Relative performance of ancilla verification and decoding in the $[[7,1,3]]$ Steane code\textsuperscript{1} ALI ABU-NADA, BENJAMIN FORTESCUE, MARK BYRD, Southern Illinois University at Carbondale, SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE TEAM — We present numerical simulation results comparing the logical error rates for the fault-tolerant $[[7,1,3]]$ Steane code using standard ancilla verification techniques vs. the newer method of ancilla decoding, as described in [1]. We simulate a realistic QEC procedure in which failed ancilla creation requires storing the data until a new ancilla can be created; we expect the decoding method, which avoids the need for such storage, to be advantageous when the failure probability is sufficiently high. For the $[[7,1,3]]$ code, we analyze the effect of both different syndrome extraction techniques and of different classes of physical error (initialization, measurement, hold etc.) on the relative performance of these two methods.


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