TROY TECHNICAL

QUANTUM COMPUTING
WEEKLY REPORT

October 24 - October 30, 2026 | Issue 2026-W43

Verified computational advantage, error control and usable access

13	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-10-30 | English edition | fixed approved cover artwork



Quantum Computing: the boundary moved from isolated claims to qualification evidence

13 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | QUBIT DEVICE

Binary Quantum Codes: 28 New Certified Error Correction Codes

Researchers from the Air Force Engineering University have developed a technique to rigorously certify the minimum distance of binary quantum error correction codes.

SIGNAL 02 | CONTROL STACK

ABCI-Q: AIST and QuEra's Quantum-HPC Integration Roadmap

AIST has launched ABCI-Q, a full-stack quantum-HPC testbed within the G-QuAT facility designed to integrate quantum processors into high-performance computing environments.

SIGNAL 03 | ERROR CORRECTION

China's Neutral-Atom Ecosystem: 2026 Scaling and Commercial Specs

Chinese research and commercial entities have achieved world-leading physical benchmarks in neutral-atom quantum computing, including 11,000-atom trapping and 99.84% gate fidelity. While lagging in system-level quantum error correction compared to U.S.

SIGNAL 04 | SYSTEM ACCESS

IQM Emerald: Full-Chip Entanglement of 54-Qubit Processor

IQM Quantum Computers has achieved a Greenberger-Horne-Zeilinger (GHZ) entangled state across all 54 qubits of its cloud-accessible Emerald system.

DECISION

Focus this week's management attention on verified computational advantage, error control and usable access. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: benchmark valuable workloads against classical alternatives, including total execution and validation cost.
2. Suppliers: tie components and control systems to fidelity, uptime, calibration and scaling evidence.
3. Executives: track error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Five numbers or evidence anchors that require conditions

99.84%
A08

SOURCE-BOUND CONDITION
Chinese research and commercial entities have achieved world-leading physical benchmarks in neutral-atom quantum computing, including 11,000-atom trapping and 99.84% gate fidelity.

54 qubits
A02

SOURCE-BOUND CONDITION
IQM Quantum Computers has achieved a Greenberger-Horne-Zeilinger (GHZ) entangled state across all 54 qubits of its cloud-accessible Emerald system.

97%
A12

SOURCE-BOUND CONDITION
The quantum-assisted model achieved a 97% chemical validity rate for generated molecular representations, significantly outperforming classical models.

110 years
A05

SOURCE-BOUND CONDITION
The team generated a sample ensemble in 19 seconds that would take approximately 110 years to reproduce on the Frontier supercomputer.

P05
A12

SOURCE-BOUND CONDITION
Shionogi has won first place in the Quality of Life category of the NEDO Challenge for integrating D-Wave's annealing quantum computing into a generative AI model for molecular design.

HOW TO USE THESE NUMBERS
Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Qubit device

P01/P06

Researchers from the Air Force Engineering University have developed a technique to rigorously certify the minimum distance.

2

Control stack

P02/P07

AIST has launched ABCI-Q, a full-stack quantum-HPC testbed within the G-QuAT facility designed to integrate quantum.

3

Error correction

P03/P08

Chinese research and commercial entities have achieved world-leading physical benchmarks in neutral-atom quantum computing.

4

System access

P04/P09

IQM Quantum Computers has achieved a Greenberger-Horne-Zeilinger (GHZ) entangled state across all 54 qubits of its.

5

Applications

P05/P10

Shionogi has won first place in the Quality of Life category of the NEDO Challenge for integrating D-Wave's annealing quantum.

EVIDENCE REQUIRED AT EACH HANDOFF

Qubit device to Control stack	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.
Control stack to Error correction	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.
Error correction to System access	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.
System access to Applications	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

Priority map: maturity and next decision locus



P01	Binary Quantum Codes: 28 New Certified Error Correction Codes Tech / process | cue: no system/business cue
P02	ABCI-Q: AIST and QuEra's Quantum-HPC Integration Roadmap System / adoption | cue: Integration
P03	China's Neutral-Atom Ecosystem: 2026 Scaling and Commercial Specs System / adoption | cue: Commercial
P04	IQM Emerald: Full-Chip Entanglement of 54-Qubit Processor Business / rules | cue: fid
P05	Shionogi: Quantum-assisted AI for drug discovery and NEDO award System / adoption | cue: integrating
P06	Fujitsu Research: QPE Roadmap for Early-FTQC Molecular Simulation Tech / process | cue: no system/business cue
P07	Trapped-Ion Control: University of Tokyo's 8mV/m Stray Field Method Tech / process | cue: no system/business cue
P08	BlueQubit: Quantum Advantage in RCS on IBM Nighthawk r2 Tech / process | cue: no system/business cue
P09	Quantum State Smoothing: RIKEN and UTokyo's 2026 Demonstration Tech / process | cue: no system/business cue
P10	Surface Code Teleportation: 125-Qubit Processor Specs and Distance 7 Results Tech / process | cue: no system/business cue

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems). Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01 Binary Quantum Codes: 28 New Certified Error Correction Codes

A07 | Qubit device | Pilot

Date not stated

FACT

Researchers from the Air Force Engineering University have developed a technique to rigorously certify the minimum distance of binary quantum error correction codes. This method has certified 21 record-breaking codes and improved 34 others, moving beyond previous estimations to provide precise performance verification.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P02 ABCI-Q: AIST and QuEra's Quantum-HPC Integration Roadmap

A11 | Control stack | Research

Date not stated

FACT

AIST has launched ABCI-Q, a full-stack quantum-HPC testbed within the G-QuAT facility designed to integrate quantum processors into high-performance computing environments. The platform combines NVIDIA H100 GPUs with neutral-atom and optical quantum hardware to enable hybrid workflows and agent-driven system operation.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03 China's Neutral-Atom Ecosystem: 2026 Scaling and Commercial Specs

