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Fast resonator reset in circuit QED using open quantum system optimal control SAMUEL BOUTIN, Département de Physique, Université de Sherbrooke, CHRISTIAN KRAGLUND ANDERSEN, Department of Physics and Astronomy, Aarhus University, JAYAMEENAKSHI VENKATRAMAN, Department of Physics, Indian Institute of Technology Kanpur, ALEXANDRE BLAIS, Département de Physique, Université de Sherbrooke and Canadian Institute for Advanced Research — Practical implementations of quantum information processing requires repetitive qubit readout. In circuit QED, where readout is performed using a resonator dispersively coupled to the qubits, the measurement repetition rate is limited by the resonator reset time. This reset is usually performed passively by waiting several resonator decay times. Alternatively, it was recently shown that a simple pulse sequence allows to decrease the reset time to twice the resonator decay time [1]. In this work, we show how to further optimize the ring-down pulse sequence by using optimal control theory for open quantum systems. Using a new implementation of the open GRAPE algorithm that is well suited to large Hilbert spaces, we find active resonator reset procedures that are faster than a single resonator decay time. Simple quantum speed limits for this kind of active reset processes will be discussed. [1] McClure et al., arXiv 1503.01456

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