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Tomography via Correlation of Noisy Measurement Records<sup>1</sup> COLM RYAN, BLAKE JOHNSON, BBN Technologies, JAY GAMBETTA, JERRY CHOW, IBM T.J. Watson Research Center, MARCUS SILVA, BBN Technologies, OLIVER DIAL, IBM T.J. Watson Research Center, THOMAS OHKI, BBN Technologies — We present methods and results of shot-by-shot correlation of noisy measurements to extract entangled state and process tomography in a superconducting qubit architecture <sup>2</sup>. We show that averaging continuous values, rather than counting discrete thresholded values, is a valid tomographic strategy and is in fact the better choice in the low signal-to-noise regime. We show that the effort to measure *N*-body correlations from individual measurements scales exponentially with *N*, but with sufficient signal-to-noise the approach remains viable for few-body correlations. We provide a new protocol to optimally account for the transient behavior of pulsed measurements. Despite single-shot measurement fidelity that is less than perfect, we demonstrate appropriate processing to extract and verify entangled states and processes.

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