CENTRE FOR QUANTUM TECHNOLOGIES

SINGAPORE

Benchmarking of NQCH's quantum computer

December 1, 2025

1. Report of Changes

Platform: sinq20
Calibration-id: *3826882f81128980b5e49b0e1bec76e24e40e158*
Calibration date: *2025-12-01 02:09:45*
Calibration note: chore(sinq20): Partial recal q0-q1 and q0-q3 pairs

Experiment-id: *None*
Experiment date: *2025-12-01 16:28:53*
Experiment note: *temporary note!!!*

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Experiment-id: *None*
**Experiment date:** *2025-12-01 13:59:36*
Experiment note: *temporary note!!!*
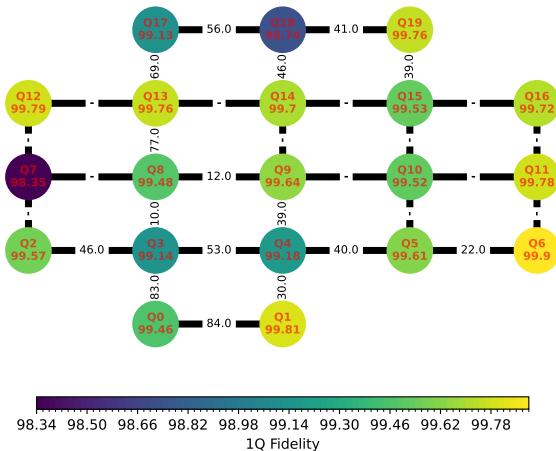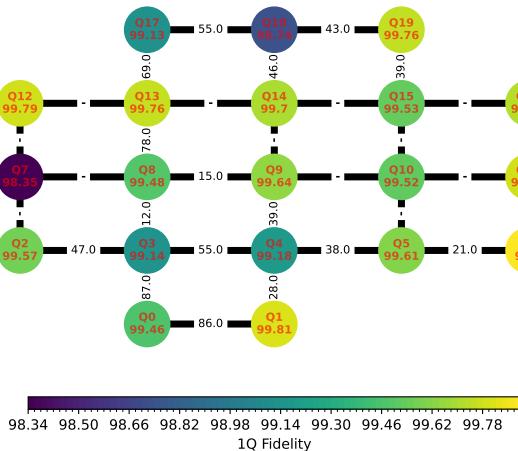
2. Version Comparison

Library	Version	Library	Version
qibo	0.2.22	numpy	2.3.5
qibolab	0.2.9	qibocal	0.2.3
matplotlib	3.10.3	scipy	1.15.3
scikit-learn	1.6.1	pandas	2.2.3
networkx	3.4.2	sympy	1.14.0
torch	2.7.0		

Library	Version	Library	Version
qibo	0.2.19	numpy	2.2.6
qibolab	0.2.7	qibocal	0.2.3
matplotlib	3.10.3	scipy	1.15.3
scikit-learn	1.6.1	pandas	2.2.3
networkx	3.4.2	sympy	1.14.0
torch	2.7.0		

3. One and two qubit fidelities

The single qubit fidelity is obtained via Randomized-Benchmarking. The two-qubit fidelity is the "Bell-state fidelity".

4. Statistics

	Average	Median	Min	Max
T1 (ns)	1.28e+04	1.23e+04	646	3.65e+04
T2 (ns)	2.36e+25	4.11e+03	125	9.43e+26
Fidelity	None	None	None	None
RO fidelity	0.794	0.777	0.777	0.927

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5. Best Qubits Selection

k-qubits	Best Qubits	Fidelity
2	0, 3	0.870
3	0, 1, 3	0.868
4	0, 1, 2, 3	0.735
5	0, 1, 3, 8, 13	0.659

k-qubits	Best Qubits	Fidelity
2	0, 1	0.838
3	0, 1, 3	0.836
4	0, 1, 2, 3	0.711
5	0, 1, 3, 8, 13	0.637

6. Benchmark Results
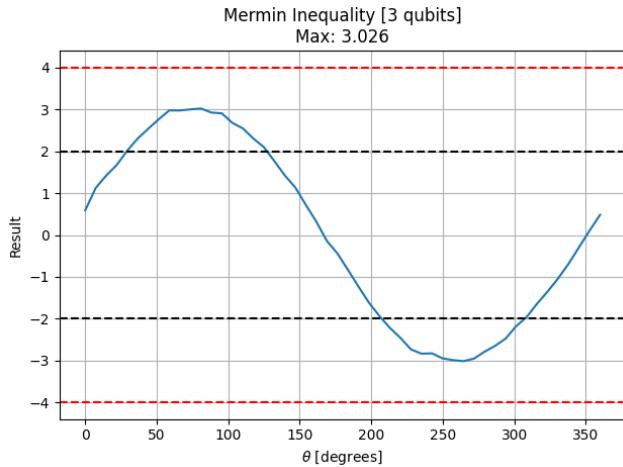
Qubit n	Fidelity	Error Bars
0	0.995	± 0.00112
1	0.998	± 0.0006
2	0.996	± 0.000236
3	0.991	± 0.000805
4	0.992	± 0.00145
5	0.996	± 0.000826
6	0.999	± 0.000308
7	0.983	± 0.00219
8	0.995	± 0.00054
9	0.996	± 0.000782
10	0.995	± 0.000441
11	0.998	± 0.000246
12	0.998	± 0.000396
13	0.998	± 0.000344
14	0.997	± 0.000357
15	0.995	± 0.000647
16	0.997	± 0.000463
17	0.991	± 0.0006
18	0.987	± 0.00163
19	0.998	± 0.00042

