

# Update Qiskit-Experiment Tutorials

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## Verification Experiments

`StandardRB`(qubits, lengths[, num\_samples, ...])

`InterleavedRB`(interleaved\_element, qubits, ...)

`StateTomography`(circuit[, ...])

`ProcessTomography`(circuit[, ...])

`QuantumVolume`(qubits[, trials, seed, ...])

## Characterization Experiments

`T1`(qubit, delays[, unit])

`T2Ramsey`(qubit, delays[, unit, osc\_freq, ...])

`QubitSpectroscopy`(qubit, frequencies[, ...])

`EFSpectroscopy`(qubit, frequencies[, unit, ...])

## Calibration Experiments

`DragCal`(qubit)

`Rabi`(qubit)

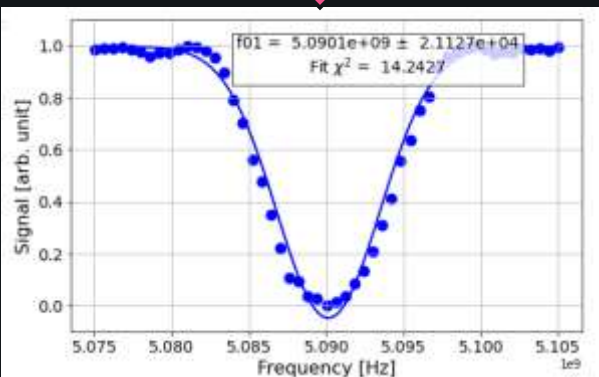
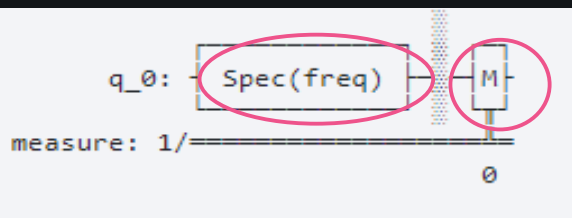
`EFRabi`(qubit)

`FineAmplitude`(qubit)

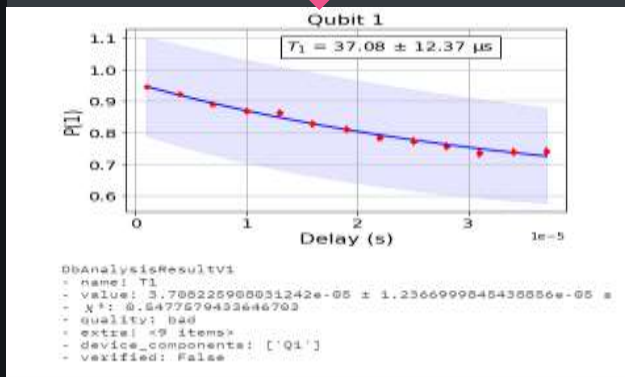
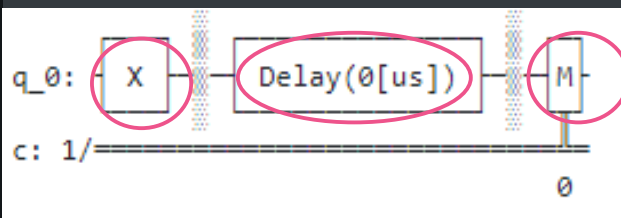
`FineXAmplitude`(qubit)

`FineSXAmplitude`(qubit)

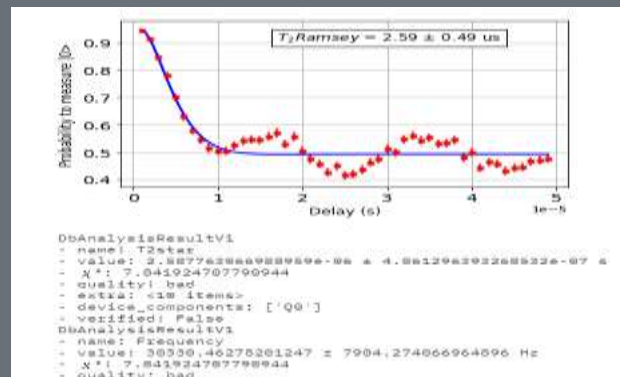
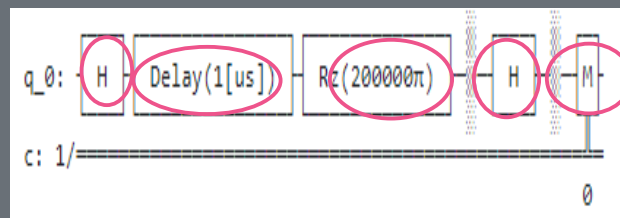
# Qubit Spectroscopy



