



Josephson Parametric Amplifier Design

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INFN Florence, University of Pisa

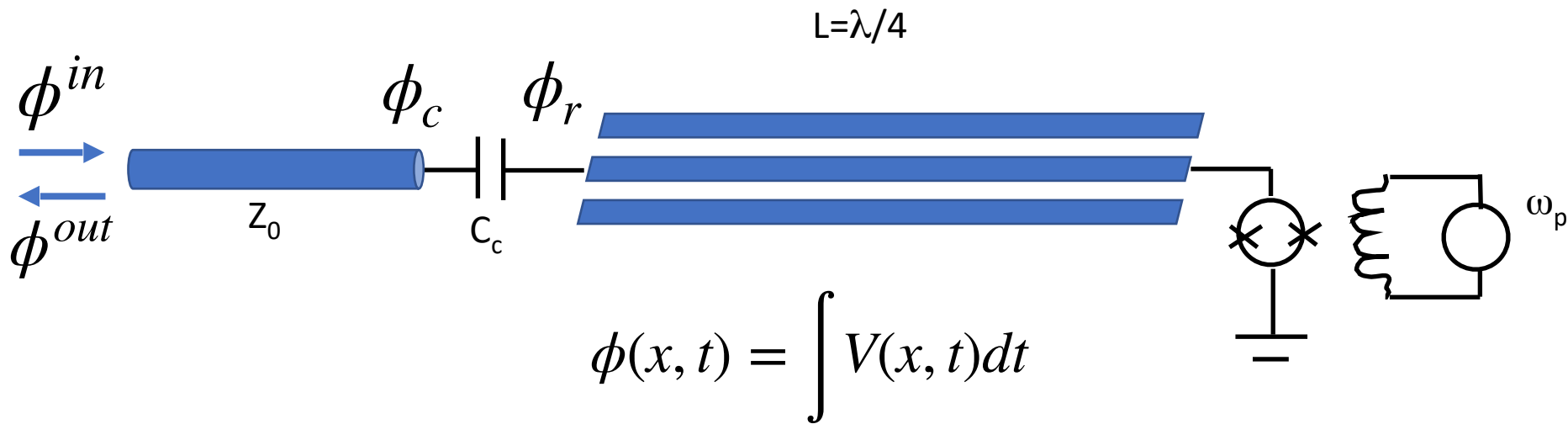
Outline

- Goal
- Design tech-stack
- Design
- Flux Simulations



Josephson Parametric Amplifier (JPA)

We designed and simulated a Flux JPAs working at 5.6 GHz



Qiskit Metal

- Open-source quantum hardware design framework
- Python based
- Extensive use of Jupyter Notebook
- Parasitic extraction through Ansys Q3D
- EM simulation through Ansys HFSS

