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Quantifying Entanglement with a Joint Readout of Superconducting Qubits JERRY CHOW, LEONARDO DICARLO, Yale University, JAY GAMBETTA, Institute of Quantum Computing, University of Waterloo, ANDREAS NUNNENKAMP, LEV BISHOP, LUIGI FRUNZIO, MICHEL DEVORET, STEVEN GIRVIN, ROBERT SCHOELKOPF, Yale University — We employ a single channel as a joint readout of highly-entangled two-qubit states in a circuit quantum electrodynamics architecture. The measurement model for the readout is fully characterized using a set of Rabi experiments demonstrating a large sensitivity to two-qubit correlations. We quantify the high degree of entanglement by measuring the violation of a Clauser-Horne-Shimony-Holt inequality with a value of 2.61 ± 0.04, without any optimization for the target state. In its present form, this joint readout will be capable of resolving improvements to the fidelity of two-qubit operations and will be extendable to systems of three or four qubits.

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