A08 | Error correction | Joint evaluation

Date not stated

FACT

Chinese research and commercial entities have achieved world-leading physical benchmarks in neutral-atom quantum computing, including 11,000-atom trapping and 99.84% gate fidelity. While lagging in system-level quantum error correction compared to U.S. programs, China has rapidly transitioned laboratory prototypes into cabinet-scale commercial hardware.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 3/5 | DECISION LOCUS: SYSTEM / ADOPTION

P04 IQM Emerald: Full-Chip Entanglement of 54-Qubit Processor

A02 | System access | Research

Date not stated

FACT

IQM Quantum Computers has achieved a Greenberger-Horne-Zeilinger (GHZ) entangled state across all 54 qubits of its cloud-accessible Emerald system. The processor reached a fidelity of 0.516 with readout error mitigation, surpassing the 0.500 threshold required to distinguish genuine entanglement from noise. This result enables cloud customers to utilize the entire processor for computations rather than a fraction of the chip.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05 Shionogi: Quantum-assisted AI for drug discovery and NEDO award

A12 | Applications | Research

Date not stated

FACT

Shionogi has won first place in the Quality of Life category of the NEDO Challenge for integrating D-Wave's annealing quantum computing into a generative AI model for molecular design. The quantum-assisted model achieved a 97% chemical validity rate for generated molecular representations, significantly outperforming classical models. This research demonstrates the potential for quantum computing to increase the efficiency of early-stage drug candidate identification.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

P06 Fujitsu Research: QPE Roadmap for Early-FTQC Molecular Simulation

A09 | Qubit device | Pilot

Date not stated

FACT

Researchers from Fujitsu Research and Osaka University have demonstrated that ground-state energy estimation for complex molecular systems is achievable using approximately 10^5 physical qubits. By targeting an " early-FTQC regime" with partial fault tolerance, the team suggests that chemically accurate simulations of strongly correlated systems can be performed before full fault-tolerant quantum computers are available.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07 Trapped-Ion Control: University of Tokyo's 8mV/m Stray Field Method

A13 | Control stack | Pilot

Date not stated

FACT

Researchers at The University of Tokyo have developed a technique to stabilize trapped ions against stray electric fields with a statistical uncertainty of 8mV/m. By converting ion displacement into measurable qubit signals, the method enables precise micromotion compensation compatible with advanced quantum sensing. This breakthrough allows the use of complex motional states previously inaccessible due to interference.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P08 BlueQubit: Quantum Advantage in RCS on IBM Nighthawk r2

A05 | Error correction | Research

Date not stated

FACT

BlueQubit, EPFL, and the XPRIZE Foundation demonstrated quantum computational advantage using random-circuit sampling (RCS) on IBM's 120-qubit ibm_phoenix processor. The team generated a sample ensemble in 19 seconds that would take approximately 110 years to reproduce on the Frontier supercomputer. This result validates the performance of the Nighthawk r2 architecture in executing classically hard quantum tasks.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09 Quantum State Smoothing: RIKEN and UTokyo's 2026 Demonstration

A10 | System access | Joint evaluation

Date not stated

FACT

An international research group led by RIKEN and the University of Tokyo has successfully demonstrated " quantum state smoothing," a method that estimates the dynamics of light's quantum state by combining past and future observation records. This technique achieves higher precision than conventional methods, providing a critical foundation for optimizing measurement-induced quantum computers and other quantum information processing systems.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 19/25 | MATURITY 3/5 | DECISION LOCUS: TECH / PROCESS

P10 Surface Code Teleportation: 125-Qubit Processor Specs and Distance 7 Results

A03 | Applications | Pilot

Date not stated

FACT

Researchers from Zhejiang University and The Hong Kong University of Science and Technology (Guangzhou) demonstrated robust quantum teleportation of a topological rotated surface code using a 125-qubit superconducting processor. The team achieved code distances up to 7, establishing a new benchmark for scaling quantum error correction and distributed fault-tolerant quantum computation.

WHY IT MATTERS

The decision relevance is verified computational advantage, error control and usable access. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie components and control systems to fidelity, uptime, calibration and scaling evidence.

ACTION

Within 30 days, benchmark valuable workloads against classical alternatives, including total execution and validation cost; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW | 0-30 DAYS	NEXT | 1-12 MONTHS	LATER | 1-5 YEARS
Operating companies	benchmark valuable workloads against classical alternatives, including total execution and validation cost	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	tie components and control systems to fidelity, uptime, calibration and scaling evidence	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map error rates, logical qubits, workload advantage, uptime, cost and roadmap timing.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW | 0-30 DAYS
Evidence ledger
Owner: Strategy + quality
Deliverable: claim, source, condition, owner

NOW | 0-30 DAYS
Risk screen
Owner: Procurement + legal
Deliverable: unknowns, alternatives, stop

NEXT | 1-12 MONTHS
Joint qualification
Owner: R&D + supplier
Deliverable: process window and failure data

NEXT | 1-12 MONTHS
Commercial gate
Owner: Business + finance
Deliverable: unit economics and capacity

LATER | 1-5 YEARS
Platform strategy
Owner: Executive team
Deliverable: portfolio and interface roadmap

LATER | 1-5 YEARS
Service layer
Owner: Operations + channel
Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	**Quality**	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	**R&D**	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	**Business**	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	**Operations**	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-13

