Benchmark Report

Benchmarking of NQCH's quantum computer

November 12, 2025

1. Report of Changes

Platform: sinq20
Calibration-id: *2447f0fad33dfea493b4e7bc4143c8bd2e28d979*
Calibration date: *2025-11-05 08:58:37*
Calibration note: chore(sinq20): Retune CZ for Q5-Q6 and Q17-Q18

Experiment-id: *20251110092039*
Experiment date: *2025-11-10 09:25:32*
Experiment note: *Second execution.*

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Calibration date: *2025-11-05 08:58:37*
Calibration note: chore(sinq20): Retune CZ for Q5-Q6 and Q17-Q18

Experiment-id: *20251108115234*
Experiment date: *2025-11-08 11:54:43*
Experiment note: *First execution after malfunctioning of cables.*

2. Version Comparison

Library	Version	Library	Version
qibo	0.2.19	numpy	2.2.6
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		

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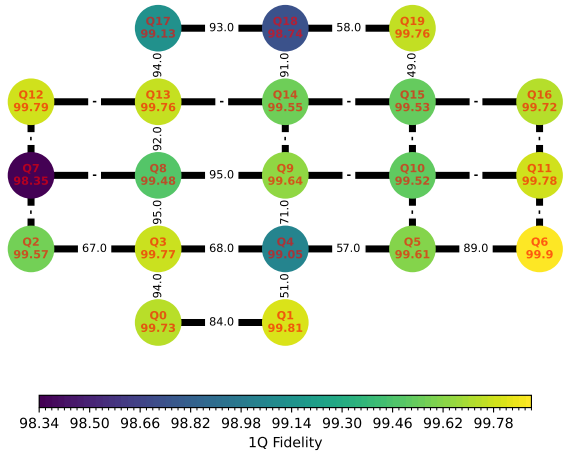
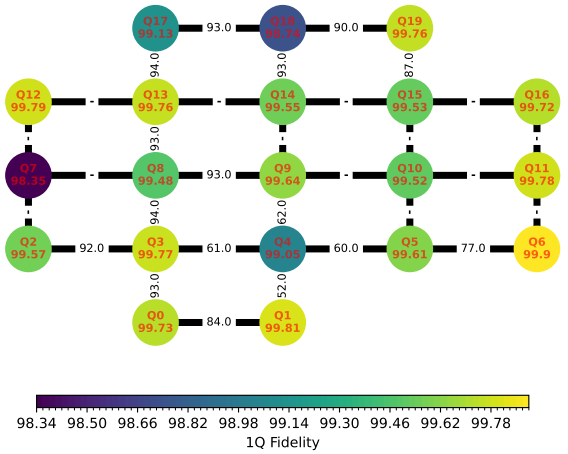
3. One and two qubit fidelities

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	3, 8	0.949
3	3, 8, 9	0.948
4	0, 3, 8, 9	0.945
5	3, 8, 9, 13, 17	0.938

k-qubits	Best Qubits	Fidelity
2	13, 17	0.945
3	13, 17, 18	0.938
4	3, 8, 13, 17	0.936
5	3, 8, 9, 13, 17	0.935

6. Benchmark Results

Qubit n	Fidelity	Error Bars
0	0.997	± 0.00041
1	0.998	± 0.0006
2	0.996	± 0.000236
3	0.998	± 0.000236
4	0.99	± 0.00167
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	0.996	± 0.000846
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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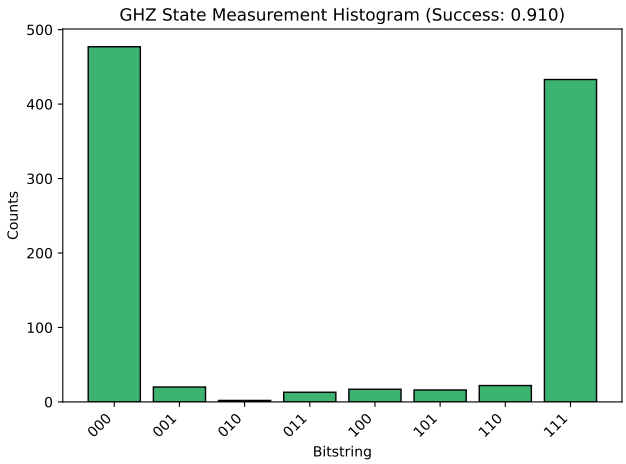
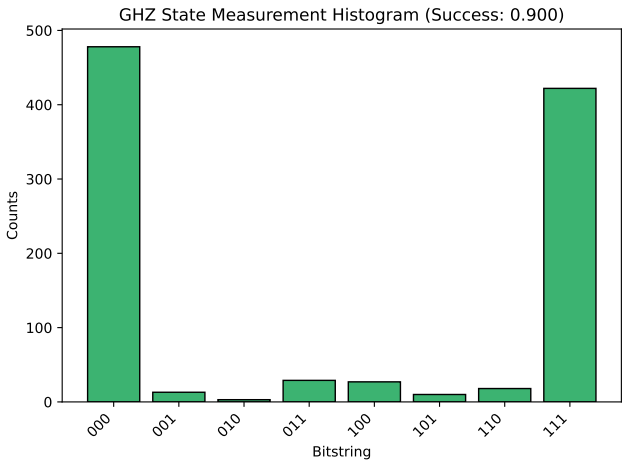
7. GHZ state preparation

