Benchmark Report

Benchmarking of NQCH's

October 29, 2025

1. Report of Changes

Platform: sinq20
Calibration-id: *fdb93a3978fe6356741e31b98c93c68837767080*
Calibration date: *2025-09-19 10:30:45*
Calibration note: chore(sinq20): 1q tuneup, q11, q12, q18...

Experiment-id: *1001051119997110101*
Experiment date: *2025-10-20 10:30:45*
Experiment note: *Default scheduled run for sinq20.*

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Calibration date: *2025-09-19 10:30:45*
Calibration note: chore(sinq20): 1q tuneup, q11, q12, q18...

Experiment-id: *1001051111091011141009 7*
Experiment date: *2025-10-15 10:30:44*
Experiment note: *Default scheduled run for sinq20.*

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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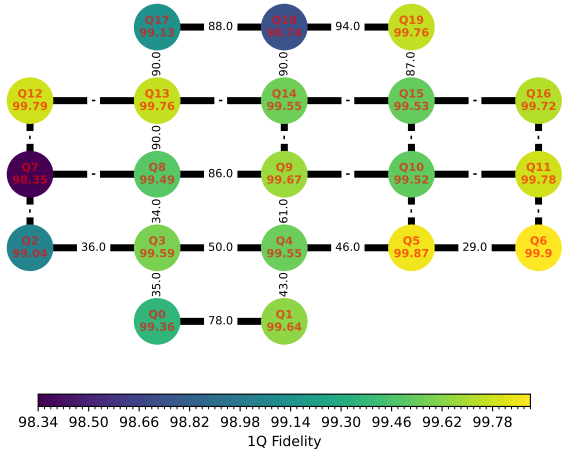
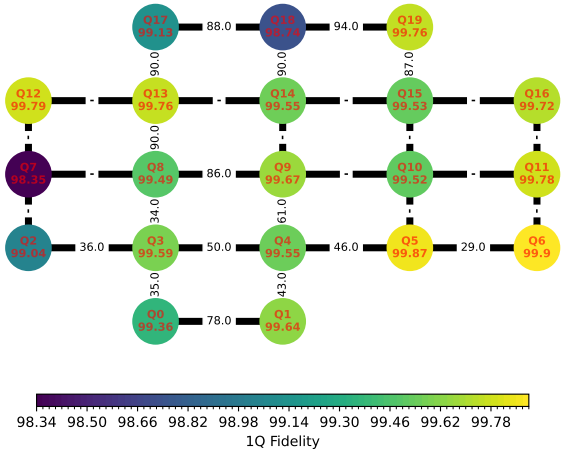
3. One and two qubit fidelities





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
Mermin Max	N/A			

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5. Best Qubits Selection

k-qubits	Best Qubits	Fidelity
2	18, 19	0.940
3	14, 18, 19	0.922
4	17, 14, 18, 19	0.908
5	13, 17, 14, 18, 19	0.907

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6. Benchmark Results

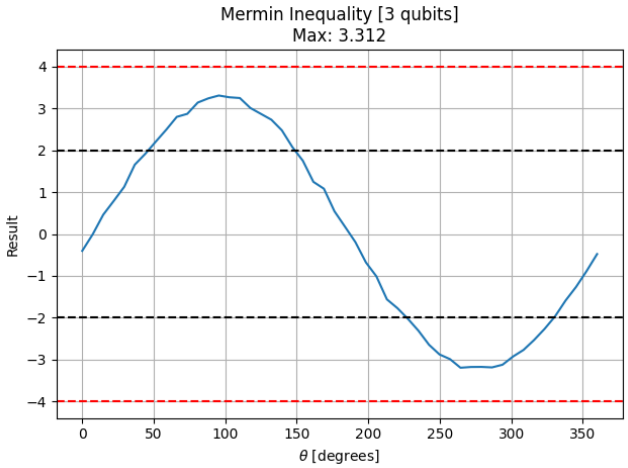
Qubit n	Fidelity	Error Bars

Qubit n	Fidelity	Error Bars

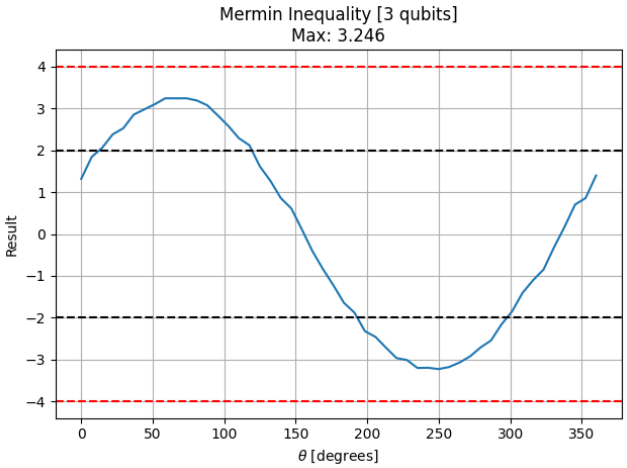
7. Mermin

Mermin's algorithm for 3 qubits.

