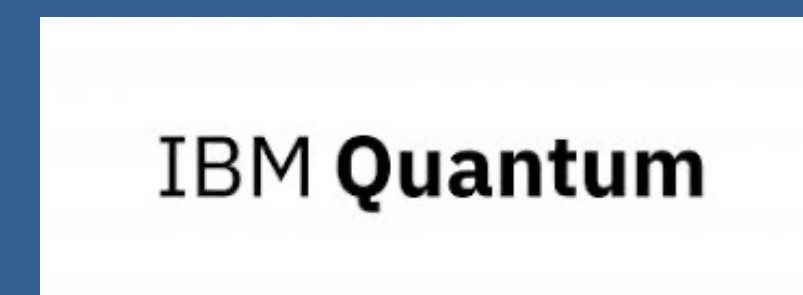




Distilling Magic States in the Bicycle Architecture

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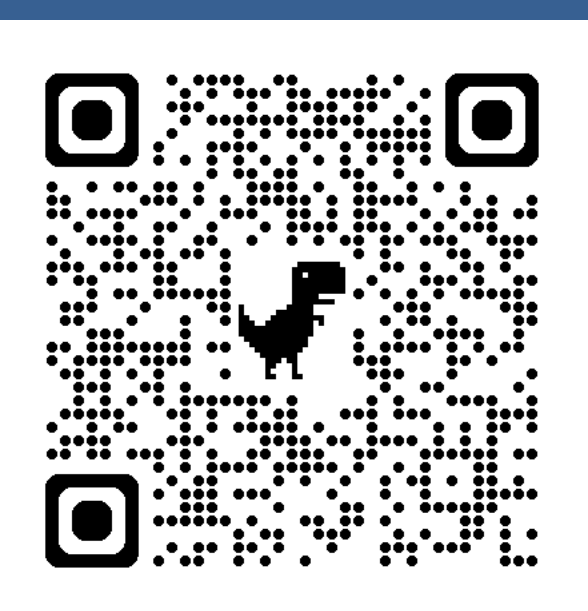


Magic State Distillation is considered to be one of the promising methods for supplying the non-Clifford resources required to achieve universal fault tolerance. Conventional MSD protocols implemented in surface codes often require multiple code blocks and lattice surgery rounds, resulting in substantial qubit overhead, especially at low target error rates.

In this work, we present practical magic state distillation factories on Bivariate Bicycle (BB) codes that execute Pauli-measurement-based Clifford circuits inside a single BB code block. We formulate distillation circuit design as a joint optimization of logical qubit mapping, gate scheduling, measurement nativization, and protocol compression via qubit recycling. Based on detailed resource analysis and simulations, our BB factories have space-time volume comparable to that of leading distillation factories while delivering lower target error at a smaller qubit footprint, and are particularly compelling as second-round distillers following magic state cultivations.

