

# Benchmarking of NQCH's quantum computer

November 9, 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:** 20251108115234  
**Experiment date:** 2025-11-08 11:54:43  
**Experiment note:** First execution after malfunctioning of cables.

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

**Experiment-id:** df31a65089fe  
**Experiment date:** 2025-10-20 10:30:45  
**Experiment note:** Default scheduled run for sinq20.

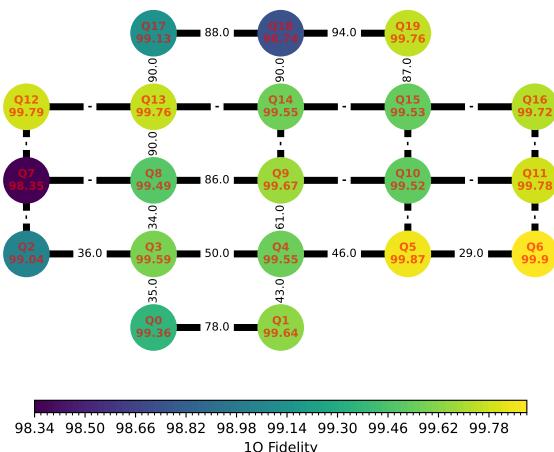
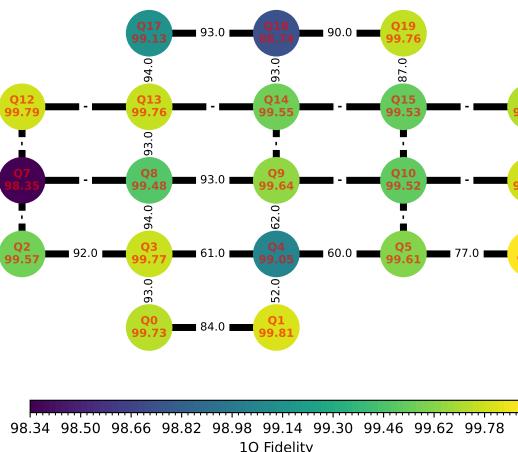
## 2. Version Comparison

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

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	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

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

## 6. Benchmark Results

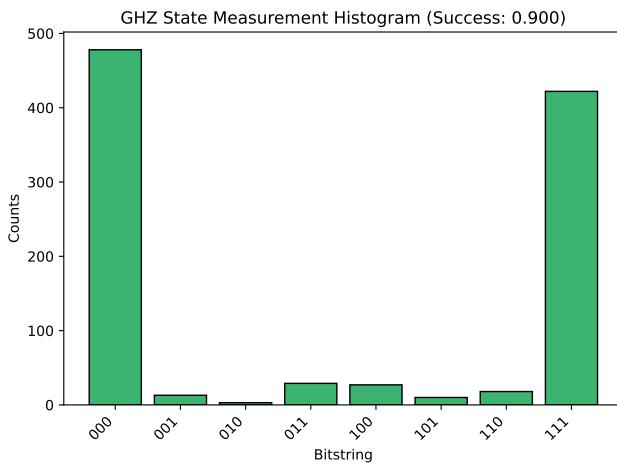
Qubit n	Fidelity	Error Bars
0	0.997	$\pm 0.00041$
1	0.998	$\pm 0.0006$
2	0.996	$\pm 0.000236$
3	0.998	$\pm 0.000236$
4	0.99	$\pm 0.00167$
5	0.996	$\pm 0.000826$
6	0.999	$\pm 0.000308$
7	0.983	$\pm 0.00219$
8	0.995	$\pm 0.00054$
9	0.996	$\pm 0.000782$
10	0.995	$\pm 0.000441$
11	0.998	$\pm 0.000246$
12	0.998	$\pm 0.000396$
13	0.998	$\pm 0.000344$
14	0.996	$\pm 0.000846$
15	0.995	$\pm 0.000647$
16	0.997	$\pm 0.000463$
17	0.991	$\pm 0.0006$
18	0.987	$\pm 0.00163$
19	0.998	$\pm 0.00042$

Qubit n	Fidelity	Error Bars
0	0.994	$\pm 0.000465$
1	0.996	$\pm 0.000249$
2	0.99	$\pm 0.00117$
3	0.996	$\pm 0.000322$
4	0.995	$\pm 0.000816$
5	0.999	$\pm 0.000534$
6	0.999	$\pm 0.000308$
7	0.983	$\pm 0.00219$
8	0.995	$\pm 0.000549$
9	0.997	$\pm 0.000698$
10	0.995	$\pm 0.000441$
11	0.998	$\pm 0.000246$
12	0.998	$\pm 0.000396$
13	0.998	$\pm 0.000344$
14	0.996	$\pm 0.000846$
15	0.995	$\pm 0.000647$
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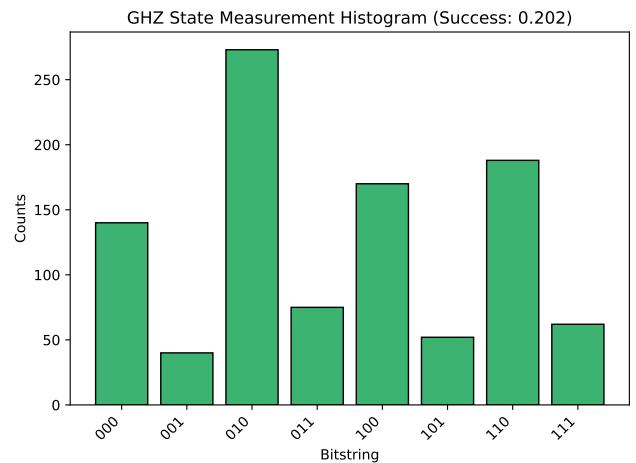
## 7. GHZ state preparation