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	IBM Quantum Interconnect: 120-Qubit Processor Modular Scaling	https://thequantuminsider.com/2026/10/27/ibm-connects-two-120-qubit-processors-with-99-state-transfer-fidelity/
A02	IQM Emerald: Full-Chip Entanglement of 54-Qubit Processor	https://thequantuminsider.com/2026/10/29/iqm-full-chip-entanglement-54-qubit-processor/
A03	Surface Code Teleportation: 125-Qubit Processor Specs and Distance 7 Results	https://quantumzeitgeist.com/hefei-quantum-teleportation-works-surface-code/
A04	Mamba State-Space Decoder: Yonsei University's QEC Latency Fix	https://quantumcomputingreport.com/yonsei-university-researchers-develop-mamba-state-space-neural-decoder-to-enable-real-time-quantum-error-correction/
A05	BlueQubit: Quantum Advantage in RCS on IBM Nighthawk r2	https://quantumcomputingreport.com/bluequbit-benchmarks-quantum-computational-advantage-in-random-circuit-sampling-on-ibm-nighthawk-r2-hardware/
A06	Silicon Spin Qubits: Scaling Quantum Processors via Shared Control	https://www.sciencedaily.com/releases/2026/10/261024222024.htm
A07	Binary Quantum Codes: 28 New Certified Error Correction Codes	https://quantumzeitgeist.com/quantum-error-correction-binary-stabilizer-codes-additive-qc/
A08	China's Neutral-Atom Ecosystem: 2026 Scaling and Commercial Specs	https://quantumcomputingreport.com/review-unpacks-chinas-surging-neutral-atom-ecosystem-world-record-arrays-commercial-systems-and-scaling-milestones/
A09	Fujitsu Research: QPE Roadmap for Early-FTQC Molecular Simulation	https://quantumzeitgeist.com/fujitsu-research-iron-sulfur-clusters-within/
A10	Quantum State Smoothing: RIKEN and UTokyo's 2026 Demonstration	https://www.nikkei.com/article/DGXZRSP714661_Q6A031C2000000/
A11	ABCI-Q: AIST and QuEra's Quantum-HPC Integration Roadmap	https://quantumzeitgeist.com/abci-q-quantum-hpc-testbed-aist/
A12	Shionogi: Quantum-assisted AI for drug discovery and NEDO award	https://jen.jiji.com/jc/eng_bw?k=20261028058314
A13	Trapped-Ion Control: University of Tokyo's 8mV/m Stray Field Method	https://quantumzeitgeist.com/trapped-ions-stray-electric-fields-measurement-fidelity/

QuantumComputing — Selected Articles

Date: 2026-10-31

Articles: 13

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#07 Binary Quantum Codes: 28 New Certified Error Correction Codes

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#10 Quantum State Smoothing: RIKEN and UTokyo's 2026 Demonstration

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#12 Shionogi: Quantum-assisted AI for drug discovery and NEDO award

#13 Trapped-Ion Control: University of Tokyo's 8mV/m Stray Field Method

#01 IBM Quantum Interconnect: 120-Qubit Processor Modular Scaling

Published October 27, 2026 The Quantum Insider USA

OVERVIEW

IBM researchers linked two 120-qubit Nighthawk R1 processors using four superconducting cables, achieving an average quantum state-transfer fidelity of 99%. This demonstration of a multichannel interconnect enables entanglement and operations across separate chips, providing a pathway to scale quantum computers beyond the limits of a single processor.

IN DEPTH

Key Findings

IBM has demonstrated a multichannel quantum interconnect between two 120-qubit superconducting processors, achieving state-transfer fidelities of at least 98.86% across four links, with a peak fidelity of 99.29%. The researchers successfully performed controlled-Z gates between qubits on separate processors with an average fidelity of 94.75% and a maximum of 96.42%. Furthermore, the team generated entangled pairs across chips and extended entanglement to groups of four and six computing qubits, with statistically corrected fidelities of 91.70% and 90.87%, respectively.

Technical Details

The experiment utilized two IBM Nighthawk R1 processors connected by four aluminum coaxial cables, each approximately 80 centimeters long. These cables functioned as superconducting microwave links within an ultracold environment. To facilitate the transfer of quantum information, the team used dedicated qubits at the cable ends and adjustable coupling devices. The cables were attached perpendicular to the processor surface to allow for higher connection density compared to previous parallel designs.

The researchers employed network benchmarking to isolate transfer errors from preparation and measurement errors. While state transfers were highly efficient, complete operations—which combined two state transfers, three local two-qubit gates, and single-qubit controls—showed lower fidelity due to the increased number of steps.

Background and Context

Scaling quantum computers is often limited by the physical constraints of a single chip. A modular approach divides workloads among multiple processors, but requires links that can preserve fragile quantum states and support entanglement. While previous experiments used smaller modules with single connections, this work represents the first demonstration of a multichannel interconnect between large superconducting processors.

Significance and Outlook

This modular architecture allows developers to expand computing capacity by linking separate chips. However, IBM notes that further improvements are required in qubit stability, magnetic shielding, and manufacturing before this approach can be fully scaled. Additionally, the current experiment only wired and measured a subset of the 240 total qubits to accelerate development.

Source: https://thequantuminsider.com/2026/10/27/ibm-connects-two-120-qubit-processors-with-99-state-transfer-fidelity/

Collected: October 31, 2026 | Automated Research System (AI)

#02 IQM Emerald: Full-Chip Entanglement of 54-Qubit Processor

Published October 29, 2026 The Quantum Insider フィンランド

OVERVIEW

IQM Quantum Computers has achieved a Greenberger–Horne–Zeilinger (GHZ) entangled state across all 54 qubits of its cloud-accessible Emerald system. The processor reached a fidelity of 0.516 with readout error mitigation, surpassing the 0.500 threshold required to distinguish genuine entanglement from noise. This result enables cloud customers to utilize the entire processor for computations rather than a fraction of the chip.

