

NQCC and Digital Catapult joined forces to launch a new phase of the Quantum Technology Access Programme (QTAP), sponsored by SparQ from the NQCC. This combines the Digital Catapult's expertise in accelerating the practical application of deep tech in industry with the NQCC's growing national capability in quantum computing and testbeds.

The collaboration is supporting eleven organisations across a whole range of sectors including energy, healthcare, transport and logistics, financial services, aerospace and defence. By enabling industry professionals to use quantum computing for business impact, the programme aims to drive early adoption and develop the next generation of quantum skilled practitioners through learning and guidance.





QTAP Cohort 3 kick-off event at the NQCC in July 2026.

Highlight:

Sector leaders join quantum innovation programme to drive UK industrial transformation

Digital Catapult has announced eleven organisations joining the third cohort of its Quantum Technology Access Programme (QTAP), delivered with NQCC's SparQ programme. The initiative accelerates practical quantum innovation across industry, with participants including NatWest, the Rail Safety and Standards Board (RSSB), and Health Innovation North West Coast. NatWest will investigate fraud and illicit activity detection across transaction networks, while CTA Fintech Solutions will examine optimising legacy-to-cloud transaction flows to improve efficiency and resilience.

Another innovative use case will apply quantum computing to improve diagnosis, treatment pathways and outcome forecasting for thrombotic thrombocytopenic purpura (TTP), a rare, life-threatening blood disorder. Health Innovation North West Coast will explore opportunities to improve patient outcomes using ORCA Computing's PT-2 quantum computer.

QTAP gives UK companies a guided pathway to understand quantum technologies, assess their sector-specific value and progress from concept to practical application through expert guidance and experimentation.

Through SparQ, we're helping organisations move towards practical exploration of quantum computing. This cohort demonstrates growing confidence in quantum computing across UK industry, building the expertise, evidence and partnerships needed to accelerate responsible adoption and strengthen the UK's quantum capabilities.



Launch of the Harwell Quantum Cluster on 13 November 2025.

Harwell Quantum Cluster

The Harwell Quantum Cluster has been launched at Harwell Science and Innovation Campus, marking a significant step in strengthening the UK's position as a global leader in quantum technologies.

Building on more than £250 million in private investment, the cluster aims to attract £1 billion in further investment and create over 1,000 high-value jobs over the next decade. Bringing together government, academia and industry, it will support business growth, attract international investment and accelerate the commercialisation of emerging quantum technologies. The cluster will build on Harwell's established strengths in scientific research, advanced engineering and technology development, providing an environment where businesses and researchers can collaborate, access specialist infrastructure and translate scientific breakthroughs into practical applications.

The NQCC will anchor the cluster, providing access to specialist expertise, quantum computing testbeds and advanced research facilities. It will play a central role in supporting collaboration, developing industry capabilities and helping businesses explore the practical applications of quantum computing.

By connecting world-class research with commercial expertise and investment, the Harwell Quantum Cluster will support the growth of the UK's quantum ecosystem, strengthen national capabilities and create opportunities for long-term economic growth.

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Quantum Standards Network Community

The Quantum Standards Network (QSN) is the UK's national coordination initiative for quantum technology standardisation, managed by the National Physical Laboratory (NPL) and funded by the UK Government. It is developed in collaboration with the British Standards Institution (BSI), the NQCC, the National Cyber Security Centre (NCSC), and UKQuantum. The QSN Community provides a dedicated space for people researching, developing, applying, and enabling quantum technologies to access resources and guidance, follow standards activity, and engage with expertise from across the quantum ecosystem.

From quantum computing and networks to PNT, sensing, and imaging, members can stay up to date on activity relevant to their field and understand how standards and best practice can support the development and adoption of emerging technologies.

Join the QSN Community at https://qsn.org.uk/

Why join?

- Learn more about standards and innovation
- Follow progress on quantum technologies in the UK
- Read insight from key industry voices
- Attend workshops, deep-dives, and other community exclusive events
- Share knowledge and contribute your expertise to standards development and the UK's quantum sector.



Workforce readiness – skills development and outreach:
Building an open and inclusive quantum community

NQCC's role extends beyond technical capability to strengthening the wider community around quantum computing.

Quantum Public Engagement Network

In 2026, NQCC convened the Quantum Public Engagement Network (QPEN), creating a UK-wide community for researchers, educators, communicators and professionals working to make public engagement in quantum science, engineering and technology meaningful and inclusive.

The network provides opportunities for peer collaboration, training, sharing best practice and member-led activity.

The year also saw continued public engagement and education activity, from introductory opportunities for students to specialist workshops and sector-focused events including Edinburgh Science Festival and Futurelab at Goodwood. This work helps broaden understanding of quantum computing and create opportunities for people to engage with the technology at different stages of their education and careers.

The recognition of NQCC's outreach and education work through Daisy Shearer's inclusion in the Quantum 100 during the International Year of Quantum Science and Technology provided further recognition of the importance of accessible and inclusive engagement in building the future quantum workforce.



Highlight:
UK Quantum Hackathon 2026

Organised by the NQCC, the annual quantum hackathon held in the UK brings students and early-career researchers together with industry mentors and technology experts.

