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NMR-like Operation and Analysis of Decoherence of a Superconducting Quantum Bit

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The Quantronium [1], a superconducting circuit with Josephson junctions, can be regarded as a solid state qubit prototype with built-in decoupling from its environment. We demonstrate that arbitrary operators can be applied to it using NMR-like and atomic physics-like techniques that involve quasi-resonant microwave or adiabatic DC pulses [2]. Then, we explain how the symmetry of the circuit limits decoherence of a superposition of states, at an optimal working point. Coherence time measurements, performed both during free and driven evolution of the qubit are presented and analyzed using a simple model involving different noise sources. A complete picture of decoherence in this quantum electrical circuit is thus provided. [1] D. Vion *et al.*, Science **296** (2002). [2] E. Collin *et al.*, Phys. Rev. Lett. **93**, 15, (2004).