Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Grid state displacement sensor under noise DANIEL WEIGAND, KASPER DUIVENVOORDEN, BARBARA TERHAL, JARA Institute for Quantum Information, RWTH Aachen University, 52056 Aachen, Germany — Grid states have been introduced by Gottesman, Kitaev and Preskill in the context of quantum error correction, as a method to encode a qubit into an oscillator. The development of new experimental techniques in the past years provide the tools to generate and control this type of quantum state in microwave cavities. In earlier work, we developed a protocol to generate grid states without post-selection. This protocol uses a variant of phase estimation implemented by coupling a transmon ancilla qubit to a microwave oscillator. A unique property of grid states is that they can be characterized by *two* squeezing parameters, one for each quadrature. We recently proposed that grid states can be used as displacement sensors that accurately resolve small displacements in both quadratures simultaneously. In this work, we investigate the performance of the generating protocol under imperfect conditions. This is done by monitoring the evolution of the two squeezing parameters during the protocol, using realistic error models from current 2D and 3D microwave-cavity experiments with transmon qubits. The error models include photon loss, amplitude damping of the ancilla qubit, measurement errors and nonlinearities in the system Hamiltonian.

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Date submitted: 20 Nov 2016 Electronic form version 1.4