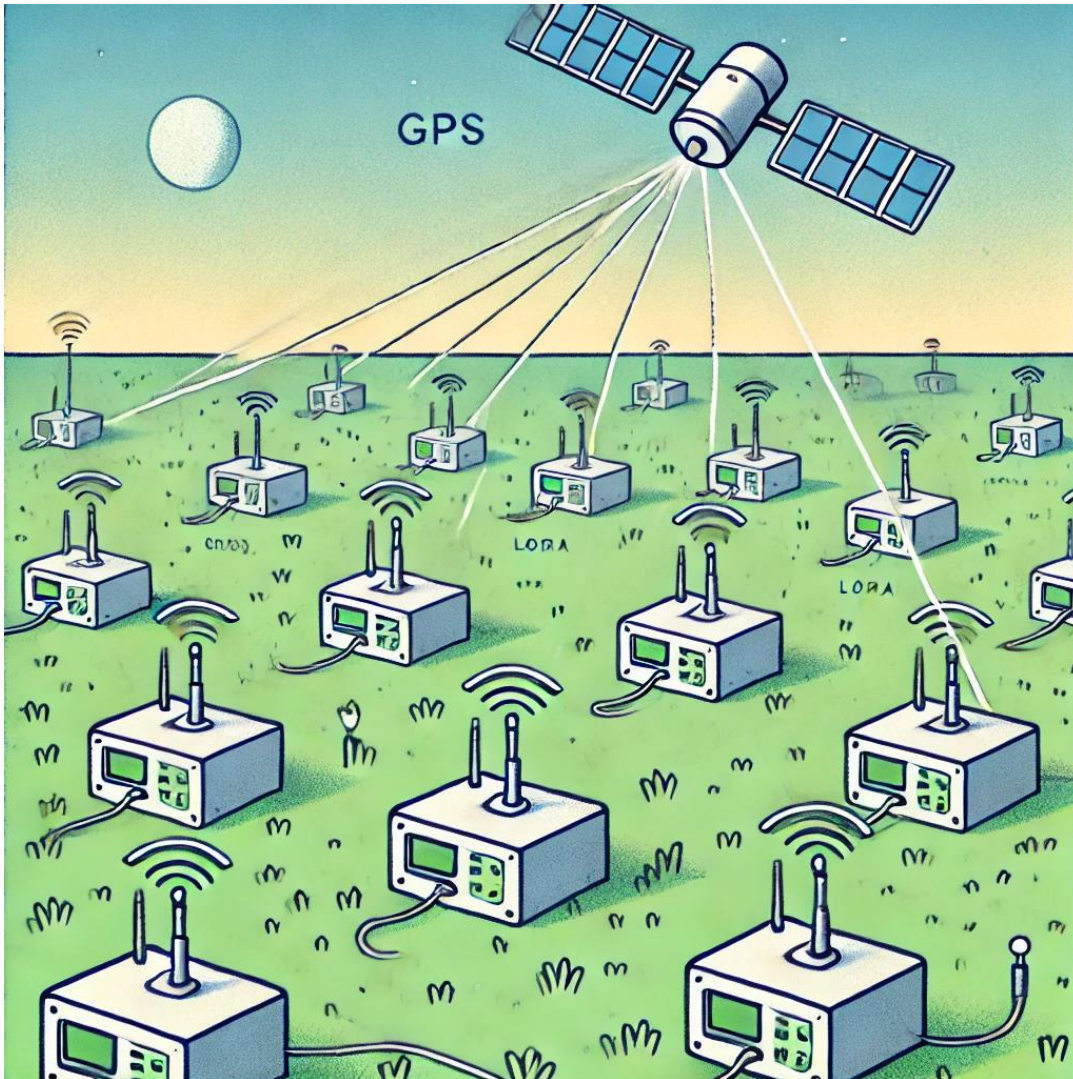


# CosmoLink : Wireless Coincidence Detector Network



**Yuvaraj Elangovan**  
**CosmoLink Collaboration**  
**Research Engineer**  
**University of Pittsburgh**

[yue8@pitt.edu](mailto:yue8@pitt.edu)