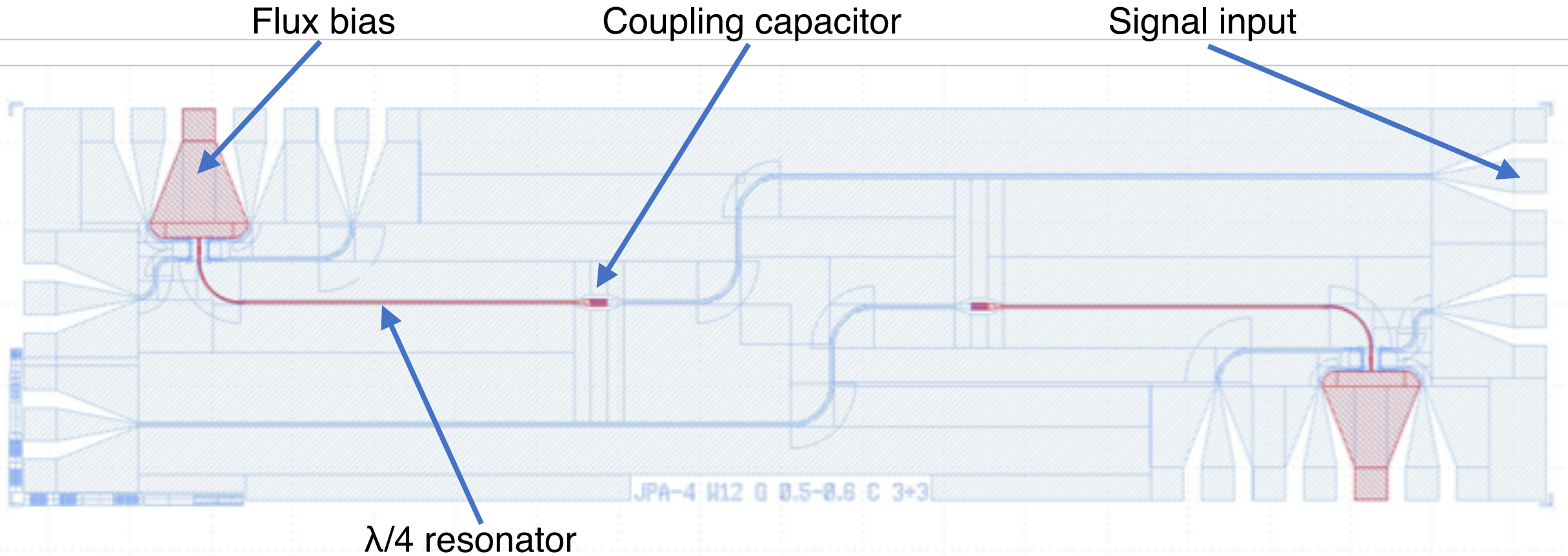
Qiskit Metal installer

<https://github.com/Qiskit/qiskit-metal>

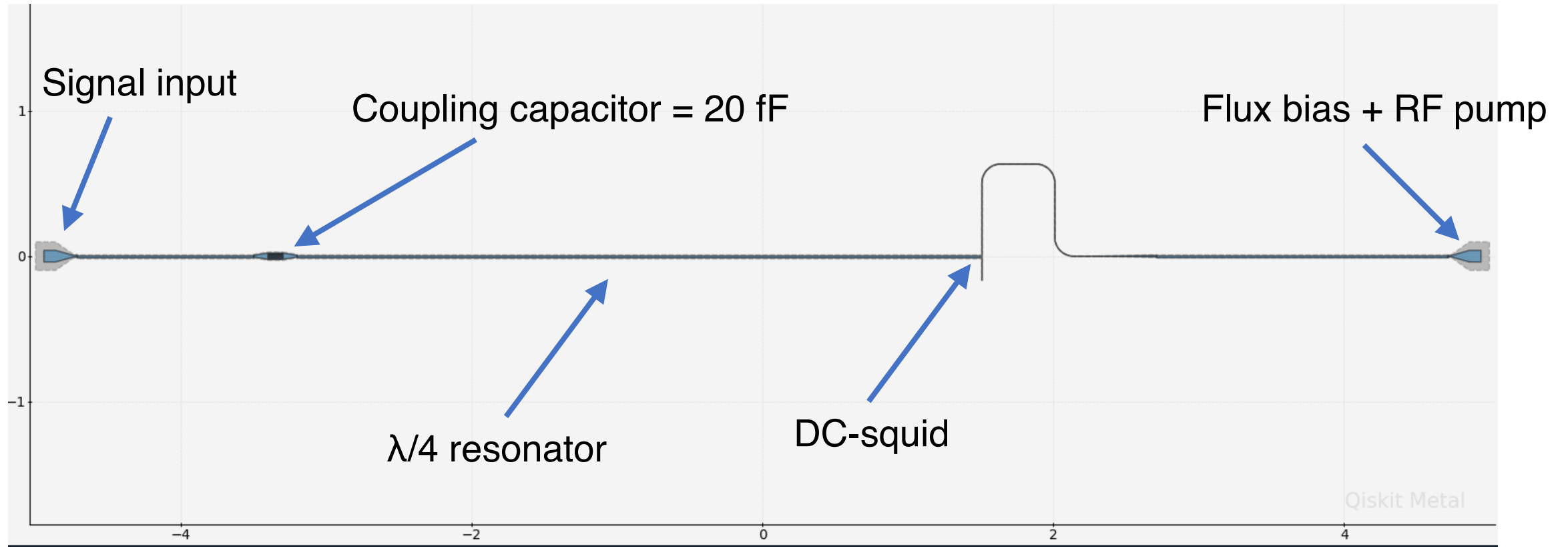
Qiskit Metal documentation