With just two days to develop their approaches, the teams explore diverse use cases, and test ideas on quantum emulators and physical processors to find out how quantum computing could benefit businesses, people and communities.

At the 2026 UK Quantum Hackathon, ten teams came together at the University of Warwick for three days of collaboration, creativity and hands-on experimentation, tackling real-world challenges with quantum computing. From ambitious technical challenges to surprising creative possibilities, the hackathon demonstrated the value of bringing fresh perspectives to quantum computing – and exploring where the technology could take us next.

UK Quantum Hackathon 2026 winners

1st place
Use case: The Self-Forecasting Green Network: Photonic Quantum Reservoir Computing for Carbon-Aware Mobile Traffic Prediction
Use case provided by: Tech Mahindra

2nd place
Use case: Quantum-Assisted Discovery of Melodic Variant Families in Large Folk-Music Archives
Use case provided by: Ross Carbery

3rd place
Use case: Quantum-Accelerated Catalyst Design for Sequential Hydrogenation
Use case provided by: Johnson Matthey

'Best group name' winning name
404: Medical Degree Not Found
Use case provided by: Applied Quantum Computing

The future of quantum computing will be shaped not only by better hardware and algorithms, but by people who can identify where this technology can make a real difference. Events like this are helping build that community and talent pipeline. The Irish folk music use case was a particularly unexpected example of how quantum computing could reach beyond science and technology into wider cultural applications.



Workforce development through training and workshops

Doctoral Studentship Scheme

In collaboration with the EPSRC, and co-developed by the NQCC and university partners, this scheme will have thirty students over five annual cohorts working on cutting-edge collaborative projects to advance the development of quantum computing across the technology stack.

We have developed a programme of complementary training and development opportunities for doctoral students, helping to provide a well-rounded cohort experience alongside their research projects. The second cohort of the NQCC Doctoral Studentship Scheme commenced in October 2026. For cohort 3, we received 40 project expression of interest from 25 different universities across the UK and are currently in the final stage to shortlist the 6 proposals for our third cohort.

Bristol courses

The NQCC has delivered the University of Bristol quantum training courses for the fifth consecutive year, continuing to support professionals transitioning into quantum computing. In 2024/25, 19 learners completed the Quantum Information course and 16 completed the Quantum Computation course. In 2025/26, 8 learners have successfully completed the Quantum Information course, with the Quantum Computation course currently underway. Feedback indicates that participants join these courses to develop their quantum computing knowledge and skills, with many seeking to support a transition into quantum-related roles.

The continued demand for the programme highlights the important role that high-quality, structured training opportunities play in supporting skills development within the growing quantum workforce.



CDT and PhD training engagement

The NQCC has been engaging with the quantum CDTs through a range of activities, including delivering training workshops on quantum programming and public engagement, technical lectures, hosting visits to the NQCC, supervision of case study projects, and collaboration on events.

Through a quantum programming workshop delivered by NQCC quantum applications scientists two consecutive years in a row, more than 30 doctoral students received hands-on training in quantum programming. Building on this success, the NQCC is exploring partnerships with external providers to further scale and expand its training provision in 2026.

Online quantum skills course

Delivered using Q-CTRL's Black Opal platform, this course provides an accessible entry point into quantum computing for undergraduate and graduate students, as well as professionals from diverse backgrounds. Through interactive visualisations and hands-on learning, participants develop understanding of core quantum computing concepts, explore real-world applications and gain experience in quantum programming.



Quantum Programming Residency 2026

For second year in a row, we hosted a Quantum Programming Residency at the NQCC in February 2026. We welcomed students from the Quantum Informatics Doctoral Training Programme at the University of Edinburgh for a month-long hackathon-style residency. Students gained hands-on experience in quantum programming, tackled industrially relevant use cases under the guidance of our senior quantum applications engineers, and had the chance to run their solutions on real quantum hardware.

Alongside, we delivered seminars on a range of quantum computing modalities through sessions led by NQCC hardware experts, providing participants with insight into different approaches to quantum computing. We also delivered two workshops on Responsible and Ethical Quantum Computing (REQC), facilitated by the NQCC's Policy and Ethics Lead for quantum computing. The workshops introduced key REQC concepts and best practices, and provided participants with an opportunity to explore ethical considerations relevant to their own use cases and areas of interest.

PhD placements

In 2026, the NQCC hosted its first PhD placement, marking a significant milestone in its early-career training activities. Unlike standard STFC placement schemes, this programme was developed internally by the NQCC to provide doctoral students with a unique opportunity to gain hands-on experience. During the three-month placement, students worked on application-oriented quantum computing challenges under the supervision of NQCC experts, while benefiting from access to NQCC facilities, expertise, and collaborative networks.

The placement provides valuable exposure to real-world quantum computing projects and complements students' academic research. The NQCC plans to continue hosting PhD students and expanding opportunities for researchers to gain practical experience in the quantum computing ecosystem.

