Lab 3

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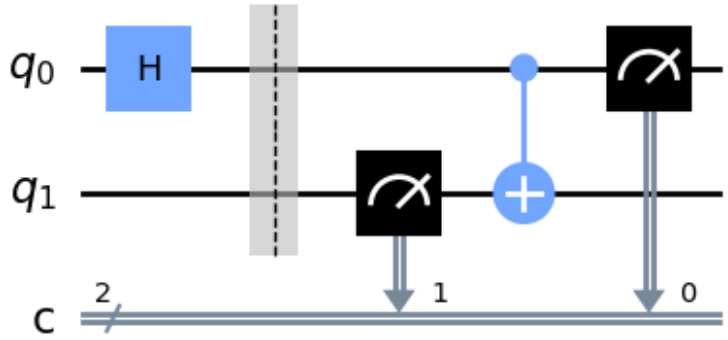
When observing the not superposition q-bit before entanglement, the measurement of it stays the same. 01 and 00. while the superposition one has a probability of 1 or 0.

When observing the not superposition q-bit after entanglement, the measurement of it is the same as the superposition 00 and 11, if one is 0 then the other is also 0 and if one is 1 then the other one is also 1.

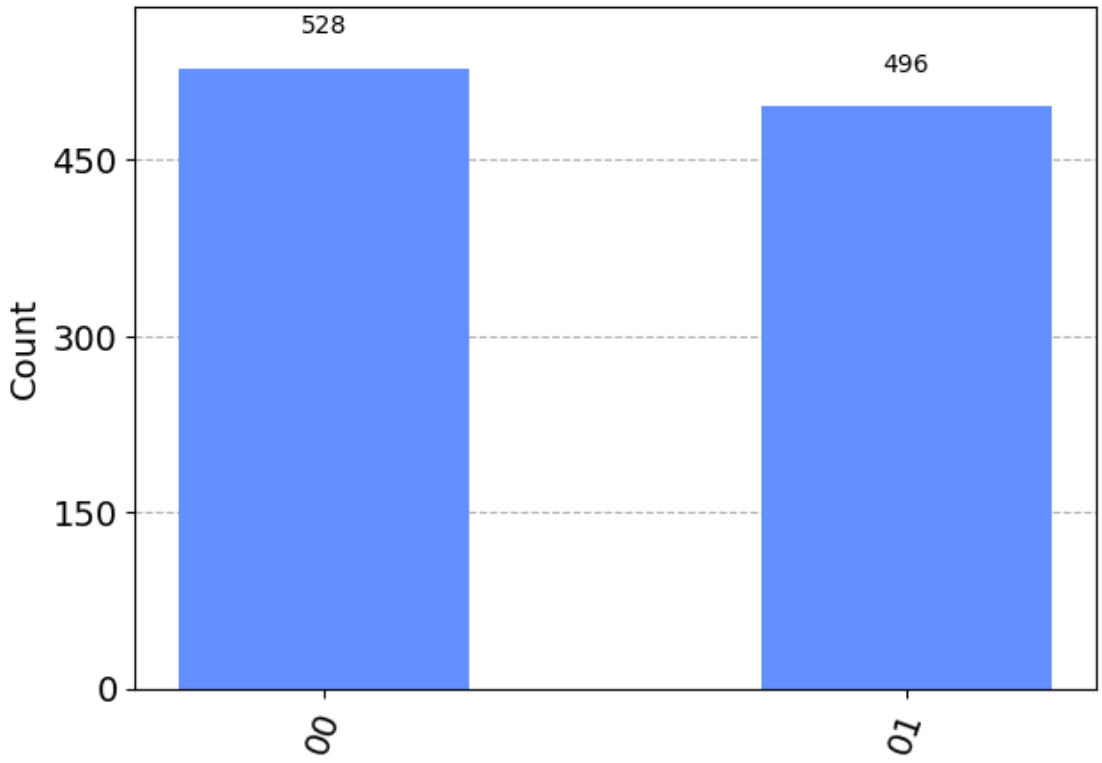
Probability shows the probability of the output, but the Q-sphere is just the phase shift of the Q-sphere.