<https://qiskit.org/documentation/metal/>

Benno's JPA Design



New JPA Design

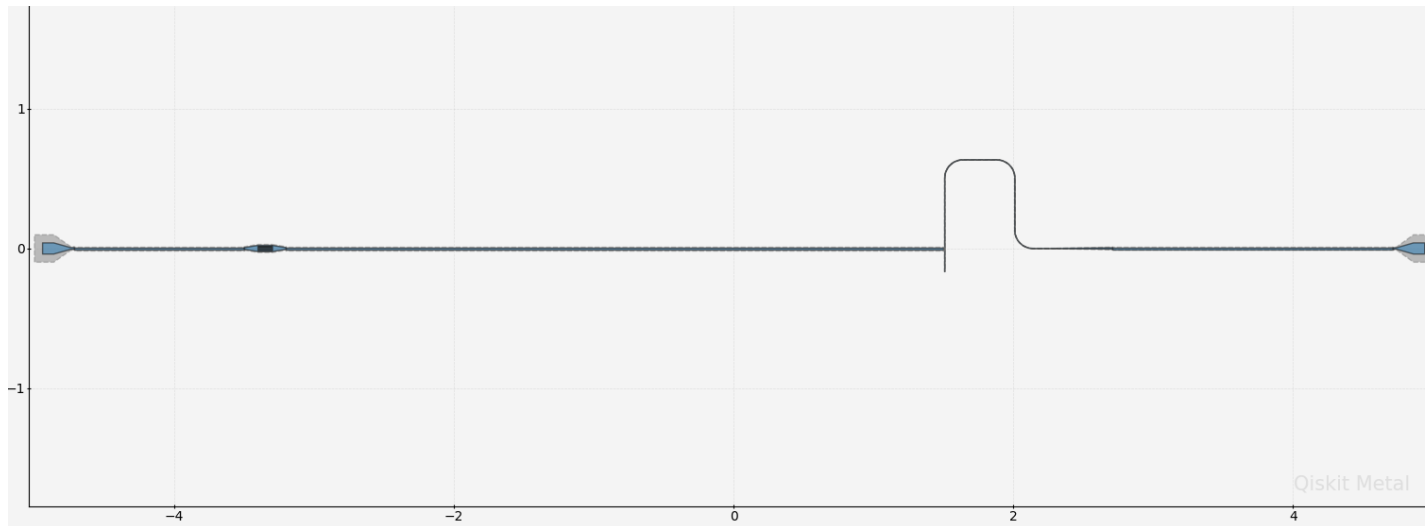


JPA Design

The superconductor used is Aluminum