IN DEPTH

Key Findings

IQM Quantum Computers has demonstrated simultaneous entanglement across all 54 qubits of its superconducting quantum processor, the IQM Emerald. The company reported a fidelity of 0.516 for the full 54-qubit processor when readout error mitigation (REM) was applied. Without REM, the system achieved a fidelity of 0.515 at 40 qubits. Both figures exceed the classical threshold of 0.500, confirming the presence of genuine entanglement.

Technical Details

The demonstration utilized the Greenberger–Horne–Zeilinger (GHZ) state as a benchmark for large-scale entanglement. To achieve this, IQM implemented an automated state-preparation routine that optimizes the selection of two-qubit gates. This routine balances gate fidelity against qubit idle time, selecting both the specific qubits and the gate order to minimize idle time during state construction.

The achievement is the result of approximately one year of hardware and calibration development. Technical improvements include:

- An updated calibration methodology and an improved gate set.
- The deployment of error-reduction tools, including qubit selection and dynamical decoupling.
- A reduction in quantum operation error rates by up to 50%.

Background & Context

Historically, users of the IQM Emerald could reliably utilize approximately 30 qubits within a single algorithm. Furthermore, many studies on large quantum chips typically employ only 10 to 20 qubits, even when the hardware capacity is higher. The current result demonstrates that the entire processor can work together on a single computation.

Significance & Outlook

The ability to entangle the entire chip indicates that every qubit and connection within the circuit is functioning correctly. This performance is now available to IQM's cloud customers, allowing them to draw on the full-chip capacity. This development is part of a broader strategy to automate quantum computer operations, which includes AI-driven agentic calibration work to automate the tuning of quantum systems.

Source: https://thequantuminsider.com/2026/10/29/iqm-full-chip-entanglement-54-qubit-processor/

Collected: October 31, 2026 | Automated Research System (AI)

#03 Surface Code Teleportation: 125-Qubit Processor Specs and Distance 7 Results

Published October 27, 2026 Quantum Zeitgeist

OVERVIEW

Researchers from Zhejiang University and The Hong Kong University of Science and Technology (Guangzhou) demonstrated robust quantum teleportation of a topological rotated surface code using a 125-qubit superconducting processor. The team achieved code distances up to 7, establishing a new benchmark for scaling quantum error correction and distributed fault-tolerant quantum computation.

IN DEPTH

Key Findings

Researchers have successfully demonstrated the teleportation of logical states encoded within a topological rotated surface code on a superconducting quantum processor. The experiment achieved a new benchmark in scaling quantum error correction by reaching code distances up to 7. This result indicates that superconducting processors are a viable platform for realizing fault-tolerant quantum computation and simulating topological quantum matter.

Technical Details

The experiment utilized a 125-qubit superconducting processor configured as two square lattices, designated as Alice and Bob. To ensure high-fidelity operations, the system achieved the following performance metrics:

- Single-qubit gate fidelity: 99.94% (median)
- Two-qubit gate fidelity: 99.64%
- Readout fidelity: 99.08% (median), achieved by pumping qubits from the |1〉 state to the |2〉 state before the readout pulse.

The team used tunable nearest-neighbor couplings to facilitate rapid two-qubit gates. For the distance 7 configuration, specific adjustments were made to the qubits on Bob’s lattice boundary. To improve performance, researchers injected "magic resources" via coherent qubit rotations, which restored electric–magnetic duality symmetry and minimized the entanglement resources required for successful teleportation.

Background & Context

The approach is based on Z 2 lattice gauge theory and topological order. By systematically adjusting the strength of local entangling gates across a defined threshold, the team determined the teleportation phase diagram. This method moves the system beyond the limitations of Clifford circuits, enhancing the entangling threshold—the minimum entanglement level necessary for reliable operation.

Significance & Outlook

This demonstration proves that the theoretical advantages of surface codes can be realized in practice. While challenges remain regarding coherence periods and scaling to larger qubit counts, the combination of high-fidelity gates and innovative entanglement enhancement provides a blueprint for future research. The ultimate objective is the creation of a network of interconnected quantum computers capable of solving currently intractable problems.

Source: https://quantumzeitgeist.com/hefei-quantum-teleportation-works-surface-code/

Collected: October 31, 2026 | Automated Research System (AI)

#04 Mamba State-Space Decoder: Yonsei University's QEC Latency Fix

Published October 28, 2026 Quantum Computing Report South Korea

OVERVIEW

Researchers at Yonsei University have developed a neural quantum error correction (QEC) decoder using Mamba structured state-space architecture to reduce computational complexity from $O(d^4)$ to $O(d^2)$. The model matches the accuracy of Transformer-based decoders while eliminating self-attention bottlenecks, enabling the potential for real-time feedback on physical quantum hardware.

IN DEPTH

Key Findings

Yonsei University researchers have introduced a neural QEC decoder based on the Mamba structured state-space architecture that significantly lowers the computational overhead of deep-learning decoding. The team demonstrated that this architecture reduces complexity from $O(d^4)$ to $O(d^2)$ in code distance d. In benchmarks using experimental memory and the Google Quantum AI Sycamore hardware dataset, the Mamba decoder matched the accuracy of Transformer-based models, such as AlphaQubit, while providing a distinct advantage in error suppression when accounting for decoder-induced latency noise.

Technical Details

In planar surface codes, syndrome extraction generates sequences based on the number of stabilizers ($N_{stab} = d^2 - 1$). While standard Transformer decoders rely on multi-head self-attention mechanisms that perform pairwise comparisons between all stabilizer tokens—resulting in $O(d^4)$ scaling—the Mamba decoder utilizes selective state-space layers. This approach employs input-dependent linear scans to maintain historical syndrome contexts within compressed hidden states, bypassing the quadratic bottlenecks of self-attention.