Highlight: **InQuanto summer school**

As part of its commitment to growing the UK's quantum workforce, the NQCC provided funding and curriculum development support for the quantum chemistry summer school delivered by Quantinuum in Cambridge. The programme provided early-career academic and industry researchers with intensive training in quantum computing and quantum chemistry through a week of lectures, practical workshops and project-based learning. By giving participants hands-on experience with techniques relevant to real-world applications, the summer school helped develop skills that are critical to the future adoption and exploitation of quantum technologies.

NQCC values



Responsible and ethical quantum computing

We continue to advance the responsible development and use of quantum computing, with a growing focus on putting principles into practice, building awareness and skills across the ecosystem, and deepening understanding of the ethical and societal implications of quantum computing.

In 2026, we launched our Responsible and Ethical Quantum Computing (REQC) Action Plan, building on the Quantum STATES principles. The five-year plan sets out how we will embed responsible innovation across NQCC activities, strengthening accountability and providing practical guidance on operationalising REQC.

Our approach has contributed to national and international policy discussions, including the OECD's Recommendation of the Council on Quantum Technologies. We are also embedding REQC in skills development and research. At the UK Quantum Hackathon 2026, participants were encouraged to consider the wider implications of their use cases and incorporate ethical considerations into their approaches. Underpinning this, our research continues to develop on both practical approaches and best practice for responsible innovation, as well as technical dimensions of quantum computing ethics, drawing on NQCC experience and expertise.



Equality, Diversity and Inclusion (EDI)

The NQCC continues to strengthen its commitment to EDI, celebrating the diversity of our people and embedding inclusive practices across the organisation. Now in its fourth year, the **EDI Working Group** continues to champion inclusive approaches, raise awareness and help address barriers to participation across the quantum ecosystem.

In 2026, this included reviewing communications and materials to ensure our external presence reflects our diverse community and inclusive values, alongside regular drop-in sessions providing colleagues with opportunities to share ideas, ask questions and access support. Through these activities, the Working Group continues to help embed EDI considerations across NQCC projects and activities.

Responsible and ethical innovation must be at the heart of quantum computing's development. By translating principles into practical action, fostering collaboration and building awareness across the ecosystem, we aim to ensure quantum technologies are developed and deployed responsibly, delivering positive societal impact while anticipating and addressing the challenges they may bring.





NQCC: Organisation and people

At the heart of the NQCC are the people whose expertise, ideas and shared commitment are helping advance the future of quantum computing. By bringing together diverse skills and perspectives, we foster an environment where colleagues can learn from one another, collaborate across disciplines and contribute to our national mission. Alongside our technical ambitions, we recognise the importance of an inclusive, supportive workplace where people feel valued, connected and empowered to make a difference.

Leadership team

NQCC's Leadership Team bring a wealth of experience from across the quantum technologies sector. They are accountable for delivering NQCC's mission and vision and positioning NQCC to deliver UK sovereign capability in quantum computing. Here they share their highlights of the last year.



Supporting public investment

As the UK's trusted authority on quantum computing, we continue to build evidence supporting national infrastructure and wider research investment. In 2026, there was renewed government commitment to £2 bn of investment in quantum technologies, with the NQCC at the heart of programmatic design and delivery.

Michael Cuthbert Director



Strengthening the UK quantum ecosystem

Over the past year, the NQCC has continued to strengthen the UK's quantum ecosystem by expanding access to cutting-edge technologies, accelerating applications development, and supporting the skills, partnerships and infrastructure needed for quantum computing to deliver tangible benefits.

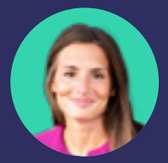
Simon Plant Deputy Director for Innovation



A stand-out year of scientific progress

Bringing together NQCC researchers and the Quantum Software Lab in Edinburgh as a single research base has accelerated our scientific impact. From demonstrating verified quantum computation on hardware, to advances in fault tolerance, quantum algorithms and verification, our researchers have strengthened the foundations needed to realise practical quantum computing and deliver Quantum Mission 1.

Elham Kashefi Chief Scientist



Driving economic growth and building national capability

Through partnerships with organisations across all eight Industrial Strategy sectors, the NQCC has supported the Government's growth ambitions and strengthened the UK's leadership in quantum computing. Effective governance and clear accountability underpin our work, ensuring public investment delivers tangible value for money, while enhancing the UK's international competitiveness and reputation.

Anne-Claire Blet Deputy Director for Programme Delivery



Convening the quantum computing community

NQCC led architecture thinking with a blueprint on Trapped-ion M-QuOp systems to host a workshop that convened industry and academic experts to shape thinking on future quantum computing architectures. The initiative demonstrated how scientific discussion and collaboration can be accelerated through white-box activities that encourage transparency through shared problem-solving. It provided a template for similar activities across other quantum computing modalities in the future.

Jonathan Burnett Deputy Director for Research

Governance

The NQCC programme is jointly delivered and funded by two UK Research and Innovation (UKRI) councils: the Engineering and Physical Sciences Research Council (EPSRC) and the Science and Technology Facilities Council (STFC).

As a national laboratory within STFC, the NQCC is supported by STFC's shared business services and is headquartered at Harwell Campus in Oxfordshire, within dedicated facilities on the Rutherford Appleton Laboratory site.

