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Quantum Devices Bonded Beneath a Superconducting Shield: Part 2 COREY RAE MCRAE, ADEL ABDALLAH, JEREMY BEJANIN, CAROLYN EARNEST, THOMAS MCCONKEY, ZACHARY PAGEL, MATTEO MARIANTONI, University of Waterloo — The next-generation quantum computer will rely on physical quantum bits (qubits) organized into arrays to form error-robust logical qubits. In the superconducting quantum circuit implementation, this architecture will require the use of larger and larger chip sizes. In order for on-chip superconducting quantum computers to be scalable, various issues found in large chips must be addressed, including the suppression of box modes (due to the sample holder) and the suppression of slot modes (due to fractured ground planes). By bonding a metallized shield layer over a superconducting circuit using thin-film indium as a bonding agent, we have demonstrated proof of concept of an extensible circuit architecture that holds the key to the suppression of spurious modes. Microwave characterization of shielded transmission lines and measurement of superconducting resonators were compared to identical unshielded devices. The elimination of box modes was investigated, as well as bond characteristics including bond homogeneity and the presence of a superconducting connection.

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