# T1



# T2



# Backends with different properties of qubits

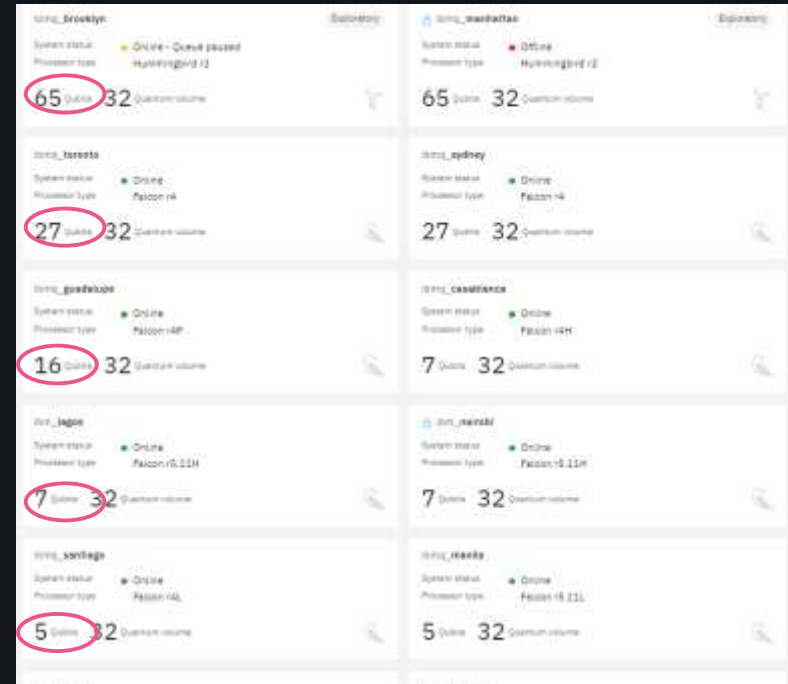
✓ 23 backends in IBM Quantum Experiences

✓ All backends consists of different number of qubits with different properties

✓ Characterizing all the qubit at once.

ibmq\_lima (5 qubits)

Qubit	T1 (us)	T2 (us)	Frequency (GHz)
Q0	90.9	116.85	5.03
Q1	98.64	132.95	5.128
Q2	74.26	83.94	5.247
Q3	12.44	16.36	5.302
Q4	20.86	17.36	5.092



# Running Composite Experiment – Qubit Characterization Experiment

```
from qiskit_experiments.framework import ParallelExperiment
```

```
: combine separate component experiments as a single composite experiment
```

```
Composite_exp=ParallelExperiment[exp1, exp2, exp3...]
```

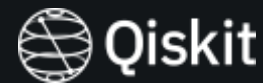
```
Composite_exp.run(backend).block_for_results()
```

```
from qiskit_experiments.library.characterization.qubit_spectroscopy import QubitSpectroscopy
```

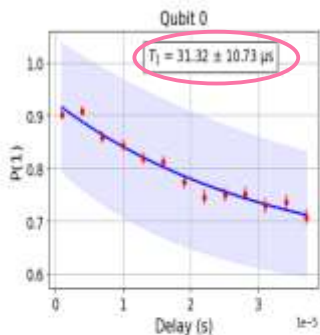
```
from qiskit_experiments.library import T1
```

```
from qiskit_experiments.library import T2Ramsey
```

# Ibmq\_lima : All T1 at once

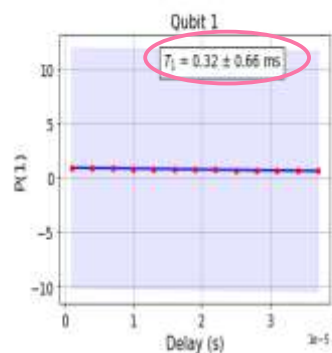


Component experiment 0



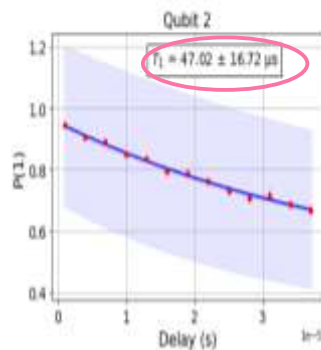
```
Qiskit AnalysisResultV1
- name: T1
- value: 3.1219690748279930e-05 ± 1.072897100103945e-05 s
- y^1: 1.34501683065869
- quality: bad
- extra: <9 items>
- device_components: ['Q0']
- verified: False
Component experiment 0
```

Component experiment 1



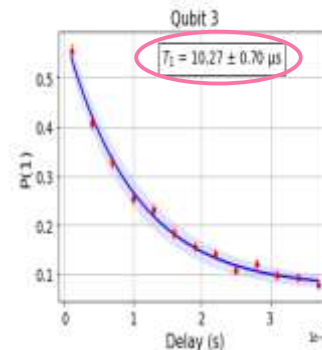
```
Qiskit AnalysisResultV1
- name: T1
- value: 0.00015761229323428 ± 0.000663679161634252 s
- y^1: 1.3088187627877653
- quality: bad
- extra: <9 items>
- device_components: ['Q1']
- verified: False
```