Delivery of the NQCC programme is overseen by the Programme Oversight Board, supported by the Strategic Advisory Committee, which provides advice and challenge to inform the work of the Board and Senior Leadership Team. The Technical Advisory Group provides specialist expertise to support delivery of the NQCC's technical roadmap.

We thank the members of these groups, including those rotating off this year (Angeli Moller and Sadie Creese from SAC, Viv Kendon and Martin Dawson from TAG), and our partners and colleagues, whose expertise and commitment continue to support the NQCC's development and delivery.

Programme Oversight Board

The Programme Oversight Board (POB) provides oversight of the NQCC programme and activities. Chaired by EPSRC's Deputy Director for Quantum Technologies and Advanced Connectivity Technologies (QT&ACT), Dr Neil Robinson, it includes senior sponsors from EPSRC, STFC, UKRI, Office for Quantum, and representatives from other government organisations.. The Board supports strategic direction, oversees programme delivery, monitors risks and barriers, and ensures alignment between the NQCC programme, wider research council activities, and the UK's National Quantum Technologies Programme. The POB typically meets quarterly.

Strategic Advisory Committee

The Strategic Advisory Committee (SAC) provides advice, support and challenge on the NQCC's activities and programme. Drawing on expertise across quantum technologies, programme delivery, technical innovation, defence, cybersecurity and government, SAC members provide external perspectives to the NQCC Senior Leadership Team. Meeting twice a year, the Committee helps maintain links with related activities across the UK's National Quantum Technologies Programme and supports engagement with stakeholders across academia, industry and government.

Chair: Professor Ian Walmsley CBE FRS

Members: Professor Anike Te; Professor Danielle George CBE; Professor Dominic O'Brien; Professor Gerald Buller; Mr Jonathan Legh-Smith MBE; Professor Julia Sutcliffe; Mr Simon Andrews.

Technical Advisory Group

The Technical Advisory Group (TAG) provides independent expertise to support delivery of the NQCC's technical roadmap and programme. Its members bring experience from quantum computing and related fields, offering insight into developments within the NQCC and the wider sector. Working with the Senior Leadership Team, the TAG reviews technical priorities, milestones and objectives, advises on technical initiatives, and supports the review of quality and acceptance criteria for key deliverables. The Group meets annually as part of the technical programme review cycle.

Chair: Professor Elham Kashefi

Members: Professor Mag. Dr Barbara Kraus; Dr Donatella Cassettari; Professor Gerard Milburn; Dr Giovanna Sammacro Tancredi; Professor Loyd McKnight; Michael Groves; Dr Tobias Lindstrom.

Working at the NQCC

Collaboration is central to how we work at the NQCC. Our people work across teams, disciplines and professional backgrounds, engaging with colleagues, research institutions, industry and partners across the wider quantum ecosystem. This exchange of knowledge and ideas helps us tackle complex challenges, strengthen our collective expertise and support the development of quantum computing technologies. By nurturing a culture of openness, shared learning and innovation, we create opportunities for our people to grow while contributing to the NQCC's evolving role in the UK's quantum computing landscape.

Celebrating our values – recognising people and teamwork

Building on the launch of the NQCC Values Awards in 2025, we continue to recognise colleagues whose contributions bring our organisational values to life. Through peer nominations, the awards celebrate individuals who demonstrate Objectivity, Agility, Collaboration, Innovation and Leadership in their everyday work. The Team Award also recognises the collective achievements of cross-functional groups, highlighting the importance of shared purpose and working together to deliver our objectives. This approach to recognition helps reinforce the behaviours and relationships that underpin a positive, inclusive and collaborative workplace.



Wellbeing and connection – the Qubats rounders team

The NQCC's Qubats rounders team continued to bring colleagues together through sport and friendly competition, taking part in the Harwell Campus summer tournament for the third consecutive year and reaching the semi-finals.

Open to all NQCC colleagues, regardless of previous experience, the club offers a relaxed way to stay active, build relationships across teams and connect with the wider campus community. Activities such as these support staff wellbeing and demonstrate how informal opportunities to connect can strengthen our sense of belonging.



Sharing knowledge across the centre – Quantum Hourglass

The Quantum Hourglass seminar series provides a platform for colleagues to explore the breadth of work taking place across the NQCC and the wider quantum ecosystem. Bringing together speakers from technical and non-technical backgrounds, the series highlights the research, expertise and operational activities that collectively enable the Centre to deliver its mission.

By making complex topics accessible to colleagues across different disciplines and roles, Quantum Hourglass encourages knowledge-sharing, broadens understanding and strengthens connections across the organisation. It reflects the NQCC's commitment to learning together, recognising the contribution of every team and building a shared understanding of the opportunities and challenges shaping quantum computing.



Space to connect – Tuesday Cake Club

Sometimes, the simplest traditions make a meaningful difference. The Tuesday Cake Club offers colleagues a regular opportunity to pause, share refreshments and catch up beyond their day-to-day work. Home-baked treats and dishes inspired by colleagues' cultural backgrounds bring an added sense of variety and shared experience. As the NQCC grows, these informal moments help people get to know one another, celebrate different backgrounds and sustain the personal connections that contribute to a welcoming workplace.