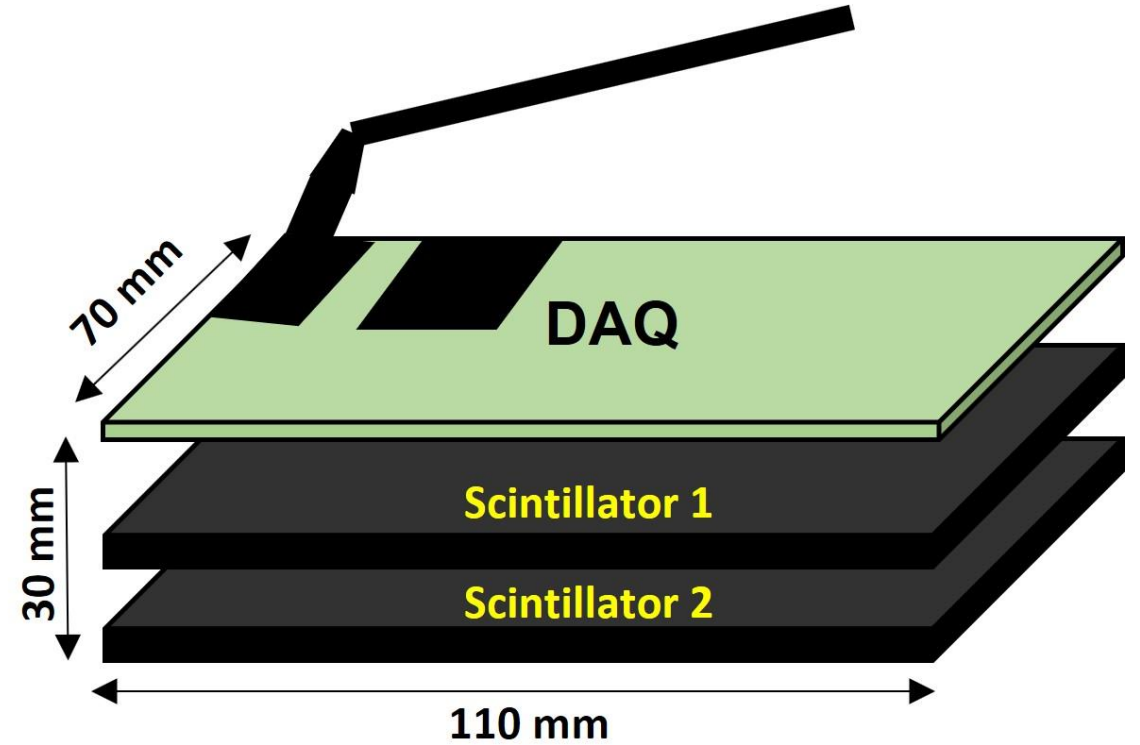
11/20/2024

## Objective

This project's aim is to design and develop handheld, cost-effective, Wireless and low-power Muon Detectors for Array Experiments and Science Outreach

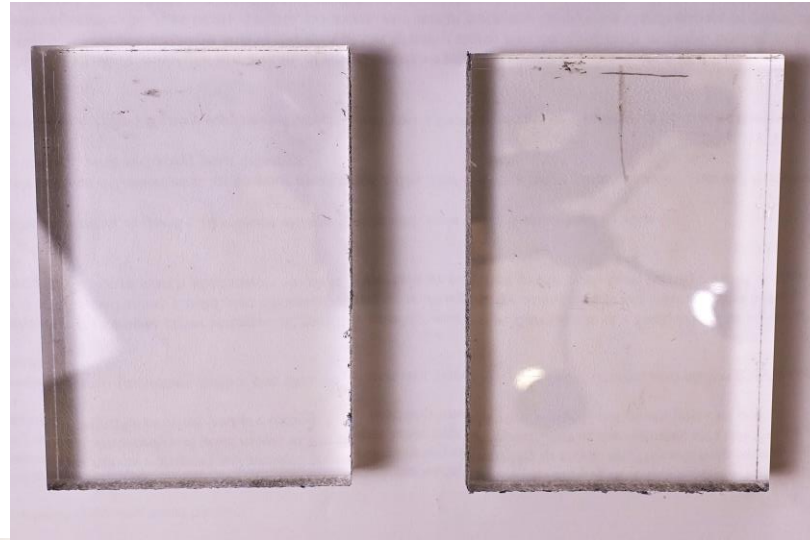
## Overview

- 2 Fold
- Sophisticated Readout(Peak and Trigger etc..)
- Wireless Data Acquisition
- GPS Enabled
- On and Offsite Data Storage
- Wireless Coincidence
- Temp Compensated
- Battery Operated