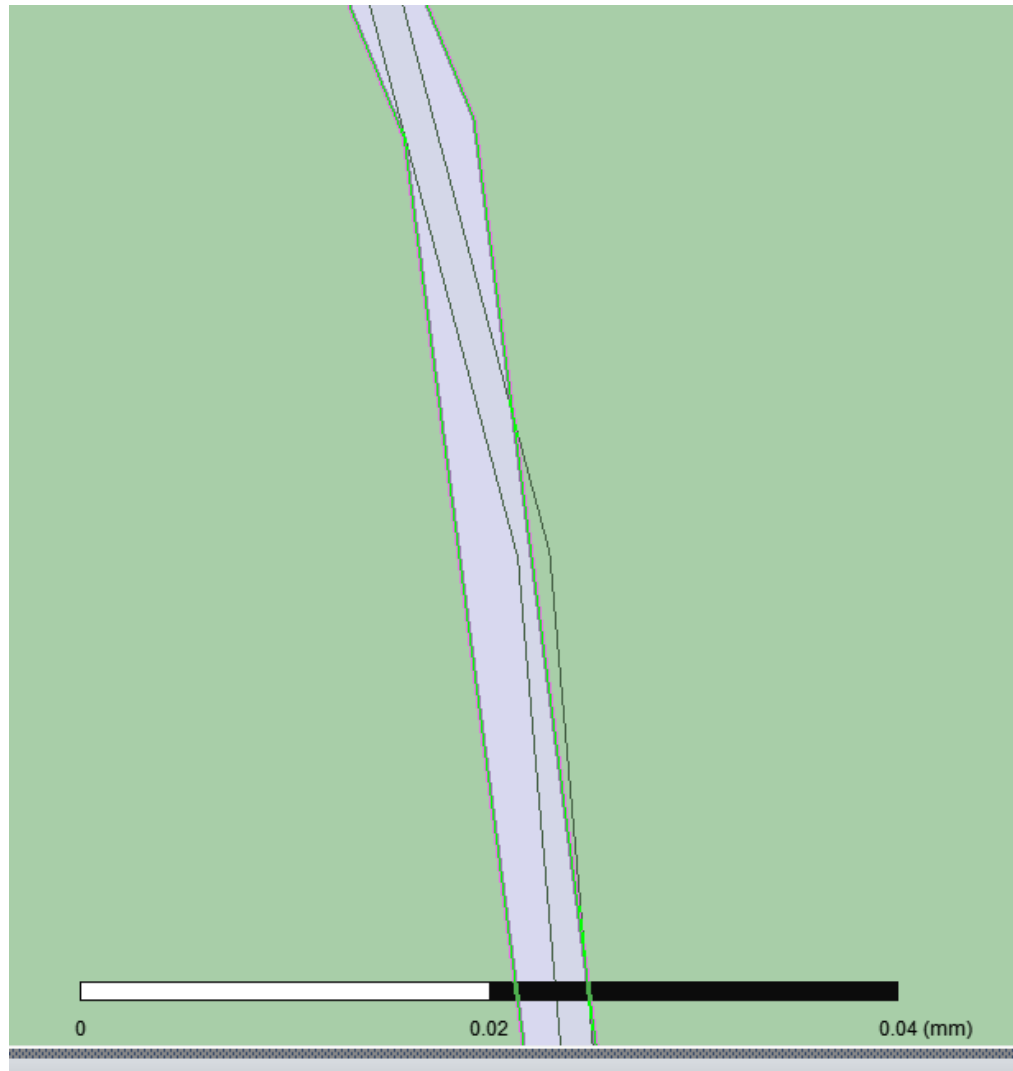
The substrate is 600 um thick Silicon

All lines are CPW matched to 50 Ohm



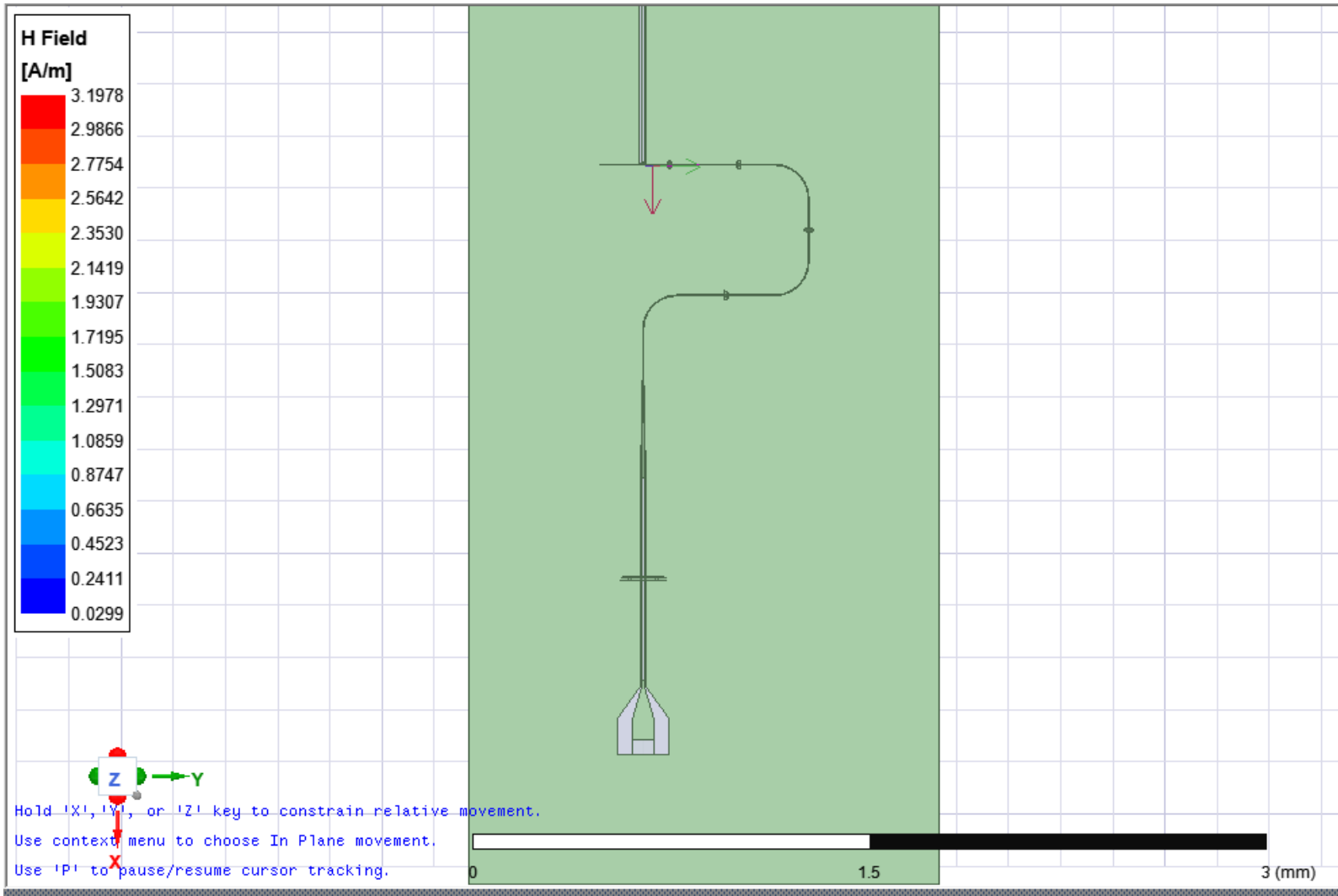
Chip dimensions