Background and Context

The necessity for this architecture stems from the strict timing constraints of fault-tolerant quantum computing. On superconducting hardware, physical cycle times typically range between 200 and 1,000 ns; if a decoder cannot process syndromes within this window, idling physical data qubits accumulate uncorrected environmental noise. Under the circuit-level depolarizing SI1000 model, the latency-induced error gap between the Mamba model and Transformer models expanded monotonically from $d = 3$ through $d = 9$.

Significance and Outlook

While the Mamba architecture resolves the scaling bottleneck, the researchers note that physical deployment requires overcoming edge-compute limitations. To execute inference within sub-microsecond cycle budgets, the recurrent core, dilated convolutions, and ResNet feature embedders must be ported onto custom application-specific integrated circuits (ASICs) or low-latency field-programmable gate arrays (FPGAs). The research has been published in *npj Quantum Information*, with numerical datasets available on GitHub.

Source: https://quantumcomputingreport.com/yonsei-university-researchers-develop-mamba-state-space-neural-decoder-to-enable-real-time-quantum-error-correction/

Collected: October 31, 2026 | Automated Research System (AI)

#05 BlueQubit: Quantum Advantage in RCS on IBM Nighthawk r2

Published October 28, 2026 Quantum Computing Report USA

OVERVIEW

BlueQubit, EPFL, and the XPRIZE Foundation demonstrated quantum computational advantage using random-circuit sampling (RCS) on IBM's 120-qubit ibm_phoenix processor. The team generated a sample ensemble in 19 seconds that would take approximately 110 years to reproduce on the Frontier supercomputer. This result validates the performance of the Nighthawk r2 architecture in executing classically hard quantum tasks.

IN DEPTH

Key Findings

Researchers have demonstrated quantum computational advantage via random-circuit sampling (RCS) using the IBM Nighthawk r2 architecture. Utilizing the 120-qubit ibm_phoenix processor, the team operated over 61 active qubits. The experiment produced 106 samples in 19 seconds of active quantum processing unit (QPU) time. Under baseline rejection-sampling assumptions, reproducing this ensemble on the Oak Ridge National Laboratory Frontier supercomputer would require an estimated 1.2 × 1027 machine floating-point operations (FLOPs), totaling roughly 110 years of exascale compute.

Technical Details

The experiment employed a four-color brickwork schedule across 102 active couplers, averaging 25.5 native controlled-Z (CZ) gates per cycle. Fidelity was verified across depths of 4 to 40 cycles using mirror benchmarking with randomized compiling and multi-partition cross-entropy benchmarking (XEB). At a depth of 36 cycles, which incorporates 918 CZ gates, the experimental fidelity reached FXEB ≈ 2.3 × 10−3. This depth was selected because tensor-network contraction costs saturate at full system size with a width of w = 64.

Background & Context

The study compared the Nighthawk r2 architecture against its predecessor, the Nighthawk r1 (ibm_miami). The per-cycle fidelity improved from 0.836 on the r1 to 0.872 on the r2, resulting in a fidelity gain of more than an order of magnitude at deep cycle depths. To ensure the results were not due to classical simulations of decoupled sub-circuits, the team performed "severing attacks." At 36 cycles, all severing-attack modes scored below 2.2 × 10−4, confirming the benchmark operates on the classically hard side of the noise-induced phase transition.

Significance & Outlook

The circuits were submitted via standard Qiskit Runtime cloud queues without bespoke hardware calibration, demonstrating the accessibility of the hardware. While the current runtime estimate provides a baseline, the authors note that future classical developments—such as GPU-accelerated multi-amplitude reuse, matrix-product state approximations, or batched tensor slicing—could potentially lower classical runtimes.

Source: https://quantumcomputingreport.com/bluequbit-benchmarks-quantum-computational-advantage-in-random-circuit-sampling-on-ibm-nighthawk-r2-hardware/

#06 Silicon Spin Qubits: Scaling Quantum Processors via Shared Control

Published October 25, 2026 ScienceDaily USA

OVERVIEW

Researchers at the RIKEN Center for Emergent Matter Science have achieved high-fidelity control of multiple silicon spin qubits operating simultaneously using shared microwave control lines. By implementing a pairwise calibration method to mitigate the AC Stark shift, the team maintained fidelity above 99.99% for up to three qubits. This advance provides a practical pathway toward scaling quantum processors using existing semiconductor manufacturing methods.

IN DEPTH

Key Findings

Researchers have demonstrated highly accurate simultaneous control of an array of five silicon spin qubits connected to a shared microwave control line. When tested individually, single-qubit gate fidelity exceeded 99.99%, with the highest reaching 99.999%. In simultaneous operations, fidelity remained above 99.99% for up to three qubits and approximately 99.9% when all five qubits were controlled at once, approaching the thresholds required for fault-tolerant quantum computing.

Technical Details

The team identified the AC Stark shift as a primary source of error during simultaneous operation. This phenomenon occurs when microwave control signals alter a qubit's effective energy levels, causing phase shifts in the quantum state that disrupt individual qubit operations. To resolve this, the researchers developed a calibration method that compensates for these shifts using calibrations performed between pairs of qubits, rather than calibrating every possible combination.

While this technique significantly reduced phase errors, the researchers noted a remaining loss of accuracy attributed to drive-induced decoherence. This effect is caused by the increased microwave power necessary to operate multiple qubits simultaneously, leading to a loss of quantum coherence.

Background & Context

Silicon spin qubits are promising for quantum computing because they leverage established semiconductor manufacturing processes. Unlike conventional bits, these qubits use the spin of individual electrons confined in silicon to store information. However, a major obstacle has been the degradation of accuracy when multiple qubits are controlled concurrently.

