
Contribution ID: **53** Type: **Talk**

# Abatement of Ionizing Radiation for Superconducting Quantum Devices

*Tuesday, 1 October 2024 18:35 (20 minutes)*

Ionizing radiation has been shown to reduce the performance of superconducting quantum circuits. In this report, we evaluate the expected contributions of different sources of ambient radioactivity for typical superconducting qubit experiment platforms. Our assessment of radioactivity inside a typical cryostat highlights the importance of selecting appropriate materials for the experiment components nearest to qubit devices, such as packaging and electrical interconnects. We present the Low Background Cryogenic Facility operating in PNNL's Shallow Underground Laboratory (30-meter water equivalent) to reduce the flux of cosmic rays and a lead shielded cryostat to abate the naturally occurring radiogenic gamma-ray flux in the laboratory environment. We predict that superconducting qubit devices operated in this facility could experience a reduced rate of correlated multi-qubit errors by a factor of approximately 20 relative to the rate in a typical above-ground, unshielded facility. Finally, we outline overall design improvements that would be required to further reduce the residual ionizing radiation rate, down to the limit of current generation direct detection dark matter experiments.

**Primary author:** LOER, Ben (Pacific Northwest National Laboratory)

**Presenter:** LOER, Ben (Pacific Northwest National Laboratory)

**Session Classification:** Radiation Impact on Quantum Systems