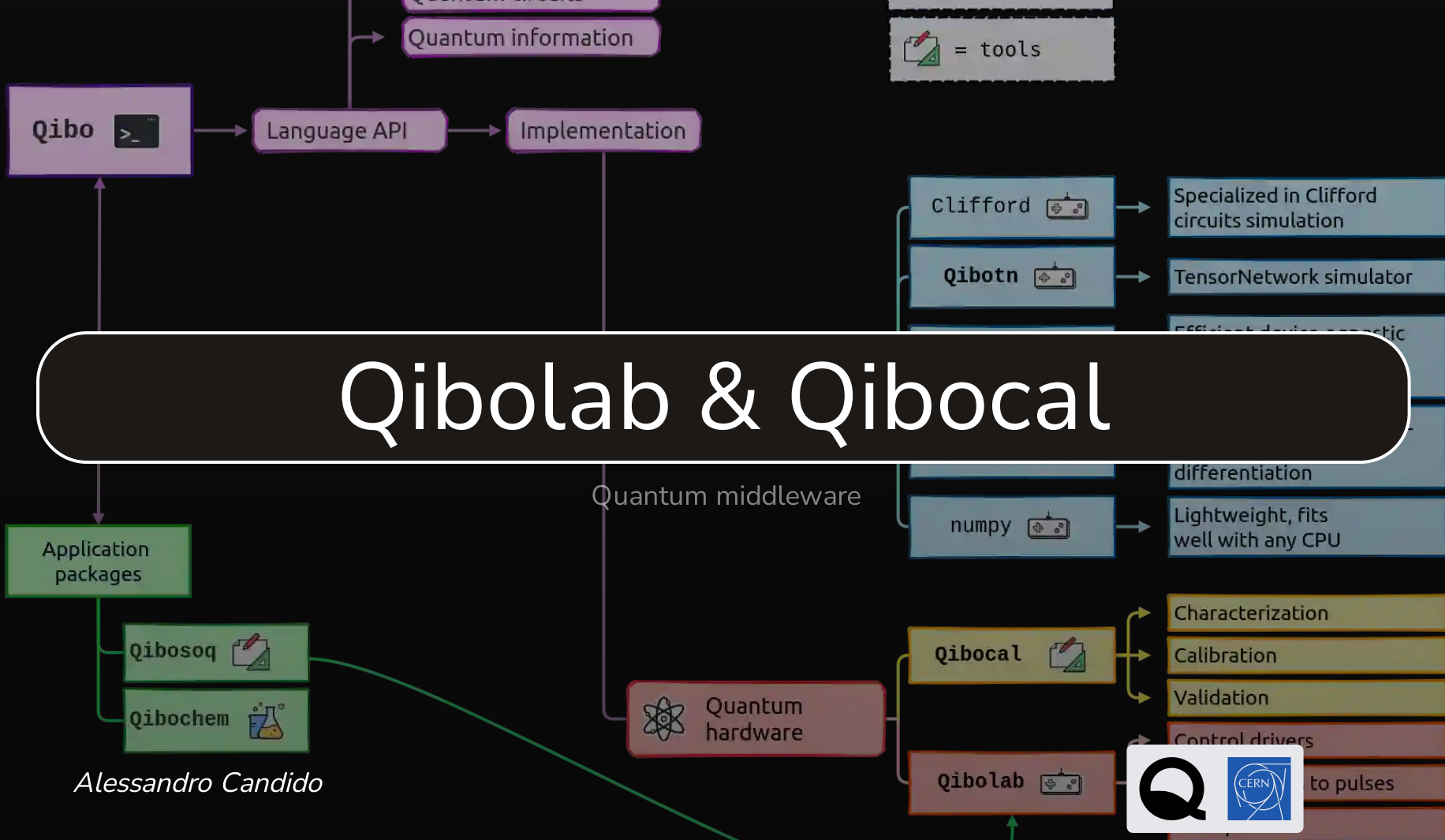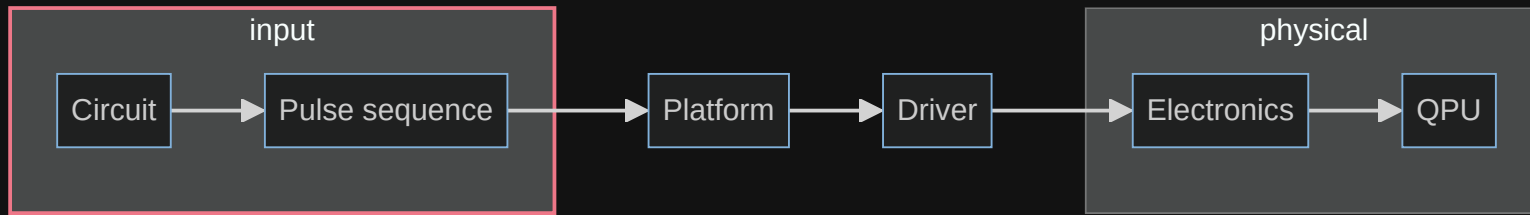# Qibolab [arXiv: 2308.06313]