Significance & Outlook

The ability to use shared microwave control lines is critical for scaling. Providing independent control systems for every qubit would make large-scale devices prohibitively complex to manage. By addressing control errors through pairwise calibration, this approach supports the development of larger, more complex quantum processors. The long-term objective is the creation of a fault-tolerant quantum computer capable of reliable calculations despite system disturbances.

Source: https://www.sciencedaily.com/releases/2026/10/261024222024.htm

Collected: October 31, 2026 | Automated Research System (AI)

#07 Binary Quantum Codes: 28 New Certified Error Correction Codes

Published October 30, 2026 Quantum Zeitgeist USA

OVERVIEW

Researchers from the Air Force Engineering University have developed a technique to rigorously certify the minimum distance of binary quantum error correction codes. This method has certified 21 record-breaking codes and improved 34 others, moving beyond previous estimations to provide precise performance verification.

IN DEPTH

Key Findings

The Air Force Engineering University has certified 21 new binary quantum codes that break existing records across 20 entries in Grassl's established code table. In addition to these record-breaking results, the team improved parameters for 34 existing codes and provided explicit constructions for three previously unconfirmed "GV" codes that lacked public construction methods. A total of 28 members have been certified through this process.

Technical Details

The breakthrough relies on an "ancestor lifting" theorem applied to quasi-cyclic (QC) additive codes over F4 (a four-element number system). This technique allows for the construction of longer error-correcting codes from shorter ones. To ensure precision, the team used divisor lattices to verify performance, which allows for the exact calculation of "minimum distance"—a critical metric for fault-tolerant computation—rather than relying on the estimates used previously.

Background and Context

Quantum error correction is essential for protecting information during computation. Previously, the quality of these codes was often estimated. By linking the mathematical structure of additive codes over F4 to the performance of binary quantum stabilizer codes, the researchers established a reproducible method for certification. While the results significantly update benchmarks like Grassl's table, the team noted that six additional candidate codes currently show strong evidence of quality but require more exhaustive verification before full certification.

Significance and Outlook

These results establish new benchmarks for future quantum code designs by providing unprecedented precision in distance calculation. However, a gap remains between these theoretical improvements and practical scalability. The research demonstrates that while mathematical structures can be linked to verifiable performance, further investigation is required to extend these methods toward the large-scale applications necessary for practical fault-tolerant quantum computation.

Source: https://quantumzeitgeist.com/quantum-error-correction-binary-stabilizer-codes-additive-qc/

Collected: October 31, 2026 | Automated Research System (AI)

#08 China's Neutral-Atom Ecosystem: 2026 Scaling and Commercial Specs

Published October 24, 2026 Quantum Computing Report USA

OVERVIEW

Chinese research and commercial entities have achieved world-leading physical benchmarks in neutral-atom quantum computing, including 11,000-atom trapping and 99.84% gate fidelity. While lagging in system-level quantum error correction compared to U.S. programs, China has rapidly transitioned laboratory prototypes into cabinet-scale commercial hardware.

IN DEPTH

Key Findings

A comprehensive review published on arXiv (arXiv:2608.05010) reveals that China has matched or exceeded international peers in raw physical gate metrics and hardware scaling. Notable achievements include two-qubit gate fidelities exceeding 99.8%, constant-time parallel array rearrangements, and the trapping of over 11,000 atoms using metasurface-generated tweezer arrays.

Technical Details

- **USTC:** In August 2025, Pan Jianwei's group implemented an AI-driven, constant-time atom rearrangement protocol, assembling 2,024-atom 2D and 3D arrays within 60 milliseconds. The system achieved a two-qubit gate fidelity of 99.84%, single-qubit fidelity of 99.97%, and readout fidelity of 99.92%.
- **Tsinghua University:** Zhai Hui's group trapped an average of 11,022 neutral atoms across an 18,225-site grid using a 2-cm-diameter planar metasurface chip. Using the "Zhui Feng" graph neural network algorithm, sorting times for 10,000-atom scales were reduced to under 20 milliseconds.
- **Fudan University & APM:** Fudan developed quantum annealing architectures for NP-hard problems using 1,000-atom hardware. The Innovation Academy for Precision Measurement Science and Technology (APM) pioneered 87 Rb– 85 Rb entangling gates and fiber-array architectures.

Commercial Landscape

Several startups have moved toward deployable hardware. Zhongke Kuyuan launched Hanyuan 2 in 2026, a dual-core machine supporting over 500 optical tweezers with T2 coherence times exceeding 300 ms and a domestic component localization rate over 80%. Taiyi Liangsheng, founded in early 2026, focuses on 171 Yb platforms and has secured over ¥400 million in financing. Liangyi Wanxiang demonstrated a 500+ atom platform with 99.5% two-qubit fidelity, targeting a 1,000-qubit fault-tolerant platform by 2027. Additionally, Zhongqi Wuliang and Xuanxiang Technology are validating a million-tweezer metasurface optical chip.

Significance and Outlook

China has closed the gap in hardware scaling and supply chain maturity for lasers and vacuum systems. However, a significant gap remains in system-level quantum error correction and practical algorithmic fault tolerance compared to U.S. ventures, such as QuEra and Harvard, which have demonstrated transversal logical gates across 48 logical qubits.

Source: https://quantumcomputingreport.com/review-unpacks-chinas-surging-neutral-atom-ecosystem-world-record-arrays-commercial-systems-and-scaling-milestones/

#09 Fujitsu Research: QPE Roadmap for Early-FTQC Molecular Simulation

Published October 28, 2026 Quantum Zeitgeist USA

OVERVIEW

Researchers from Fujitsu Research and Osaka University have demonstrated that ground-state energy estimation for complex molecular systems is achievable using approximately 10^5 physical qubits. By targeting an "early-FTQC regime" with partial fault tolerance, the team suggests that chemically accurate simulations of strongly correlated systems can be performed before full fault-tolerant quantum computers are available.

