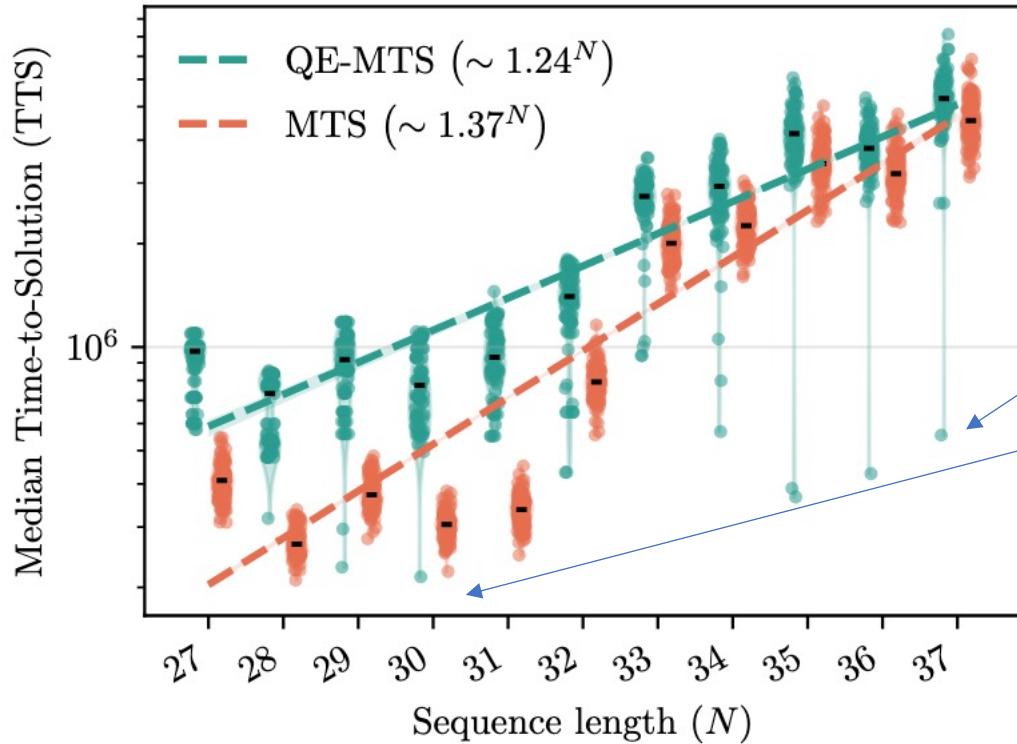


# Statistical analysis on Fast- Outliers in QE-MTS

Raife Foulkes

# Core Question:



Very fast outliers occur  
with DCQA - Why?



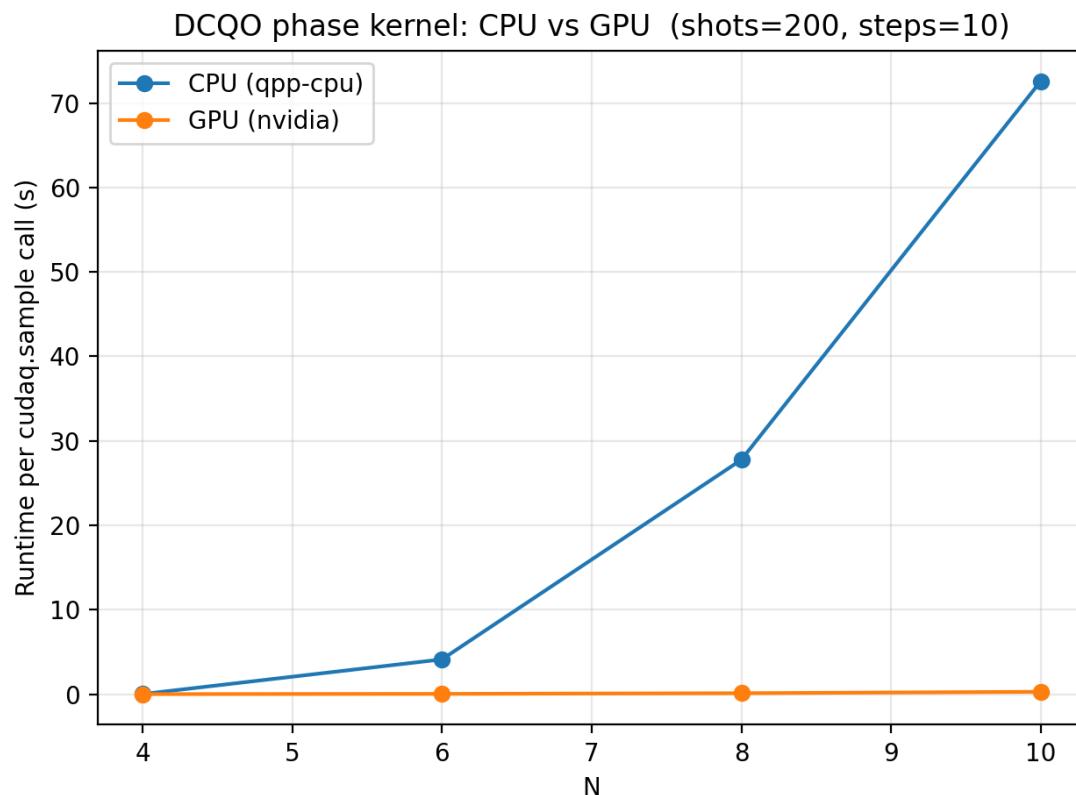
Is this due to  
counterdiabatic workflow

FIG. 2. Per- $N$  distributions of per-replicate medians  $\tilde{Y}_{N,m,r}$  for QE-MTS (teal) and MTS (orange) on a log-scaled TTS axis.

