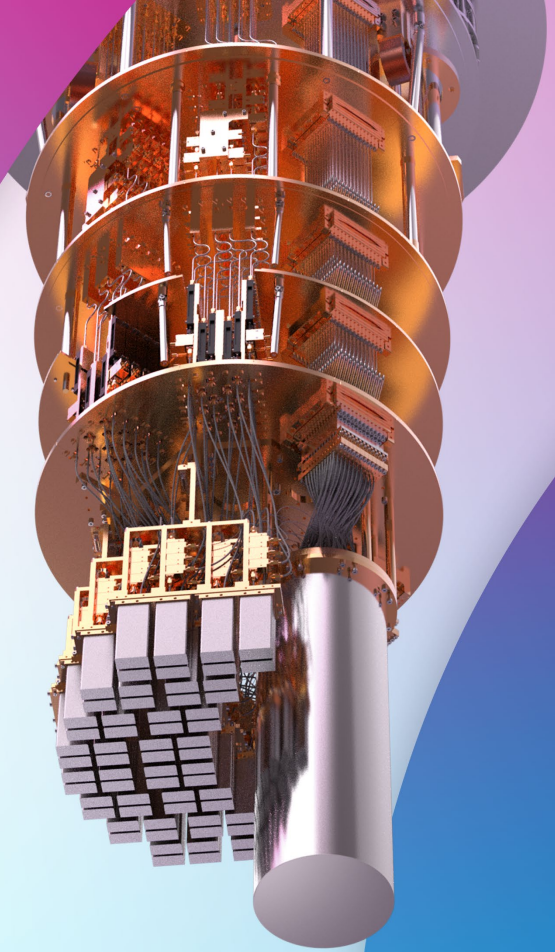
Overview of Quantum Computing at Fujitsu

Fellow, Head of Quantum Laboratory
Fujitsu Research, Fujitsu Limited

Shintaro Sato

April 21,2026



© 2026 Fujitsu Limited

Evolution toward Next-Generation Computing

FUJITSU

2023 — **NISQ**
Accelerating the development of quantum applications

2030 — **Early-FTQC**
Realizing practical quantum computing (※)

2040 — **FTQC**
Unleashing the true potential of quantum computers

※In some areas where supercomputers are not practically able to solve problems

Computation scale: high

Drug discovery
Material
Finance
Quantum for AI
CAE/CFD

Practical quantum computation

Quantum computing

64 qubits
Quantum simulator
256 qubits
Diamond spin
1,024 qubits
STAR Architecture
10,000+ qubits
(250 logical qubits)
1,000 logical qubits
Evolving through the integration of different technologies

Integrated HPC - AI - Quantum Computing

Quantum-inspired computing / AI

Digital Annealer
Service-in

Conventional Computing

HPC
FX1000

Processor
A64FX

Processor
FUJITSU-MONAKA
2nm

Processor
FUJITSU-MONAKA-X
1.4nm

Processor
FUJITSU-MONAKA-XX
cutting edge process node

© 2026 Fujitsu Limited

Fujitsu's Strategy for Quantum Computing

FUJITSU

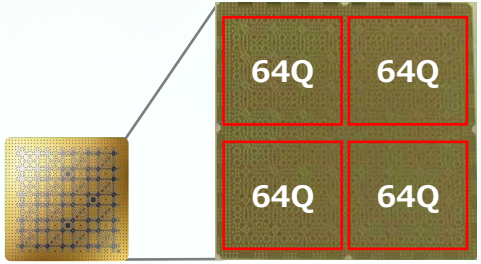
- Cover all the technology layers with the world's leading research institutions
- Put emphasis on software technologies, while working on several types of hardware
- Develop applications with end users by using Hybrid Quantum Computing Platform

Quantum Application	Research with end-user input: **Materials** | **Drug discovery** | **Finance**		**FUJIFILM, Tokyo Electron, etc.**	**TU Delft**
Quantum Software	Algorithm	**UC Berkeley** Quantum Error Correction	**U of Osaka** Quantum Error Correction	
Quantum Platform	Complier Middleware	**U of Edinburgh** Hybrid Computing	Cloud Technology	
Quantum State Control Quantum Device & Integration	**RIKEN** Superconducting Qubit	**TU Delft** Diamond Spin Qubit	Exploring other possibilities, Neutral Atom etc.	

