Benchmarking of NQCH's quantum computer

January 19, 2026

1. Report of Changes

Platform: sinq20
Calibration-id: *4dc4082f38a53222b3956c22202d32a520d4bc78*
Calibration date: *2026-01-15 02:03:03*
Calibration note: chore(sinq20): 2q gates cal 0-1, 0-3, 2-3, 3-4, 1-4, 4-5, 4-9, 3-8, 8-9

Experiment-id: *20260118161538*
Experiment date: *2026-01-18 16:15:38*
Experiment note: *temporary note!!!*

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 13:59:36*
Experiment note: *temporary note!!!*

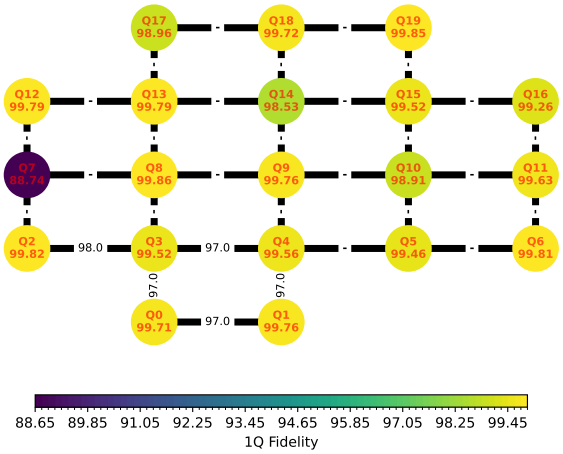
2. Version Comparison

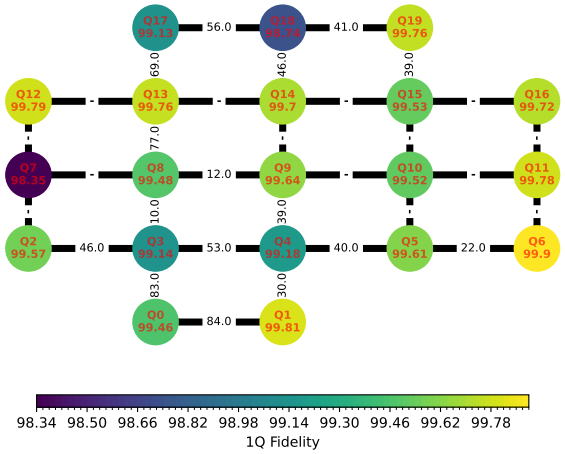
Library	Version	Library	Version
qibo	0.2.22	numpy	2.2.6
qibolab	0.2.9	qibocal	0.2.4
matplotlib	3.10.3	scipy	1.15.3
scikit-learn	1.6.1	pandas	2.2.3
networkx	3.4.2	sympy	1.14.0
torch	2.7.0		

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	3.68e+03	125	9.43e+26
Fidelity	None	None	None	None
RO fidelity	0.794	0.777	0.777	0.927

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Fidelity	None	None	None	None
RO Fidelity	0.794	0.777	0.777	0.927

5. Best Qubits Selection

k-qubits	Best Qubits	Fidelity
2	2, 3	0.981
3	0, 2, 3	0.976
4	0, 1, 2, 3	0.970
5	0, 1, 2, 3, 4	0.965

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

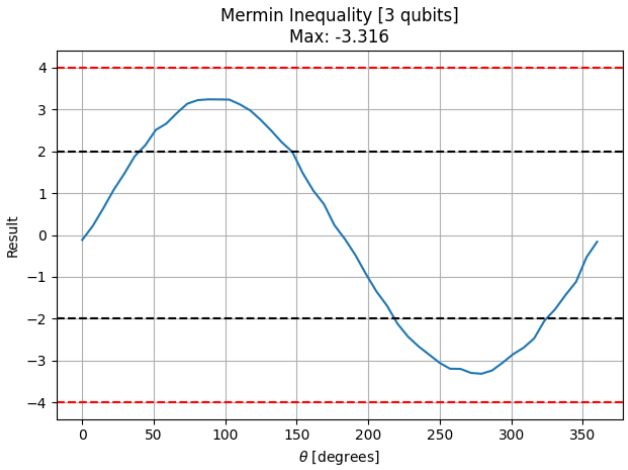
Qubit n	Fidelity	Error Bars
0	0.997	± 0.000131
1	0.998	± 7.47e-05
2	0.998	± 7.57e-05
3	0.995	± 0.000163
4	0.996	± 0.000185
5	0.995	± 0.000147
6	0.998	± 8.34e-05
7	0.887	± 0.0287
8	0.999	± 4.48e-05
9	0.998	± 7.2e-05
10	0.989	± 0.000582
11	0.996	± 0.000218
12	0.998	± 0.000126
13	0.998	± 7.15e-05
14	0.985	± 0.00183
15	0.995	± 0.000469
16	0.993	± 0.000558
17	0.99	± 0.000502
18	0.997	± 0.00026
19	0.998	± 9.05e-05

