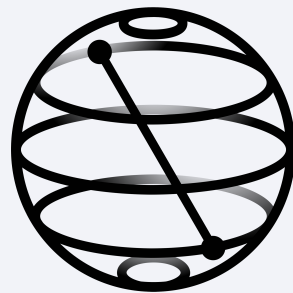
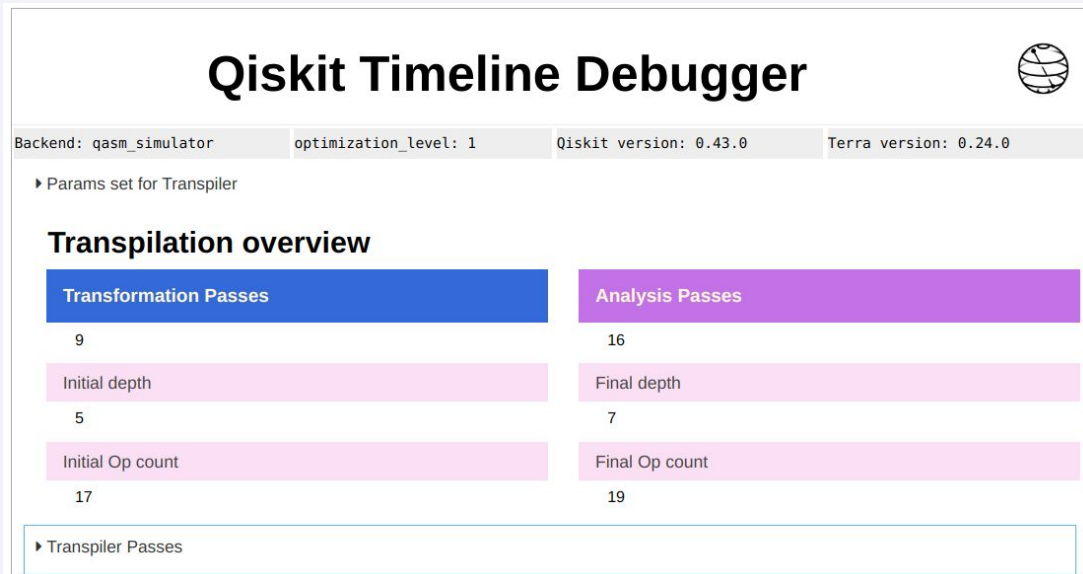

Timeline Debugger for the Qiskit Transpiler

Harshit Gupta



What is the Transpiler Debugger?