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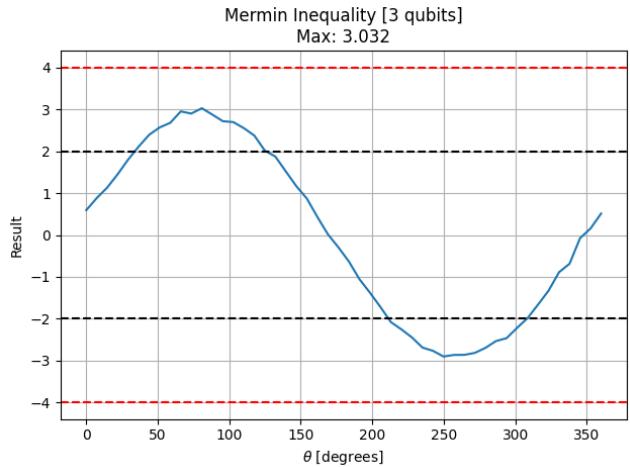
7. Mermin

Mermin's algorithm for 3 qubits.

- **Runtime:** 6.10 seconds
- **Qubits used:** [0, 1, 3]
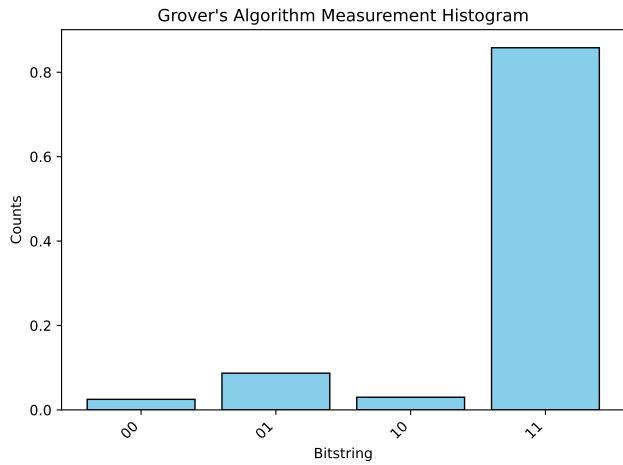
- **Runtime:** 0.93 seconds
- **Qubits used:** [0, 1, 3]
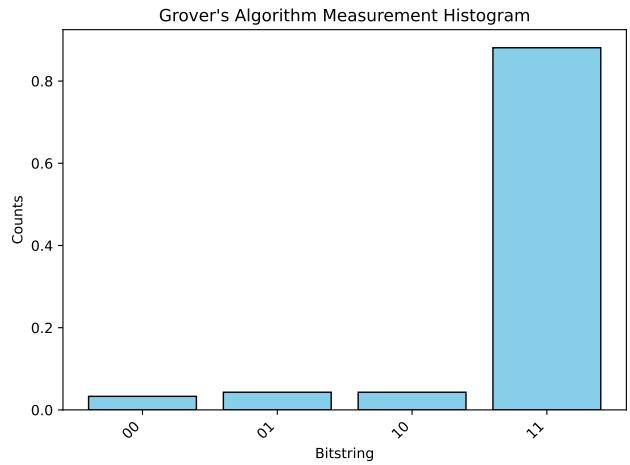
8. Grover - 2 qubits

Grover's algorithm for 2 qubits executed on sinq20 backend with 1000 shots per circuit. We measure the success rate of finding the target state '11' for each pair of qubits in [[0, 3]].