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

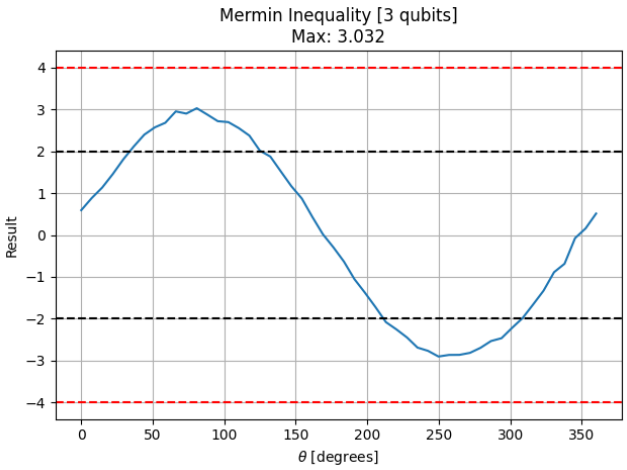
7. Mermin

Mermin's algorithm for 3 qubits.

- **Runtime:** 1.02 seconds
- **Qubits used:** [0, 2, 3]



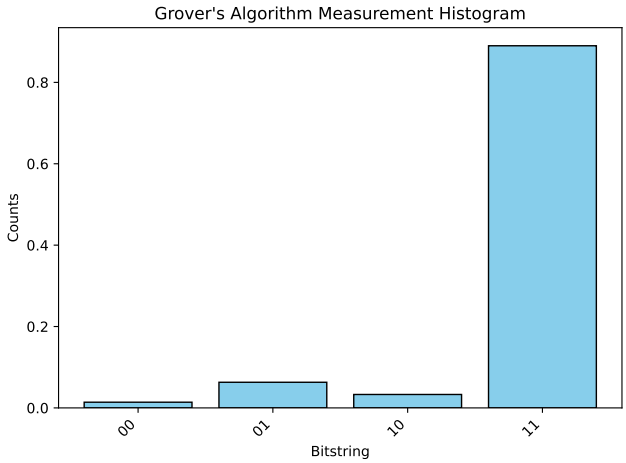
- **Runtime:** 0.93 seconds
- **Qubits used:** [0, 1, 3]



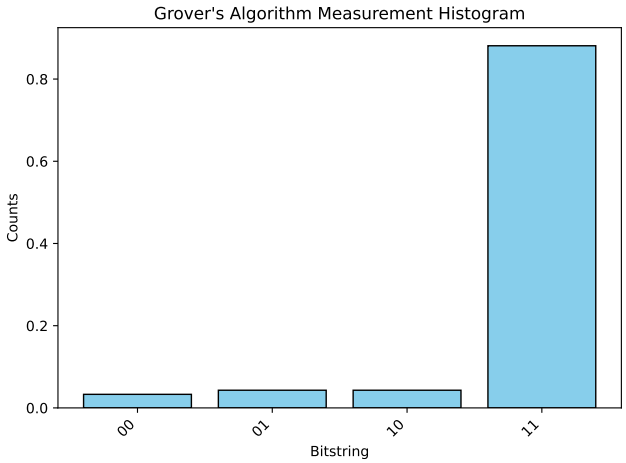
8. Grover - 2 qubits

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 [[2, 3]].

- **Runtime:** 2.36 seconds
- **Qubits used:** [[2, 3]]



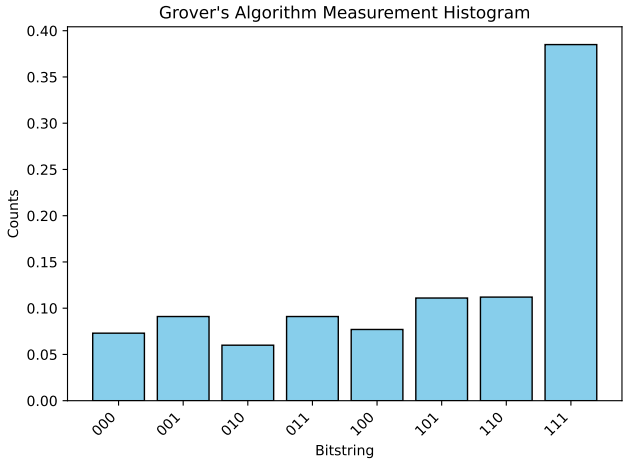
- **Runtime:** 4.22 seconds
- **Qubits used:** [[0, 1]]



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, 3], [2, 3]].

- **Runtime:** 2.43 seconds
- **Qubits used:** [0, 2, 3]



- **Runtime:** 4.30 seconds
- **Qubits used:** [1, 3, 0]