Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Implementation of a two-qubit Grover algorithm using superconducting qubits[1] MATTHIAS STEFFEN, ANTONIO CORCOLES, JERRY CHOW, JAY GAMBETTA, JOHN SMOLIN, IBM, MATT WARE, JOEL STRAND, BRITTON PLOURDE, Syracuse University — High fidelity two-qubit gates have previously been demonstrated with fixed frequency superconducting qubits and employing the cross-resonance effect generating the qubit-qubit interaction in which qubit 1 is driven at the frequency of qubit 2. The drawback of previous implementations of the cross-resonance gate is the fact that single qubit gates on qubit 2 emerge when the qubits are multi-level systems instead of strictly two-level systems. As a result, two-qubit gates must be tuned up by careful timing or by explicitly applying single-qubit correction pulses. This is a cumbersome procedure and can add overall errors. Instead, we show a refocusing scheme which preserves the two-qubit interaction but eliminates the single-qubit gates. The total gate length is only increased by the duration of two single qubit pi-pulses which is a low overhead. When tuning up this composite pulse we show an implementation of a two-qubit Grover's algorithm without applying any correction pulses. The average success probability of the algorithm is consistent with fidelity metrics obtained by independent randomized bench-marking experiments (both single and two-qubit).

[1]We acknowledge support from IARPA under contract W911NF-10-1-0324.

Matthias Steffen
IBM

Date submitted: 09 Nov 2012 Electronic form version 1.4