- **Runtime:** 1.44030 seconds.
- **Qubits used:** — No "qubits_used" provided. —



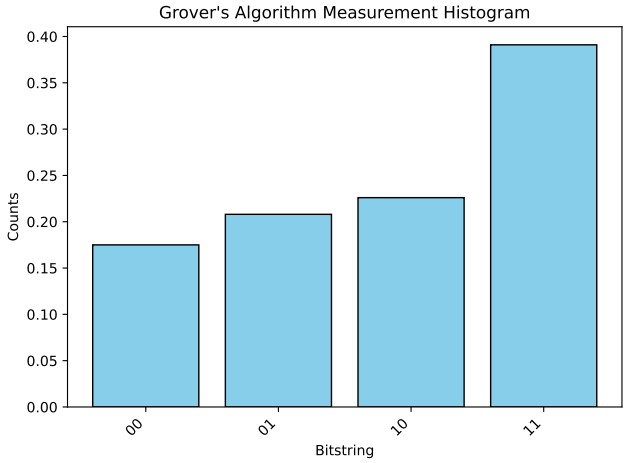
- **Runtime:** 0.70308 seconds.
- **Qubits used:** [[13, 17, 18]]



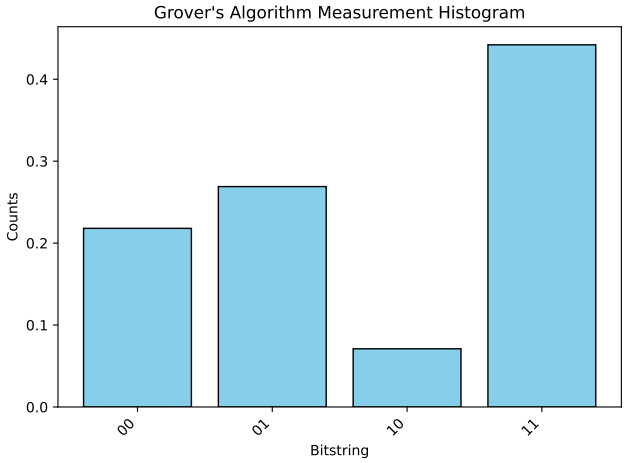
8. Grover - 2 qubits

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 [[13, 14]].

- **Runtime:** 14.16 seconds.
- **Qubits used:** [[13, 14]]



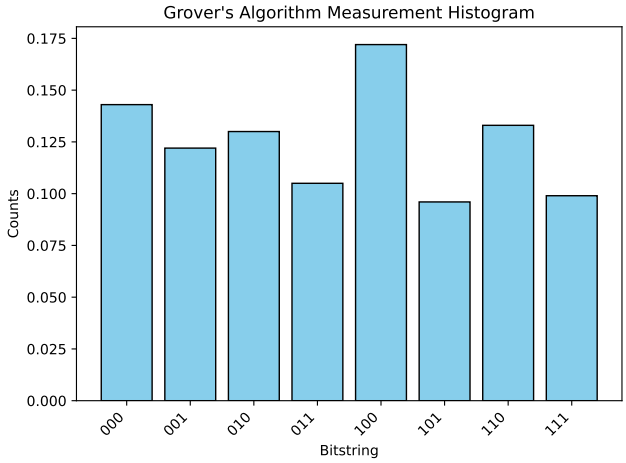
- **Runtime:** 11.27 seconds.
- **Qubits used:** [[13, 14]]



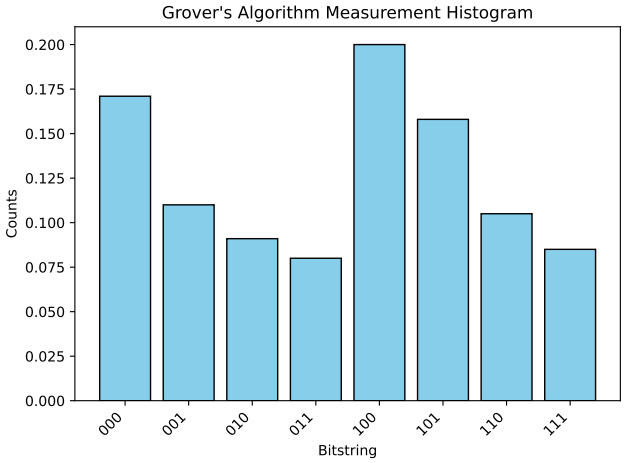
9. Grover - 3 qubits

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 [[17, 13, 18, 14]].