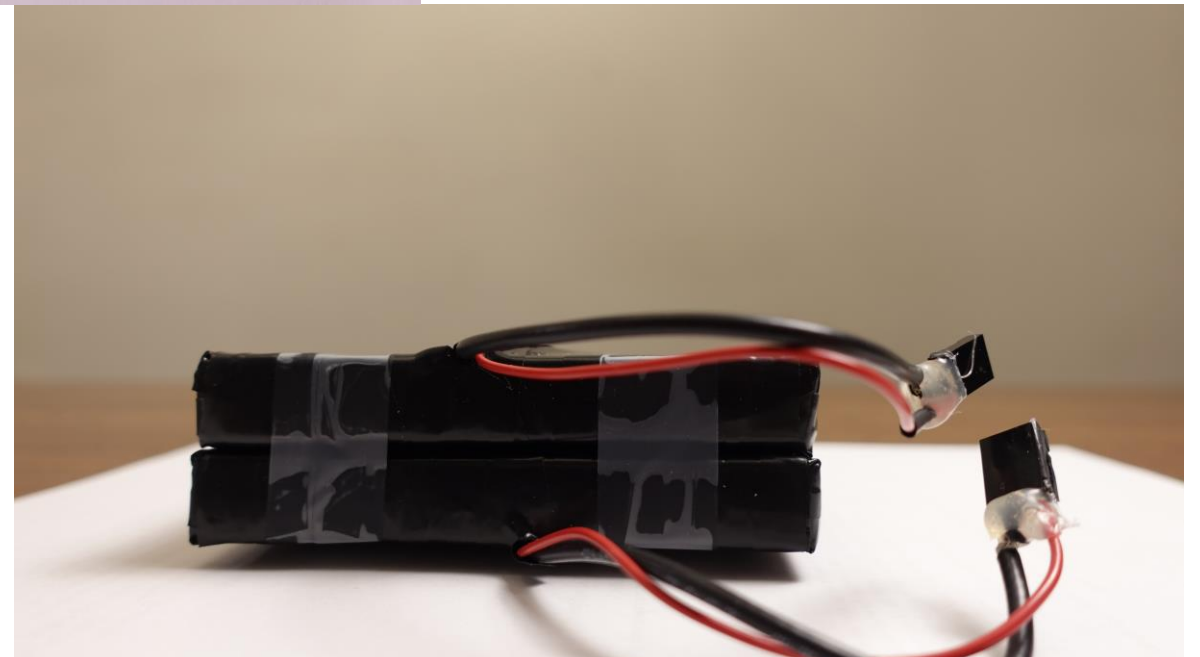


# Detector Overview

Top View

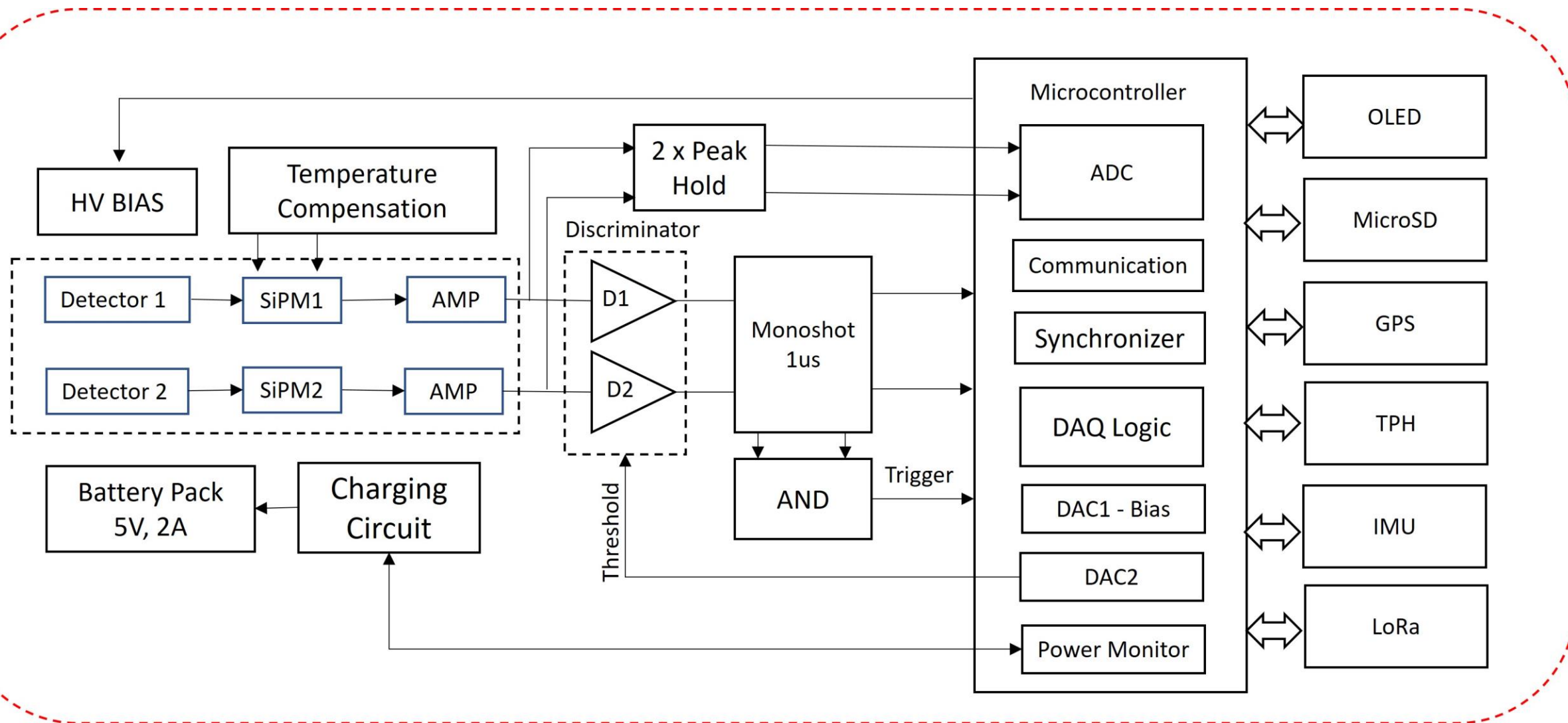


Side View

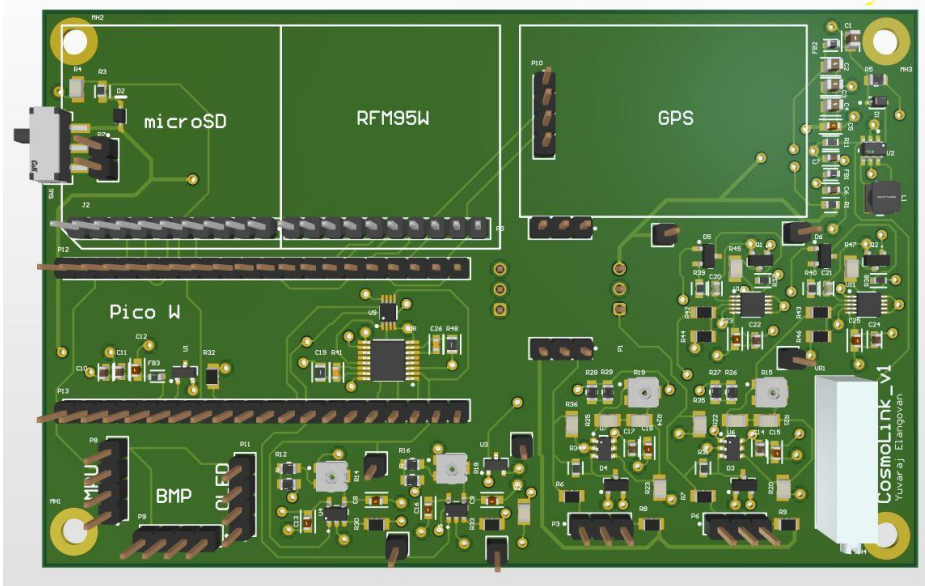


Packed Plastic Scintillators (100 x 60 x 10 mm)

