Fully-integrated control stacks for quantum computing

To reach noisy intermediate-scale quantum (NISQ) applications, gate fidelity and qubit numbers need to be improved. Qblox supports this with time-efficient, ultralow-noise, and cost-effective control stacks. Qblox Cluster control stacks integrate all the necessary hardware and software to control and readout superconducting qubits in a wide frequency range from DC to 18.5 GHz.

Qblox's high level software architecture, Quantify, allows hybrid scheduling of gate-level and pulse-level descriptions to define experiments on the quantum circuit layer and translates them into low level definitions for the hardware to generate the pulses. The Cluster system incorporates Q1 sequence processors capable of sequencing pulses, their parameters, and measurement operations in real time. This architecture speeds up experiments, e.g. qubit characterization on superconducting qubits, by orders of magnitude as it avoids the overhead caused by software-controlled loops. This speed-up is realized by multi-parameter real-time pulse modification and by on-board data processing (integrating, averaging, binning) of readout signals and storing up to 131072 measurement results per experimental run. The state-of-the-art signal noise level (14 nV/√Hz @ 1 MHz and 5 Vpp) supports improved gate fidelities and the low gain and offset drift (a few ppm/K) reduces the need for recalibrations.

In this talk, we introduce you to this full-stack architecture that facilitates NISQ applications, and further supports the path to fault-tolerant quantum computing thanks to our proprietary SYNQ and LINQ protocols.