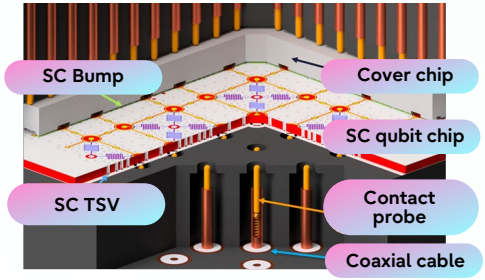
© 2026 Fujitsu Limited

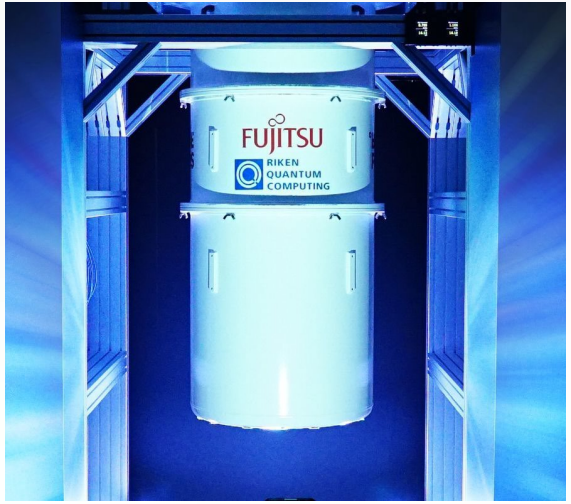
Launch of a 64/256-qubit Superconducting Quantum Computers

- Developed at RIKEN RQC-Fujitsu Collaboration Center with Prof. Nakamura

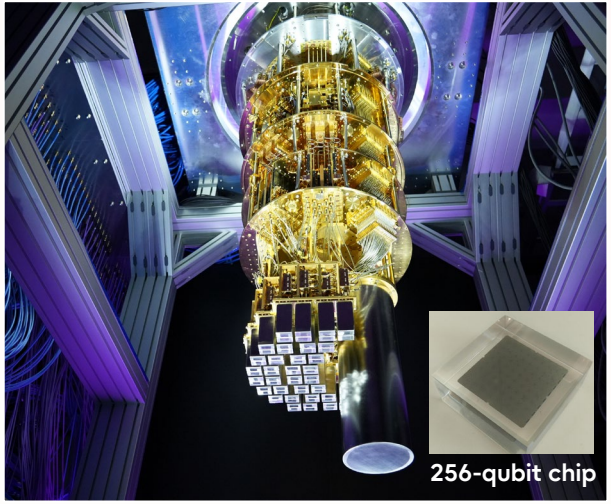


64-qubit 256-qubit





64-qubit system (Oct. 5, 2023)
https://pr.fujitsu.com/jp/news/2023/10/5.html



256-qubit system (April 22, 2025)
https://pr.fujitsu.com/jp/news/2025/04/22.html

© 2026 Fujitsu Limited

Our First Commercial Quantum Computer

- Delivered to G-QuAT, AIST in March, 2025
- We also plan to sell prototype systems overseas.

Quantum computer delivered to G-QuAT

Source: Web page of Prime Mnister's Office of Japan
https://www.kantei.go.jp/jp/103/actions/202505/18ibaraki.html

© 2026 Fujitsu Limited

1024-Qubit System: Under Development

- The construction of facility to house a 1024-qubit quantum computer has been completed.
- We are planning to launch the 1024-qubit system by the end of 2026.

