

# Qiskit Advocate Mentorship Program (QAMP) 2021

## #25: Good First Issues and Short Projects in qiskit-terra

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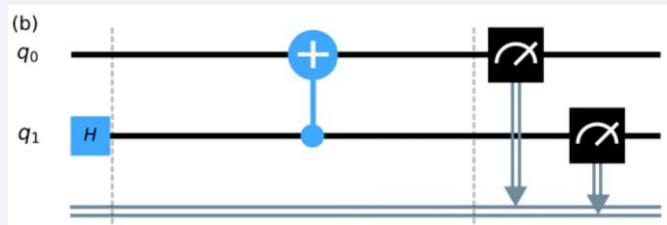
Mentee: Shi-Ning Sun

Mentor: Kevin Krsulich

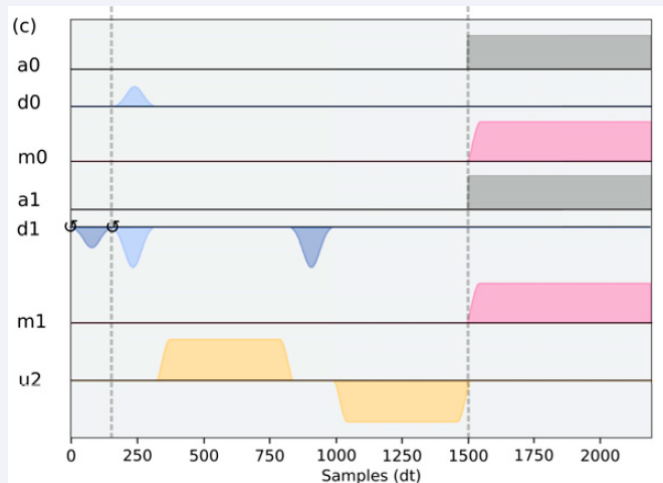
Code Reviewers: Naoki Kanazawa, Thomas Alexander

# The Qiskit Pulse Module

Circuit model



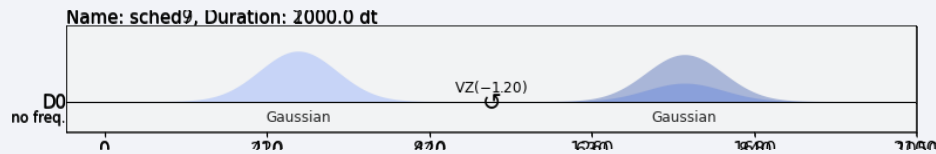
Pulse model



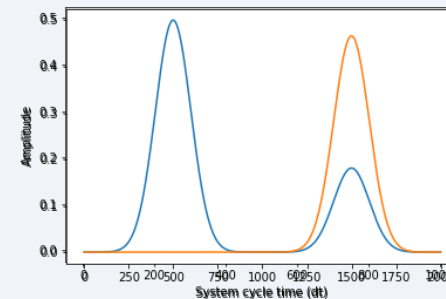
“Apply” a “Pulse” on a “Channel” in a “Schedule”

- Instruction (“Apply”)
  - Play, Acquire, Delay
  - SetPhase, ShiftPhase, SetFrequency, ShiftFrequency
- Pulse
  - ParametricPulse, e.g. Gaussian pulse
  - Waveform
- Channel
  - PulseChannel, e.g. DriveChannel, ControlChannel
  - AcquireChannel, MemorySlot
- Schedule

# The Issue



Pulse objects



Numpy arrays

**Can we access the waveform samples of all pulses on a channel?**

## Tasks:

1. Write a function that combines all the waveforms of the pulses on a channel
2. Port the pulse transformation functionalities over from the visualization module to the pulse module

# Solution

Waveform instructions: Play, Acquire, Delay

Frame instructions: SetPhase, ShiftPhase, SetFrequency, ShiftFrequency

Functionality	Current Implementation	New Implementation
Calculate frame changes and bind to waveform instructions	<code>get_waveforms</code> and <code>_calculate_current_frame</code> in <code>events.py</code>	<code>get_parsed_instructions</code> in <code>channel_transforms.py</code>
Parse waveform instructions	<code>_parse_waveform</code> in <code>generators/waveform.py</code>	<code>_parse_waveform</code> in <code>channel_transforms.py</code>
Apply phase modulation	<code>gen_filled_waveform_stepwise</code> in <code>generators/waveform.py</code>	<code>_parse_waveform</code> in <code>channel_transforms.py</code>
Apply frequency modulation	None	<code>_parse_waveform</code> in <code>channel_transforms.py</code>
Obtain metadata for plotting functions	<code>_parse_waveform</code> in <code>generators/waveform.py</code>	<code>_get_metadata</code> in <code>generators/waveform.py</code>

# Future Work



Keep working on the Qiskit Pulse module and close a few more issues

- Issue #5472: Pulse `align_measures` implicitly assumes a `u3` gate
- Issue #5510: Result object class for IQ data
- Issue #6106: Pulse unittest reorganization