Quantum Labros

Quantum Bros | MIT iQuHACK Hackathon 2026

Team Members

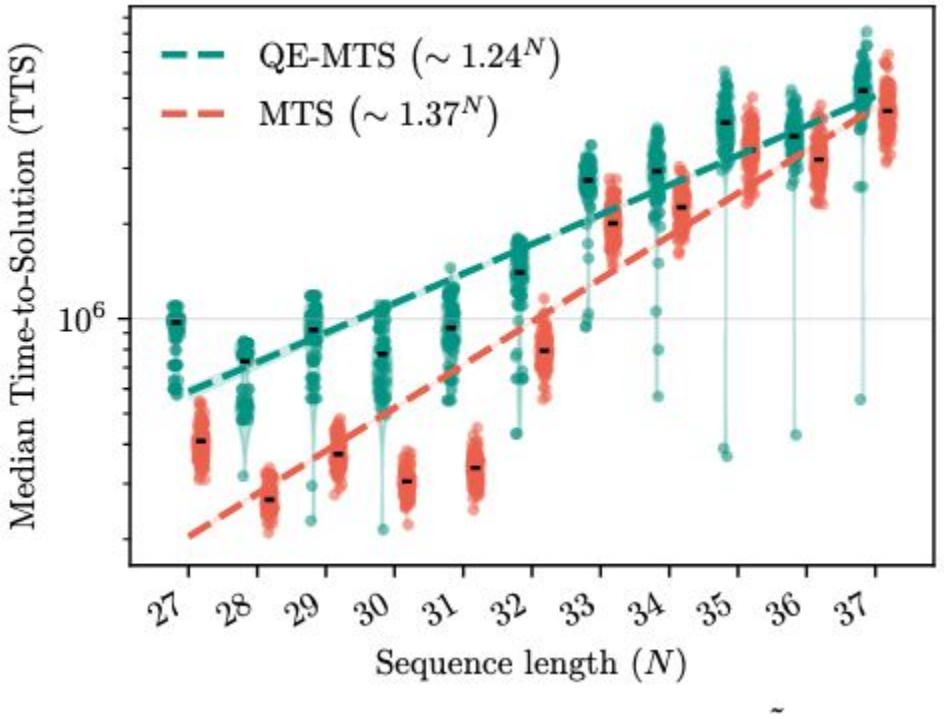
@Catomakyto | @MeghajBUD | @kel404x

LOW-AUTOCORRELATION BINARY SEQUENCES

The LABS problem aims to find binary sequences $\mathbf{s} = (s_1, \ldots, s_N) \in \{\pm 1\}^N$ that minimize the objective

$$E(\mathbf{s}) = \sum_{k=1}^{N-1} C_k^2, \quad \text{with} \quad C_k = \sum_{i=1}^{N-k} s_i s_{i+k}, \tag{1}$$