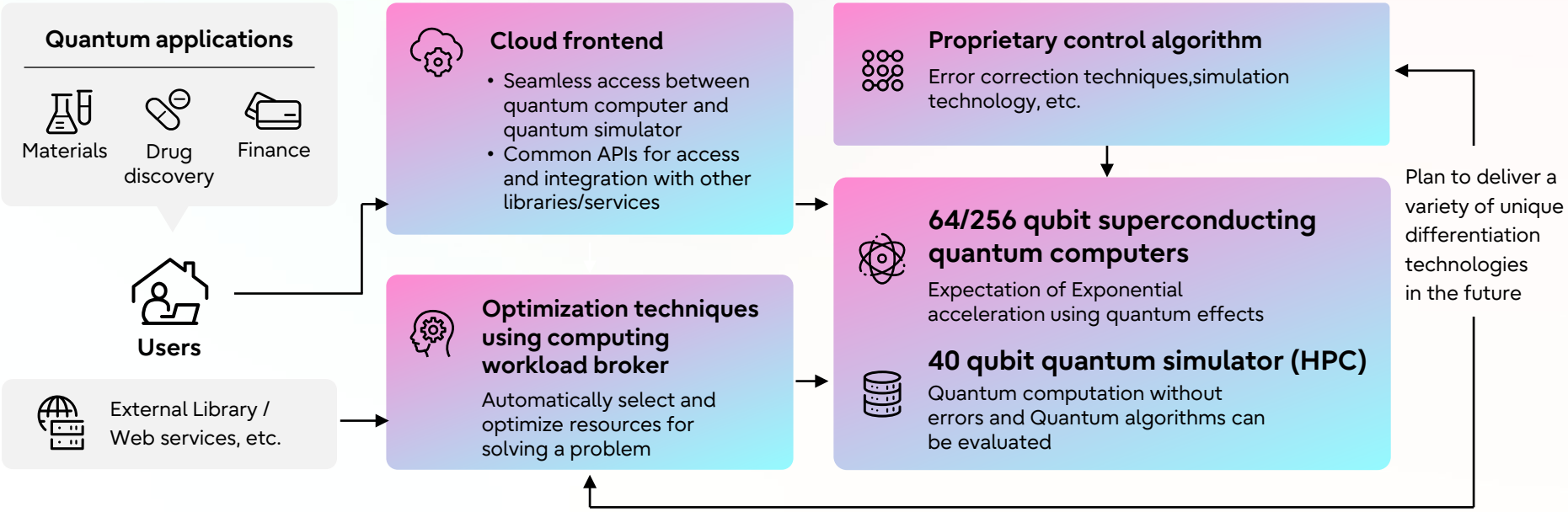
Construction site

Exterior view of the facility

© 2026 Fujitsu Limited

Platform for Hybrid Quantum Computing

- Seamless operations between quantum computer and quantum simulator
- We are now developing platform software, OQTOPUS, with U of Osaka, and released it as OSS: https://github.com/oqtopus-team



© 2026 Fujitsu Limited

Industrial PoC

FUJITSU

Materials

FujiFilm

Discover innovative materials through simulation

Precise energy calculation of organic molecules using Variational Quantum Algorithms