The <u>input</u> for a computation could be very standard, at the level of a **circuit**. That kind of interface is already defined by <u>Qibo</u> itself.

However, at a lower level, **pulses** are still a standard-enough way to interact with hardware, and these are defined by <u>Qibolab</u>.
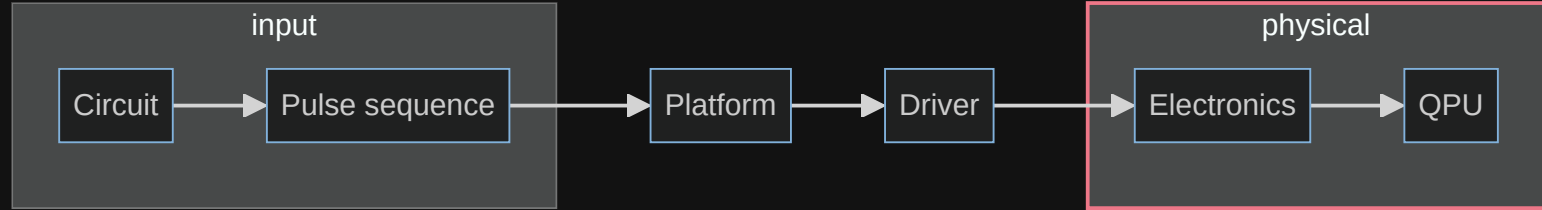
Pulse sequence plot (from notebook?)

```python
def create():
    instrument = DummyInstrument("myinstr", "0.0.0.0:0")

    channels = ChannelMap()
    channels |= Channel(
        "readout",
        port=instrument.ports("o1")
    )
    ...


    return Platform(
        "myplatform",
        qubits={qubit.name: qubit},
        instruments={instrument.name: instrument},
        ...
    )
```