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

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



- **Runtime:** 9.71 seconds.
- **Qubits used:** [13, 14, 17]

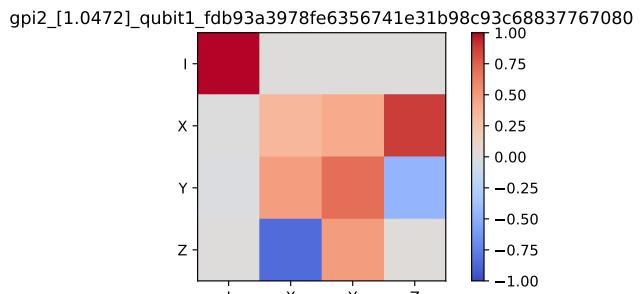
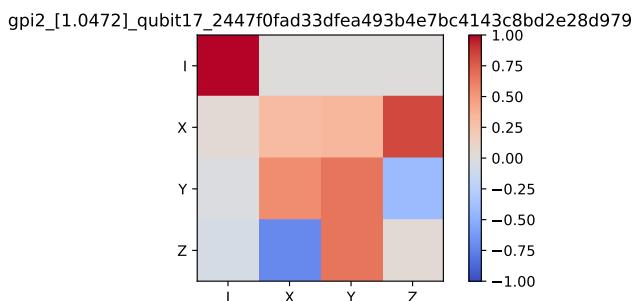
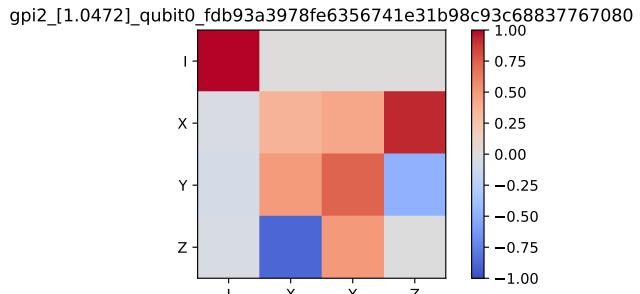
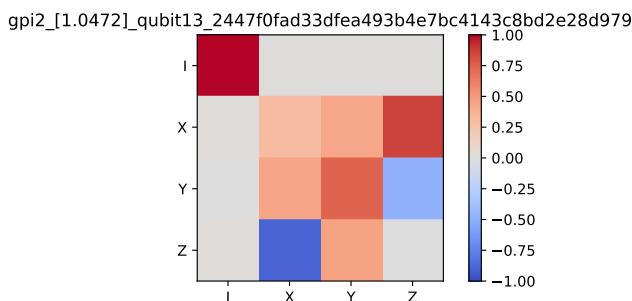
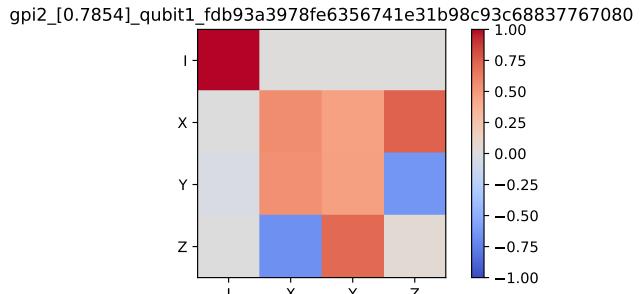
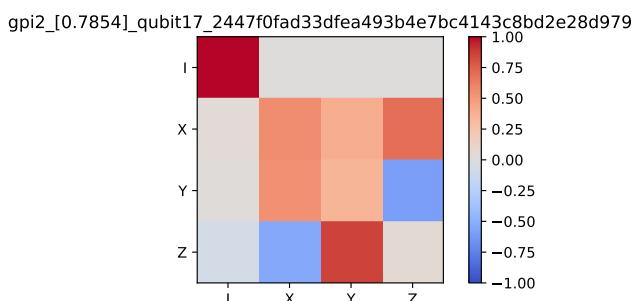
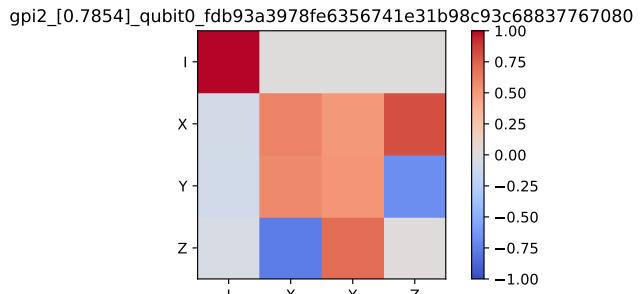
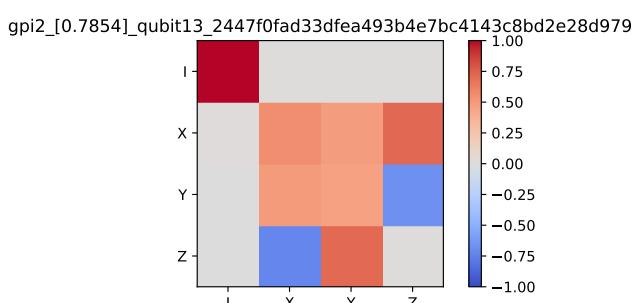
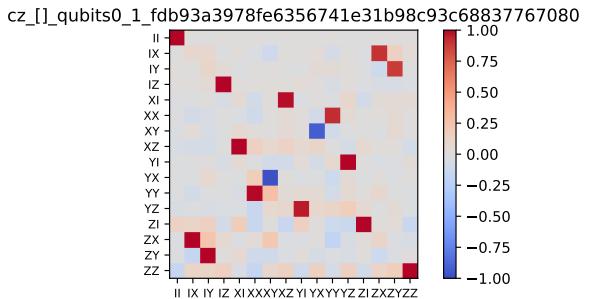
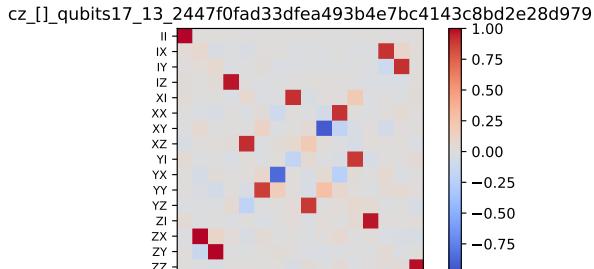