Drug Discovery

Mitsubishi Chemical Corporation

Realize drugs with high efficacy and low side effects

Computing energies of large molecules such as proteins

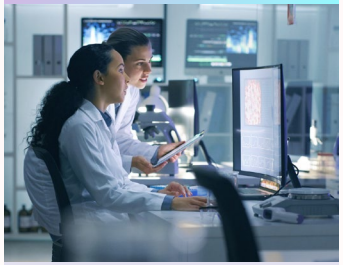
Finance

Mizuho Daiichi Financial Technology

Optimizing investment decisions

Risk assessment for portfolio optimization with Quantum Monte Carlo

Manufac-turing



AGC

Effective resource utilization to reduce environmental impact

Quantum approximate optimization algorithm for glass plate cutting problems

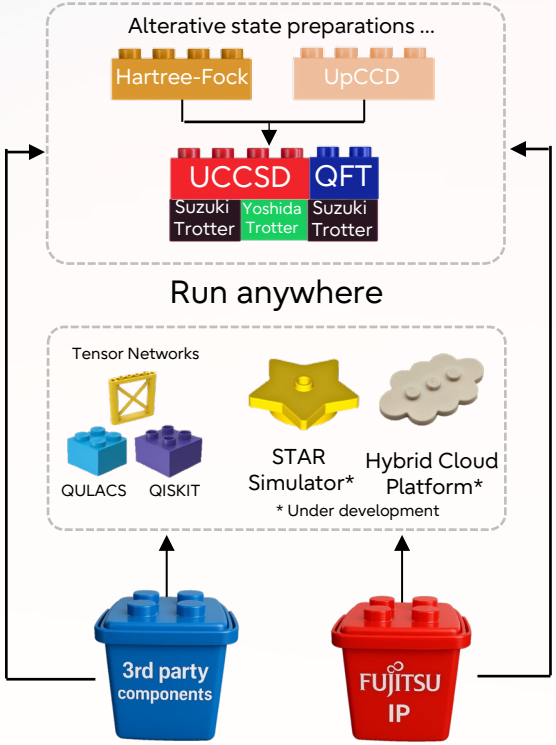
© 2026 Fujitsu Limited

QARP: Quantum Application Research Package

(Quantum application development library)

- Designed for algorithm researchers
  - Facilitate algorithm prototyping and development
  - **Build Algorithms from Blocks, target any Device**
- Designed for application researchers
  - Robust implementation of leading algorithms
  - **Run on NISQ or simulated FTQC**
- Make cutting-edge research deliverable available
  - Proprietary algorithms (e.g. circuit cutting) by FRE implemented
  - **Platform for collaborative research**
- Seamless integration
  - 3rd-party: Qulacs, Qiskit, Pytket, Tenet
- Beta-version is now ready
  - Provided to the participants of Quantum Simulator Challenge competition

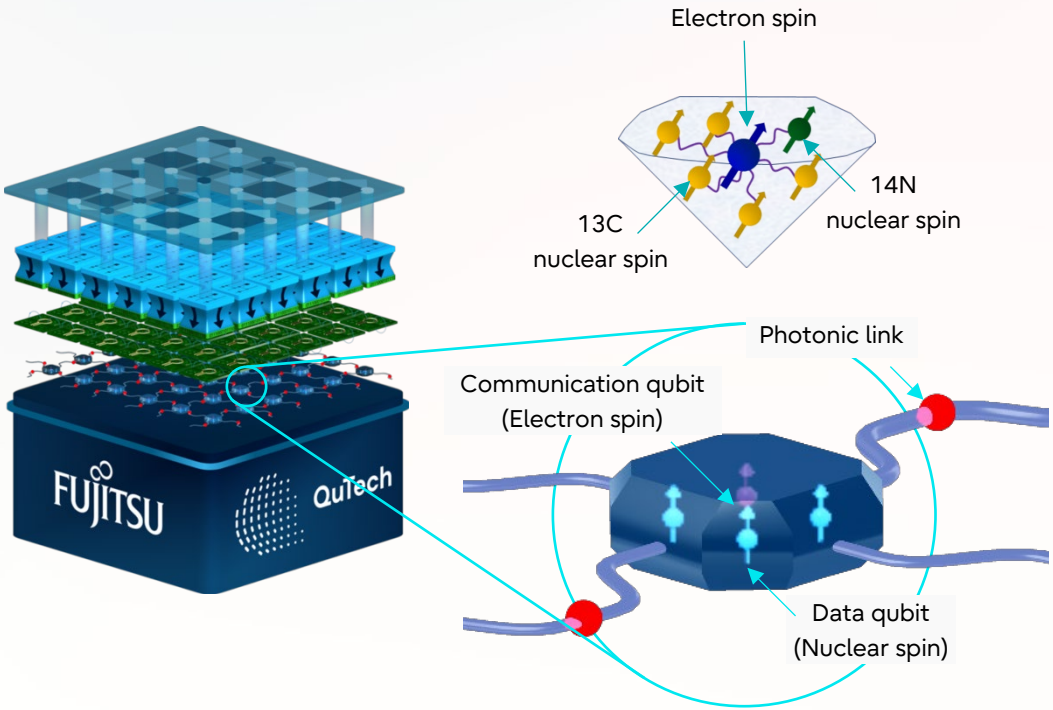
Creating algorithms easily form building blocks



© 2026 Fujitsu Limited

Diamond-Spin Qubit Technologies for Scalable Quantum Computer

- Each quantum module consists of an electron spin and nuclear spins in a diamond.
- Quantum modules are connected by photonic links, which can be used as one quantum computing system.
- This approach can allow for high-temperature operation (> 1 K) and good scalability.



