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Tunable Coupling Qubits For Direct Dispersive Three-Qubit Parity Measurements ALESSANDRO CIANI, DAVID PETER DIVINCENZO, RWTH - Aachen — A key ingredient for quantum error-correction is the ability to perform multi-qubit parity measurements. The current paradigm for these kinds of measurement is to use a quantum circuit involving CNOT gates and an ancilla qubit, that encodes the information about the parity of the string of qubits. Here we analyze how this can be done directly, .e., without a quantum circuit involving CNOT gates, for the case of three qubits using a dispersive readout technique. The scheme employs two measurement resonator modes and, in particular, a Tunable Coupling Qubit (TCQ) as qubit. After reviewing the input-output theory for this problem, we carefully analyze what are the conditions for which a parity measurement is possible, and how these can be matched with a TCQ. The crucial point is the flexibility in the dispersive Jaynes-Cummings parameters made possible by the TCQ, which other qubits, such as the simple Transmon, do not possess.

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