QE-MTS Result



Blueprint

Pivots from original plan

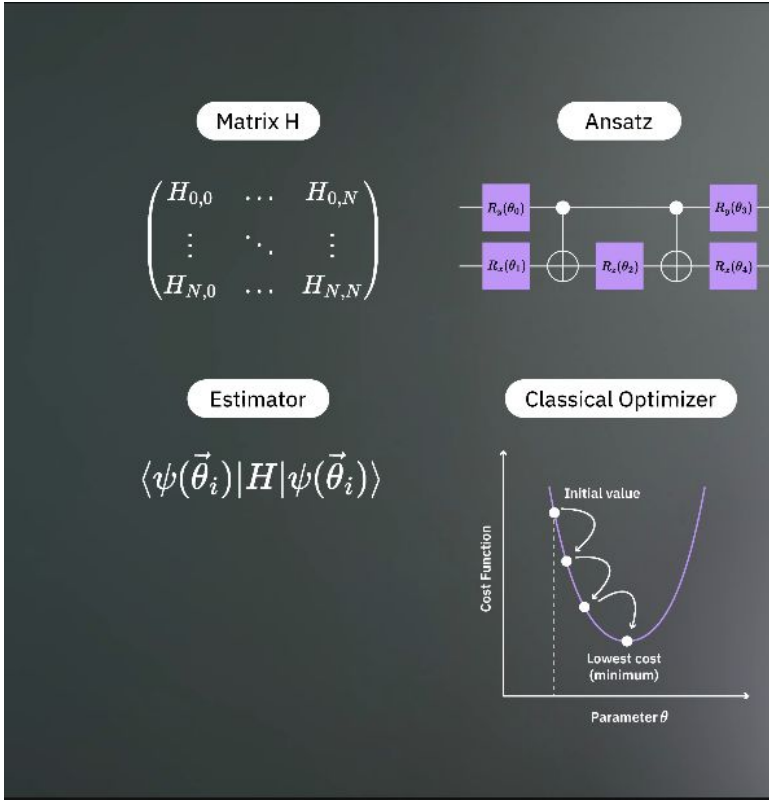
We tried,

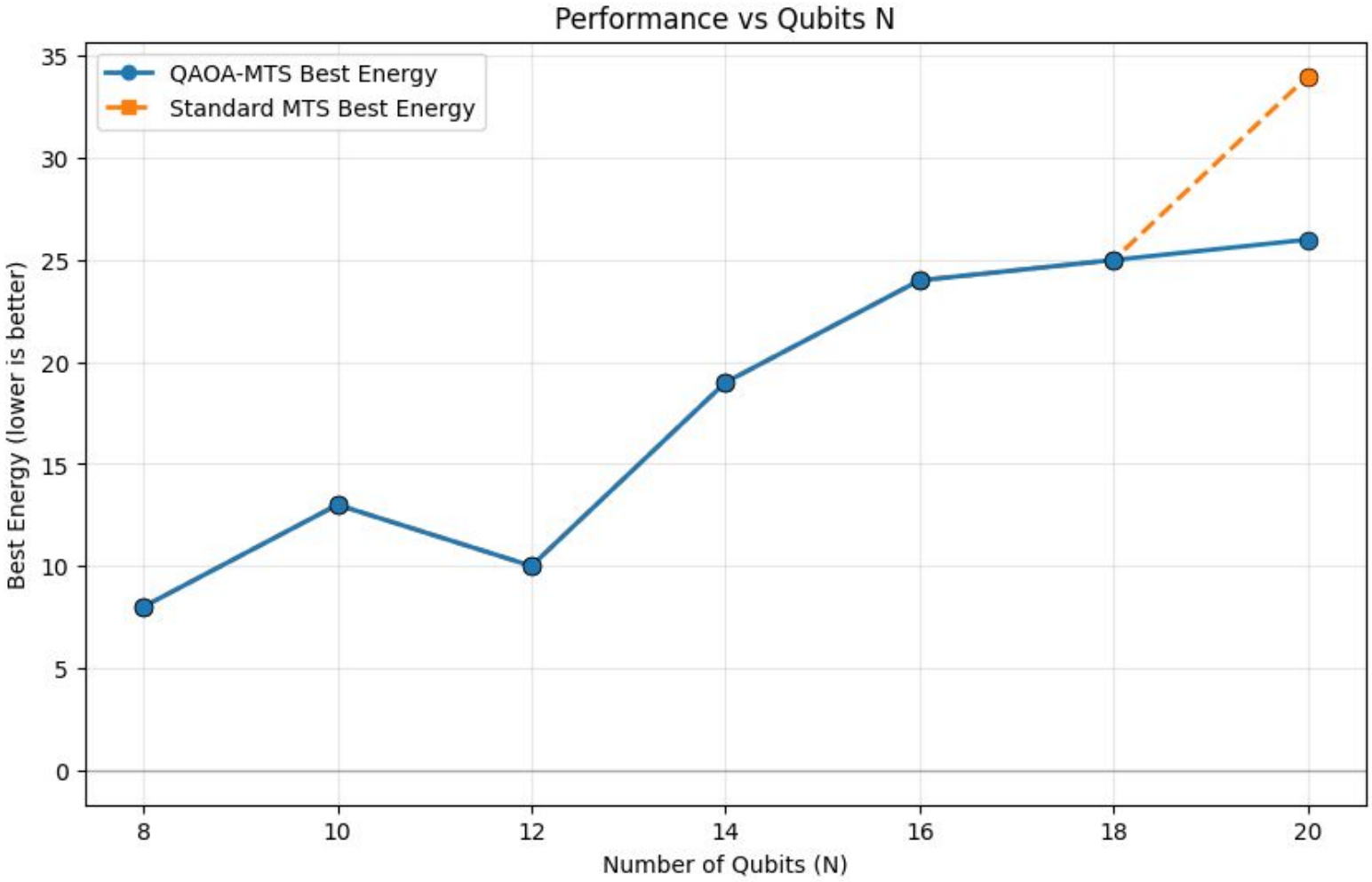
- Variational quantum eigensolver
- Grover Mixers for QAOA
- We eventually optimized QAOA such