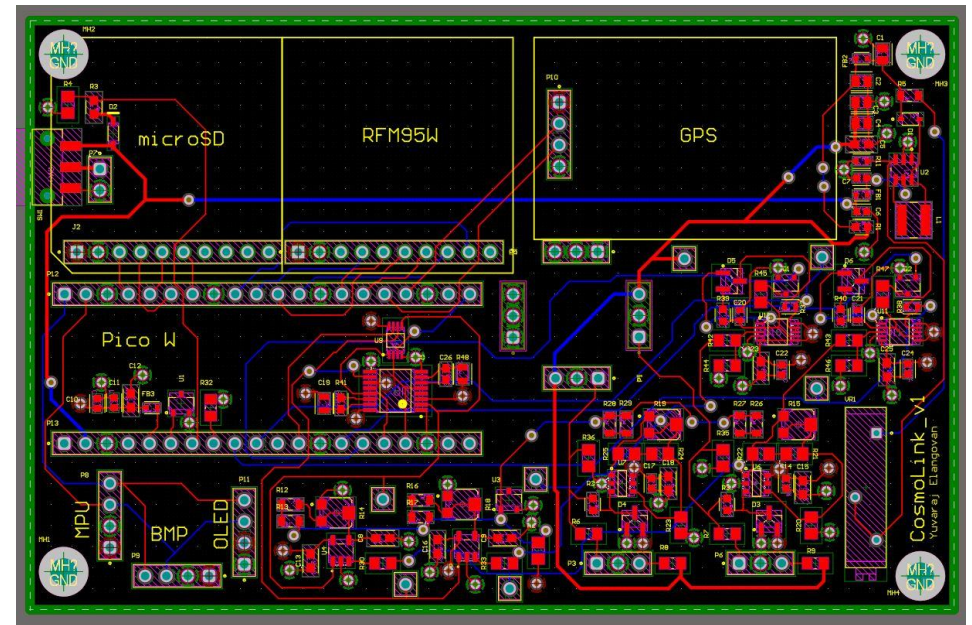
# Readout Electronics



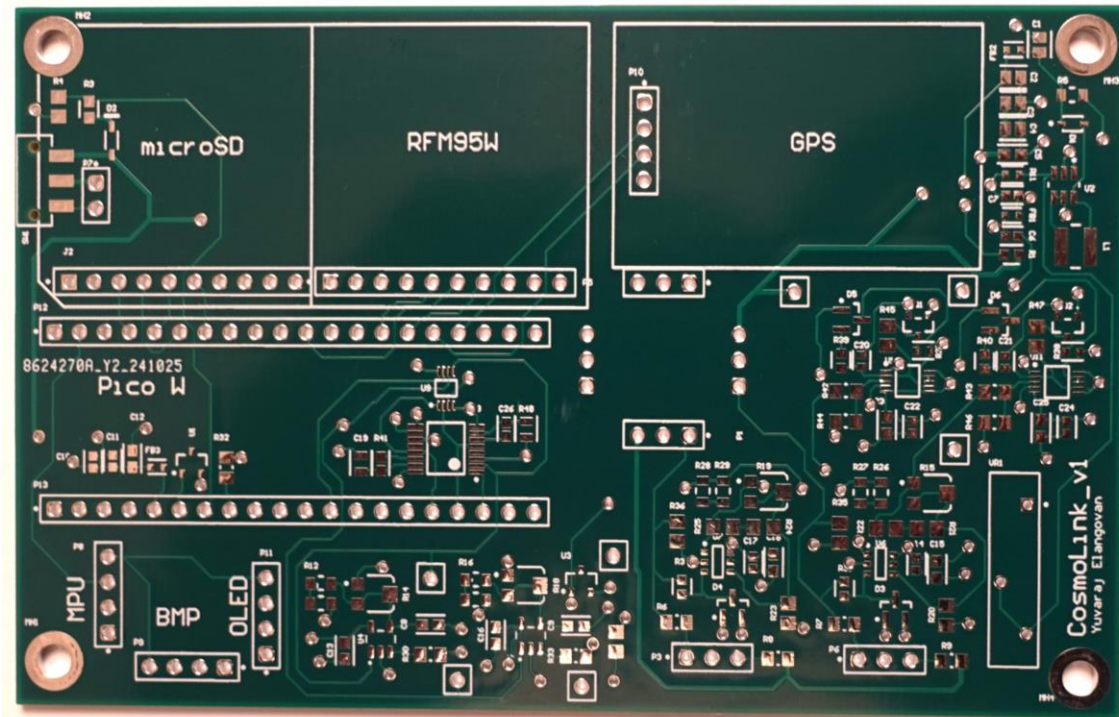




3D View