Qibolab - Drivers

- Qblox
- Zurich
- QM
- QICK
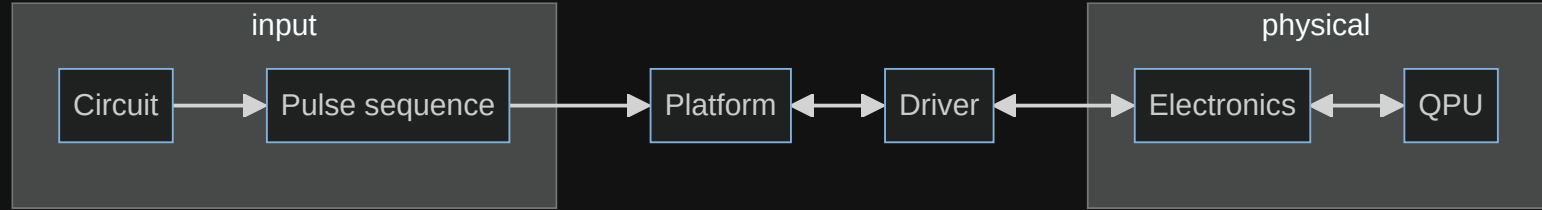
```
        move      1,R0        # Start at marker output channel 0 (move 1 into R0)
        nop                   # Wait a cycle for R0 to be available.

loop:   set_mrk   R0          # Set marker output channels to R0
        upd_param 1000        # Update marker output channels and wait 1μs.
        asl       R0,1,R0     # Move to next marker output channel (left-shift R0).
        nop                   # Wait a cycle for R0 to be available.
        jlt       R0,16,@loop # Loop until all 4 marker output channels have been set once.

        set_mrk   0           # Reset marker output channels.
        upd_param 4           # Update marker output channels.
        stop                  # Stop sequencer.
```
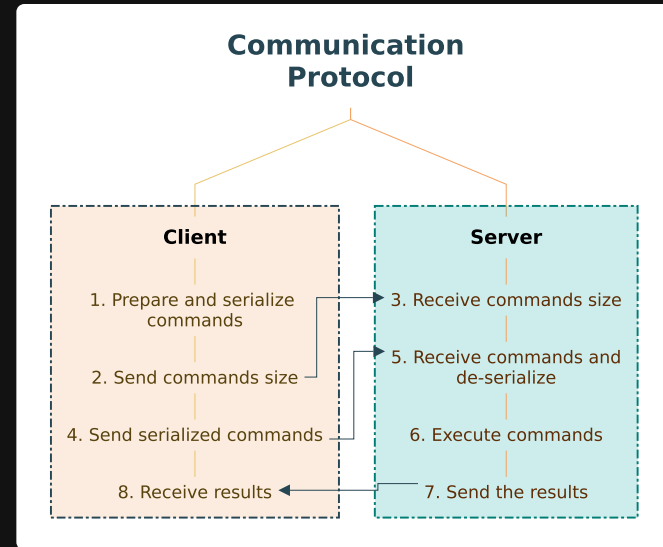
by Qblox

Qibosoq - Server on QICK `[arXiv: 2310.05851]`

input

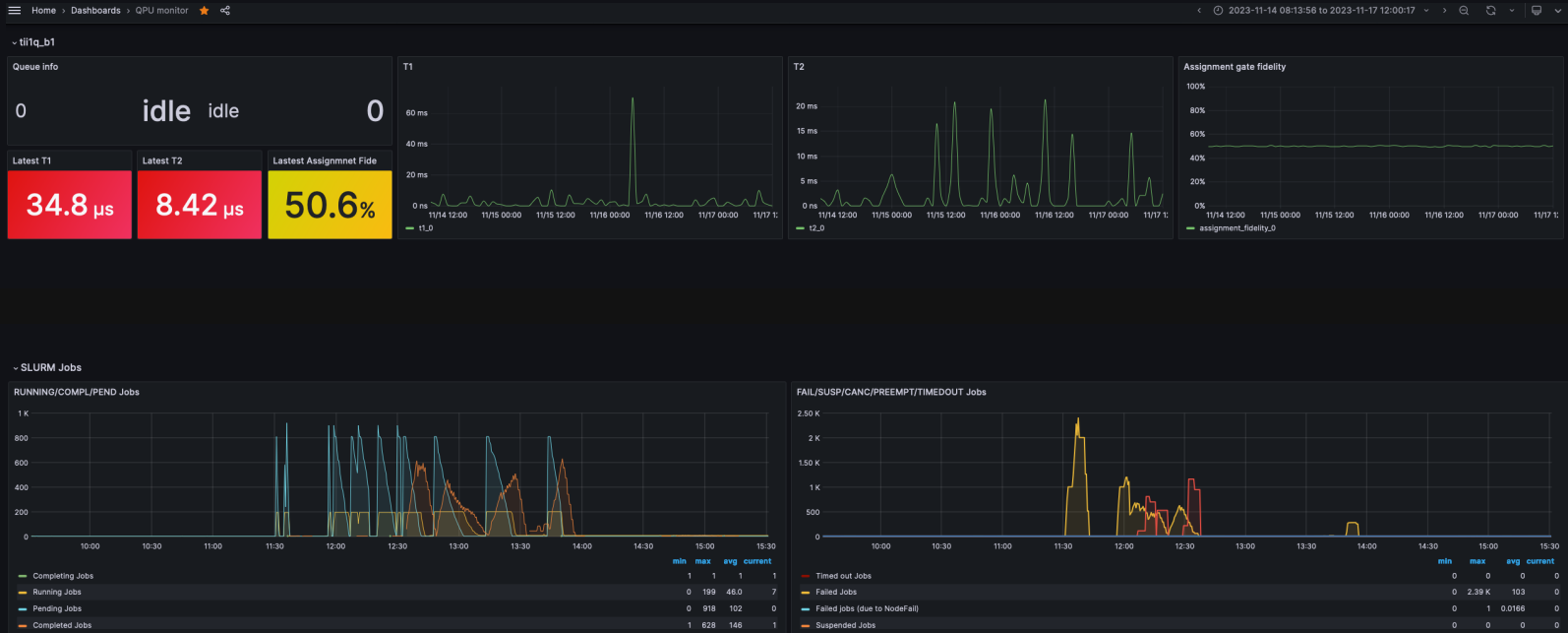Circuit → Pulse sequence → Platform ↔ Driver

