Abstract Submitted for the MAR14 Meeting of The American Physical Society

High-Fidelity Single-Qubit Gates for Two-Electron Spin Qubits TIM BOTZEM, PASCAL CERFONTAINE, Department of Physics, RWTH Aachen University, D-52074 Aachen, Germany, DAVID P. DIVINCENZO, Peter Gruenberg Institute, Forschungszentrum Juelich, D-52425 Juelich, Germany, HENDRIK BLUHM, Department of Physics, RWTH Aachen University, D-52074 Aachen, Germany — High fidelity gate operations for manipulating individual and multiple qubits in the presence of decoherence are a prerequisite for fault-tolerant quantum information processing. However, the control methods used in earlier experiments on semiconductor two-electron spin qubits are based on unrealistic approximations which preclude reaching the required fidelities. An attractive remedy is to use control pulses found in numerical simulations that minimize the infidelity from decoherence and take the experimentally important imperfections and constraints into account. Using this approach and experimentally determined noise spectra, we find pulses for singlet-triplet qubits in GaAs double quantum dots with fidelities as high as 99.9%. Fully eliminating systematic pulse errors will likely require a calibration of the pulses on the experiment using some form of self-consistent approach. Starting with inaccurate control pulses we show that elimination of individual systematic gate errors is possible by applying a modification of the bootstrap protocol proposed by Dobrovitski et al. (PRL 105, 2010) while still retaining the pulses' high fidelities.

> Tim Botzem Department of Physics, RWTH Aachen University, D-52074 Aachen, Germany

Date submitted: 15 Nov 2013 Electronic form version 1.4