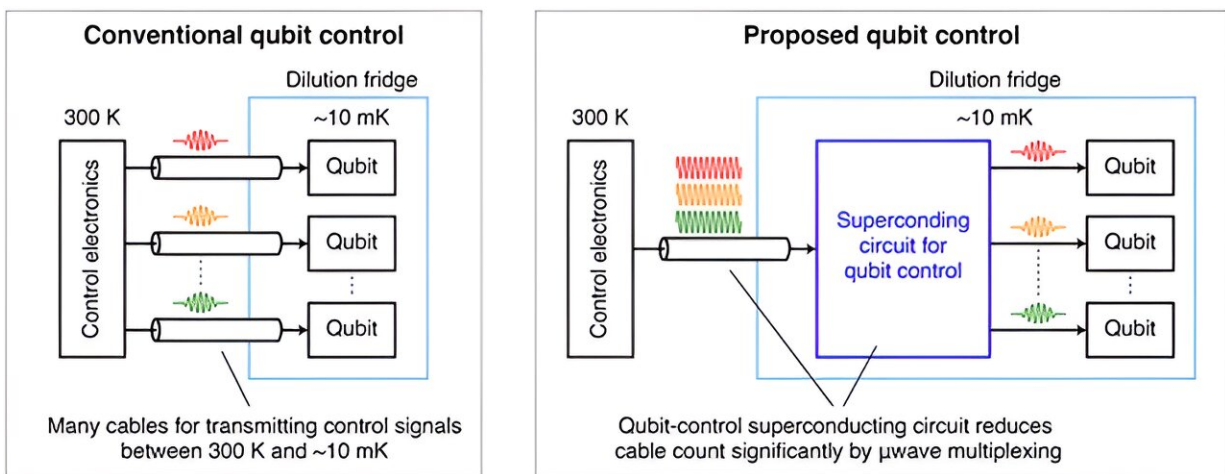


Superconducting circuit for qubit control within large-scale quantum computer systems successfully demonstrated

June 3 2024



Comparison between conventional and proposed qubit control. Credit: Advanced Industrial Science and Technology

In support of the development of large-scale superconducting quantum computers, researchers with the National Institute of Advanced Industrial Science and Technology (AIST), one of the largest public research organizations in Japan, in collaboration with Yokohama National University, Tohoku University, and NEC Corporation, proposed and successfully demonstrated a superconducting circuit that can control many qubits at low temperature.

To realize a practical quantum computer, it is necessary to control the state of a huge number of qubits (as many as 1 million) operating at low temperature. In conventional quantum computers, [microwave signals](#) for controlling qubits are generated at [room temperature](#) and are individually transmitted to qubits at low temperature via different cables.

This results in numerous cables between room and low temperature and limits the number of controllable qubits to approximately 1,000.

In the new [study](#), published in *npj Quantum Information*, a superconducting circuit that can control multiple qubits via a single cable using microwave multiplexing was successfully demonstrated in proof-of-concept experiments at 4.2 K in [liquid helium](#).

This circuit has the potential of increasing the density of microwave signals per cable by approximately 1,000 times, thereby increasing the number of controllable [qubits](#) significantly and contributing to the development of large-scale quantum computers.

More information: Naoki Takeuchi et al, Microwave-multiplexed qubit controller using adiabatic superconductor logic, *npj Quantum Information* (2024). [DOI: 10.1038/s41534-024-00849-2](https://doi.org/10.1038/s41534-024-00849-2)

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