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

- **Runtime:** 5.60 seconds.
- **Qubits used:** [3, 8, 9]



- **Runtime:** 4.32 seconds.
- **Qubits used:** [13, 17, 18]

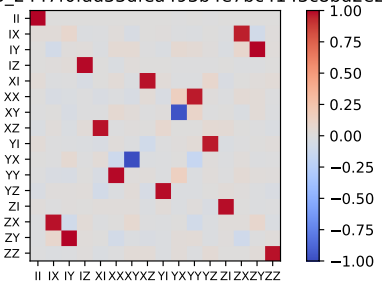


8. Process Tomography state preparation

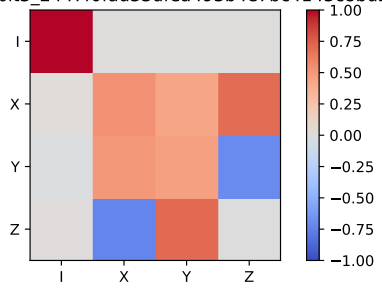
Process tomography involves preparing a circuit particular set of states, appending a gate (process) to the circuit, and measuring the circuit in the Pauli basis. The data is processed to get the Pauli Liouville representation of a process (gate). - Single qubit process tomography executed on qubits: [3, 8] - Two qubit process tomography on coupled qubits: [[8, 3]]

- **Runtime:** 612.76 seconds.
- **Qubits used:**

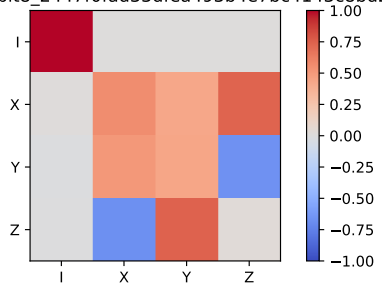
cz_[]_qubits8_3_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



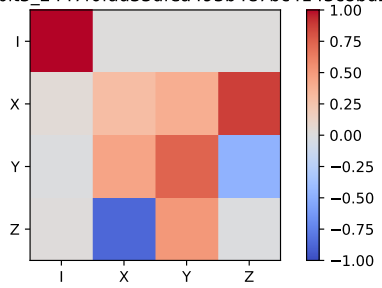
gpi2_[0.7854]_qubit3_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



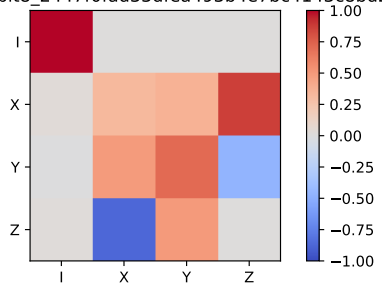
gpi2_[0.7854]_qubit8_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