```
from qiskit import *
from numpy import pi
from qiskit.visualization import plot_histogram

# Experiment 1

qreg_q = QuantumRegister(2, 'q')
creg_c = ClassicalRegister(2, 'c')
circuit = QuantumCircuit(qreg_q, creg_c)

circuit.h(qreg_q[0])
circuit.barrier(qreg_q[0], qreg_q[1])
circuit.measure(qreg_q[1], creg_c[1])
circuit.cx(qreg_q[0], qreg_q[1])
circuit.measure(qreg_q[0], creg_c[0])
circuit.draw('mpl')
```

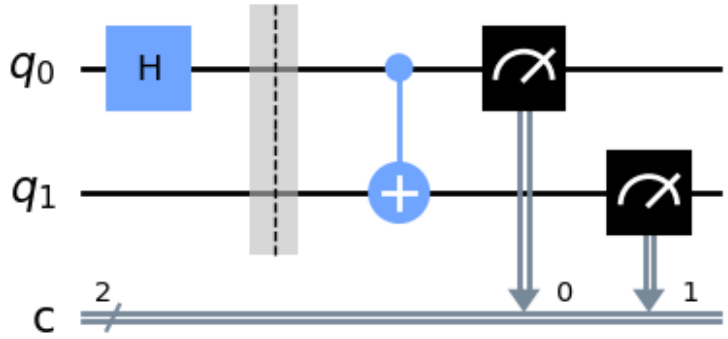



```
backend = Aer.get_backend('qasm_simulator')
job = backend.run(transpile(circuit, backend), shots = 1024)
result = job.result()
counts = result.get_counts(circuit)
print(counts)
plot_histogram(counts)
```

```
{'01': 496, '00': 528}
```

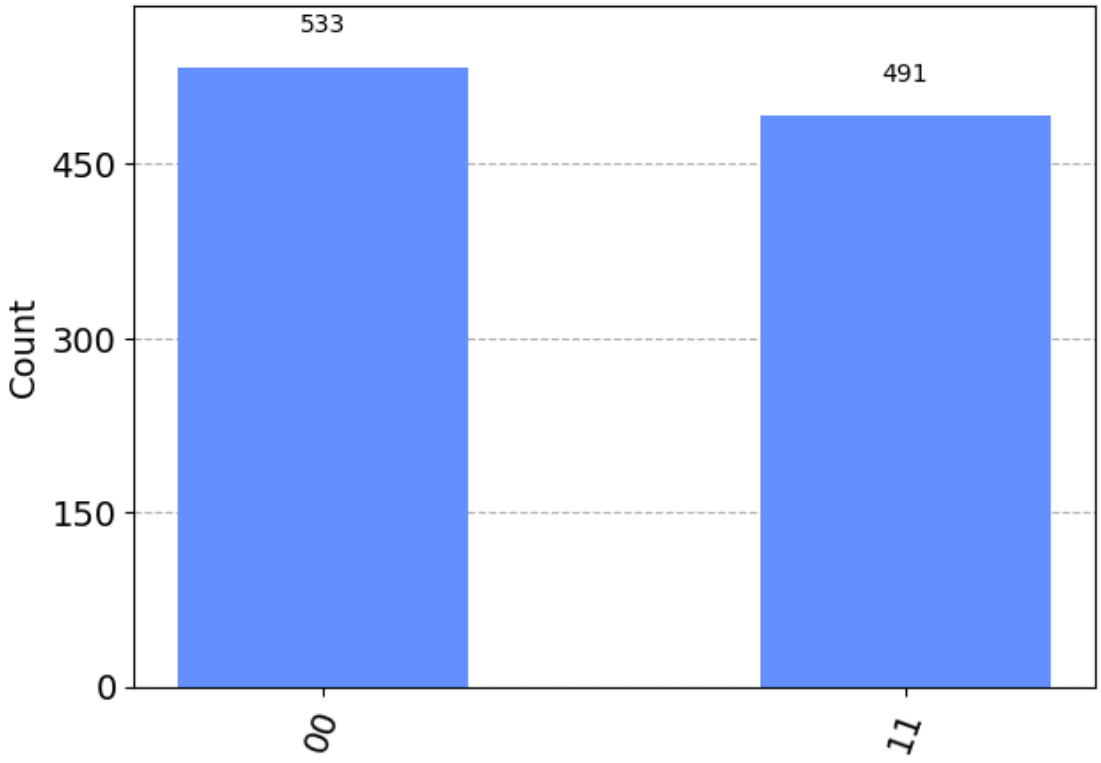


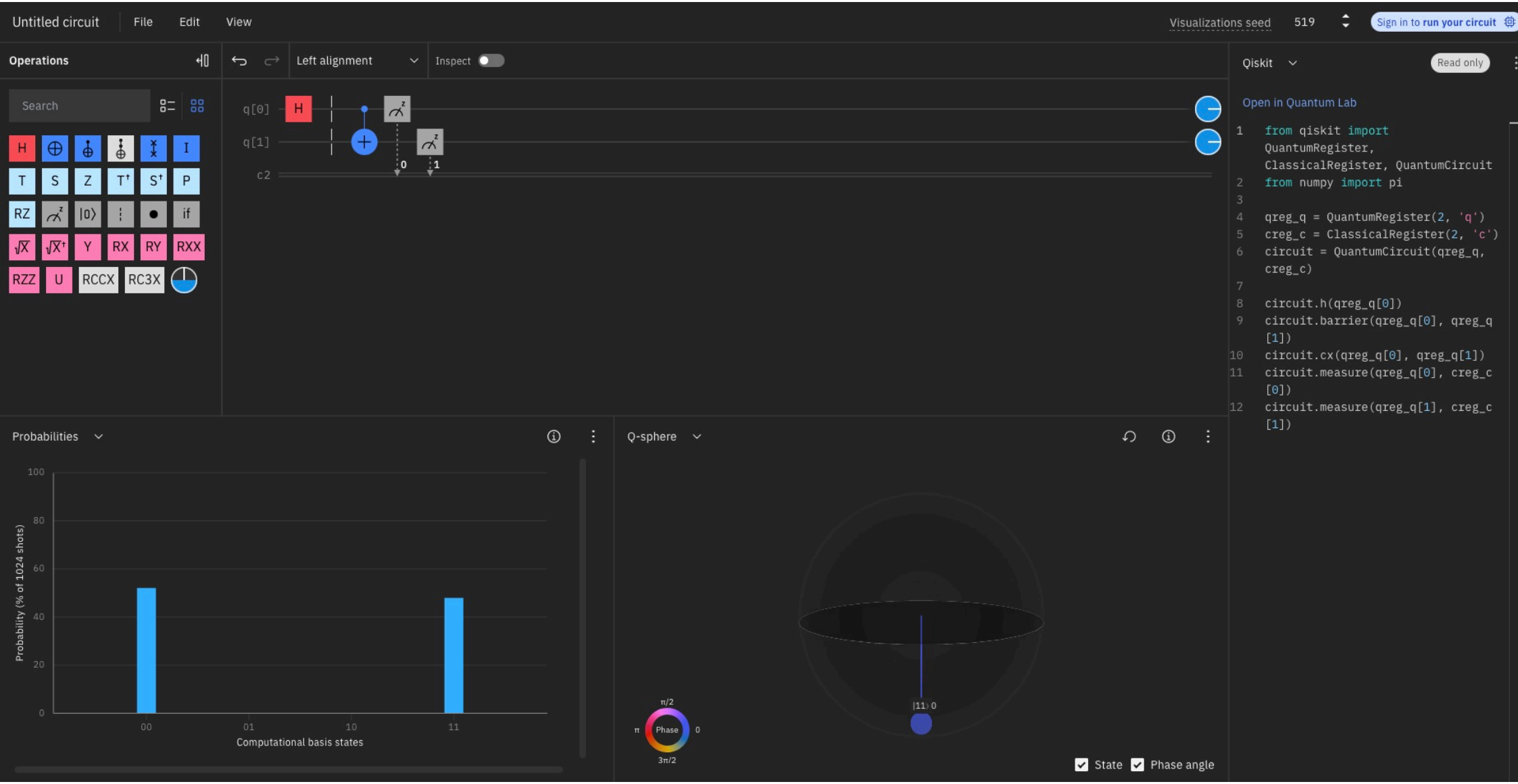

```
