Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Optimal post-processing for a generic single-shot qubit readout[1]

BENJAMIN D'ANJOU, WILLIAM A. COISH, McGill Univ — We analyze three different post-processing methods applied to a single-shot qubit readout: the average-signal (boxcar filter), peak-signal, and maximum-likelihood methods. In contrast to previous work, we account for a stochastic turn-on time t_i associated with the leading edge of a pulse signaling one of the qubit states. This model is relevant to spin-qubit readouts based on spin-to-charge conversion and would be generically reached in the limit of large signal-to-noise ratio r for several other physical systems, including fluorescence-based readouts of ion-trap qubits and nitrogen-vacancy center spins. We find that the peak-signal method outperforms the boxcar filter significantly when t_i is stochastic, but is only marginally better for deterministic t_i. We generalize the theoretically optimal maximum-likelihood method to stochastic t_i and show numerically that a stochastic turn-on time t_i will always result in a larger single-shot error rate. Based on this observation, we propose a general strategy to improve the quality of single-shot readouts by forcing t_i to be deterministic.

[1]We acknowledge finanical support from NSERC, CIFAR, FQRNT and INTRIQ

Benjamin D'Anjou
McGill Univ

Date submitted: 13 Nov 2013 Electronic form version 1.4