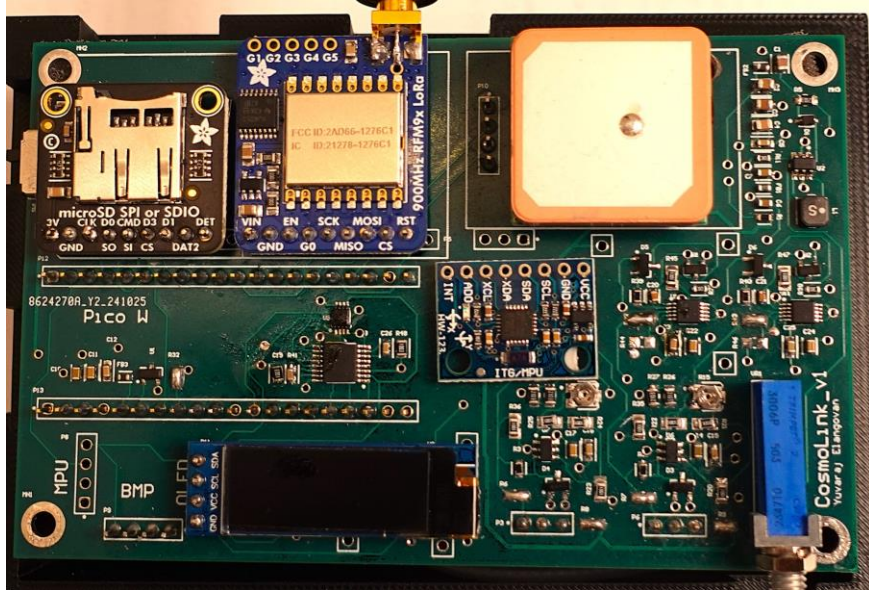
PCB Layout



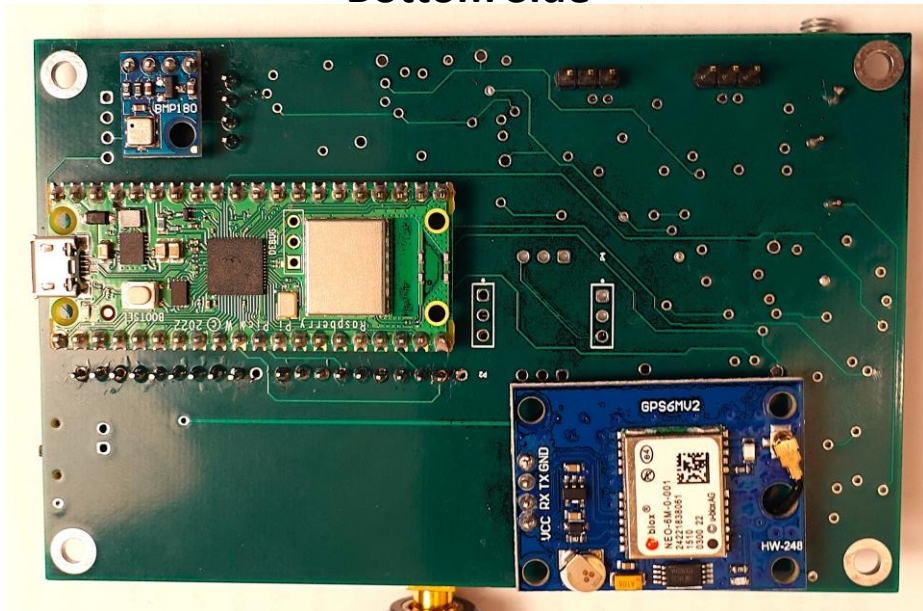
Printed Board



Top Side

