

High performance commercial trapped ion quantum computers based on the QCCD architecture

Patty Lee

Honeywell Quantum Solutions

Abstract

Honeywell Quantum Solutions launched its first commercial trapped-ion quantum computer in 2020, designed around the quantum charge-coupled device (QCCD) architecture. By applying fast transport operations to reorder and position ion qubits across multiple trapping zones simultaneously on the device, the QCCD architecture creates a fully-connected, high fidelity, and scalable quantum computer. These systems offer the unique capability of performing conditional quantum operations dependent on mid-circuit measurement outcomes, and qubits can be re-used in the same circuit after measurements. This feature allows users to perform efficient quantum simulations and execute repeated cycles of quantum error correction, which was demonstrated for the first time on System Model H1. Recently, the system became the first quantum computer to pass the quantum volume 1024 benchmark, the largest quantum volume ever measured on a commercial quantum computer. Future generation systems will incorporate new technologies such as 2D trap architectures and integrated photonics, in order to scale the number of physical qubits and further increase system performance.