Looking ahead

With the announcement of £2 billion quantum innovation investment in March, the UK government laid down the gauntlet to the quantum computing industry to accelerate research and development, to bring forward the potential of large-scale quantum computing, driving end-user adoption for early societal benefit and UK economic advantage.

The first-of-its-kind governmental procurement programme, 'ProQure: Scaling UK Quantum Computing', will move from design and assessment in 2026 into delivery of state-of-the-art prototypes for evaluation in 2027 and beyond. It is intended that the most promising technologies will be made accessible for use by scientists, researchers, the public sector, and businesses, as part of our national computing infrastructure – transforming the UK into a hotbed for the latest, cutting-edge quantum technology. For the NQCC, ProQure represents a significant ramp-up in our assurance, benchmarking and verification effort.

Following a decade of global leadership in quantum sensing, imaging, timing, networking, and computing, the UK has a thriving ecosystem and vibrant commercial landscape. By anchoring businesses at scale in the UK, we should expect to see value through intellectual property, high-value jobs, followed by high-skill manufacturing. Our UK quantum start-ups have raised over £1 billion in private capital to date, and internationally, the levels of investment into quantum tech have surged, with over $12.6 billion in venture funding raised thus far in 2026.

Across the breadth of our activities, I see four areas where the NQCC programme maps directly onto the ambitions of ProQure and the year ahead.

Technology road-mapping and collaborative R&D

We published our first technical roadmap in 2020 as we launched. This was a cautious framing of the challenges associated with the pathway towards fault-tolerant capabilities ahead and a systematic approach to scaling – not just at the qubit layer but full stack, including control architecture, algorithms, and applications. This approach continues, and as our internal technology programmes have matured, we have incorporated academic and industry input into our blueprints. We see the delivery of these hardware roadmaps as now largely an industry scaling challenge, but recognise there are bottlenecks to collective progress where we, as a National Lab, can convene partners to work collaboratively. Topics such as optical-to-microwave transduction, error correction, readout noise performance, data throughput, and noise modelling are active projects.

This road-mapping activity has enabled a framework for the UK to develop, scoping the feasibility and challenge of progress towards our key performance milestones. We now have a robust framework to chart our collective progress, as well as lay out this ambitious forward view through the ProQure endeavour. We will publish a refreshed strategic intent in the year ahead.

Benchmarking performance

Through the NQCC Testbed Initiative and associated follow-on Technical Test & Evaluation programme, NQCC has both acted as an early customer to our commercial partners and driven assurance on platform performance. By building internal capability, as well as a suite of protocols and benchmarking tools, we are well placed to continue on this pathway of providing independent technical assurance across different modalities as the stages of the ProQure activity progress and as decisions are made to down-select on modalities and providers. Commercial due diligence will play its role, but technical due diligence is vital to support long-term procurement decision-making from a robust and transparent evidence base. I was delighted to see our Testbed Initiative publication earlier this month highlighting early progress. This programme will conclude in Spring 2027 and forms the foundations for our assurance work on ProQure.

Delivering value through applications

As the road-mapping for ProQure evolved, indeed from the earliest engagement on how the Quantum Missions would be delivered, the need to drive useful purpose from the technology as it was developed became a clear requirement. The NQCC SparQ Programme has been actively driving industry sector engagement in user adoption, access to QC cloud resources, and sharing best practices through engagement in quantum readiness as an industry challenge. As the technology has developed and the suite of available tools expanded, we have been able to grow our offer to end users with a new £750,000 partnership with Phasecraft announced this month. These software tools will be rolled out to our users in 2027.

Skills & workforce development

The final area of immediate overlap is the perennial challenge of skills and workforce development. Whether it is growing activities at the NQCC or scaling our companies in the UK, we all need talented people to deliver our programmes. Over the next 20 years, quantum computing should drive a 7% increase in productivity and create more than 100,000 jobs. Today, we have approximately 3,000 in quantum workforce across government, industry and academia.

Doctoral Training Centres alone will not produce the talent needed – indeed, our future quantum workforce is not solely the domain of PhD physicists. We need engineers, technical sales and marketing professionals, systems architects, software developers, data scientists, application specialists, domain champions and more. Through activities such as the annual NQCC Hackathon, our self-directed web training toolkit, and deep-dive quantum information science immersive courses in partnership with the University of Bristol, we are supporting the drive for continuous professional development and specific domain expertise, supporting our growing quantum sector.

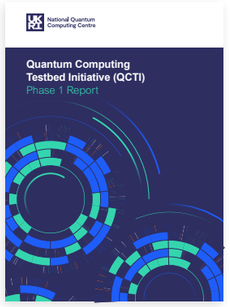


Building on £1 bn investment across the NQTP since 2014 in skills, research, and commercialisation of quantum technologies, the UK is doubling down on this commitment to a further £1 billion over the coming four years, driving quantum at scale, with a future £1 billion of advanced market commitment to procure large-scale quantum computing platforms capable of delivering a billion quantum operations by 2031.

