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Threshold calculation and optimization for measurementless quantum error correction GEOFFREY SIMMS, MARK GYURE, JACOB WEST, HRL Laboratories, LLC. Malibu, California — General-purpose quantum computing will rely on measurement as a primitive operation, but the operations of measurement and classical feed-forward are not necessary to perform certain useful computations, including quantum error correction. Measurementless quantum computation is appealing because it reduces the classical control system to an automaton, having no conditional operations. Measurementless, fault-tolerant quantum error correction (MFTQEC) of Calderbank-Shor-Steane (CSS) encoded logical qubits requires logical zero states to be prepared with high fidelity as an initial step, and this logical zero preparation has a threshold of its own, analogous to, but not identical to, the threshold of the entire error correction algorithm. In this talk, we present the results of mapping the MFTQEC algorithm onto a specific semiconductor-based qubit system using the Quantum Computing Architectural Design (QCAD) program, discussed in another talk in this session. The algorithm is translated from the set of "design gates" to the set of accessible "physical gates," and the resulting quantum circuit is optimized to improve the threshold. Limited 2-dimensional connectivity is assumed, making this well suited to the "enhancement mode" quantum dot qubits described in other talks in this session.

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