<https://arxiv.org/abs/2602.20546>

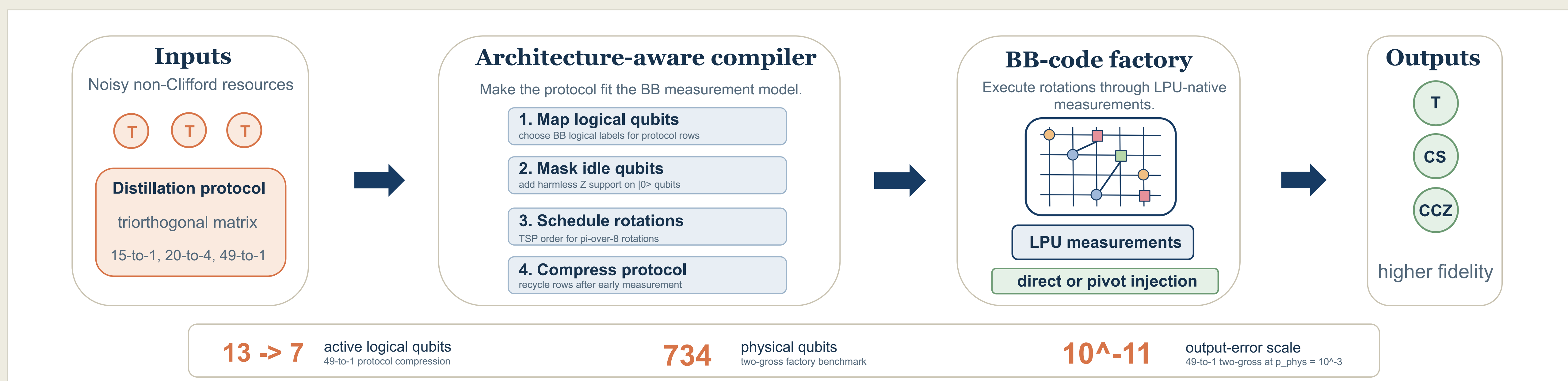
ISCA 2026



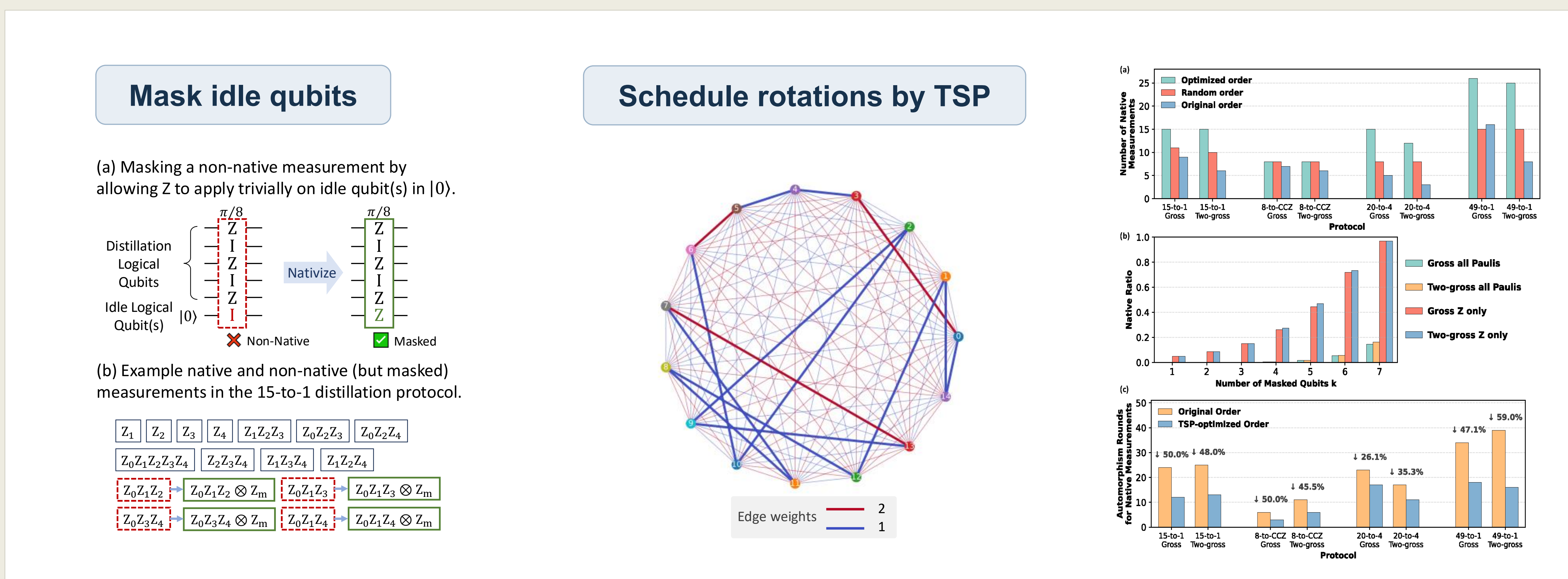
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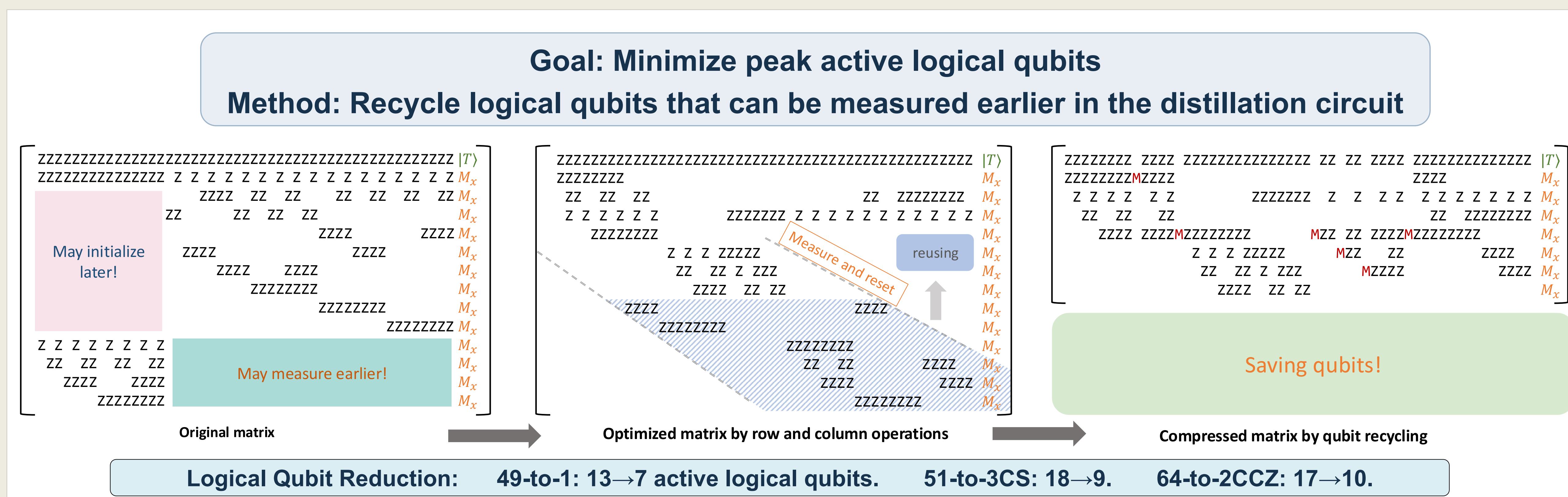
Overview