Finally, as I look to the year ahead, I reflect on the forthcoming retirement of Sir Peter Knight, one of the founding voices of the UK National Quantum Technologies Programme, as he steps back from the quantum industry. Sir Peter has been an unwavering champion of UK research, our start-ups, the impact we are making and, above all, the people who make up our quantum ecosystem. He has also been a steadfast supporter of the NQCC, providing vision, guidance and unstinting encouragement throughout our journey. His insight, wisdom and support across our programmes will be greatly missed. Sir Peter has helped lay the foundations for the UK's quantum industry and has sown the seeds of a legacy that will endure for generations. As quantum technologies move from research into real-world deployment, transforming lives and creating lasting societal and economic impact, I hope he takes enormous pride in knowing just how much he has helped make this possible. It is a legacy of which he should be extraordinarily proud.

Dr Michael Cuthbert
Director, NQCC

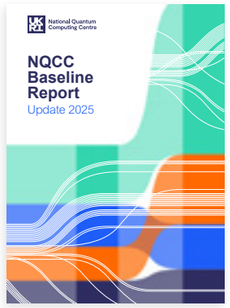
NQCC reports



Quantum Computing Testbed Initiative (QCTI)

On successful completion of the QCTI Phase 1, this report is published to highlight the achievements and near-term outcomes.

https://www.nqcc.ac.uk/wp-content/uploads/2026/10/NQCC_Quantum-Computing-Testbed-Initiative_Phase-1-report.pdf



NQCC Baseline Report – Update 2025

The 2025 update to the NQCC's annual Baseline Report is published, which analyses the quantum computing landscape in the UK.

https://www.nqcc.ac.uk/nqcc-baseline-report-update-2025-2/

NQCC-authored publications

Routing and wavelength assignment problems in optical networks – comparing formulations for solution by quantum annealing
Davies, E; Banfield, D; Weaver, B; White, C; Walker, N.
Journal of Optical Communications and Networking. 2025; 17: 12.
https://doi.org/10.1364/JOCN.553657

Efficiently routing information through optical networks is a challenging optimisation problem. This paper examines whether quantum annealing can offer advantages over conventional approaches, comparing several mathematical formulations and identifying the trade-offs that could influence future quantum-enabled telecommunications infrastructure.

Resource-Efficient Quantum Algorithms for Selected Hamiltonian Subspace Diagonalization
Vincent Graves ; Manqoba Q. Hlatshwayo; Theodoros Kapourniotis; Konstantinos Georgopoulos
Journal of Chemical Theory and Computation. 2026; 22: 15.
https://doi.org/10.1021/acs.jctc.6c00521

Understanding the properties of complex quantum systems often requires calculations that quickly become impractical on classical computers. This paper introduces more resource-efficient quantum algorithms for selected Hamiltonian subspace diagonalisation, reducing the computational demands of these calculations. The work represents an important step towards solving larger and more scientifically relevant problems on quantum computers.

A cross-platform study of near-term quantum optimisation algorithms on the graphene defect problem
Kieran McDowall, Theodoros Kapourniotis, Christopher Oliver, Phalgun Lolur and Konstantinos Georgopoulos
Physica Scripta. 2026; 101: 36.
10.1088/1402-4896/aea063

Finding the lowest-energy configuration of defects in graphene is a complex optimisation challenge with applications in materials discovery. This paper compares quantum annealing and variational quantum algorithms across commercially available quantum platforms, benchmarking them against classical methods and providing valuable insight into the practical capabilities of near-term quantum optimisation technologies.

Design and implementation of a modular laser system for AMO experiments
Theophilo, K; Thomas, S; Croft, G; Lekhai, Y; Owens, A; Smith, D; Muralidharan, S; Deans, C.
arXiv. 2026.
https://doi.org/10.48550/arXiv.2603.17697

Reliable laser systems are essential for many quantum technologies. This paper presents a modular platform that combines laser delivery, stabilisation and control within a scalable architecture, demonstrating an approach that could improve the robustness, maintainability and reproducibility of future quantum computing systems.

Energy efficiency of quantum computers
Miquel Carrasco-Codina; Pau Escofet; Paul Hilaire; Ariane Soret; Sam Nerenberg; Victor Champain;
arXiv. 2026.
https://doi.org/10.48550/arXiv.2605.15090

As quantum computing moves towards practical deployment, understanding its energy requirements becomes increasingly important. This paper proposes a framework for comparing the energy efficiency of different hardware platforms, providing a foundation for assessing the long-term sustainability and operational costs of quantum computing.

Quantum Accreditation with Non-Clifford Two-qubit Gates
Jackson, Andrew; Kapourniotis, Theodoros; Datta, Animesh
arXiv. 2026.
10.48550/arxiv.2605.19205

Trust in quantum computing depends on being able to verify that calculations have been performed correctly. This work extends accreditation techniques to a broader class of quantum operations, helping to ensure the reliability of results as quantum processors become more capable and widely deployed.

Spectral Gap Informed Ramp QAOA
McDowall, Kieran; Georgopoulos, Konstantinos; Wallden, Petros
arXiv. 2026.
10.48550/arxiv.2604.24580

Finding effective parameter schedules remains a key challenge for quantum optimisation. This paper introduces a ramp-based approach informed by spectral-gap analysis, demonstrating improved performance across a range of optimisation problems. The work provides new insight into how quantum algorithms can be tuned to make better use of near-term quantum hardware.

