Benchmarking of NQCH's quantum computer

April 14, 2026

1. Report of Changes

Platform: sinq20
Calibration-id: *aefd4fc38780f3205427ef59f0121c7d9ad23b87*
Calibration date: *2026-04-13 10:16:43*
Calibration note: Revert "sq_coarsecal_130426-1342"
This reverts commit 1c413066ddbbf42dad8b9da7f3f453ab4930170f.

Experiment-id: *20260413212203*
Experiment date: *2026-04-13 21:22:03*
Experiment note: *temporary note!!!*

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!!!*

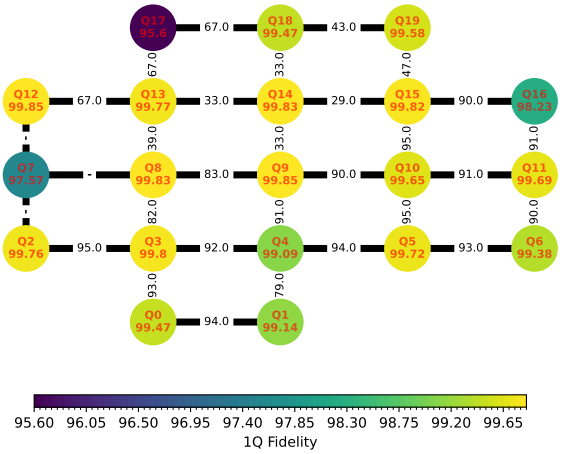
2. Version Comparison

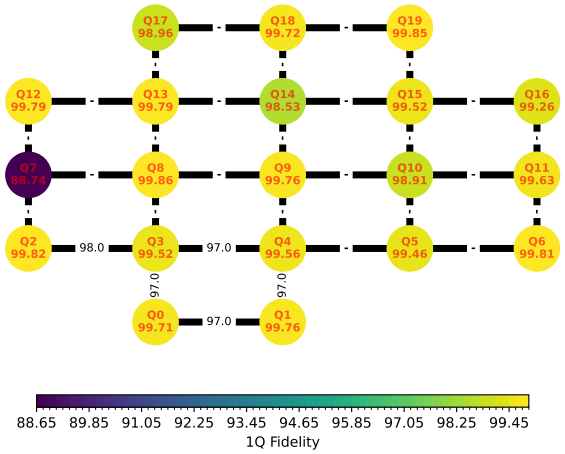
Library	Version	Library	Version
qibo	0.2.23	numpy	2.4.4
qibolab	0.2.9	qibocal	0.2.5
matplotlib	3.10.8	scipy	1.17.1
scikit-learn	1.8.0	pandas	2.3.3
networkx	3.6.1	sympy	1.14.0
torch	2.11.0		

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		

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)	-	-	-	-
T2 (ns)	-	-	-	-
Fidelity	0.866	0.951	0.517	0.998
RO Fidelity	0.986	0.986	0.983	0.991
2q RB Fidelity	-	-	-	-
2q CZ Fidelity	-	-	-	-

	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	0.99	0.997	0.887	0.999
RO Fidelity	0.794	0.777	0.777	0.927
2q RB Fidelity	0.965	0.972	0.923	0.981
2q CZ Fidelity	0.975	0.974	0.967	0.991

5. Best Qubits Selection

k-qubits	Best Qubits	Fidelity
2	2, 3	0.953
3	5, 10, 15	0.948
4	4, 5, 10, 15	0.944
5	4, 5, 6, 10, 15	0.940

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

6. Summary metrics

Benchmark	Metric	Value	Runtime
Mermin	Max	3.54	284.78 sec
Grover 2q	Max prob	0.837	3.08 sec
Grover 3q	Max prob	0.341	2.34 sec
GHZ state prep.	Success	0.937	3.03 sec

Benchmark	Metric	Value	Runtime
Mermin	Max	-3.316	1.02 sec
Grover 2q	Max prob	0.89	2.36 sec
Grover 3q	Max prob	0.385	2.43 sec
GHZ state prep.	Success	0.910	3.95 sec