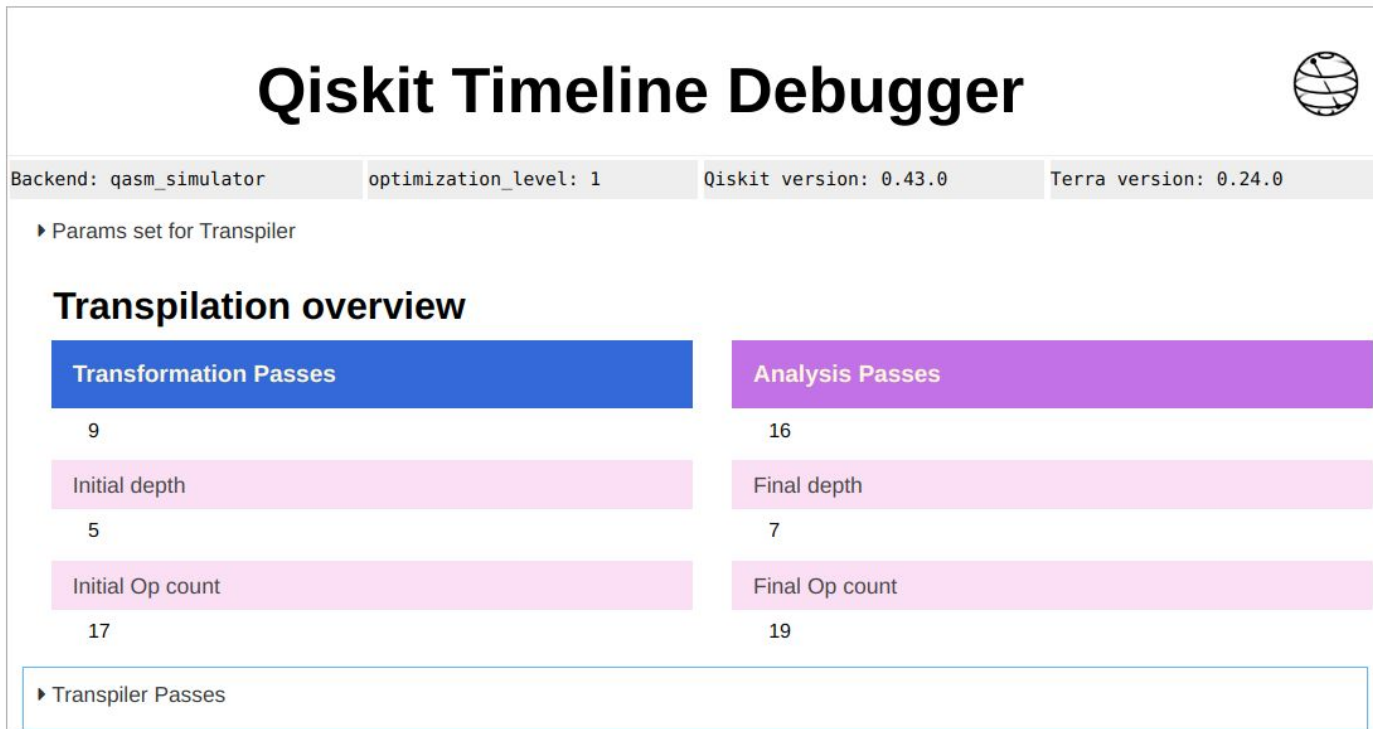
qiskit-trebugger 1.0.1

`pip install qiskit-trebugger`

- The Qiskit transpiler has built-in logging and callback mechanisms to help users understand about transpilation.
- However, most users don't know about these tools, or don't have the deep transpiler knowledge to know how to use them.
- This is where this project comes in, providing an insight into the qiskit transpiler.
- It exists as a [python package](#) available on pypi