© 2026 Fujitsu Limited

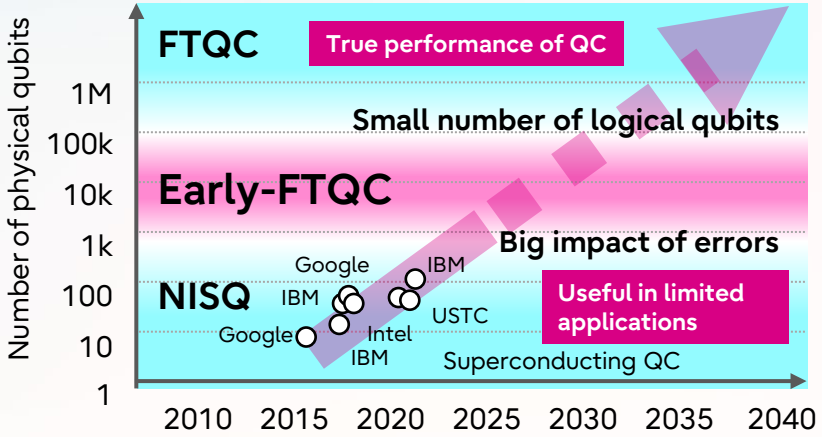
Newly Developed Quantum Computing Architecture（STAR Architecture）

大阪大学 THE UNIVERSITY OF OSAKA | FUJITSU

Background

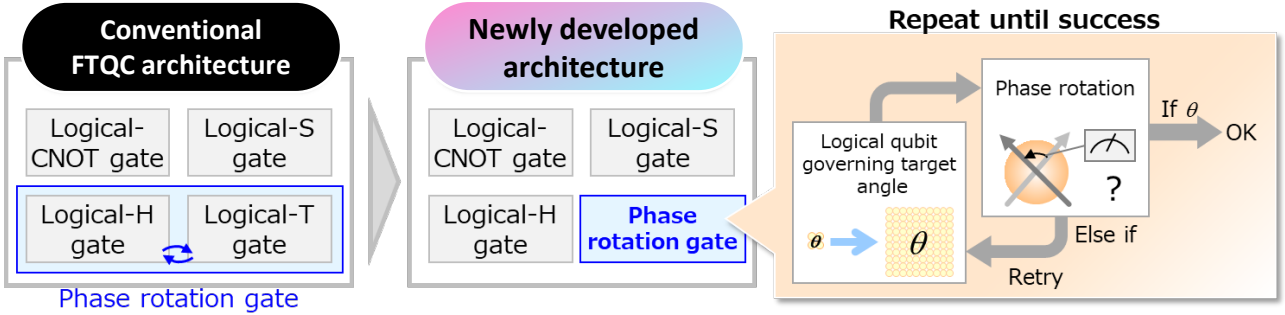
In the early-FTQC era, sufficient performance cannot be demonstrated with current approaches to NISQ and FTQC.

NISQ: Noisy Intermediate-Scale Quantum computer
FTQC: Fault-Tolerant Quantum Computer



New Quantum Computing Architecture

Introducing a new type of phase rotation gate, instead of conventional T-gate, into a universal quantum gate set.



