

# Adding a "no-inline" option to Qiskit transpiler

**Qamp-fall-22 #16**

Mentor : Adrien Suau

Mentee : Juon Kim, Pranshi Saxena

# Qiskit transpiler

## Background

- Real quantum devices can only execute a limited hardware-specific quantum gates
- Requires Human-defined gates → Machine-compatible gates

## Transpilation (≠ Compilation)

- Optimize the performance and compensate for the effects of noise, decoherence, errors
- Physically realizable with the quantum hardware

# Qiskit transpiler

## Inline Qiskit transpiler

- Optimization by unrolling(inlining in the classical context) the instruction
  - “Flat” quantum circuit
    - Each part is independent
    - Limited to reuse the module
    - Apply all the transpiler passes in each part
- Hard to handle requests for changes

## No-inline Qiskit transpiler

- “Hierarchical” structure
    - Each part is interconnected
    - Easy to reuse the module
    - Apply the transpiler pass once and reapply it to other part
- Easy to handle requests for changes → High performance

# No-inline Qiskit transpiler

## Goal

1. Implement classical feedback in the quantum circuit
  - Depends on the result of measurement
2. Make subroutine easy
  - Avoid repeating the same circuit transpilation

## Advantage

- Can apply on various quantum hardware
- Can adapt the transpiler to classical feedback
- Transpile the quantum circuits more efficient and faster