10 mm * 2.5 mm

Qiskit Metal Bug



Qiskit Metal can
introduce bugs when the
design is rendered in
HFSS

Flux Simulations

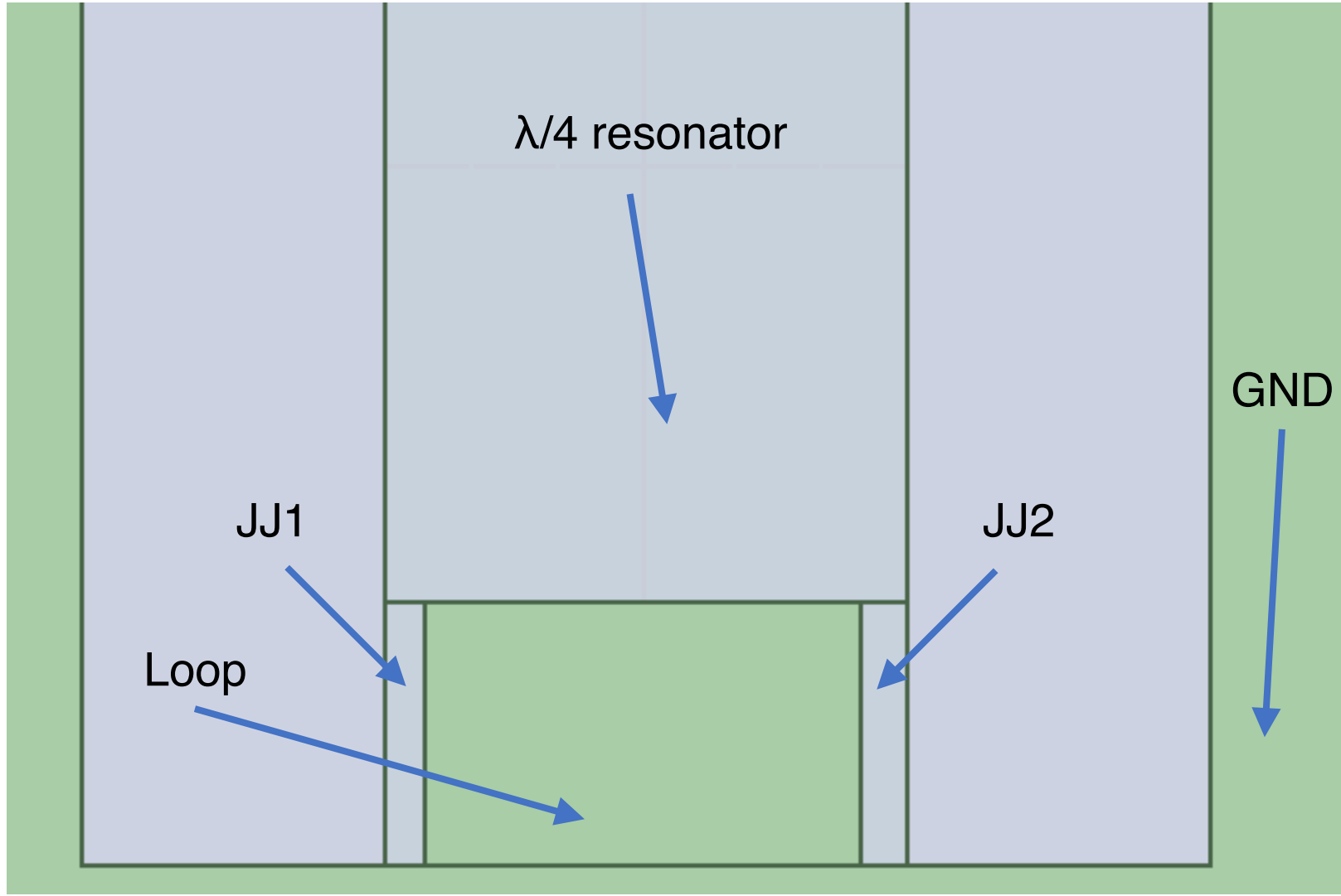