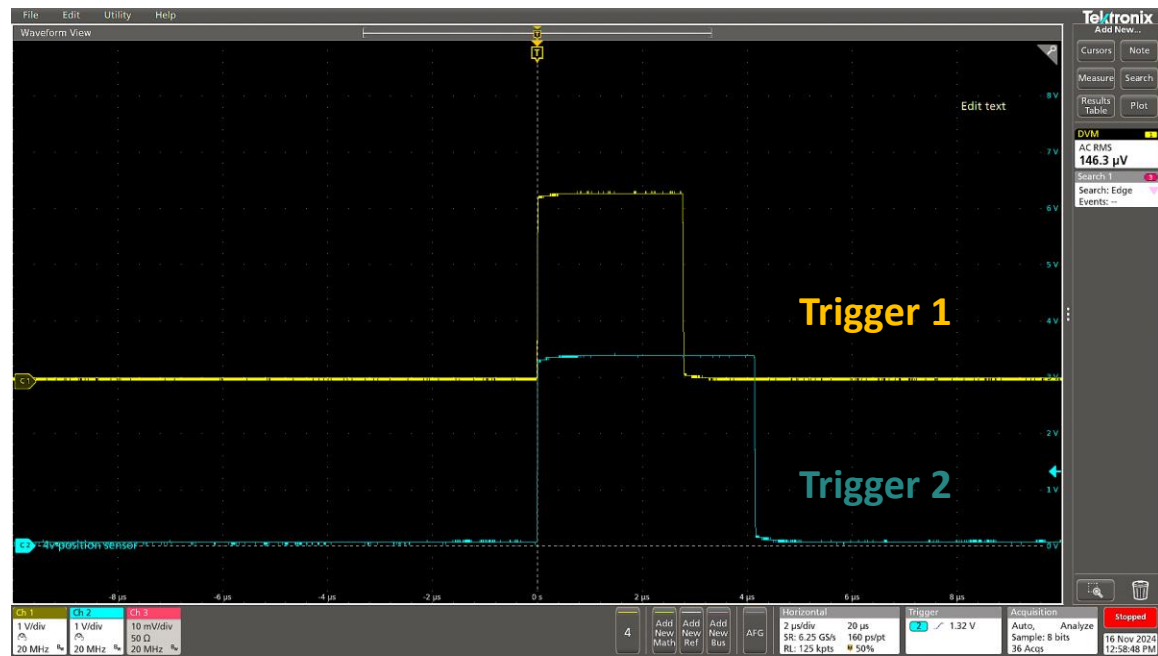
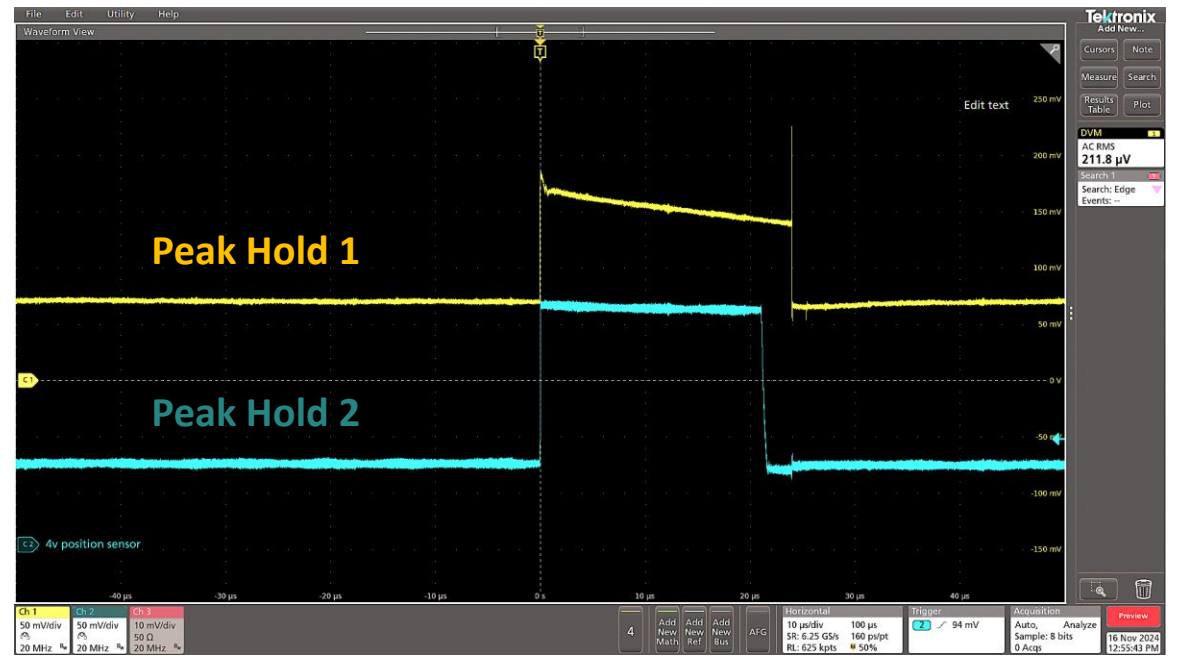
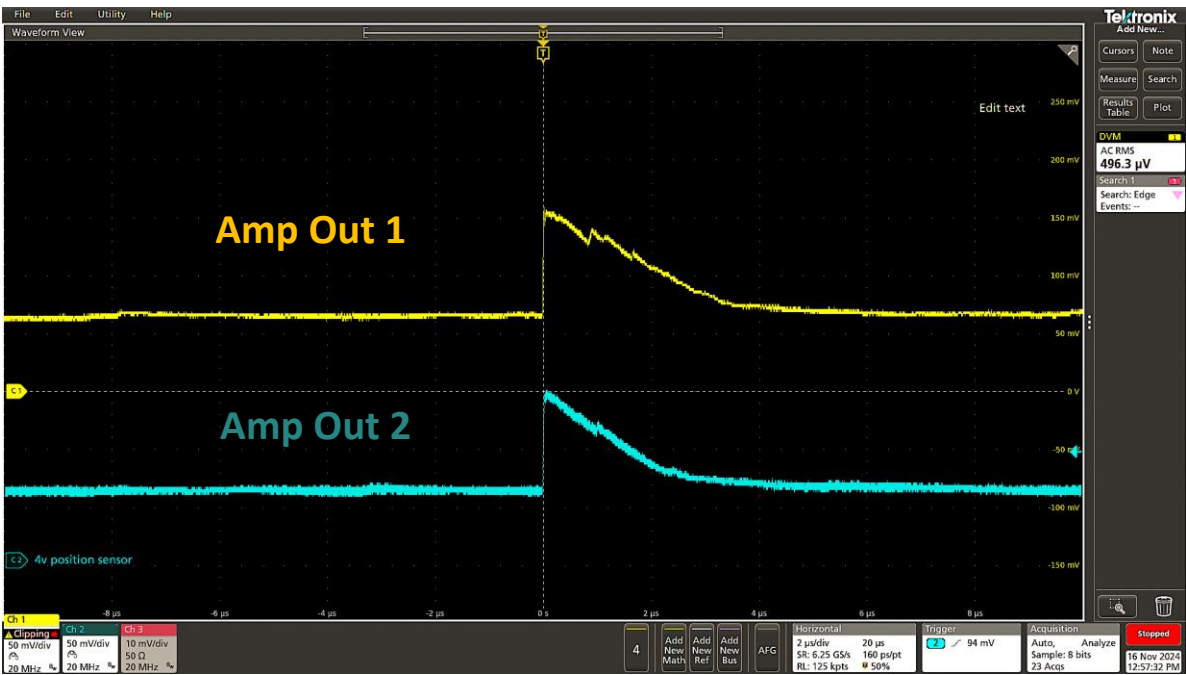


