Abstract Submitted for the MAR07 Meeting of The American Physical Society

Quantum Process Tomography Using Superconducting Qubits RADOSLAW C. BIALCZAK, U.C. Santa Barbara, M. ANSMANN, N. KATZ, E. LUCERO, R. MCDERMOTT, M. NEELEY, A. D. O'CONNELL, M. STEFFEN, E. WEIG, A. CLELAND, J. MARTINIS — Due to recent advances in device design and materials, universal quantum gates using Josephson junction phase qubits are now feasible. To measure gate performance other quantum computation architectures have utilized standard quantum process tomography (SQPT). In SQPT one obtains a process matrix with which gate operations for arbitrary input states can be predicted and performance measures such as fidelity and entangling capability can be obtained. Here we demonstrate how to implement SQPT with our Josephson junction phase qubits and use it to characterize a CNOT gate. We show how to obtain the process matrix of a CNOT gate and extract its fidelity and entangling capability. This allows us to compare our gate performance to that of quantum gates in other architectures.

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Date submitted: 20 Nov 2006

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