IN DEPTH

Key Findings

Fujitsu Research and Osaka University have determined that ground-state energy estimation for active spaces of 20-50 spatial orbitals is achievable using around 10^5 physical qubits. The researchers estimate that runtimes for these calculations would be on the order of days to weeks. This result indicates that chemically meaningful problems, including those involving iron-sulfur clusters, cytochrome P450 active sites, and -use catalysts, are within reach in an early-fault-tolerant quantum computing (early-FTQC) regime.

Technical Details

The team utilized a framework combining single-ancilla, Trotter-based quantum phase estimation (QPE) with partially randomized time evolution. A central component of this approach is a novel Hamiltonian optimization strategy called unitary weight concentration (UWC). UWC reshapes linear-combination-of-unitaries (LCU) representations to concentrate the total weight of a Hamiltonian into fewer terms, reducing the algorithmic cost of QPE. To assess practical feasibility, the researchers used the latest version of the space-time efficient analog rotation (STAR) architecture to perform end-to-end resource estimation, co-designing algorithms and Hamiltonian representations with architectural constraints imposed by error correction.

Background and Context

Simulating strongly correlated systems has traditionally been viewed as requiring millions of physical qubits on fully fault-tolerant machines. Unlike classical heuristic approaches such as coupled-cluster and DMRG methods, QPE provides explicitly quantifiable error bounds, which are essential for achieving certified chemical accuracy. The current research shifts the assumption that QPE requires advanced, fully error-corrected hardware, instead focusing on a bridge between NISQ and full FTQC.

Significance and Outlook

By lowering the barrier to entry for QPE, this framework enables the simulation of molecular systems that are beyond the reach of classical full configuration interaction. The researchers note that further gate-count reductions could be achieved by extending UWC and partially randomized time evolution to other LCU forms, such as double factorized LCU representations. This integrated approach to algorithm and hardware co-design provides a practical pathway toward quantum advantage in high-precision chemistry.

Source: https://quantumzeitgeist.com/fujitsu-research-iron-sulfur-clusters-within/

Collected: October 31, 2026 | Automated Research System (AI)

#10 Quantum State Smoothing: RIKEN and UTokyo's 2026 Demonstration

Published October 30, 2026　日本経済新聞（理研・東大のプレスリリース）　Japan

OVERVIEW

An international research group led by RIKEN and the University of Tokyo has successfully demonstrated "quantum state smoothing," a method that estimates the dynamics of light's quantum state by combining past and future observation records. This technique achieves higher precision than conventional methods, providing a critical foundation for optimizing measurement-induced quantum computers and other quantum information processing systems.

IN DEPTH

Key Findings

Researchers from RIKEN and the University of Tokyo have achieved the first experimental demonstration of quantum state smoothing. By utilizing observation records from both the "past" and the "future" relative to a specific point in time, the team successfully estimated the dynamics of light's quantum state with greater accuracy than is possible using only past records. The experiment confirmed that this approach brings the estimated state closer to the true quantum state and improves the purity and squeezing of the estimated state.

Technical Details

The research team, including Shoryu Yokoyama and Hidehiro Yonezawa from RIKEN and Assistant Professor Warit Asavanant from the University of Tokyo, overcame previous experimental hurdles by simulating a specific theoretical condition: a scenario where a "hidden observer" measures information that remains invisible to the observer performing the estimation. To ensure accuracy, the group precisely calibrated the experimental apparatus and employed an analytical model that accounted for detection efficiency and light loss.

Background and Context

Standard quantum state estimation typically relies solely on observation records available up to the moment of estimation. While incorporating future data theoretically increases accuracy, applying classical calculation methods directly to quantum systems can lead to results that contradict the principles of quantum mechanics. Quantum state smoothing was proposed as a theoretical solution to avoid these contradictions, but it remained unverified until this demonstration.

Significance and Outlook

High-precision estimation of quantum states is essential for maximizing the performance of quantum technologies. This breakthrough is expected to be applied to quantum information processing where measurement records can be processed post-hoc, specifically in the development and evaluation of measurement-induced quantum computers. The findings were published in the October 21 online edition of the scientific journal *npj Quantum Information*.

Source: https://www.nikkei.com/article/DGXZRSP714661_Q6A031C2000000/

Collected: October 31, 2026 | Automated Research System (AI)

#11 ABCI-Q: AIST and QuEra's Quantum-HPC Integration Roadmap

Published October 26, 2026 Quantum Zeitgeist USA

OVERVIEW

AIST has launched ABCI-Q, a full-stack quantum-HPC testbed within the G-QuAT facility designed to integrate quantum processors into high-performance computing environments. The platform combines NVIDIA H100 GPUs with neutral-atom and optical quantum hardware to enable hybrid workflows and agent-driven system operation.

IN DEPTH

Key Findings

AIST has established ABCI-Q as a quantum-HPC platform to bridge the gap between theoretical quantum potential and practical implementation. The center focuses on scaling toward fault-tolerant systems and integrating quantum processing units (QPUs) into existing HPC workflows. A primary objective is the transition to agent-driven operation, where AI agents—rather than humans—create, execute, and revise jobs, necessitating a redesign of APIs and schedulers to treat CPU, GPU, and QPU resources uniformly.

Technical Details

The ABCI-Q software stack connects disparate hardware through a unified layer including Covalent and Prefect for orchestration, a container engine, and frameworks such as Qiskit, CUDA-Q, Bloqade, and QURI. Users access the system via SSH, REST API, or a browser-based Open OnDemand interface with Jupyter notebooks.