- **Runtime:** 12.10 seconds.
- **Qubits used:** [[17, 13, 18, 14]]



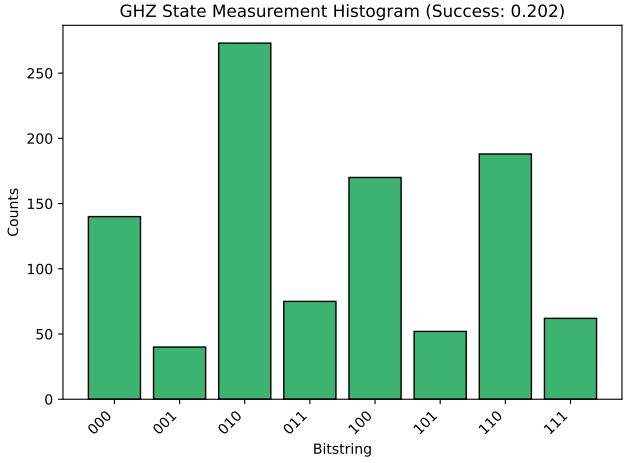
- **Runtime:** 16.51 seconds.
- **Qubits used:** [[17, 13, 18, 14]]



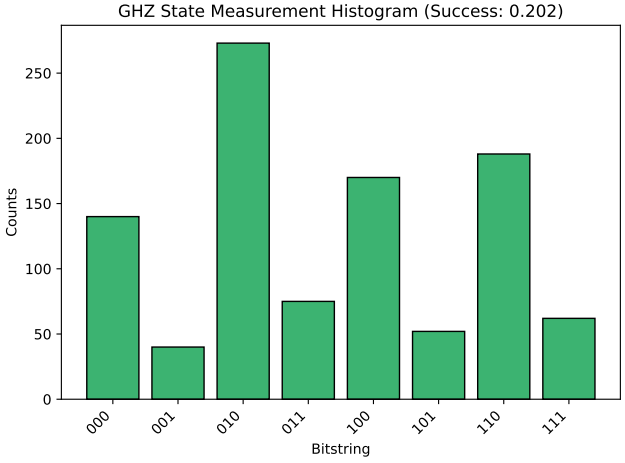
10. GHZ state preparation

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

- **Runtime:** 22.51 seconds.
- **Qubits used:** [0, 1, 2]



- **Runtime:** 9.71 seconds.
- **Qubits used:** — No "qubits_used" provided. —

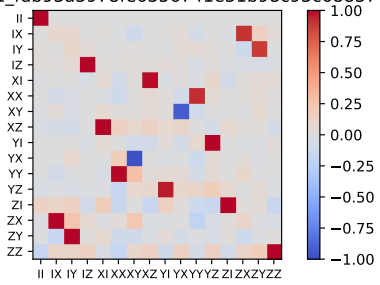


11. Process Tomography state preparation

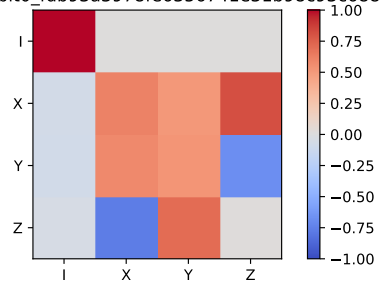
Process tomography involves preparing a circuit particular set of states, appending a gate (process) to the circuit, and measuring the circuit in the Pauli basis. The data is processed to get the Pauli Liouville representation of a process (gate). - Single qubit process tomography executed on qubits: [0, 1] - Two qubit process tomography on coupled qubits: [[0, 1]]

- **Runtime:** 2068.71072 seconds.
- **Qubits used:**

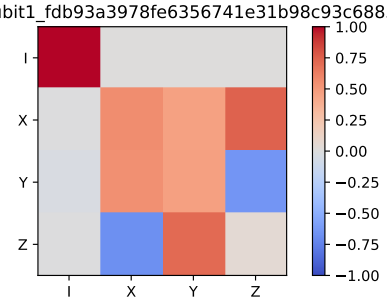
cz_[]_qubits0_1_fdb93a3978fe6356741e31b98c93c68837767080