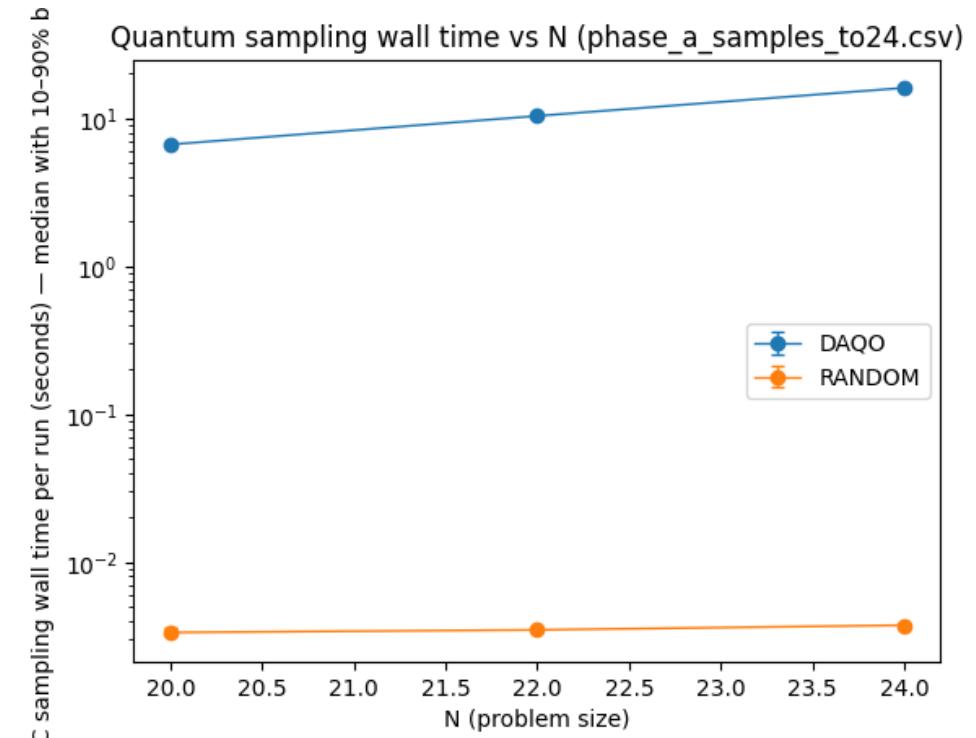
# Goal:

- Investigate the presence of these outliers for digitized adiabatic quantum optimization (DAQO)
- GPU accelerate DAQO and DCQO so that statistically many samples can be taken at large enough N
- Investigate the significance of these outliers in DCQO relative to DAQO

