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Muon tagging using Kinetic Inductance Detectors

Thursday, 30 May 2024 13:00 (15 minutes)

Ionizing radiation, particularly environmental radioactivity and cosmic-ray muons, pose significant challenges to the coherence and reliability of superconducting quantum processors. In this talk, I will introduce a novel approach to mitigate the detrimental effects of atmospheric muons on arrays of superconducting qubits. Our strategy involves equipping a superconducting quantum processor with an active muon veto system designed to tag and veto operations following a muon interaction within the chip. I will outline the concept, design, and technology behind the muon veto detector, with a focus on achieving high detection efficiency and negligible dead-time. Leveraging insights from Particle Physics experiments and the INFN CALDER project, we propose a cryogenic muon veto based on Kinetic Inductance Detectors (KIDs) technology, tightly integrated with the superconducting quantum chip. Results from Monte Carlo simulations and a preliminary design of the muon veto will be presented. By demonstrating the effectiveness of this strategy, we aim to significantly reduce correlated errors, enhancing both coherence and frequency stability of superconducting qubits. We plan to test our prototype using a high-performing quantum chip provided by the Superconducting Quantum Materials and Systems (SQMS) Center, with the objective of validating its performance and applicability in practical quantum computing scenarios.

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