## 8. Process Tomography state preparation

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: [13, 17] - Two qubit process tomography on coupled qubits: [[17, 13]]

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

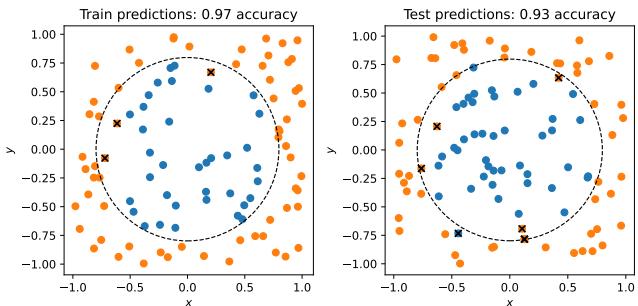
- **Runtime:** — No runtime provided. —
- **Qubits used:**



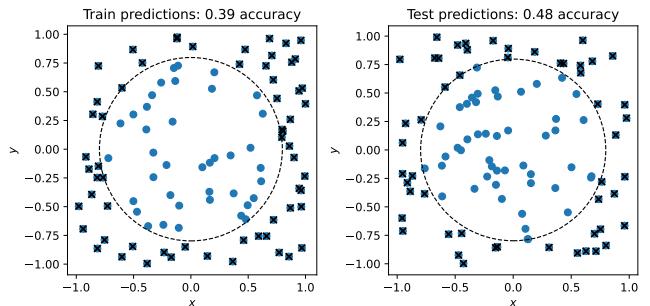
## 9. Reuploading Classifier

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

- **Runtime:** None
- **Qubits used:** — No “qubits\_used” provided. —



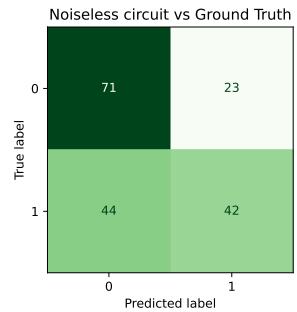
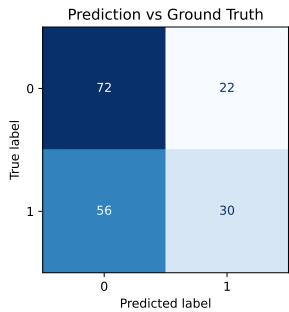
- **Runtime:** None
- **Qubits used:** — No “qubits\_used” provided. —



## 10. QML: Yeast dataset (3 qubits)

- **Duration:**
- **Accuracy:** 0.6256983240223464

QML Confusion Matrices



- **Duration:**
- **Accuracy:** 0.6256983240223464

QML Confusion Matrices