Bottom Side



Detector Unit



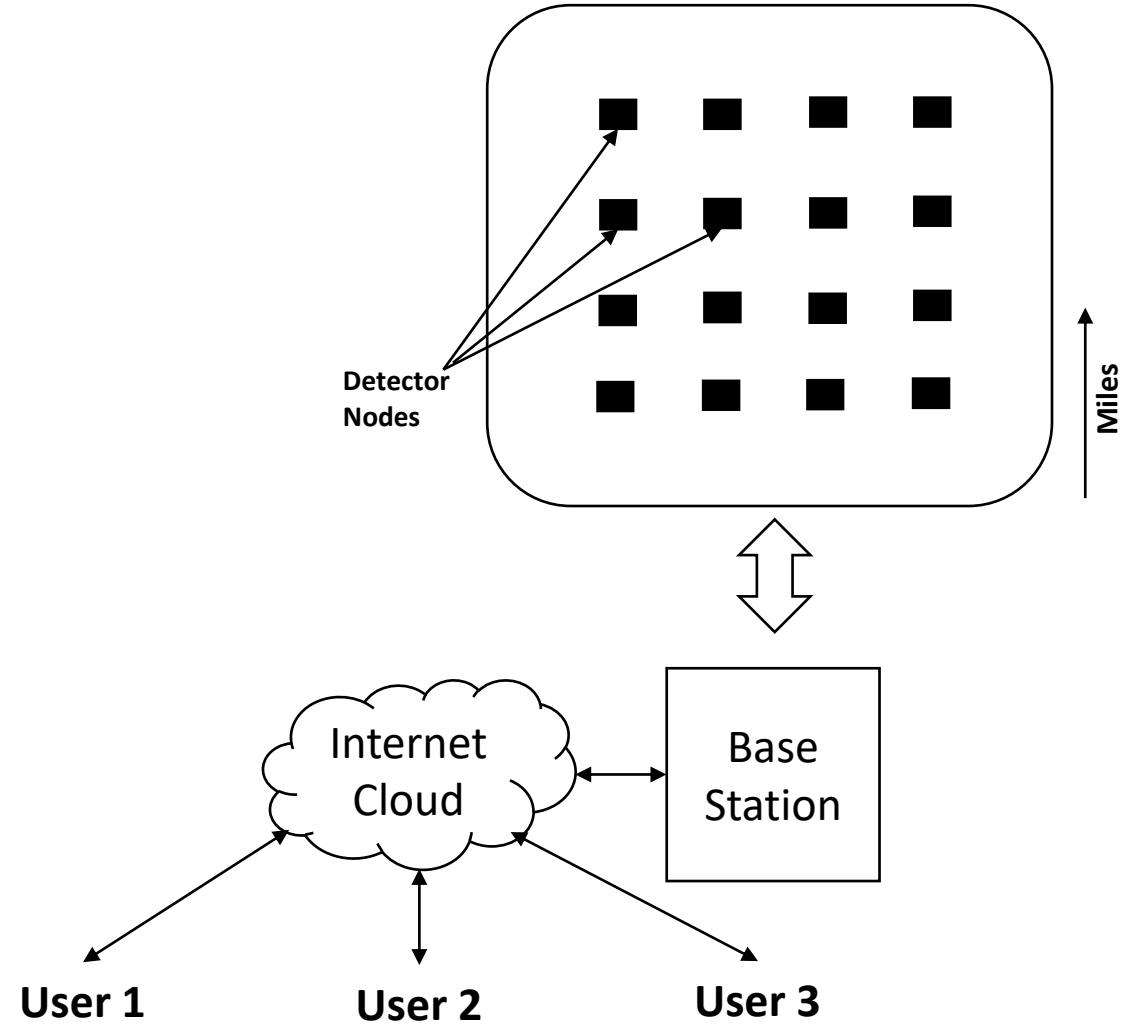




# Wireless Detector Network



LoRaWAN (Long Range Wide area Network)