The hardware infrastructure consists of:

- **System H:** A cluster of 505 compute nodes featuring approximately 2,020 NVIDIA H100 GPUs on an InfiniBand fabric.
- **QuEra Gemini:** A neutral-atom system operating at room temperature, connected via an SD network. The installation was backed by a $41 million USD contract.
- **OptQC:** A 129-qumode optical quantum computer.

A demonstration using a local LLM and a message-passing control plane currently translates plain-language prompts into executable tasks. Additionally, a collaboration with the University of Osaka utilized 1,000 GPUs to perform one of the world's largest quantum circuit simulations for quantum chemistry.

Background & Context

ABCI-Q is housed within the G-QuAT facility, established on July 27, 2023, as part of Japan's national Quantum Innovation Hub. As of May 2026, the center employs over 300 researchers, staff, and students. The facility is physically split between AIST's headquarters building (System H and System F) and a separate building 350 meters away for the Gemini system.

Significance & Outlook

AIST anticipates that fault-tolerant quantum systems will become practical in the 2030s. By providing a "landing zone" for hardware providers like QuEra, ABCI-Q serves as a co-design platform to validate integration standards and accelerate the development of practical, hybrid quantum-classical solutions.

Source: https://quantumzeitgeist.com/abci-q-quantum-hpc-testbed-aist/

Collected: October 31, 2026 | Automated Research System (AI)

#12 Shionogi: Quantum-assisted AI for drug discovery and NEDO award

Published October 28, 2026 Business Wire (via Jiji Press) USA

OVERVIEW

Shionogi has won first place in the Quality of Life category of the NEDO Challenge for integrating D-Wave's annealing quantum computing into a generative AI model for molecular design. The quantum-assisted model achieved a 97% chemical validity rate for generated molecular representations, significantly outperforming classical models. This research demonstrates the potential for quantum computing to increase the efficiency of early-stage drug candidate identification.

IN DEPTH

Key Findings

Shionogi has been awarded a ¥40 million prize by the New Energy and Industrial Technology Development Organization (NEDO) for its research in quantum-assisted drug discovery. The primary achievement recognized is a study published in Scientific Reports in July 2026, which integrated D-Wave's annealing quantum computing technology into a generative AI model designed for molecular design.

Technical Details

The research compared the performance of a quantum-assisted generative AI model against an equivalent classical model. The results showed a marked improvement in the quality of molecular representations:

- **Chemical Validity:** 97% of molecules generated by the quantum-assisted model were chemically valid, compared to 73% from the classical model.
- **Drug-likeness:** The quantum-assisted model produced a higher proportion of molecules with strong drug-likeness scores, exceeding both the training dataset and the classical model.

The methodology combines D-Wave quantum computing with classical high-performance computing (HPC) to generate and evaluate potential drug candidate molecules.

Background & Context

The NEDO Challenge, titled "Solve Social Issues!", is an initiative by Japan's national R&D organization under the Ministry of Economy, Trade and Industry to recognize quantum computing applications that address industrial and social challenges. D-Wave Quantum Inc., the provider of the annealing technology used by Shionogi, is a dual-platform company offering both annealing and gate-model quantum systems.

Significance & Outlook

The ¥40 million prize will support Shionogi's ongoing research into designing promising new drug candidate molecules, one of the most complex challenges in the pharmaceutical industry. By improving the quality of generative AI outputs, this approach aims to identify more promising molecules earlier in the discovery process, potentially accelerating the development of new medicines and improving patient outcomes.

Source: https://jen.jiji.com/jc/eng_bw?k=20261028058314

Collected: October 31, 2026 | Automated Research System (AI)

#13 Trapped-Ion Control: University of Tokyo's 8mV/m Stray Field Method

Published October 25, 2026 Quantum Zeitgeist USA

OVERVIEW

Researchers at The University of Tokyo have developed a technique to stabilize trapped ions against stray electric fields with a statistical uncertainty of 8mV/m. By converting ion displacement into measurable qubit signals, the method enables precise micromotion compensation compatible with advanced quantum sensing. This breakthrough allows the use of complex motional states previously inaccessible due to interference.

IN DEPTH

Key Findings

Researchers at The University of Tokyo have achieved a new standard in ion trap control by determining optimal compensation fields with a statistical uncertainty of 8mV/m. This represents a significant improvement over previous micromotion detection methods, which typically could not resolve displacements below approximately 10mV/m. The technique allows for the mitigation of stray electric fields, which are the primary source of unwanted ion movement that disrupts quantum experiments.

Technical Details

The new method stabilizes ions by converting ion displacement into measurable motion, which is then detected via the qubit itself. This approach bypasses the constraints inherent in traditional fluorescence or position monitoring techniques. Specifically, the technique is compatible with ground-state cooled motional modes, where lasers reduce the natural vibrations of an ion to its lowest possible energy level. By linking unwanted displacement directly to detectable qubit signals, the system enables more precise micromotion compensation than was previously possible.

Background and Context

Trapped ions are a promising platform for quantum technologies, but they are highly susceptible to stray electric fields. These fields induce "excess micromotion"—tiny wobbles or vibrations—that limit experimental control. Prior correction methods often interfered with advanced sensing techniques that require incredibly still ions. Because the new method works alongside ground-state cooling, it avoids the interference issues that plagued earlier approaches.

Significance and Outlook

This compatibility unlocks the ability to utilize complex motional states, including Fock, squeezed, and Schrödinger-cat configurations, which can enhance sensitivity and fidelity in applications ranging from atomic clocks to computing architectures. While the technique provides a fundamentally new way to control ions without disrupting delicate quantum states, scalability remains a challenge; the researchers have not yet provided details on performance with multiple qubits confined within a single trap.

Source: https://quantumzeitgeist.com/trapped-ions-stray-electric-fields-measurement-fidelity/

Collected: October 31, 2026 | Automated Research System (AI)