

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Robust Tomography using Randomized Benchmarking**<sup>1</sup> MARCUS SILVA, Quantum Information Processing Group, Raytheon BBN Technologies, SHELBY KIMMEL, Center for Theoretical Physics, MIT, BLAKE JOHNSON, COLM RYAN, THOMAS OHKI, Quantum Information Processing Group, Raytheon BBN Technologies — Conventional randomized benchmarking (RB) can be used to estimate the fidelity of Clifford operations in a manner that is robust against preparation and measurement errors — thus allowing for a more accurate and relevant characterization of the average error in Clifford gates compared to standard tomography protocols. Interleaved RB (IRB) extends this result to the extraction of error rates for individual Clifford gates. In this talk we will show how to combine multiple IRB experiments to extract all information about the unital part of *any* trace preserving quantum process. Consequently, one can compute the average fidelity to *any* unitary, not just the Clifford group, with tighter bounds than IRB. Moreover, the additional information can be used to design improvements in control.

<sup>1</sup>MS, BJ, CR and TO acknowledge support from IARPA under contract W911NF-10-1-0324.

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Date submitted: 09 Nov 2012

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