  That we utilized symmetry so we don’t

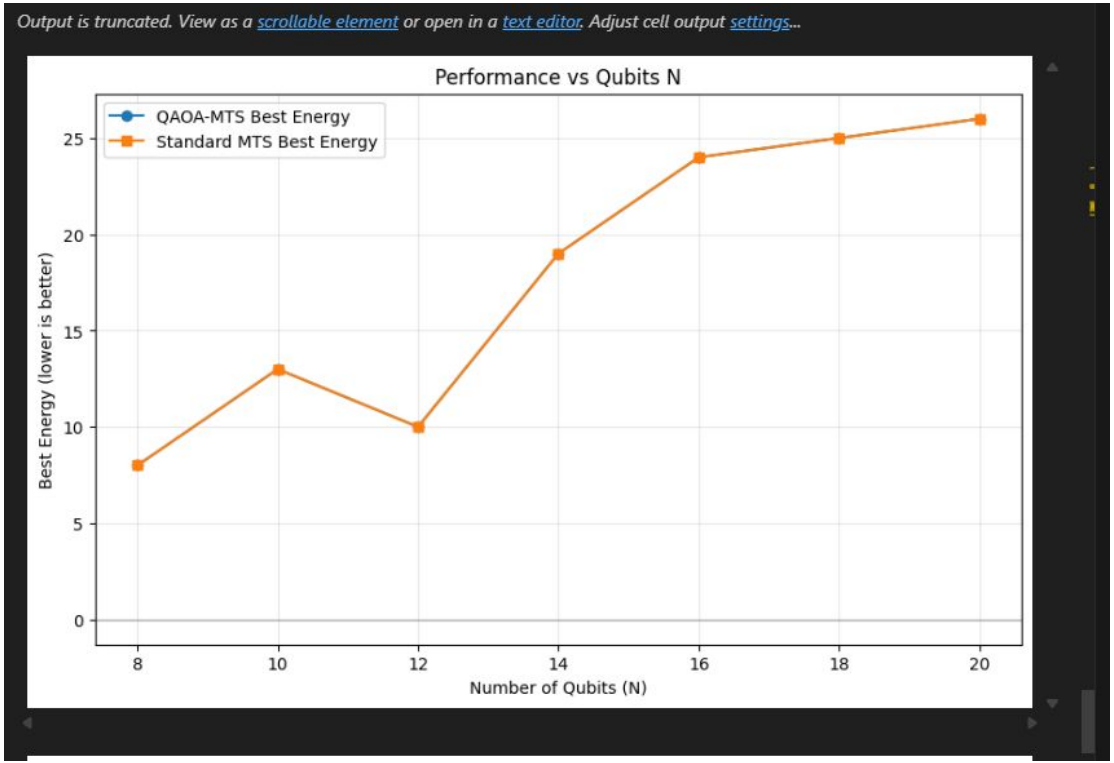
  Waste population slots on symmetry-dup

