

Scalable Control Stack Architecture for Fault-Tolerant Quantum Computing

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Achieving practical, fault-tolerant quantum computing demands scalable control electronics capable of rapid, high-fidelity operations. In this talk, we introduce the Qblox Cluster, a modular control stack architecture engineered to meet the demands of industry-leading hardware across various qubit modalities. As part of this framework, we will feature our newest modules: the QSM (Quantum Source and Measurement) for ultra-stable DC characterization, and the high-density QRC (Qubit Readout and Control) designed specifically for scalability. A core focus of the presentation will be our latest advancements in fast, integrated feedback loops, powered by the real-time synchronization of our proprietary SYNQ and LINQ technologies. Backed by the autonomous pulse execution and analog precision of our Q1 sequencers, these low-latency feedback capabilities are actively bridging the gap to practical error correction. We conclude by showcasing our software, Qblox Scheduler and Q1ASM, demonstrating how seamless hardware-software integration provides an intuitive and comprehensive control solution for accelerating state-of-the-art quantum research.

Figures

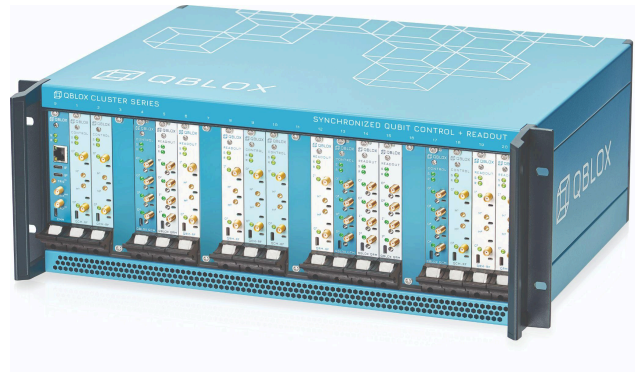


Figure 1: Qblox cluster with readout and control modules at baseband and radio frequencies.