# Experiment 2

qreg_q = QuantumRegister(2, 'q')
creg_c = ClassicalRegister(2, 'c')
circuit = QuantumCircuit(qreg_q, creg_c)

circuit.h(qreg_q[0])
circuit.barrier(qreg_q[0], qreg_q[1])
circuit.cx(qreg_q[0], qreg_q[1])
circuit.measure(qreg_q[0], creg_c[0])
circuit.measure(qreg_q[1], creg_c[1])
circuit.draw('mpl')
```



```
backend = Aer.get_backend('qasm_simulator')
job = backend.run(transpile(circuit, backend), shots=1024)
result = job.result()
counts = result.get_counts(circuit)
print(counts)
plot_histogram(counts)
```

```
{'11': 491, '00': 533}
```




Untitled circuit
File
Edit
View
Visualizations seed
519
Sign in to run your circuit
Operations
Search
H
I
T
S
Z
T†
S†
P
RZ
|0⟩
if
√X
√X†
Y
RX
RY
RXX
RZZ
U
RCCX
RC3X
Left alignment
Inspect
q[0]
q[1]
c2
Qiskit
Read only
Open in Quantum Lab
1 from qiskit import QuantumRegister, ClassicalRegister, QuantumCircuit
2 from numpy import pi
3
4 qreg_q = QuantumRegister(2, 'q')
5 creg_c = ClassicalRegister(2, 'c')
6 circuit = QuantumCircuit(qreg_q, creg_c)
7
8 circuit.h(qreg_q[0])
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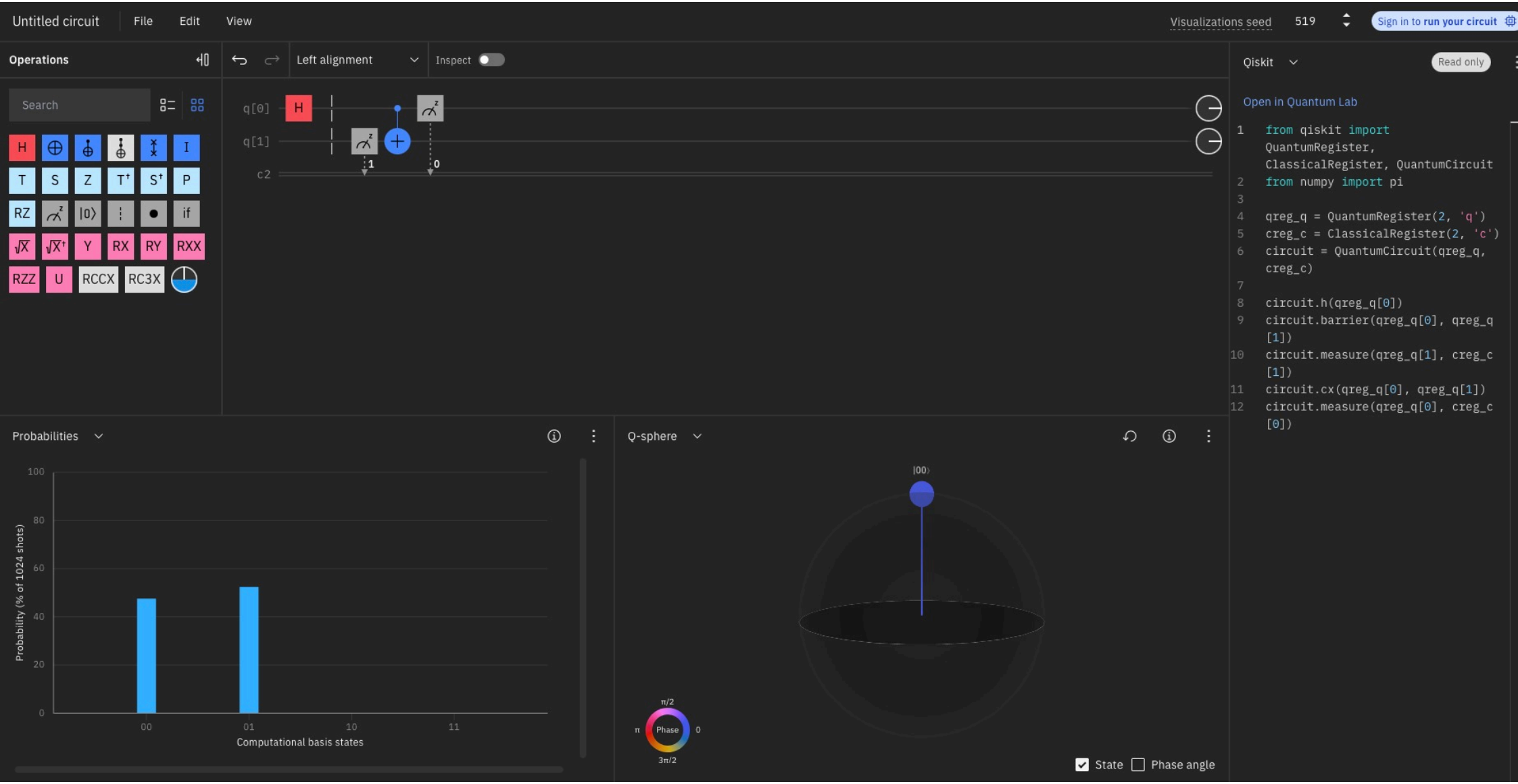
10 circuit.cx(qreg_q[0], qreg_q[1])
11 circuit.measure(qreg_q[0], creg_c[0])
12 circuit.measure(qreg_q[1], creg_c[1])
Probabilities
Probability (% of 1024 shots)
Computational basis states
00
01
10
11
Q-sphere
Phase
|11⟩
State
Phase angle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Sign in to run your circuit
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T
S
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T†
S†
P
RZ
|0⟩
if
√X
√X†
Y