Current State

Overview



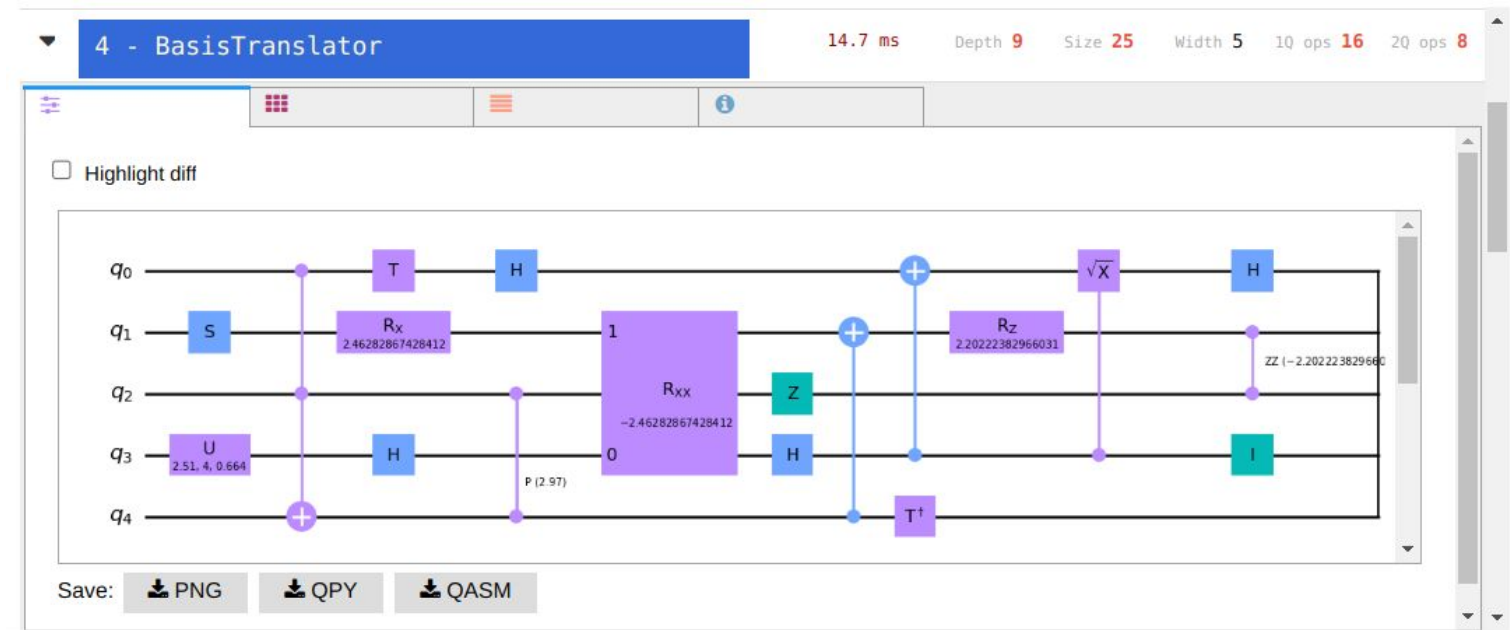
Current State

Transpiler Pass Information

| ▼ Transpiler Passes | | | | | | | |
|---------------------|-----------------------------|---------|---------|---------|---------|-----------|----------|
| ▶ | 0 - ContainsInstruction | 0.0 ms | Depth 5 | Size 17 | Width 5 | 1Q ops 10 | 2Q ops 6 |
| ▶ | 1 - UnitarySynthesis | | Depth 5 | Size 17 | Width 5 | 1Q ops 10 | 2Q ops 6 |
| ▶ | 2 - HighLevelSynthesis | 0.1 ms | Depth 5 | Size 17 | Width 5 | 1Q ops 10 | 2Q ops 6 |
| ▶ | 3 - UnrollCustomDefinitions | 0.7 ms | Depth 5 | Size 17 | Width 5 | 1Q ops 10 | 2Q ops 6 |
| ▶ | 4 - BasisTranslator | 14.7 ms | Depth 9 | Size 25 | Width 5 | 1Q ops 16 | 2Q ops 8 |
| ▶ | 5 - RemoveResetInZeroState | 0.1 ms | Depth 9 | Size 25 | Width 5 | 1Q ops 16 | 2Q ops 8 |
| ▶ | 6 - Depth | 0.2 ms | Depth 9 | Size 25 | Width 5 | 1Q ops 16 | 2Q ops 8 |
| ▶ | 7 - FixedPoint | 0.0 ms | Depth 9 | Size 25 | Width 5 | 1Q ops 16 | 2Q ops 8 |

Current State

Pass Level Details



New CLI View



Command Line View

Width: 174, Height: 45

Qiskit Transpiler Debugger

| backend: fake_melbourne | optimization level: 2 | qiskit version: 0.39.4 | terra version: 0.22.3 |

TRANSPILATION OVERVIEW

Transpiler Passes

Pass Overview

Total Passes : 43

Transformation : 18 | Analysis : 25

Runtime : 176.24 ms

Circuit Statistics

| Property | Initial | Final |
|----------|---------|-------|
| Depth | 5 | 81 |
| Size | 13 | 120 |
| Width | 5 | 14 |
| Ops | 13 | 120 |

| | Pass Name | Pass Type | Runtime | Depth | Size | 1q Gates | 2q Gates | Width |
|----|--------------------------------|----------------|---------|-------|------|----------|----------|-------|
| 0 | ContainsInstruction | Analysis | 0.02 | 5 | 13 | 4 | 6 | 5 |
| 1 | UnitarySynthesis | Transformation | 0.14 | 5 | 13 | 4 | 6 | 5 |
| 2 | HighLevelSynthesis | Transformation | 0.18 | 5 | 13 | 4 | 6 | 5 |
| 3 | Unroll3qOrMore | Transformation | 4.86 | 39 | 59 | 31 | 28 | 5 |
| 4 | SetLayout | Analysis | 0.01 | 39 | 59 | 31 | 28 | 5 |
| 5 | VF2Layout | Analysis | 2.15 | 39 | 59 | 31 | 28 | 5 |
| 6 | SabreLayout | Analysis | 48.58 | 39 | 59 | 31 | 28 | 5 |
| 7 | FullAncillaAllocation | Analysis | 0.16 | 39 | 59 | 31 | 28 | 5 |
| 8 | EnlargeWithAncilla | Transformation | 0.17 | 39 | 59 | 31 | 28 | 14 |
| 9 | ApplyLayout | Transformation | 1.36 | 39 | 59 | 31 | 28 | 14 |
| 10 | CheckMap | Analysis | 0.21 | 39 | 59 | 31 | 28 | 14 |
| 11 | BarrierBeforeFinalMeasurements | Transformation | 0.07 | 39 | 59 | 31 | 28 | 14 |
| 12 | SabreSwap | Transformation | 3.15 | 47 | 65 | 31 | 34 | 14 |
| 13 | VF2PostLayout | Analysis | 6.44 | 47 | 65 | 31 | 34 | 14 |
| 14 | ApplyLayout | Transformation | 1.45 | 47 | 65 | 31 | 34 | 14 |

STATUS BAR | t: keys / mouse cursor: Scrolling | 'I': Index into a pass | 'Q': Exit

- Text based debugger
- Faster & lightweight
- Most features of visual debugger but in CLI
- Useful for core developers
- Independent of the visual view
- Used **ncurses** tool for constructing the UI

Demo