

QAMP Spring 2022

Mentee:

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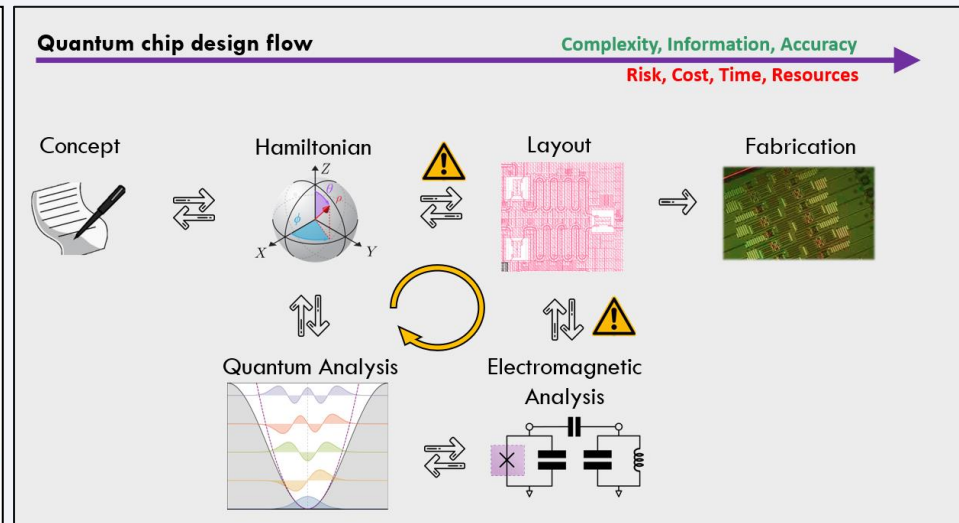
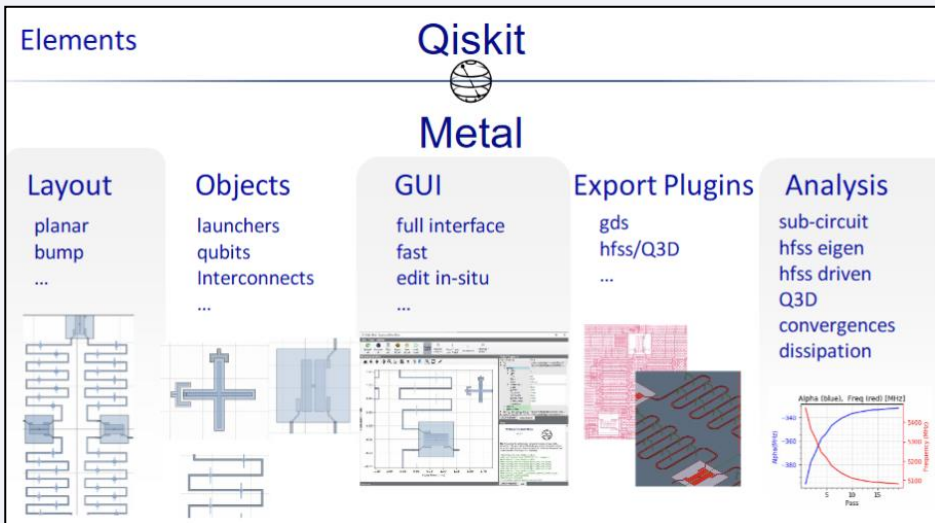
Mentors:

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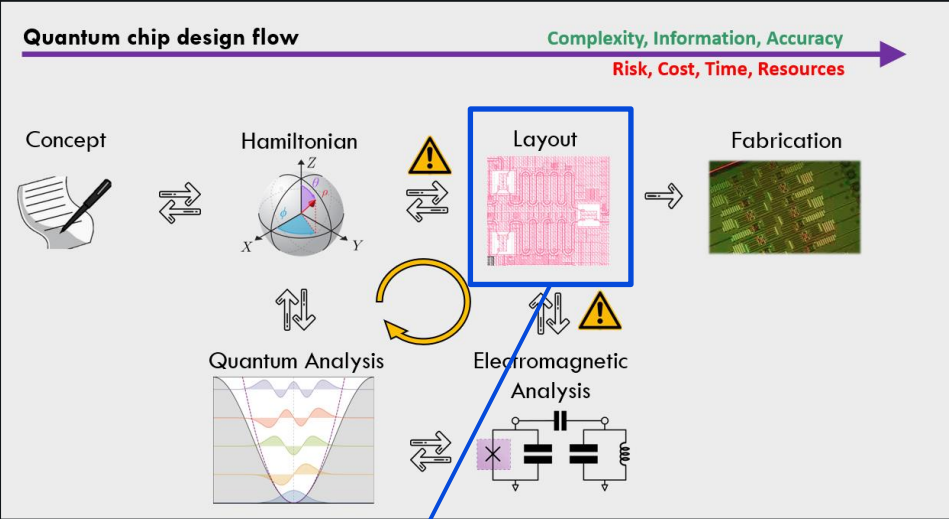
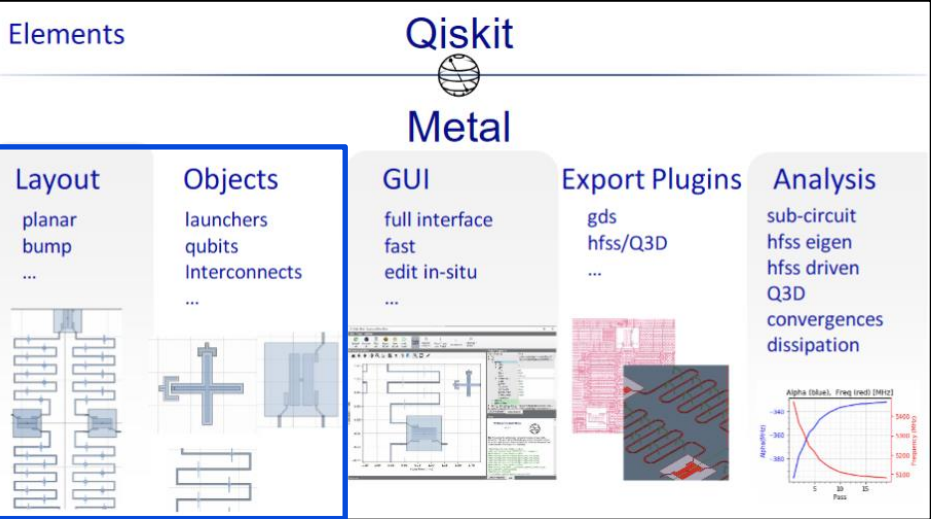
Issue #33: Qiskit Metal - Optimize qroute, adding further checks within existing code

Qiskit Metal Overview



Qiskit Metal is an end-to-end platform for the ideation, design & analysis of quantum chips

Qiskit Metal Overview

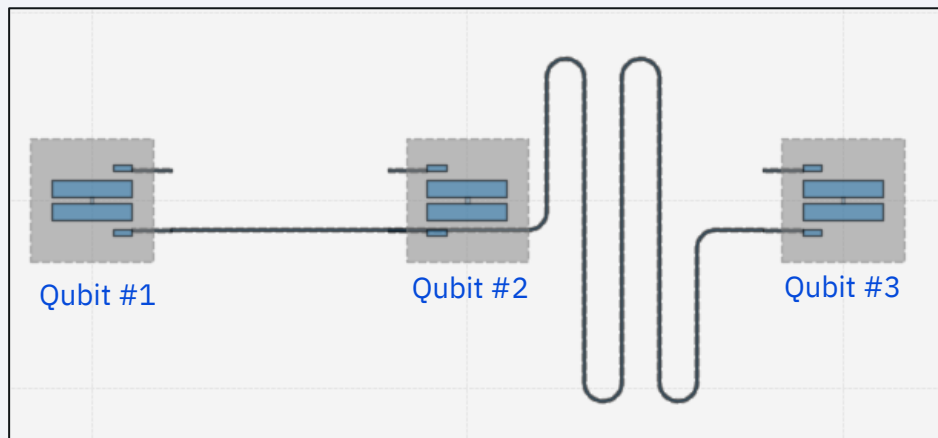


This project is related to the connectivity between design components.