The born ultimatum: Conditions for classical surrogation of quantum generative models with correlators
Mario Herrero-Gonzalez, Brian Coyle,1, Kieran McDowall, Ross Grassie, Sjoerd Beentjes, Ava Khamseh, and Elham Kashef
arXiv. 2025.
https://doi.org/10.48550/arXiv.2511.01845

Can classical models replicate the behaviour of quantum generative models? This paper explores that question, identifying situations where classical approaches can act as effective substitutes and where uniquely quantum behaviour may still provide an advantage, particularly for future machine learning applications.

A Technical Review of Quantum Computing Use Cases for Finance and Economics
MQ Hlatshwayo; Manav Babel; Dalila Islas-Sanchez; Konstantinos Georgopoulos
Quantum Rep. 2026; 8: 26.
DOI: https://doi.org/10.3390/quantum8010026

This paper explores the potential of quantum computing in finance and economics. It reviews key quantum algorithms and their possible applications in portfolio optimisation, risk modelling, option pricing, forecasting, and fraud detection. The authors also assess the current state of quantum technology, highlighting both its promise and the technical challenges that must be overcome before widespread practical adoption.

NQCC-attributed publications

Localized statistics decoding for quantum low-density parity-check codes
https://doi.org/10.1038/s41467-025-63214-7

High-threshold, low-overhead and single-shot decodable fault-tolerant quantum memory
https://doi.org/10.1103/67xf-zdjb

An almost-linear time decoding algorithm for quantum LDPC codes under circuit-level noise
https://doi.org/10.1038/s41534-026-01292-1

Quantum cryptography beyond key distribution: theory and experiment
https://doi.org/10.1103/p84v-1xqv

Heuristic Time Complexity of NISQ Shortest-Vector-Problem Solvers
10.1109/TQE.2025.3620104

Hybrid Authentication Protocols for Advanced Quantum Networks
https://doi.org/10.48550/arXiv.2504.11552

Simultaneous Estimation of Nonlinear Functionals of a Quantum State
10.1109/TIT.2026.3699531

Logical accreditation: a framework for efficient certification of fault-tolerant computations
https://doi.org/10.1103/7pj4-gcbq

Long-Range Entangling Operations via Josephson Junction Metasurfaces
10.1109/QCE65121.2025.10394

Dynamic Josephson Junction Metasurfaces for Multiplexed Control of Superconducting Qubits
https://doi.org/10.1103/n6gs-zlhc

Low Crosstalk in a Scalable Superconducting Quantum Lattice
https://doi.org/10.1140/epjqt/s40507-026-00465-3

Automating quantum computing laboratory experiments with an agent-based AI framework
10.1016/j.patter.2025.101372

Quantum Theory of Distributed-Feedback Parametric Amplifiers and Oscillators
https://doi.org/10.1002/qute.202500935

A low-circuit-depth quantum computing approach to the nuclear shell model
https://doi.org/10.1007/s44464-026-00009-9

Scalable quantum computation of Quantum Electrodynamics beyond one spatial dimension
https://doi.org/10.48550/arXiv.2510.27668

High-order splitting of non-unitary operators on quantum computers
https://doi.org/10.48550/arXiv.2511.19659

Quantum-assisted domination games on cycle graphs
doi:10.1088/1367-2630/ae73a9.

Quantum Nonlocal Games on Graph Ensembles
https://doi.org/10.48550/arXiv.2606.16784aa

Quantum Generative Diffusion Model for Real World Time Series
https://doi.org/10.48550/arXiv.2606.27561

Composably Secure Delegated Quantum Computation with Weak Coherent Pulses
10.48550/arxiv.2503.08559

Harmonic Control of Dynamical Freezing in Programmable Rydberg Atom Arrays
10.48550/arxiv.2511.09633

How "Quantum" is your Quantum Computer? Macrorealism-based Benchmarking via Mid-Circuit Parity Measurements
10.48550/arxiv.2511.15881

Investigating methods to solve large windfarm optimization problems with a minimum number of qubits using circuit-based quantum computers
10.48550/arxiv.2512.17582Q

Qubit-efficient variational algorithm for nuclear structure
10.48550/arxiv.2605.30261

Randomised measurements of a disorder-induced entanglement transition in a neutral atom quantum processor
10.48550/arxiv.2604.24854

Simulating Supersymmetric Quantum Mechanics Using Variational Quantum Algorithms
10.48550/arxiv.2603.18749

Solving Einstein Field Equations on a Digital Quantum Computer
10.48550/arxiv.2606.20975

Spectral quantum algorithm for passive scalar transport in shear flows
10.1038/s41598-025-27219-y

Spin Chain Quantum Communication on a Trapped-Ion Processor
10.48550/arxiv.2607.12999

Impact of Data Loss in Postprocessing on Training and Inference of Quantum Neural Networks
https://doi.org/10.48550/arXiv.2609.05060

A slightly improved upper bound for quantum statistical zero-knowledge
10.48550/arxiv.2512.11597

Accreditation Against Limited Adversarial Noise
10.1002/qute.202500337

Adiabatic-Inspired Hybrid Quantum-Classical Methods for Molecular Ground State Preparation
10.48550/arxiv.2512.14449

