ARIANNA Multistage Amplifier for Neutrino Detection in Antarctica

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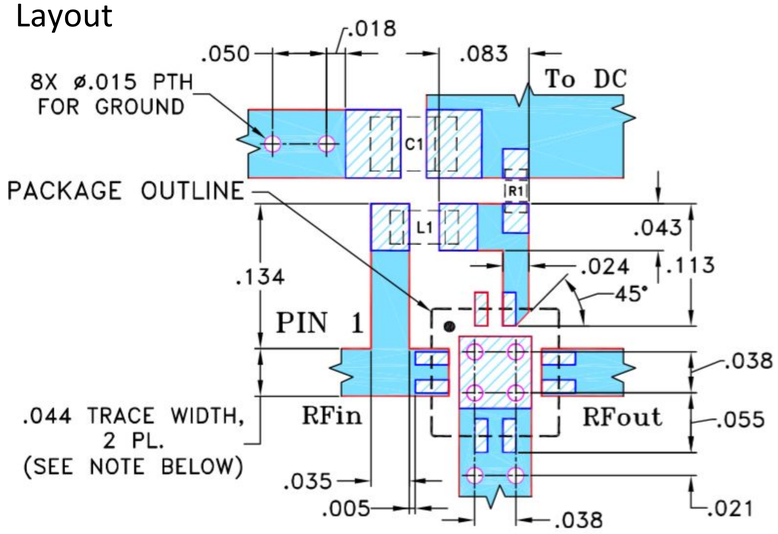
Background

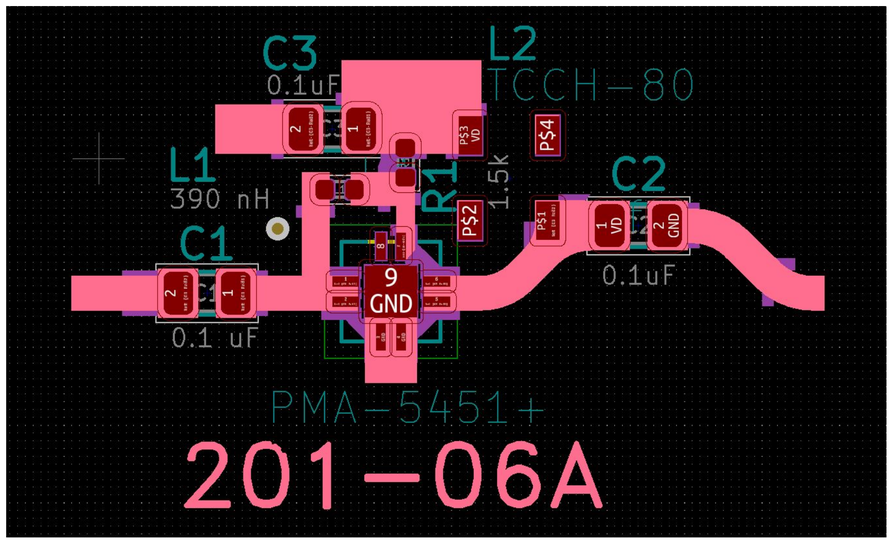
The Antarctica Ross Ice-Shelf ANtenna Neutrino Array (ARIANNA) is a neutrino detector located in Antarctica. The neutrino detector works by amplifying weak radio frequency signals generated by neutrino-ice molecule interactions. However, the current amplifier board used by ARIANNA is no longer in production and needs to be redesigned.

Project Goal

- To redesign ARIANNA'S current amplifier using updated components in KiCad (PCB Software suite)
- Print updated amplifier PCB with updated components for future testing

Evaluation Board TB-501-1+ Recommended PCB Layout





Unit cell amplifier based on TB-501-1+ evaluation board using PMA-5451+

Materials Needed

- PMA-5451+ (LNA)
- TCCH-80+ (RF Choke)
- 50 Ohm SMA Female Connectors
- Inductors (390 nH)
- Capacitors (0.1 uF)
- Resistors (1.5k Ohm)
- R04350 (PCB Material)

Milestones

Current Progress

- Recreated PCB Layout for Evaluation Board TB-501-1+ using KiCad
- PCB layout of unit cell amplifier

Future Goals

- Determine filters, components, etc. on current ARIANNA amplifier
- Produce amplifier board by cascading created PCB unit cell with necessary components

References

[1]Barwick, S et al., (2015). Design and Performance of the ARIANNA HRA-3 Neutrino Detector Systems. *IEEE Transactions on Nuclear Science*, 62(5), pp.2202-2215.

[2]Ho, W. (2019). Application Note: PCB Design Using KiCad [online] Dart.ece.ucdavis.edu.

[3]Hymel, S. (2019). An Intro to KiCad – Part 1: How PCBs Are Made | DigiKey. [online] YouTube.

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