

# Accelerating the Development of Quantum Computers through Automation

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Quantum computation holds immense promise for revolutionizing physics research and our understanding of nature. However, the reliability of qubits, the basic building blocks of quantum computers, poses a significant challenge. Millions of physical qubits are required in quantum processing units (QPUs) to ensure robust and accurate computation. Presently, QPUs are limited to fewer than a hundred qubits and are hindered by tedious characterization and tune-up processes that rely on manual intervention. This slow development pace impedes progress in both QPU scalability and quantum computing applications.

To expedite QPU development, we require innovative tools and an automated approach. Quantum EDGE [1], a software platform developed by QuantrolOx streamlines QPU tune-up through automation, providing deep insights into qubit parameters, enhancing chip fabrication and characterization efficiency, and accelerating qubit advancements in academia and industry.

We develop Quantum EDGE at Bluefors lab [2] in Delft on 5-qubit Soprano [3] chips made by QuantWare. Qubits are flux tunable transmons with fixed coupling. The qubits are controlled and measured through Quantum EDGE that seamlessly integrates control electronics from Qblox [4], Quantum Machines [5], and Zurich Instruments [6], allowing users to focus on QPU development. During this presentation, we share latest results, demonstrating a two orders of magnitude improvement in QPU characterization speed, reducing it from days to minutes across the 5-qubit chip. Future developments include extending this speed enhancement to larger QPUs, verifying different superconducting qubit modalities, and implementing automation for 2-qubit gates.

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## References

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- [1] QuantrolOx Quantum EDGE, <https://quantrolox.com>
- [2] Bluefors service lab Delft, <https://bluefors.com/services/bluefors-lab>
- [3] QuantWare Soprano, <https://www.quantware.com/product/soprano>
- [4] Qblox, <https://www.qblox.com>
- [5] Quantum Machines, <https://www.quantum-machines.co>
- [6] Zurich Instruments, <https://www.zhinst.com>