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dc SQUID Phase Qubit with Sub-Micron Junction and Interdigitated Capacitor[1] ANTHONY PRZYBYSZ, H. KWON, E. CROWE, B. K. COOPER, R. BUDOYO, K. MITRA, J. R. ANDERSON, C. J. LOBB, A. J. DRAGT, F. C. WELLSTOOD, University of Maryland, JQI, S. GLADCHENKO, V. ZARETSKY, Z. KIM, B. PALMER, K. OSBORN, Laboratory for Physical Sciences — We have designed an Al/AlO_x/Al dc SQUID phase qubit on sapphire that minimizes the effects from sources of loss and dephasing, with the goal of reaching a coherence time of 10 micro-seconds. Loss from the Josephson junction's tunnel barrier and other neighboring dielectric layers is believed to be the dominant sources of decoherence in most phase qubits. To minimize the number of charge two-level systems in the barrier and the effect of dielectric loss, our phase qubit employs a 300 x 300 nm junction with a designed critical current of 150 nA and a 1 pF interdigitated capacitor that is added in parallel. The capacitor is made on the sapphire substrate and has 100 fingers that are about 1.2 microns wide with a 1.2 micron spacing between them. To minimize loss from the bias leads, the qubit is isolated from the leads by a tunable inductive isolation network and an on-chip LC filter. We will discuss the design as well as on-going research into the effect that these parameters have on the coherence time of such a device.

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