Agnostic Process Tomography
10.1103/q2nb-zg9m

Authentication in Quantum Networks
10.48550/arxiv.2606.30636

Boson sampling beyond the dilute regime: second moments and anti-concentration
10.48550/arxiv.2604.14323

Circuit Harmonic Matrices: A Spectral Framework for Quantum Machine Learning
10.48550/arxiv.2604.04292

Classical simulation and model concentration in passive linear optics
10.48550/arxiv.2607.24728

Crosstalk dispersion and spatial scaling in superconducting qubit arrays
10.1103/2zb3-4vwq

Distributed Quantum Property Testing with Communication Constraints
10.48550/arxiv.2604.05962

Double-Bracket Algorithmic Cooling
10.48550/arxiv.2510.00302

Double-ended palindromic trees in linear time
10.1016/j.ic.2025.105379

Electromagnetic modes in spherical cavities: Angular spectra, dispersion relations, and self-adjoint extensions
10.1103/6vg1-k5zb

Entanglement of minimal dimension and a class of local state discrimination problems
10.48550/arxiv.2603.28284

Error-mitigation aware benchmarking strategy for quantum optimization problems
10.48550/arxiv.2601.18680

Exact Multimode Quantization of Superconducting Circuits via Boundary Admittance and Continued Fractions
10.48550/arxiv.2601.04407

Forward-Assisted Purification: A Spatiotemporal Framework Beyond Conventional Limits
10.48550/arxiv.2606.02990

Improved Quantum Lifting by Coherent Measure-and-Reprogram
10.48550/arxiv.2509.09896

Instance-Optimal Quantum State Certification with Entangled Measurements
10.1145/3798129.3800759

Learning junta distributions, quantum junta states, and QAC^0 circuits
10.48550/arxiv.2410.15822

Methods for non-variational heuristic quantum optimisation
10.48550/arxiv.2602.01353

Narrowband heralded single photons via Bragg grating inscription in germanium-doped photonic crystal fiber
10.48550/arxiv.2603.09679

NISQ Security and Complexity via Simple Classical Reasoning
10.48550/arxiv.2509.09900

Non-Markovian noise limits for sustaining entanglement in multiparty quantum states
10.1103/s963-rsm5

On estimating Schatten norm and power distances between quantum states
10.48550/arxiv.2505.00457

On Estimating the Trace of Quantum State Powers
10.1109/tit.2026.3683891

Optimal Quantum State Testing Even with Limited Entanglement
10.48550/arxiv.2604.07460

Phase-sensitive characterization of a quantum frequency converter by spectral interferometry
10.48550/arxiv.2602.06796

Photonic crystal fibre cavities for quantum light generation
10.1117/12.3080839
Quantum algorithms for Uhlmann transformation
10.48550/arxiv.2509.03619

Quantum data structure for range minimum query
10.1016/j.jcss.2026.103756

Quantum Elastic Network Models and their Application to Graphene
10.48550/arxiv.2601.05161

Quantum enhanced rare event discovery and sampling
10.48550/arxiv.2606.06316

Quantum Lower Bounds by Sample-to-Query Lifting
10.1137/24m1638616

Quantum Theory of Distributed-Feedback Parametric Amplifiers and Oscillators
10.1002/qute.202500935

Quench Spectroscopy of Magnetic Excitations on a Superconducting Quantum Processor
10.48550/arxiv.2607.02673

Query-Optimal and Sample-Optimal Quantum Algorithms for Estimating Fidelity to a Pure State
10.48550/arxiv.2506.23650

Routing Anonymity and Identifiability of Noisy Quantum Hardware
10.48550/arxiv.2607.05281

Scalable Message-Passing Quantum Graph Neural Networks in the Weisfeiler-Leman Hierarchy
10.48550/arxiv.2606.26873

Simulating Black Hole Thermality and Interior Scrambling on a Superconducting Quantum Processor
10.48550/arxiv.2608.19318

Statistically-Secure Bit Commitment and Coin Flipping Protocols Based on Quantum Hardware Assumptions
10.48550/arxiv.2608.11187

Towards Optimal Quantum Estimators for State Frame Potential
10.48550/arxiv.2608.24711

When quantum and classical models disagree: learning beyond minimum norm least square
10.1038/s41534-026-01217-y

On estimating the quantum distance
https://doi.org/10.4230/LIPIcs.ESA.2025.106
Scalable Message-Passing Quantum Graph Neural Networks in the Weisfeiler–Leman Hierarchy
https://doi.org/10.48550/arXiv.2606.26873

On-chip verified quantum computation with an ion-trap quantum processing unit
10.1103/jpms-v3kw

A unified linear algebraic framework for physical models and generalized contextuality
https://doi.org/10.48550/arXiv.2512.10000

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National Quantum Computing Centre

Rutherford Appleton Laboratory
Harwell Campus, Didcot, Oxfordshire, OX11 0QX

Email: **nqccinfo@nqcc.ac.uk**
Website: **www.nqcc.ac.uk**
Follow us: **linkedin.com/company/nqcc/**

Released on 5 November 2026
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