- **Runtime:** 2.94 seconds
- **Qubits used:** [[0, 3]]
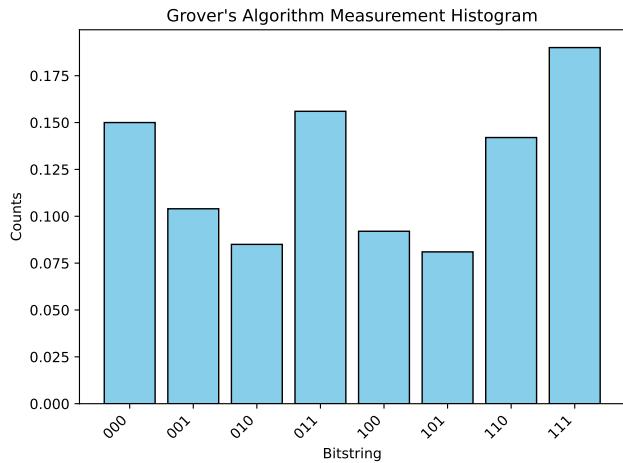
- **Runtime:** 4.22 seconds
- **Qubits used:** [[0, 1]]
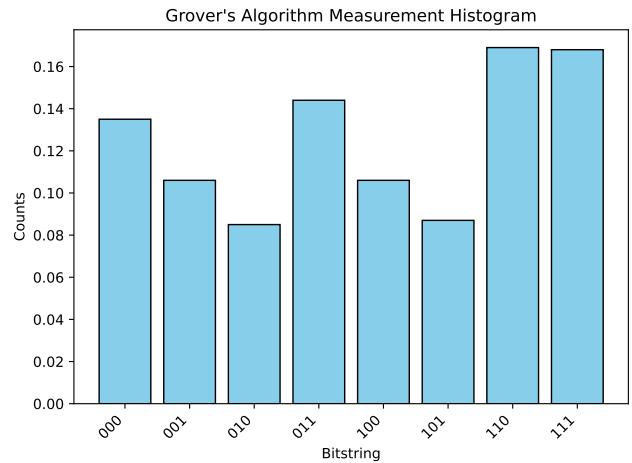
9. Grover - 3 qubits

Grover's algorithm for 3 qubits executed on sinq20 backend with 1000 shots per circuit. We measure the success rate of finding the target state '111' for each pair of qubits in [[0, 1], [0, 3]].

- **Runtime:** 4.37 seconds
- **Qubits used:** [1, 3, 0]
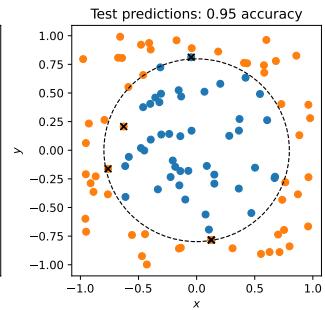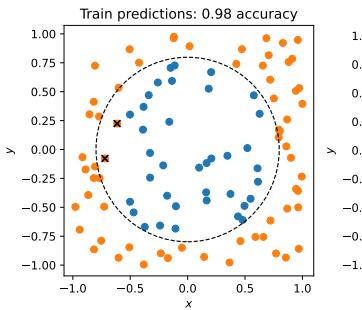
- **Runtime:** 4.30 seconds
- **Qubits used:** [1, 3, 0]
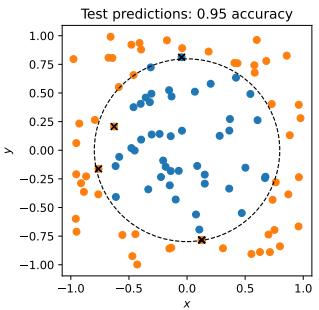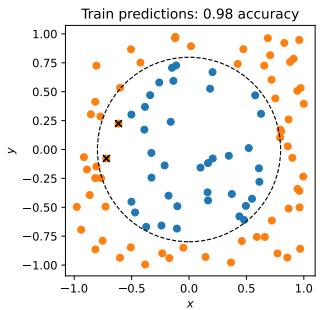
10. Reuploading Classifier

Reuploading classifier with 1 qubits, 10 layers, depth of 20, 500 shots.

- **Runtime:** N/A
- **Qubits used:** [7]
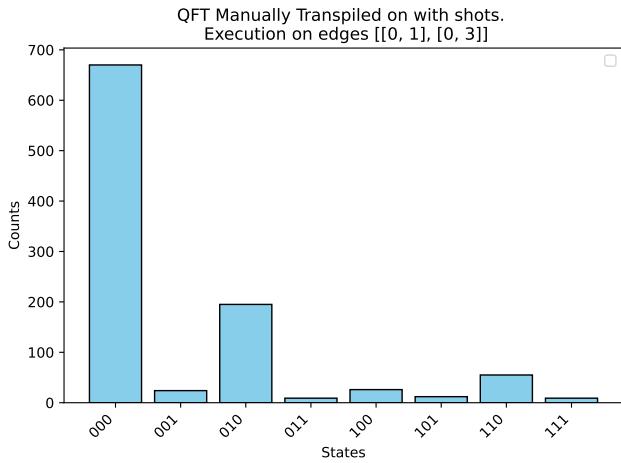
- **Runtime:** N/A
- **Qubits used:** [7]

11. QFT Plots

Implementation of the Quantum Fourier Transform on three qubits with manual transpilation. The number of gates is 66, the depth of the circuit is 40

- **Runtime:** N/A
- **Qubits used:** — No "qubits_used" provided. —

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- **Qubits used:** — No "qubits_used" provided. —