physical

Electronics ↔ QPU

Qibolab handles the whole connection, and takes care of fetching the single or multiple results.

For the single open source platform *FPGA FIRMWARE* currently in Qibolab, there has been a dedicate effort to define a suitable server, to optimize the communication with the board.

⟶ Qibosoq

in collaboration with INFN-UNIMIB-BIQUTE

Communication Protocol

Client

1. Prepare and serialize commands
2. Send commands size
4. Send serialized commands
8. Receive results

Server

3. Receive commands size
5. Receive commands and de-serialize
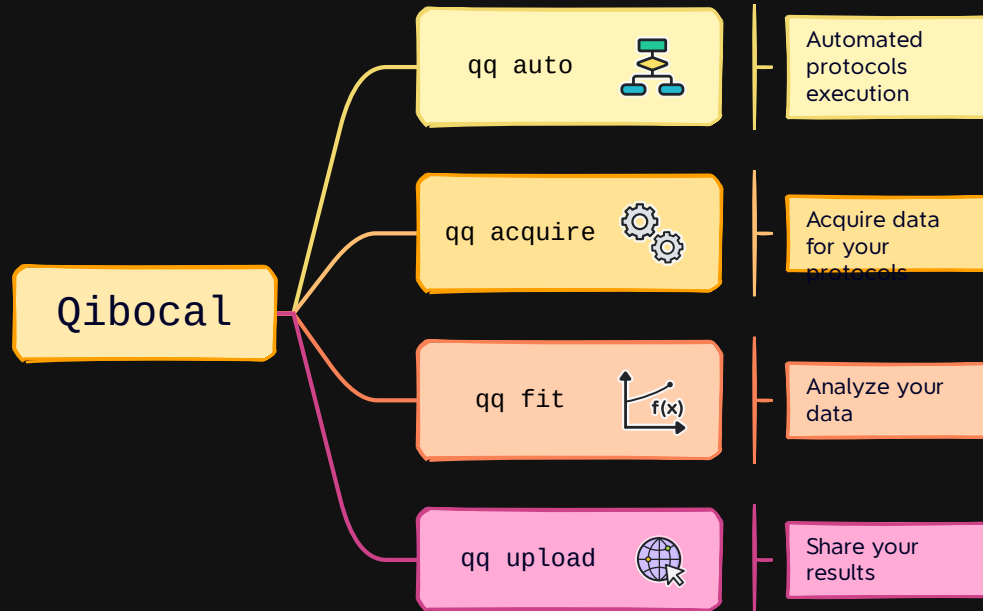6. Execute commands
7. Send the results