gpi2_[1.0472]_qubit3_2447f0fad33dfea493b4e7bc4143c8bd2e28d979

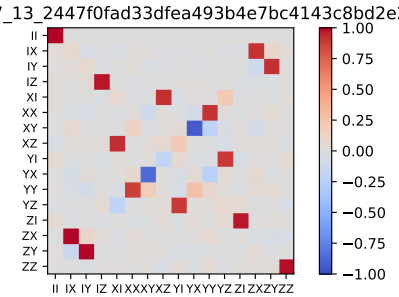


gpi2_[1.0472]_qubit8_2447f0fad33dfea493b4e7bc4143c8bd2e28d979

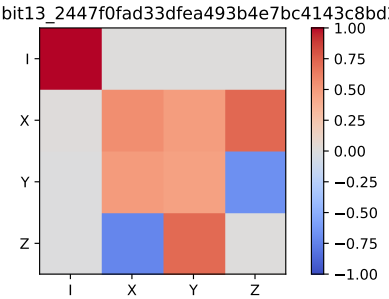


- **Runtime:** 705.76 seconds.
- **Qubits used:**

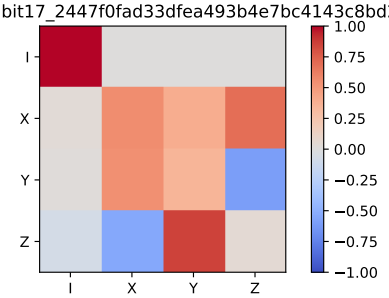
cz_[]_qubits17_13_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



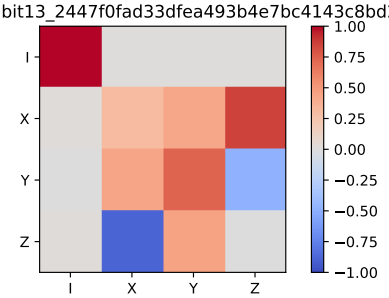
gpi2_[0.7854]_qubit13_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



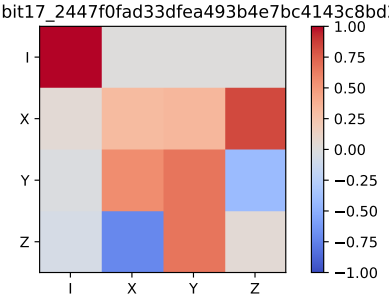
gpi2_[0.7854]_qubit17_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



gpi2_[1.0472]_qubit13_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



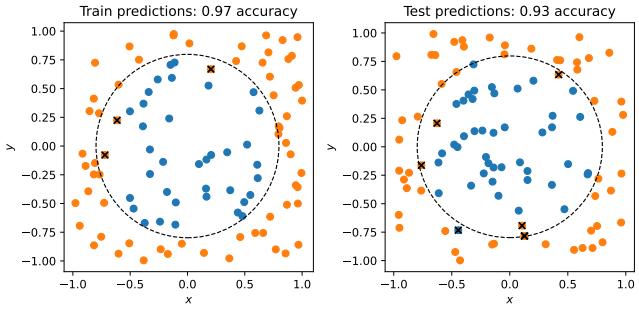
gpi2_[1.0472]_qubit17_2447f0fad33dfea493b4e7bc4143c8bd2e28d979



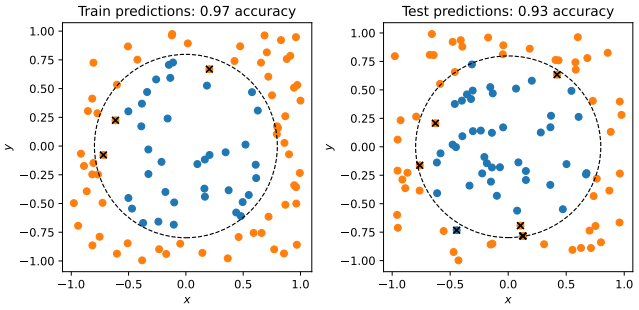
9. Reuploading Classifier

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

- **Runtime:** None
- **Qubits used:** [7]

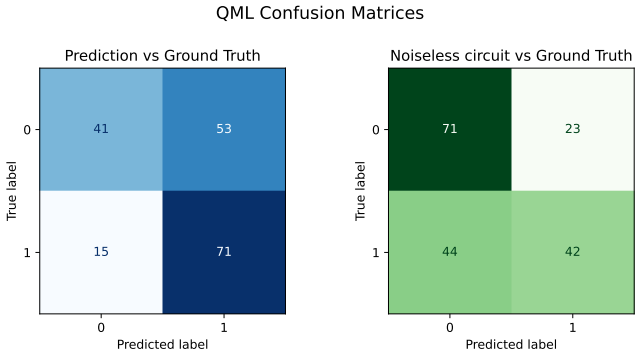


- **Runtime:** None
- **Qubits used:** — No "qubits_used" provided. —



10. QML: Yeast dataset (3 qubits)

- **Duration:** 247 seconds
- **Accuracy:** 0.62
- **Qubits used:** 3, 8, 9



- **Duration:** 793 seconds
- **Accuracy:** 0.56
- **Qubits used:** 0, 1, 2, 3