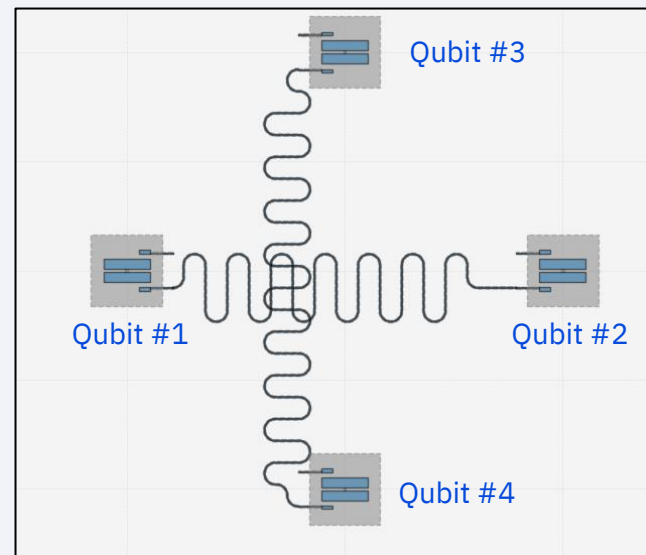
Problem Statement

The current implementation of the A-Star algorithm in Qiskit Metal still results in unwanted collisions between CPW resonators and/or between CPW resonators and qubits.

Collision between CPW resonator and qubit #2



Collision between two CPW resonators



Our Solution in Pseudocode



Test each component separately

For each component in a design:

- Shapes = Get the GeoPandas table containing the shapes making up that component

- For every *other* component in a design:

Inner Loop to Scan Over Other Components in a Design

- Collision Counter = 0

- Other_Shapes = GeoPandas table with shapes

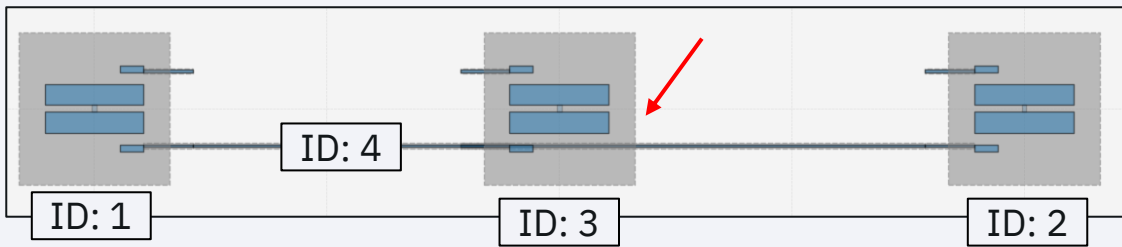
- If Shapes crosses Other_Shapes:

- Collision_Counter = Collision_Counter +1

Inner Inner Loop Tests for Overlap using the shapely "crosses" function

Case Study: Example #1

CPW/Qubit Collision



Output

```
In [6]: QDesign_Check.overlap_tester(design)
```

Component ID:
1

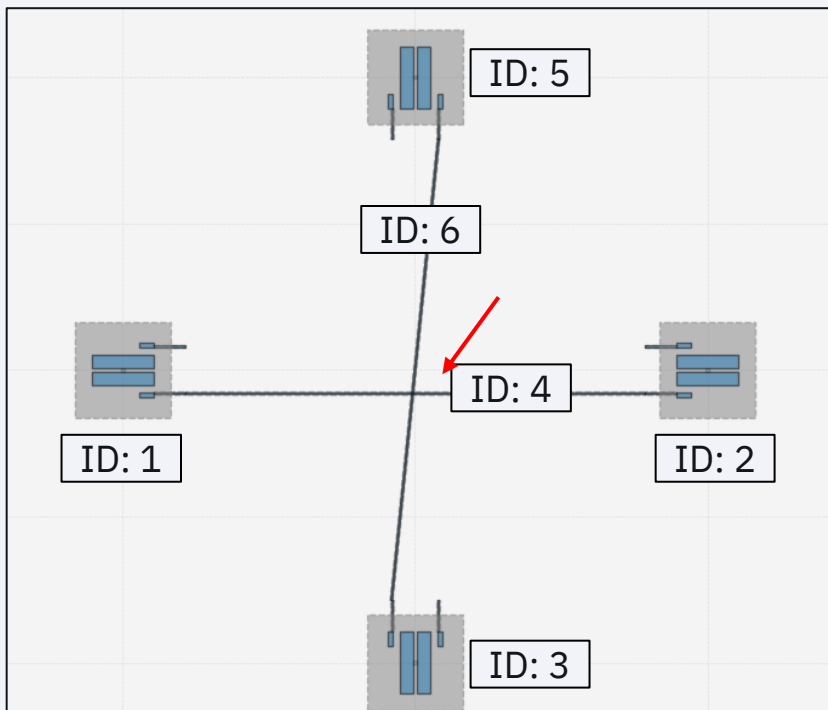
Component ID:
2

Component ID:
3
Has a collision with the following QComponent: 4

Component ID:
4
Has a collision with the following QComponent: 3

Case Study: Example #2

CPW/CPW Collision



Output

```
In [11]: QDesign_Check.overlap_tester(design)
```

Component ID:
1

Component ID:
2

Component ID:
3

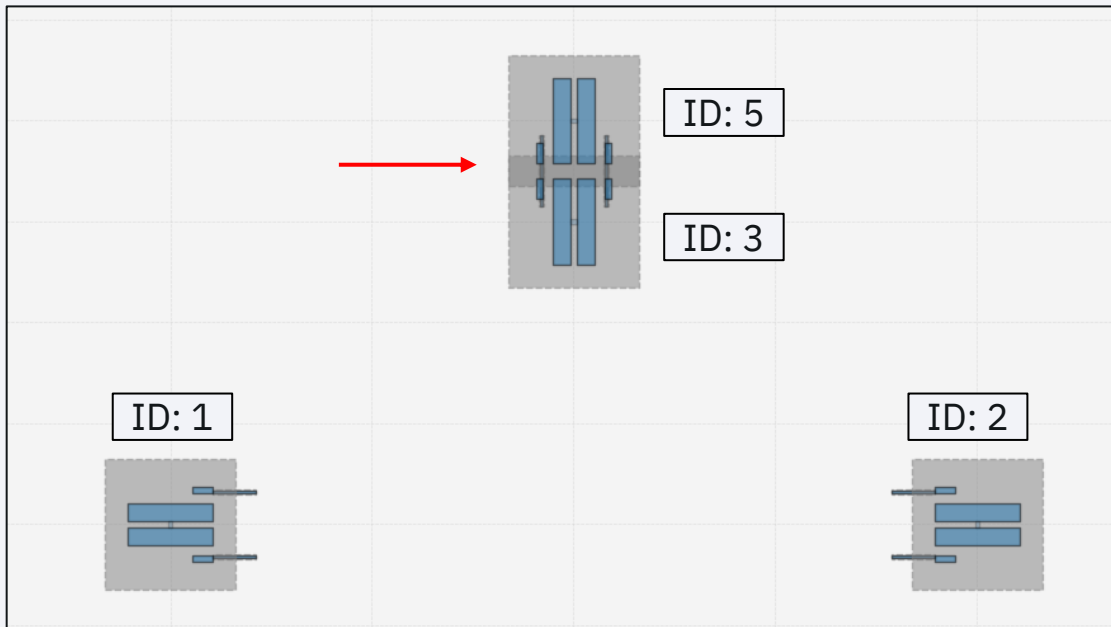
Component ID:
4
Has a collision with the following QComponent: 6

Component ID:
5

Component ID:
6
Has a collision with the following QComponent: 4

Case Study: Example #3

Qubit/Qubit Collision



Output

```
In [14]: ► QDesign_Check.overlap_tester(design)
```

```
Component ID:  
1
```

```
Component ID:  
2
```

```
Component ID:  
3  
Has a collision with the following QComponent: 5
```

```
Component ID:  
5  
Has a collision with the following QComponent: 3
```


Future work directions



- Optimize, streamline, fine-tune output of “Qdesign_Check”
- Modify routing algorithm (“Qroute”) to call on this function to test for collisions & modify routing as needed.

Thank You!