Platform dashboard

Qibocal

Qibocal

A runcard

```yaml
backend: qibolab
# for the time being, the backend has to be qibolab
platform: iqm5q
# this has to match the platform definition, examples at
# https://github.com/qiboteam/qibolab_platforms_qrc/
qubits:
- 0
# you could target multiple qubits at the same time

actions:
- id: qubit spectroscopy 01
  operation: qubit_spectroscopy
  parameters:
    drive_amplitude: 0.5
    drive_duration: 4000
    freq_step: 1000000
    freq_width: 100000000
    nshots: 1024
    relaxation_time: 5000
  qubits: []
  update: true
```

```yaml
- id: qubit spectroscopy 02
  operation: qubit_spectroscopy_ef
  parameters:
      # ...
  qubits: []
  update: true
- id: rabi
  operation: rabi_amplitude_signal
  parameters:
      # ...
  qubits: []
  update: true
- id: rabi ef
  operation: rabi_amplitude_ef
  parameters:
      # ...
  qubits: []
  update: true
- id: qutrit
  operation: qutrit_classification
  parameters:
      # the parameters could be an arbitrary object but
      # the layout is defined by the operation
    classifiers_list:
      - decision_tree
    nshots: 5000
    relaxation_time: 5000
  qubits: []
  update: true
```

Qibocal Reports

Uploaded Reports

Please select a report from the table below:

Search: [   ]

Title	Date	Platform	Start-time (UTC)	End-time (UTC)	Tag	Author
test_tii1qb1	2024-02-13	/home/users/ andrea.pasquale/ qibolab_platforms_qrc/ tii1qs_xld1000	06:53:18	06:53:26	-	andrea.pasquale
test_qubit_spec_tii1qs	2024-02-13	/home/users/ andrea.pasquale/ qibolab_platforms_qrc/ tii1qs_xld1000	06:59:45	06:59:50	-	andrea.pasquale
web_calibration_report_20240209_163420	2024-02-09	/home/users/qibocal/ webapp/ qibolab_platforms_qrc/ iqm5q	12:34:25	12:34:51	web_calibration	qibocal
web_calibration_report_20240209_154537	2024-02-09	/home/users/qibocal/ webapp/ qibolab_platforms_qrc/ iqm5q	11:45:54	11:46:21	web_calibration	qibocal
web_calibration_report_20240209_163420	2024-02-09	/home/users/qibocal/ webapp/ qibolab_platforms_qrc/ iqm5q	12:34:25	12:34:51	web_calibration	qibocal

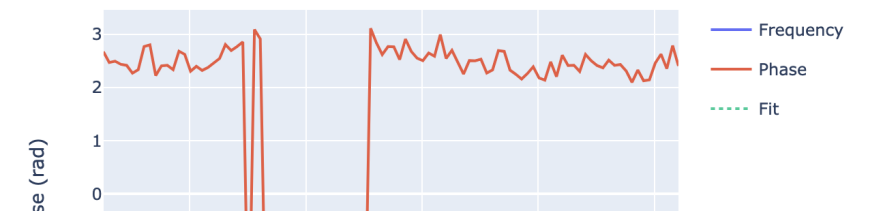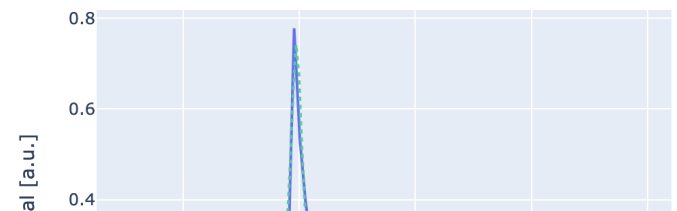# iqm5q/calibration_november/10112023/qutrit

Export to pdf

Platform: IQM5q
Run date: 2023-11-10
Start time (UTC): 15:42:15
End time (UTC): 15:42:15

Qubit Spectroscopy 01 - 0

- Qubit 0

Qubit	Parameters	Values
0	qubit frequency	4079523906.0
0	amplitude	0.5

Docs

The previous runcard was admittedly taken from an old example...

While the layout is still similar, Qibolab and Qibocal are evolving over time*.

The best way to learn and stay up-to-date with the development is reading the official docs:

- https://qibo.science/
- https://qibo.science/qibolab/stable/
- https://qibo.science/qibocal/stable/

*All versions are anyhow available on GitHub releases and PyPI

Thanks