RF pump freq. = 11.2 GHz

RF pump power = -40 dBm

No DC bias simulation possible with HFSS

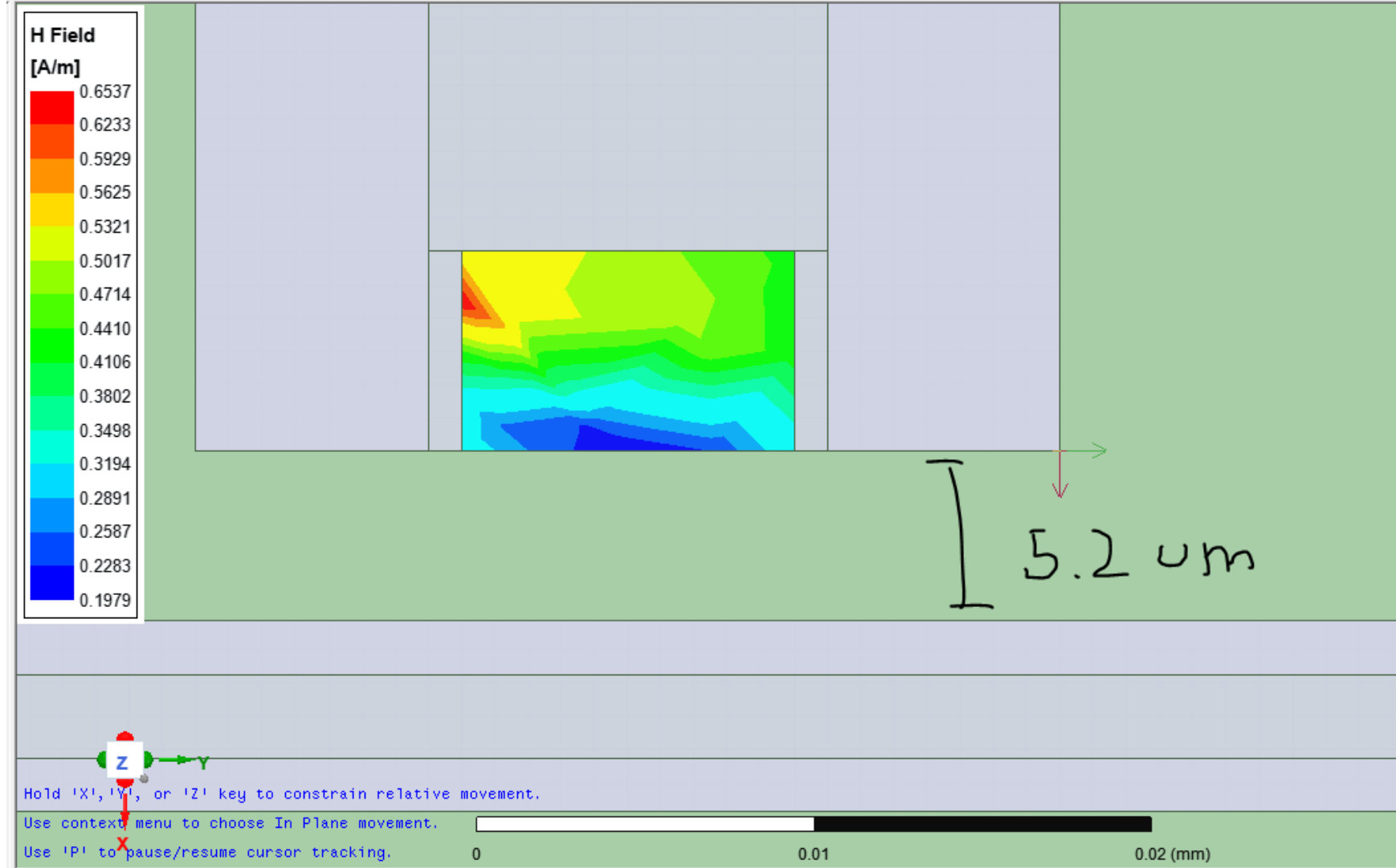
DC Squid Simulation



