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Efficient Experimental Characterization of a Feedback Scheme for Qubit Initialization YVES SALATHE, CHRISTOPHER EICHLER, THOMAS KARG, PHILIPP KURPIERS, CHRISTIAN LANG, ANDREAS WALLRAFF, ETH Zurich — Quantum feedback based on high-efficiency projective measurements has a variety of potential applications such as active qubit initialization and quantum teleportation. Here, we experimentally investigate active initialization of a single transmon qubit in circuit quantum electrodynamics using parametric amplification similar to the experiment by Ristè *et. al.* [1]. We implement the feedback scheme using field-programmable gate array (FPGA) electronics which conditions a π-pulse on the outcome of a prior quantum nondemolition measurement. Our processing unit also records multi-dimensional histograms which reveal the correlations between the initial and final state of the feedback process. We use these histograms to characterize the efficiency of our feedback implementation without the necessity of storing all individual single-shot measurement traces. The presented histogram-based measurement technique has potential applications in other experiments which involve feedback such as quantum teleportation.
[1] D. Ristè, C. C. Bultink, K. W. Lehnert, L. DiCarlo, arXiv:1207.2944v1.

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