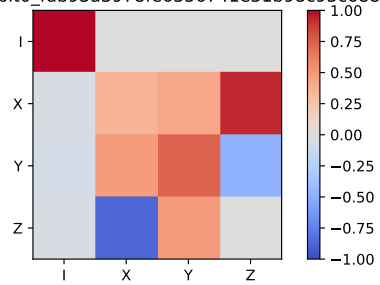
gpi2_[0.7854]_qubit0_fdb93a3978fe6356741e31b98c93c68837767080



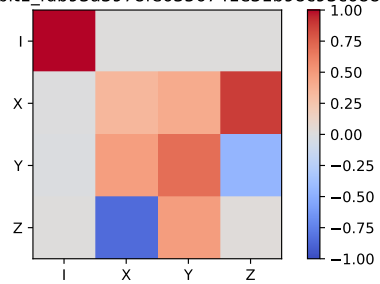
gpi2_[0.7854]_qubit1_fdb93a3978fe6356741e31b98c93c68837767080



gpi2_[1.0472]_qubit0_fdb93a3978fe6356741e31b98c93c68837767080

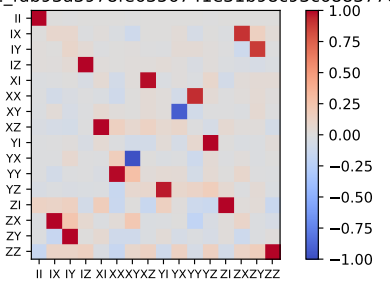


gpi2_[1.0472]_qubit1_fdb93a3978fe6356741e31b98c93c68837767080

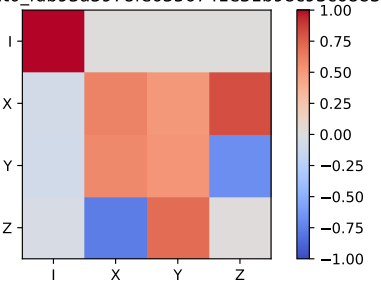


- **Runtime:** — No runtime provided. —
- **Qubits used:**

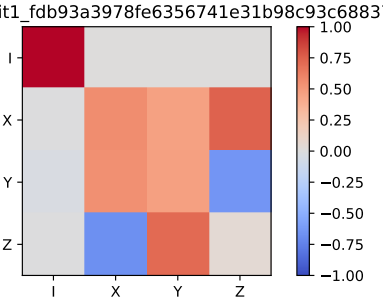
cz_[]_qubits0_1_fdb93a3978fe6356741e31b98c93c68837767080



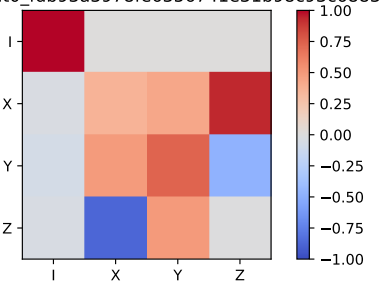
gpi2_[0.7854]_qubit0_fdb93a3978fe6356741e31b98c93c68837767080



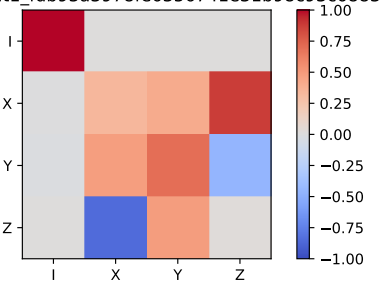
gpi2_[0.7854]_qubit1_fdb93a3978fe6356741e31b98c93c68837767080



gpi2_[1.0472]_qubit0_fdb93a3978fe6356741e31b98c93c68837767080



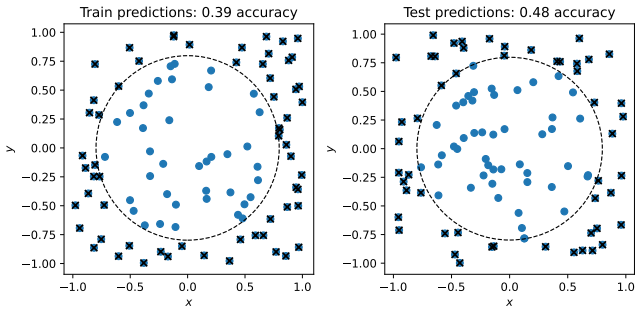
gpi2_[1.0472]_qubit1_fdb93a3978fe6356741e31b98c93c68837767080