Component experiment 2



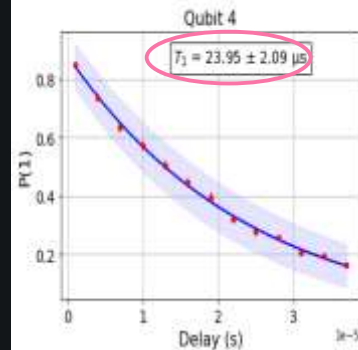
```
Qiskit AnalysisResultV1
- name: T1
- value: 4.70246927028478e-05 ± 1.672040641019927e-05 s
- y^1: 0.47481123772118
- quality: bad
- extra: <9 items>
- device_components: ['Q2']
- verified: False
```

Component experiment 3



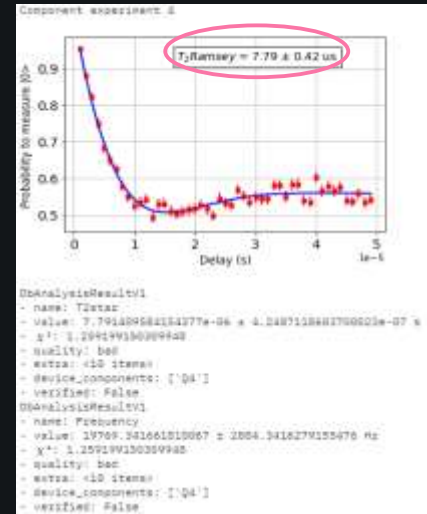
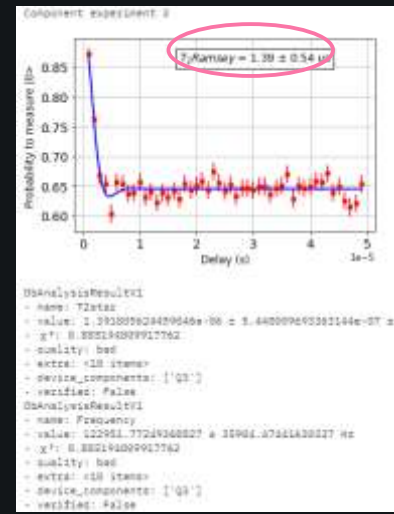
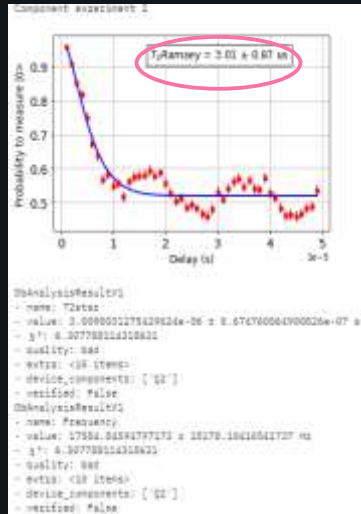
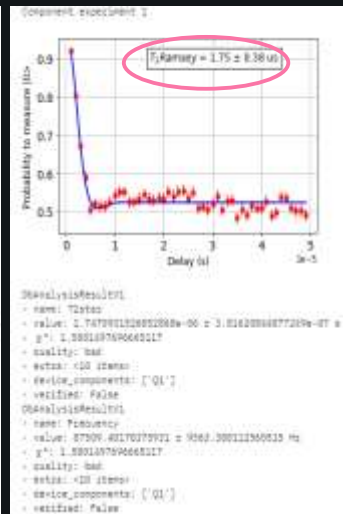
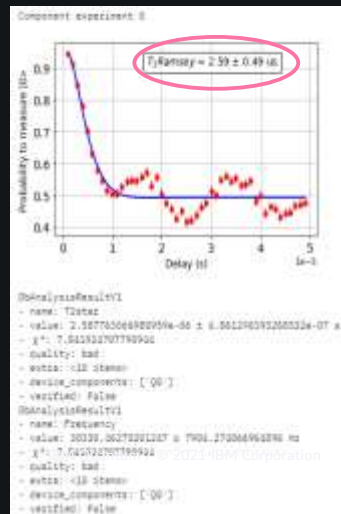
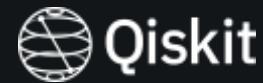
```
Qiskit AnalysisResultV1
- name: T1
- value: 1.027274174010660e-05 ± 7.067644344419226e-07 s
- y^1: 0.772722568549773
- quality: bad
- extra: <9 items>
- device_components: ['Q3']
- verified: False
```

Component experiment 4



```
Qiskit AnalysisResultV1
- name: T1
- value: 2.394760867005775e-05 ± 2.091876027600241e-06 s
- y^1: 0.51683049992068787
- quality: bad
- extra: <9 items>
- device_components: ['Q4']
- verified: False
```

# Ibmq\_lima :All T2 at once



# Thank You

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