# GPU Acceleration:

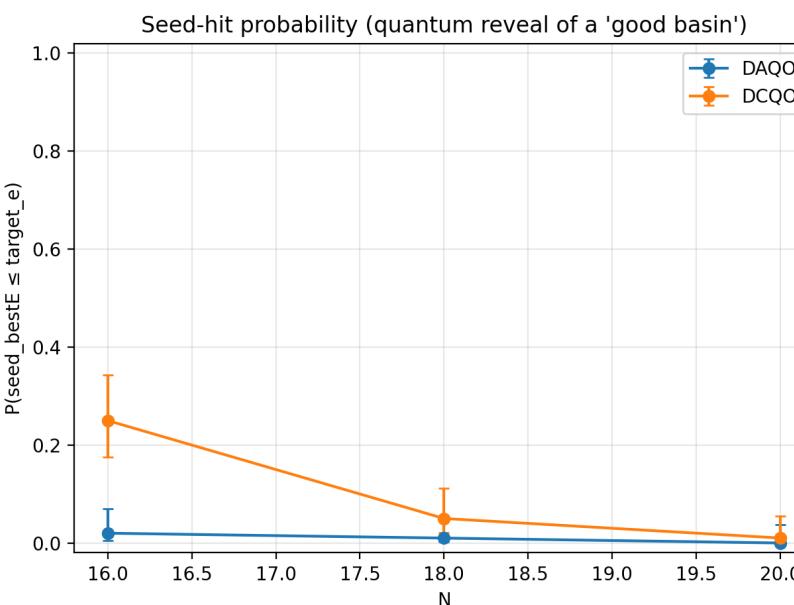
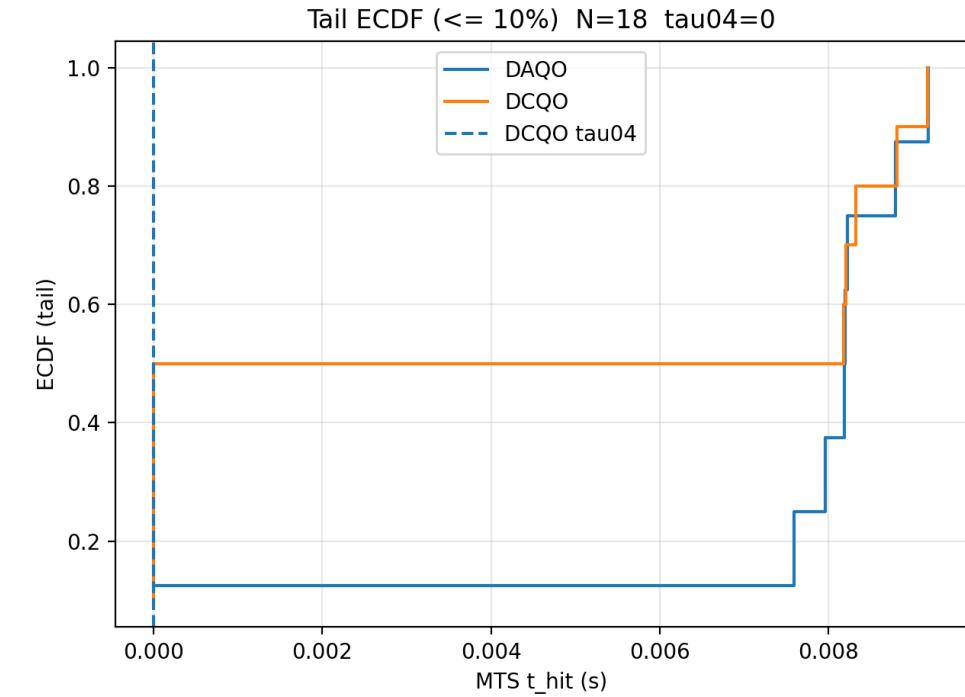
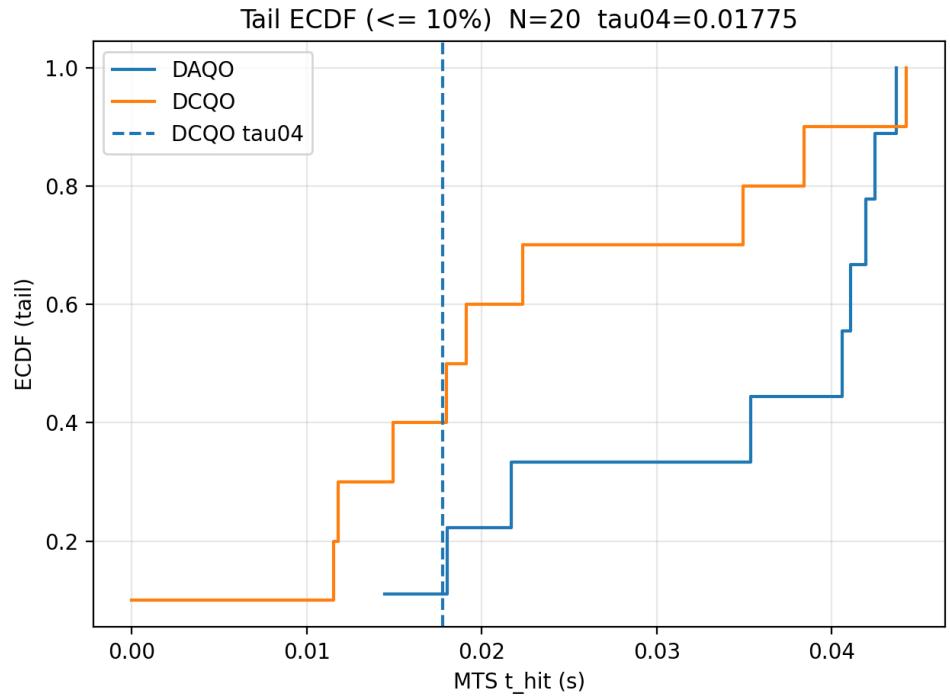


- GPU acceleration much more efficient than naïve CPU implementation



- Using GPU acceleration, runs can be computed 100 times at  $N$  scaling upwards of 24 in tractable time

# Distribution functions



# Statistics:

- **Seed-hit (“instant solve”) rate:** DCQO **10.4%** vs DAQO **1.0%** (pooled N=16–20),  $p \approx 3.8 \times 10^{-7}$ .
  - **Sampling cost dominates wall-time:** DCQO median **TTS**  $\approx 2\text{--}6$  s vs DAQO  $\approx 1\text{--}3$  s (N=16–20).
  - **MTS itself is similar:** median **MTS-to-hit**  $\approx 0.01\text{--}0.26$  s for both methods.
- Insufficient data to declare statistical significance, but the data shows a promising trend that the counterdiabatic term is responsible

Thank you for the  
challenge!