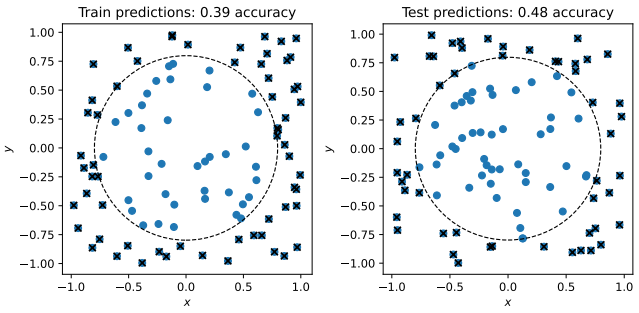
12. Reuploading Classifier

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

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



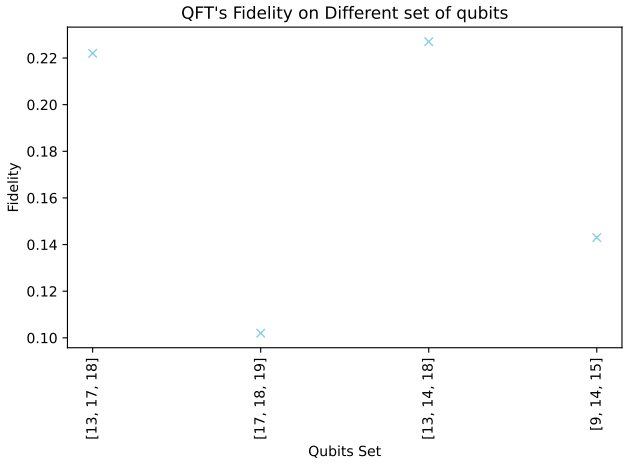
- **Runtime:** None
- **Qubits used:** — No “qubits_used” provided. —



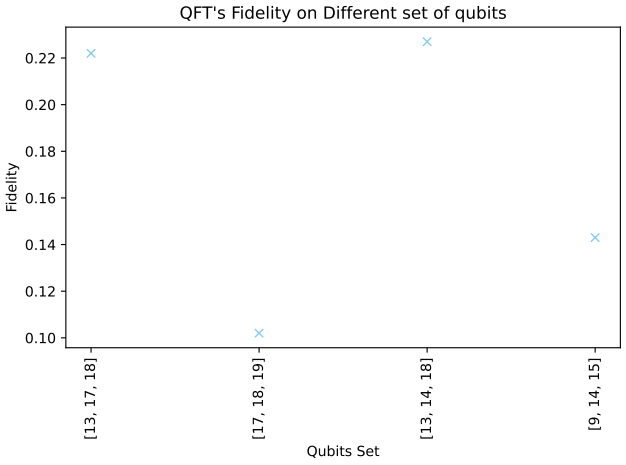
13. QFT Plots

Implementation of the Quantum Fourier Transform on different subsets of three qubits. The number of gates is 12, the depth of the circuit is 7

- **Runtime:** 13.192451105453074
- **Qubits used:** — No “qubits_used” provided. —



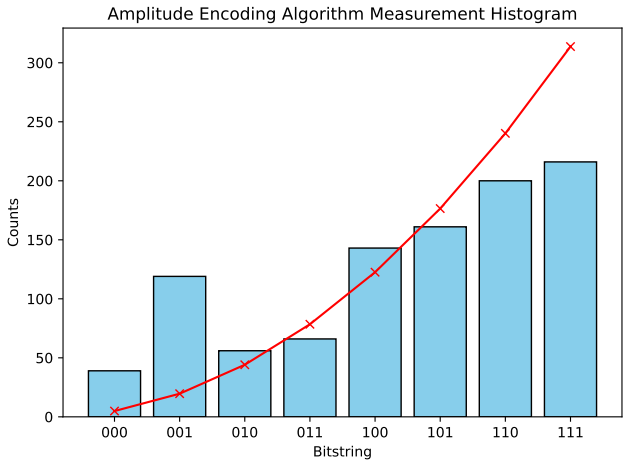
- **Runtime:** 13.192451105453074
- **Qubits used:** — No “qubits_used” provided. —



14. Amplitude Encoding

Encoding of a vector of numerical data into the amplitudes of a quantum state. The input vector is [1, 2, 3, 4, 5, 6, 7, 8]. The number of gates is 16, the depth of the circuit is 12 and the runtime execution is 16.467ms

- **Runtime:** 16.46 seconds.
- **Qubits used:** [0, 1, 4]



- **Runtime:** 11.75428 seconds.
- **Qubits used:** [0, 1, 4]