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Simulation of a Tunable, Three-dimensional Resonant Cavity for Quantum Control and Measurement[1] RAVI NAIK, KATER MURCH, I. SIDDIQI, UC Berkeley, QNL — We present the design and simulation of a tunable, superconducting, three-dimensional resonant cavity for control and measurement of quantum systems. By adjusting the dimensions of the cavity appropriately, we create a photon resonant mode in the 4-8 GHz frequency band, typical of many current superconducting qubits. We simulate the resonance behavior of the cavity using a commercial three-dimensional finite-element solver to explore the effects of various modifications of the cavity boundaries and coaxial signal ports, as well as the insertion of dielectric materials and metallic control lines within the cavity. In particular, we find that the quality factor of the cavity resonance is exponentially dependent on the insertion depth of the port pins from the surface of the cavity. A weak dependence is observed for other modifications. By adjusting the pin depth, we can achieve a range of quality factors from a few hundred to a few million, as verified by experiment.

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