7. Randomized Benchmarking Results

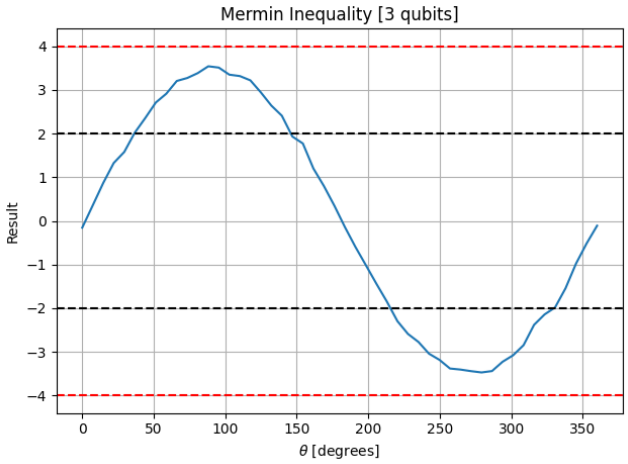
Qubit n	Fidelity	Error Bars	Qubit n	Fidelity	Error Bars
0	0.995	± 0.000224	10	0.996	± 0.00012
1	0.991	± 0.000662	11	0.997	± 0.000156
2	0.998	± 8.9e-05	12	0.998	± 7.26e-05
3	0.998	± 7.97e-05	13	0.998	± 9.89e-05
4	0.991	± 0.000559	14	0.998	± 5.64e-05
5	0.997	± 0.000197	15	0.998	± 0.000118
6	0.994	± 0.00018	16	0.982	± 0.00376
7	0.976	± 0.00421	17	0.956	± 0.0121
8	0.998	± 6.71e-05	18	0.995	± 0.000286
9	0.998	± 8.32e-05	19	0.996	± 0.000122

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

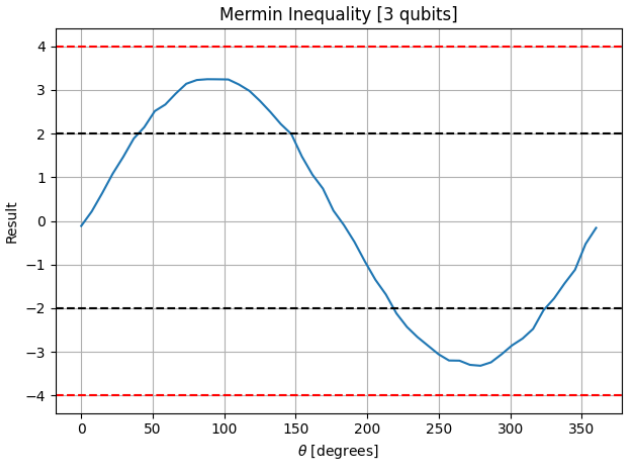
8. Mermin

Mermin's algorithm for 3 qubits.

Runtime	Qubits	Max
284.78 sec	10, 5, 15	3.54



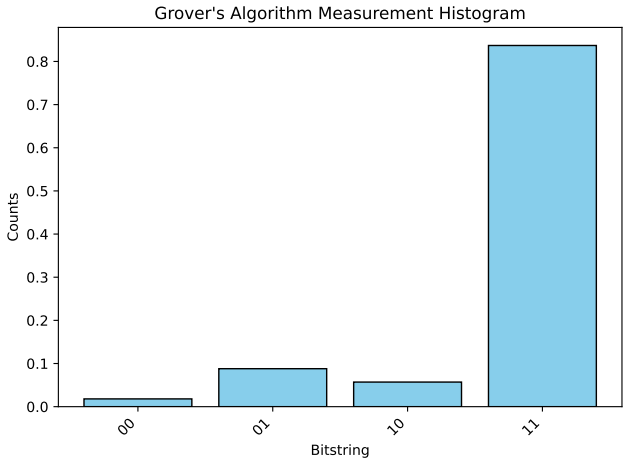
Runtime	Qubits	Max
1.02 sec	0, 2, 3	-3.316



