Abstract Submitted
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Enhancing the coherence of 3D qubits suitable for multi-qubit experiments[1] BALEEGH ABDO, DOUGLAS MCCLURE, HANHEE PAIK, MARTIN SANDBERG, JAY GAMBETTA, OLIVER DIAL, IBM T.J. Watson Research Center, Yorktown Heights, NY 10598, USA — Superconducting qubits coupled to 3D cavities [1,2] have several advantages over qubits coupled to planar cavities on the same chip, e.g., 1) they can be individually designed, tested, and integrated, 2) they exhibit better microwave hygiene than their 2D counterpart, and 3) they possess higher coherence times, in part because they have reduced participation ratios for surface dielectric layers that can be lossy. However, in order to implement the surface code using a multi-qubit system, 3D qubits and their corresponding microwave cavities have to meet several competing requirements in addition to preserving long coherence, such as large coupling of the 3D qubit to two adjacent microwave resonators, sufficient coupling to other qubits, and large microwave isolation between different cavities. Finding a qubit design that balances all of these requirements has proved challenging so far. In this work, we apply a combination of simulations and experiments to investigate a variety of loss mechanisms that are particularly relevant for multi-qubit systems. Based on this learning, we identify changes in the design and materials of these systems that can lead to enhancement of their coherence times. [1] H. Paik et al., PRL 107, 240501 (2011) [2] C. Rigetti et al., PRB 86, 100506(R)(2012).

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