

Breakdown of Adiabaticity and Role of the Environment in a Cooper-Pair Pump

S. Gasparinetti^a, Y. Yoon^a, P. Solinas^b, M. Möttönen^b, and J. P. Pekola^a

^aLow Temperature Laboratory, Aalto University, P.O. Box 13500, FI-00076 Aalto, Finland

^bDepartment of Applied Physics/COMP, Aalto University, P.O. Box 14100, FI-00076 Aalto, Finland

The Cooper-pair sluice is an all-superconducting charge pump consisting of a single-electron transistor with tunable Josephson junctions. Past theoretical and experimental investigation mainly focused on its operation in the adiabatic regime. The geometrical nature of the charge pumped in a closed-loop configuration was recently exploited for a measurement of the Berry phase. Starting from the adiabatic picture, we have moved forward and carried out our measurements at the onset of adiabaticity breakdown. Our results demonstrate that coupling to the environment effectively extends the adiabatic behavior to higher-frequency regimes, in agreement with recently developed theory.