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RY
RXX
RZZ
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RCCX
RC3X
Left alignment
Inspect
q[0]
q[1]
c2
1
0
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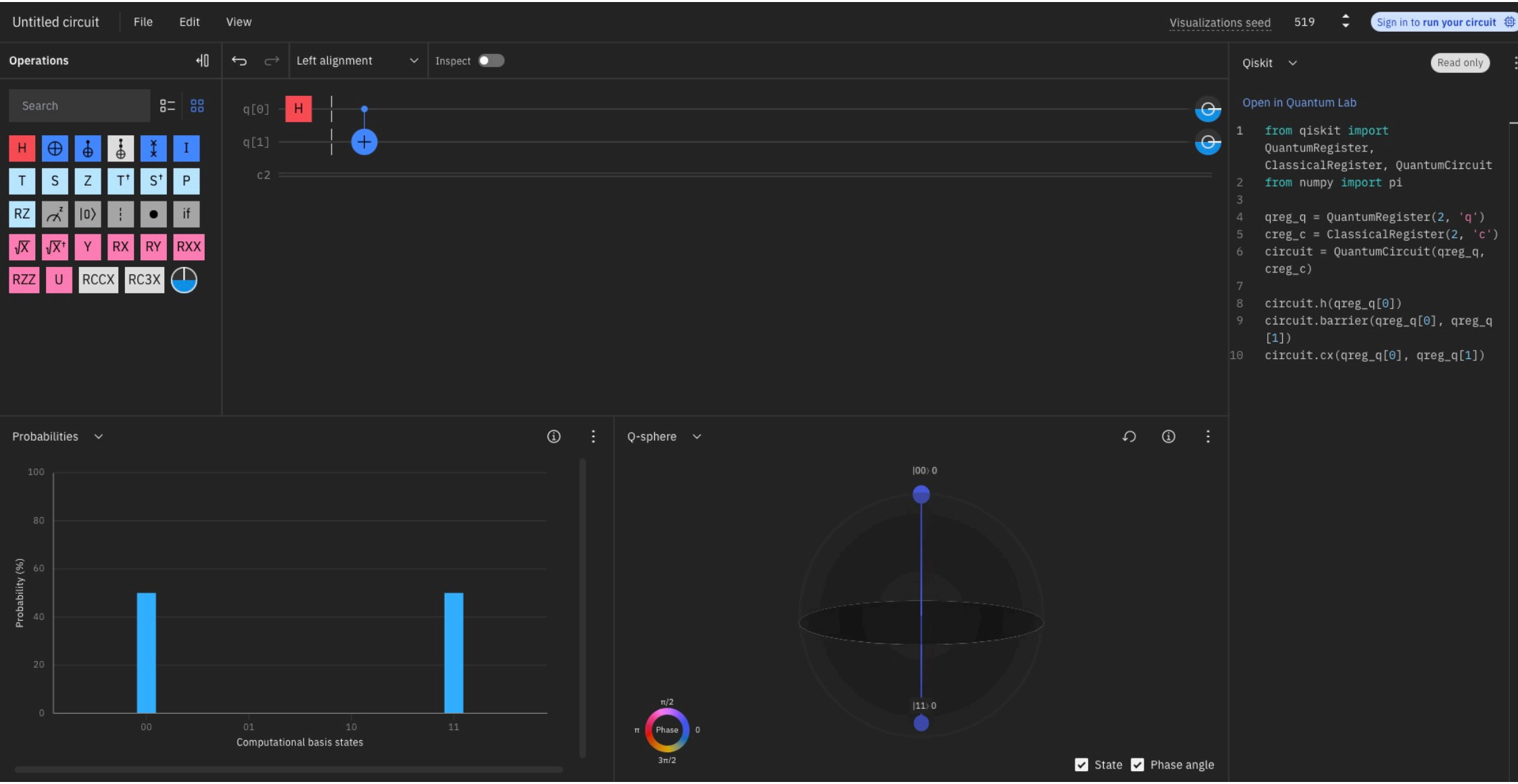
10 circuit.measure(qreg_q[1], creg_c[1])
11 circuit.cx(qreg_q[0], qreg_q[1])
12 circuit.measure(qreg_q[0], creg_c[0])
Probabilities
100
80
60
40
20
0
Probability (% of 1024 shots)
00
01
10
11
Computational basis states
Q-sphere
|00⟩
π/2
π
Phase
0
3π/2
State
Phase angle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10 circuit.cx(qreg_q[0], qreg_q[1])
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60
40
20
0
Probability (%)
00
01
10
11
Computational basis states
Q-sphere
|00⟩ 0
|11⟩ 0
π/2
π
Phase
0
3π/2
State
Phase angle