Contribution ID: **3** Type: **not specified**

# Optimal Experimental Design for Quantum Circuits: A case study for the mitigation of quasiparticle poisoning

Superconducting circuits are the most widely used system for quantum computing, and many of the key accomplishments in this field have been performed using superconducting-based quantum processors. The improvement of device performance through the mitigation and control of qubit errors is currently a critical step for executing complex quantum algorithms. However, the experimental routines used to test error mitigation strategies are often pointwise, time-consuming, and costly. Instead of an unguided research strategy, Optimal Experimental Design (OED) is a methodological approach used to maximize the information gained from a limited number of iteratively designed, computationally optimized experiments. We are developing such a methodology for the design of quantum circuits. To demonstrate the benefits of our OED methodology, we apply it to the problem of quasiparticle poisoning (QP) in superconducting quantum devices, wherein environmental high-energy radiation creates qubit errors. Our OED methodology uses key advances in the computational simulation of QP physics and high-performance-computing optimization techniques to design quantum chips that are more resilient against QP-induced errors. Ongoing work and results will be presented.

**Primary author:** BAITY, Paul (Brookhaven National Laboratory)

**Co-authors:** HOISIE, Adolfy (Brookhaven National Laboratory); ISENBERG, Natalie (Brookhaven National Laboratory); LOVE, Peter (Brookhaven National Laboratory); PARK, Gilchan (Brookhaven National Laboratory); REYES, Kristofer (Brookhaven National Laboratory); URBAN, Nathan (Brookhaven National Laboratory); WEEDEN, Spencer (University of Wisconsin-Madison); YELTON, Eric (Syracuse University); YOON, Byung-Jun (Brookhaven National Laboratory)

**Session Classification:** Poster Session