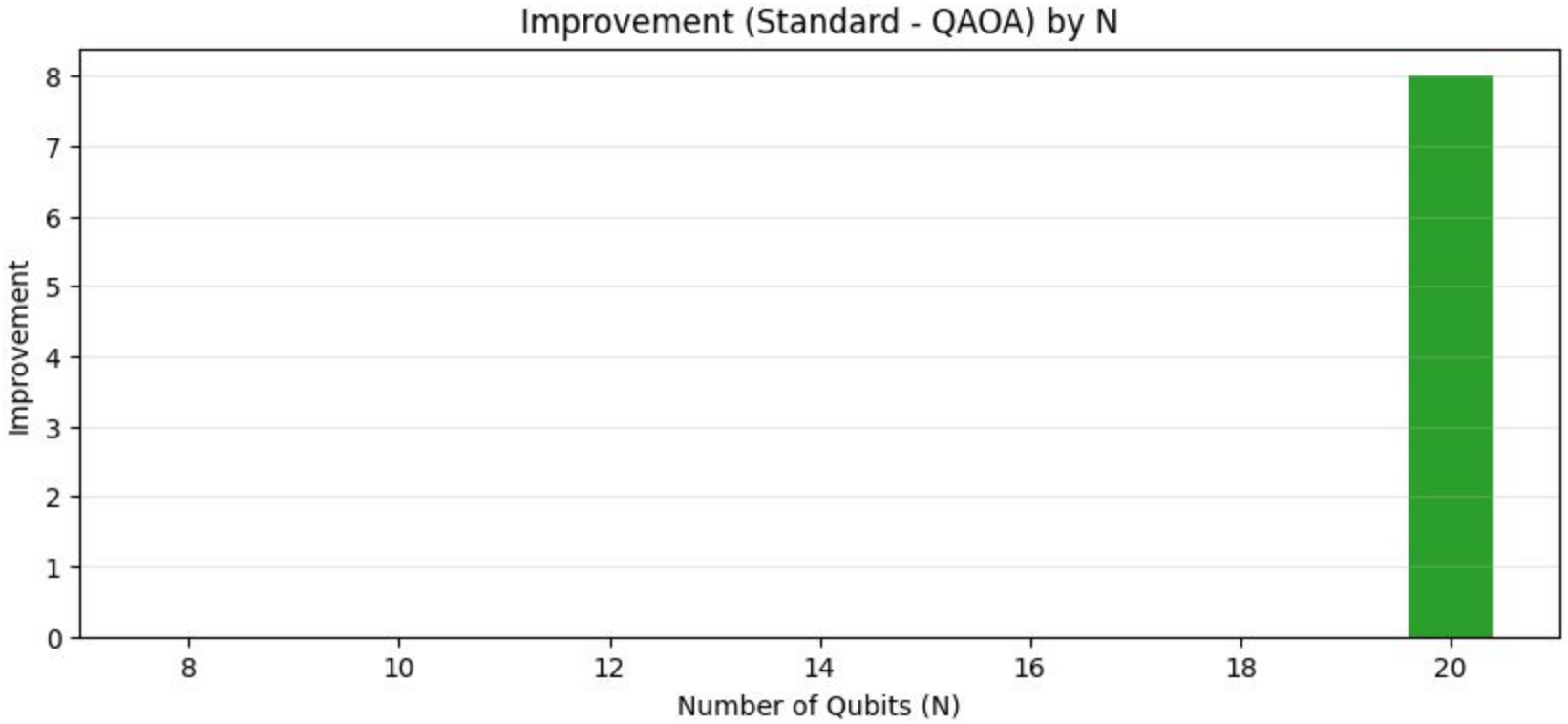
  seeds




Performance vs Qubits N
QAOA-MTS Best Energy
Standard MTS Best Energy
Best Energy (lower is better)
Number of Qubits (N)
35
30
25
20
15
10
5
0
8
10
12
14
16
18
20

Standard MTS Best Energy Graph as number of qubits (N) increase




Improvement (Standard - QAOA) by N
Improvement
0
1
2
3
4
5
6
7
8
8
10
12
14
16
18
20
Number of Qubits (N)

Future additions

We plan to reduce the cost from O(N^2) to O(N) for the algorithm used to solve LABS

Want to try to scale up number of shots

Takeaways

We learned about the integration of classical algorithms being translated into quantum computing code.

Learned how to optimize and design code for quantum computers trying minimize the performance cost as we scale up in the number of qubits we are using.