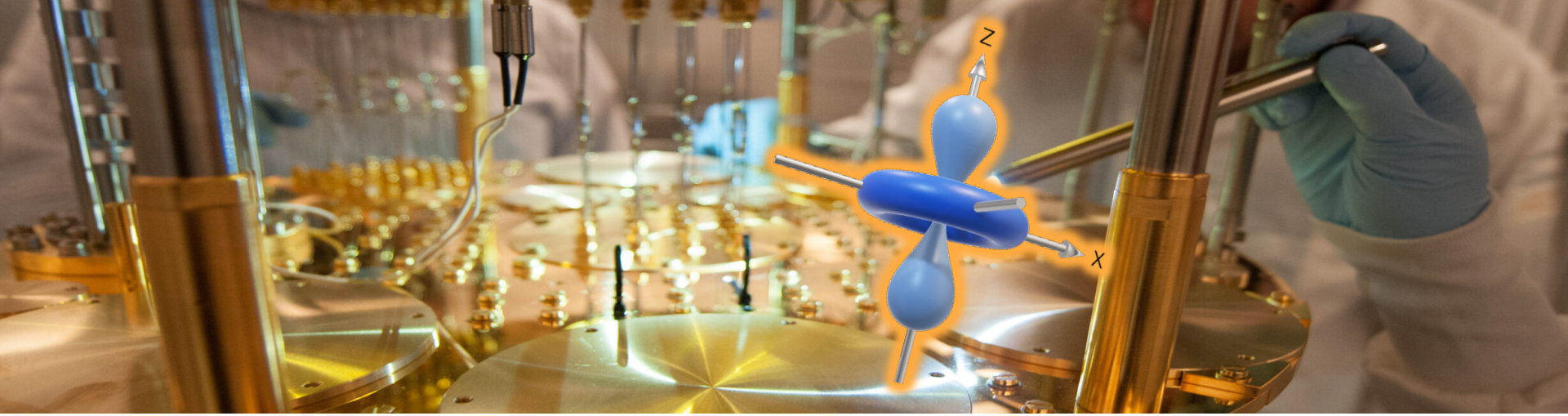

Circuit Optimization Using BQSKit

1. Dynamic Circuit Generation

2. Circuit Approximations for Quadratic Error Reduction

Costin Iancu – Lawrence Berkeley National Laboratory

BQSKit

⟨AIDE|QC⟩

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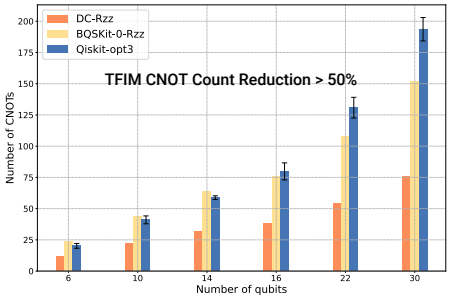
Dynamic Circuit Generation

- Dynamic circuits (MMR and Feed Forward) are useful for resource optimization
- Generating DCs requires handling non-unitary operations

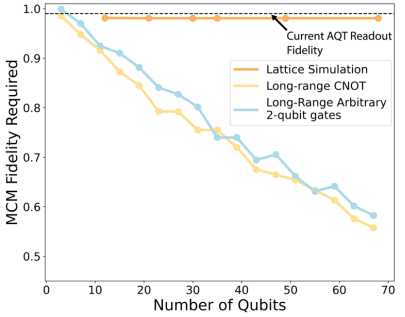
$$C_{\text{dyn1}}(U,W) = 1 - \frac{1}{2^s}\left|\text{Tr}\left(f_0(V\otimes W)^\dagger U\right)\right|$$

First general method available



Good resource optimization potential

$$\mathbf{F} = f_2^{n_2}\cdot f_1^{n_1}\cdot (f_{\text{MCM}})^{N\cdot M}\cdot \exp\left(-N\cdot\frac{C_T}{T_1}\right)$$

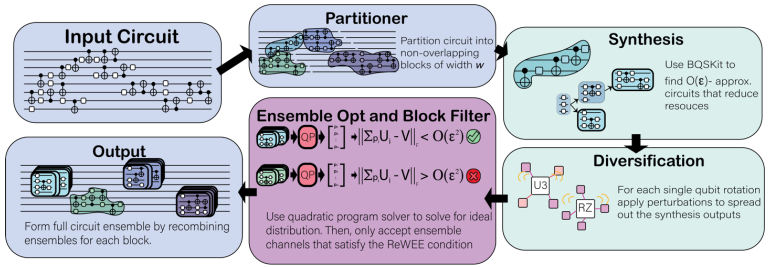


No fidelity loss even for imprecise MMR

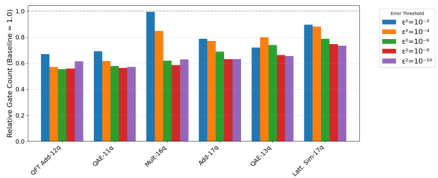
arxiv.2412.07969

Approximations for Quadratic Error Reduction

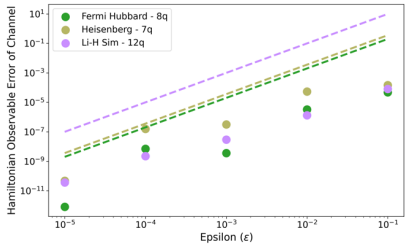
- Approximation is intrinsic to QC (FT)
- Ensemble of ϵ-distance approximate circuits is within ϵ^2-diamond norm distance



First general method available



Massive Decreases in T counts by reducing precision and removing RZs!



Diamond norm is bounded by $O(K\epsilon^2)$

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Thank You!

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