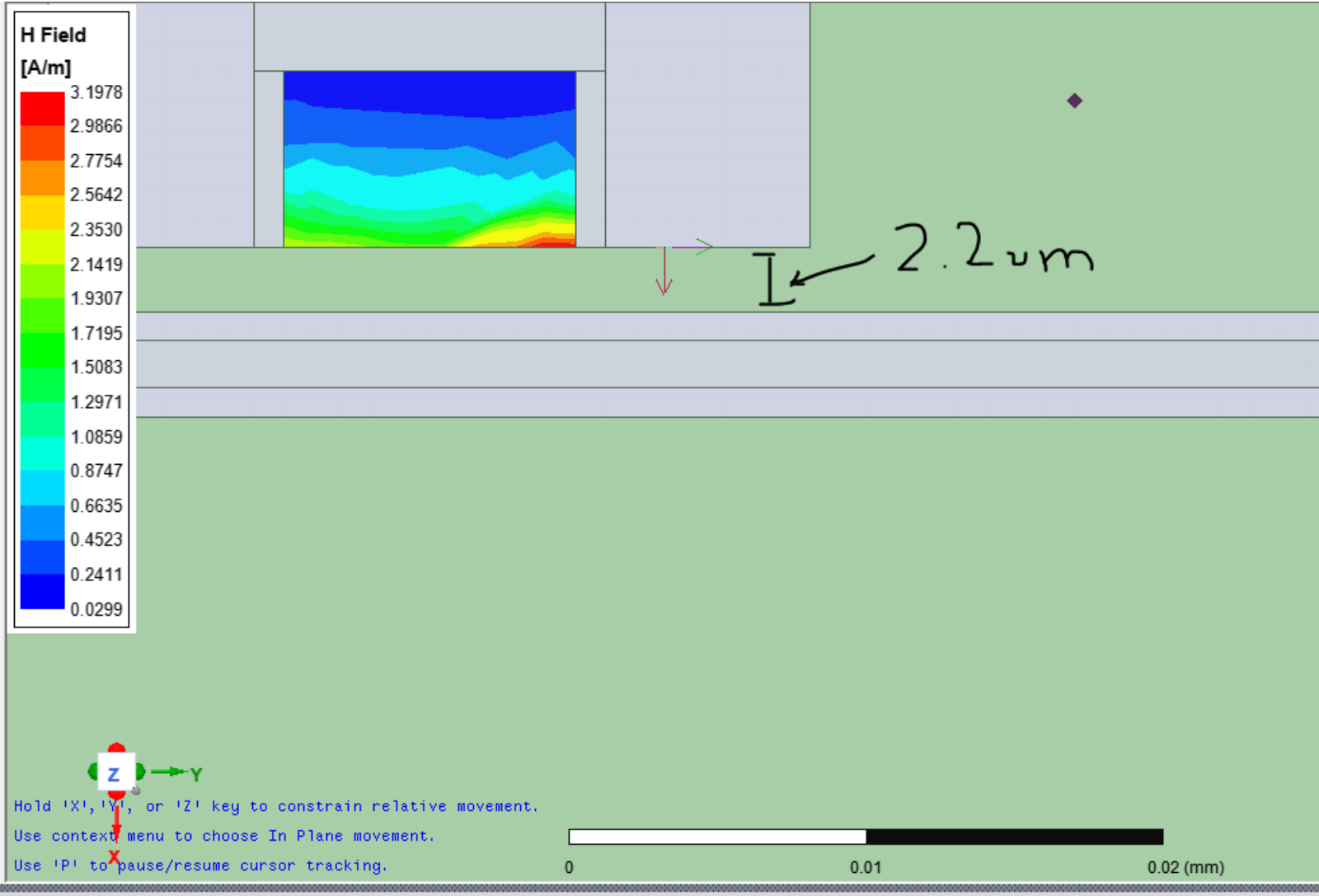
Josephson junctions
simulated as 0.22 nH
lumped inductors

The DC-squid
geometry will be
slightly different

Previous DC Squid Flux



New DC Squid Flux



Thanks for your attention!

Contact: herve.corti@phd.unipi.it

Qub-IT website: <https://web.infn.it/qub-it/>

Qub-IT agenda: <https://agenda.infn.it/category/1635/>