Reduced to approximately 1/10 in number of physical qubits and 1/20 in gate operations

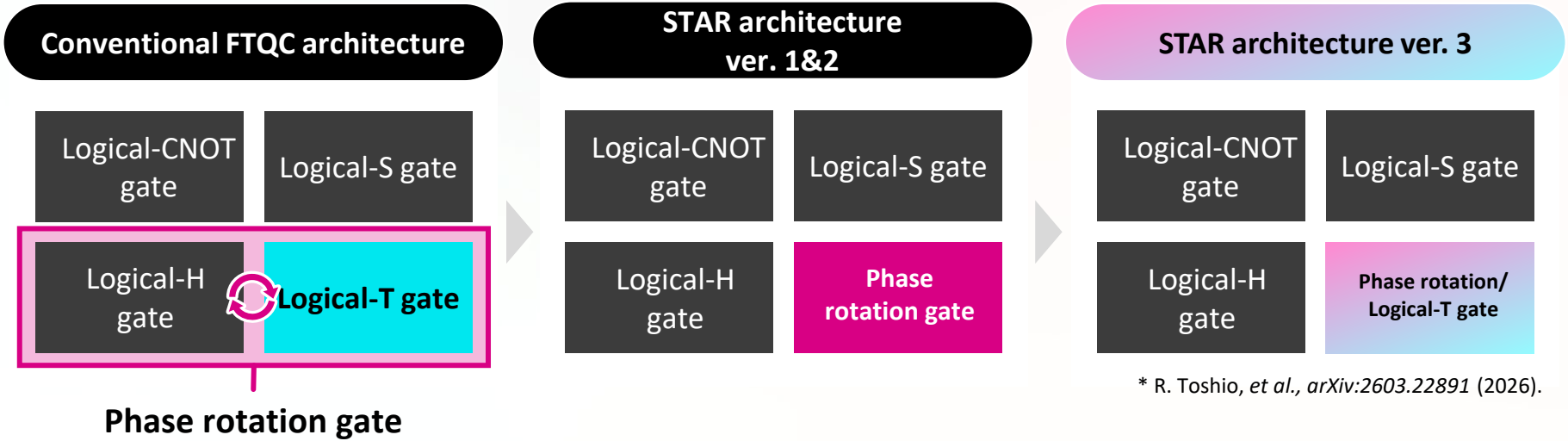
https://pr.fujitsu.com/jp/news/2023/03/23.html
Y. Akashoshi, et al., *PRX Qunatum* **5**, 010337 (2024)

© 2026 Fujitsu Limited

Further Improvement of STAR architecture (ver. 3)

大阪大学 THE UNIVERSITY OF OSAKA | FUJITSU

- **Achieving a roughly 10x improvement in computational accuracy by integrating phase rotation and logical-T gates**
  - Expanding computational scale even with the same number of qubits
  - Relaxed requirements for QC: tolerable physical error rates of 0.01% to 0.10%



* R. Toshio, *et al., arXiv:2603.22891* (2026).

© 2026 Fujitsu Limited

Effect of STAR ver. 3 and Unitary Weight Concentration (UWC)*

大阪大学 THE UNIVERSITY OF OSAKA | FUJITSU

- For the physical error rate of 0.01%

	Cytochrome P450 (Drug discovery)	Fe-S Cluster (Ammonia synthesis)	Ruthenium catalyst (Carbon recycling)
Conventional FTQC	0.74M qubits	0. 70M qubits	2.0M qubits
STAR architecture ver. 3	50k qubits、5k days	60k qubits、13k days	50k qubits、5k days
STAR architecture ver. 3 ＋Model Optimization	40k qubits、9 days	40k qubits、13 days	20k qubits、5 days

Contributes to the application of QCs in the chemical materials sector, which has an enormous market size

* S. Kanasugi, *et al.*, *arXiv:2603.22778v1* (2026).

© 2026 Fujitsu Limited

Fujitsu Quantum Day 2026

FUJITSU

- We have a special lecture by Prof. Chuang at MIT entitled “Quantum Computation: Pathway to the Future.” I’m really looking forward to his talk!
- We also have excellent invited talks from our collaborators.
- Poster and demo sessions will be presented by our young researchers.
- Please enjoy Fujitsu Quantum Day 2026!

© 2026 Fujitsu Limited

Thank you

© 2026 Fujitsu Limited