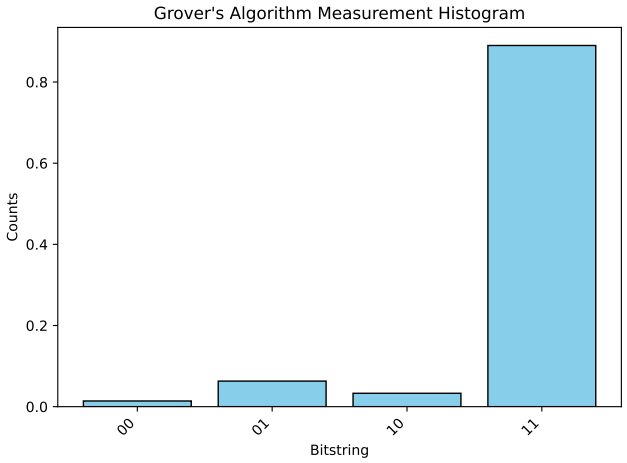
9. Grover - 2 qubits

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	Qubits	Max prob
3.08 sec	2, 3	0.837



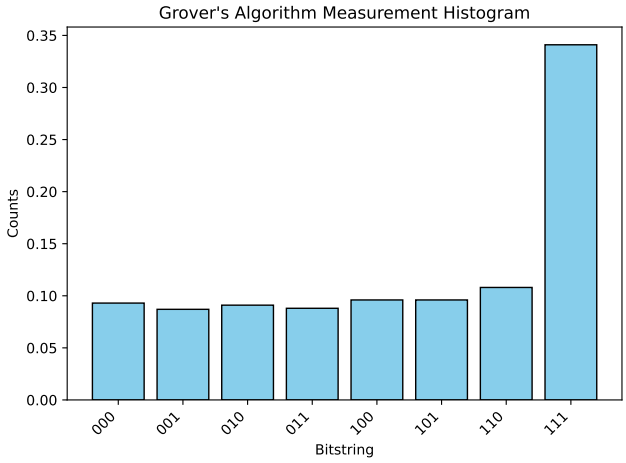
Runtime	Qubits	Max prob
2.36 sec	2, 3	0.89



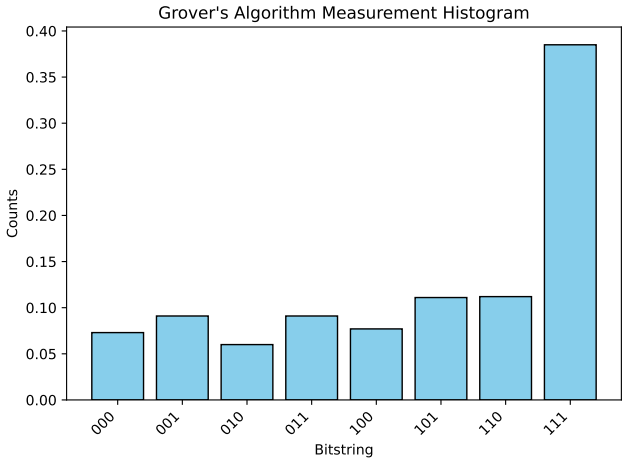
10. Grover - 3 qubits

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 [[10, 5], [10, 15]].

Runtime	Qubits	Max prob
2.34 sec	5, 15, 10	0.341



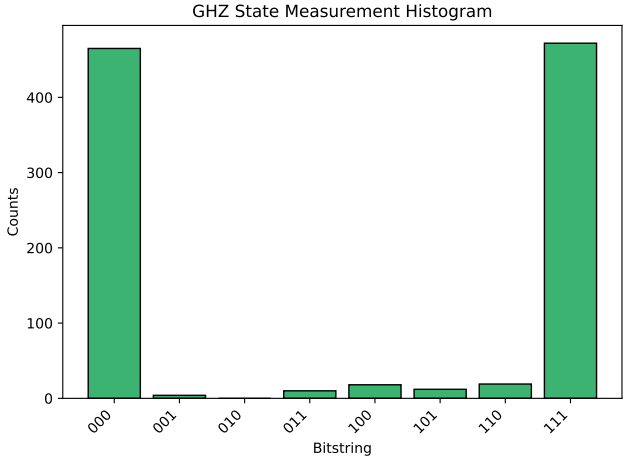
Runtime	Qubits	Max prob
2.43 sec	0, 2, 3	0.385



11. GHZ state preparation

GHZ circuit with 3 qubits executed on sinq20 backend with 1000 shots.

Runtime	Qubits	Success
3.03 sec	5, 10, 15	0.937



Runtime	Qubits	Success
3.95 sec	0, 3, 2	0.910