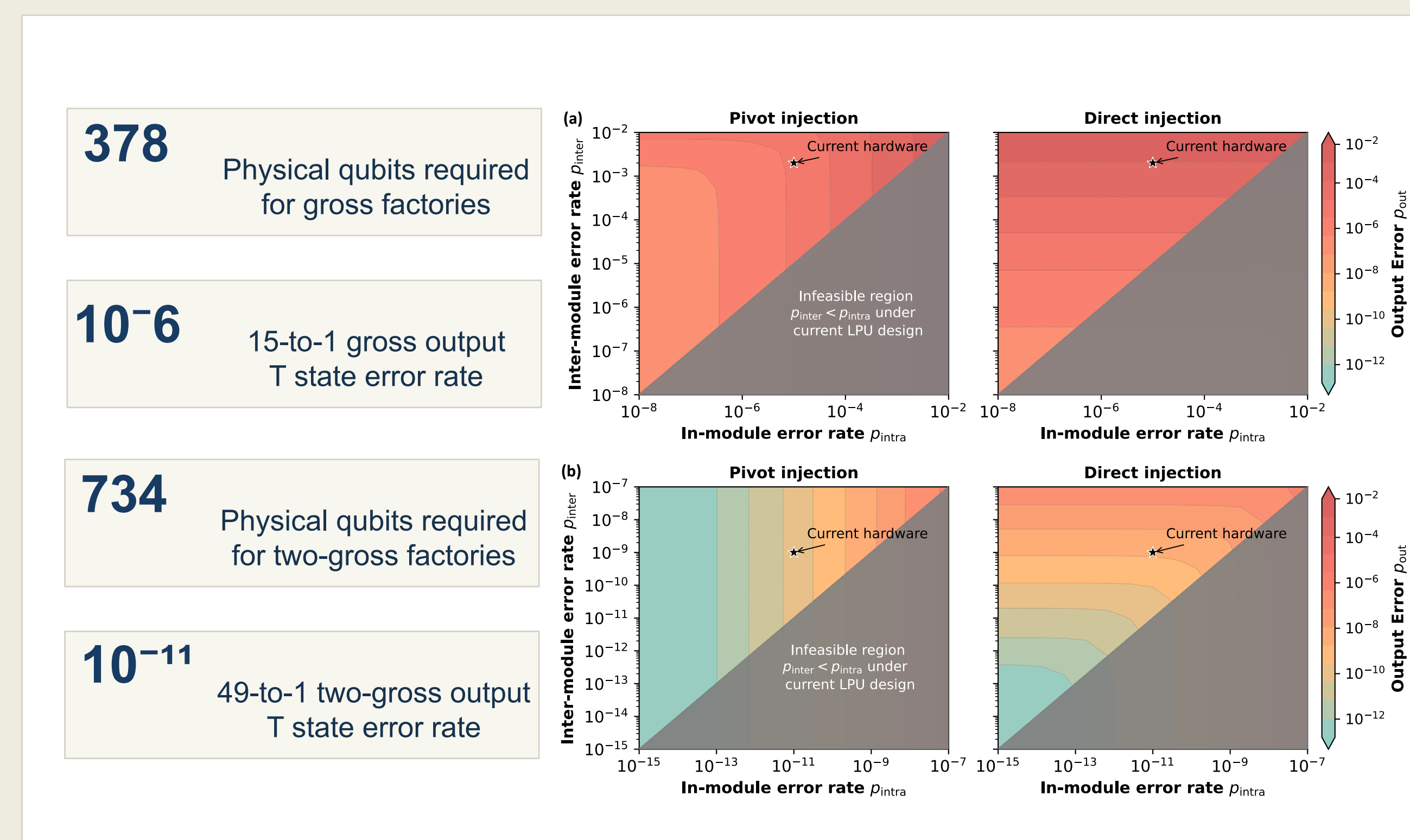
Compilation Stack



Distillation Protocol Compressor



Simulation Results



Highlights: find a proper protocol for your code