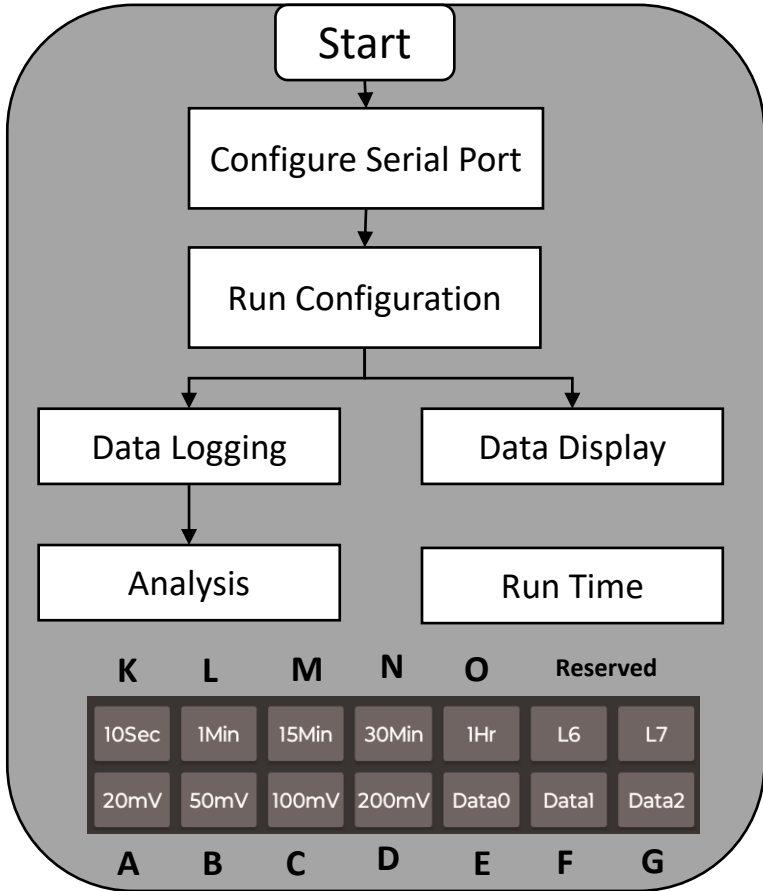
# Mobile Application for on-site Diagnostics

Terminal

```

7.19 296.85 0.00
0.02 0.18 8 8 4 23.80 97806.00 97802.00 29
7.62 297.53 0.00
0.07 0.07 8 13 4 23.80 97812.00 97805.00 2
97.27 296.67 0.00
0.18 0.03 1 12 1 23.80 97812.00 97807.00 297.
27 297.45 0.00
0.13 0.12 4 8 2 23.80 97810.00 97816.00 296.
85 296.33 0.00
0.16 0.06 5 10 1 23.80 97814.00 97813.00 296
.85 297.10 0.00
0.14 0.17 4 7 1 23.80 97810.00 97810.00 296.
50 297.36 0.00
0.05 0.23 9 10 4 23.80 97815.00 97812.00 29
6.25 296.16 0.00
0.17 0.04 1 8 1 23.80 97807.00 97817.00 296.
16 296.59 0.00
0.10 0.17 2 9 1 23.80 97814.00 97808.00 297.
10 297.02 0.00
0.19 0.05 4 12 2 23.80 97807.00 97814.00 29
6.93 297.27 0.00
0.00 0.03 0 4 0 23.80 97813.00 97809.00 29
7.19 297.02 0.00
0.09 0.06 9 25 5 23.80 97809.00 97815.00 2
96.67 296.67 0.00
    
```

Control buttons: 10Sec, 1Min, 15Min, 30Min, 1Hr, L6, L7, 20mV, 50mV, 100mV, 200mV, Data0, Data1, Data2



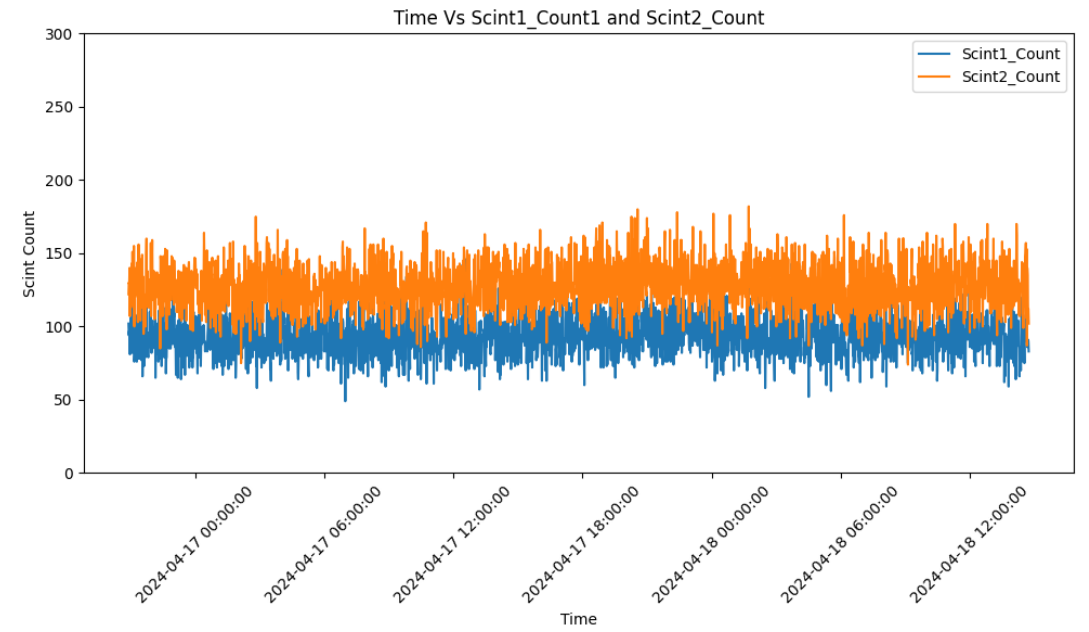
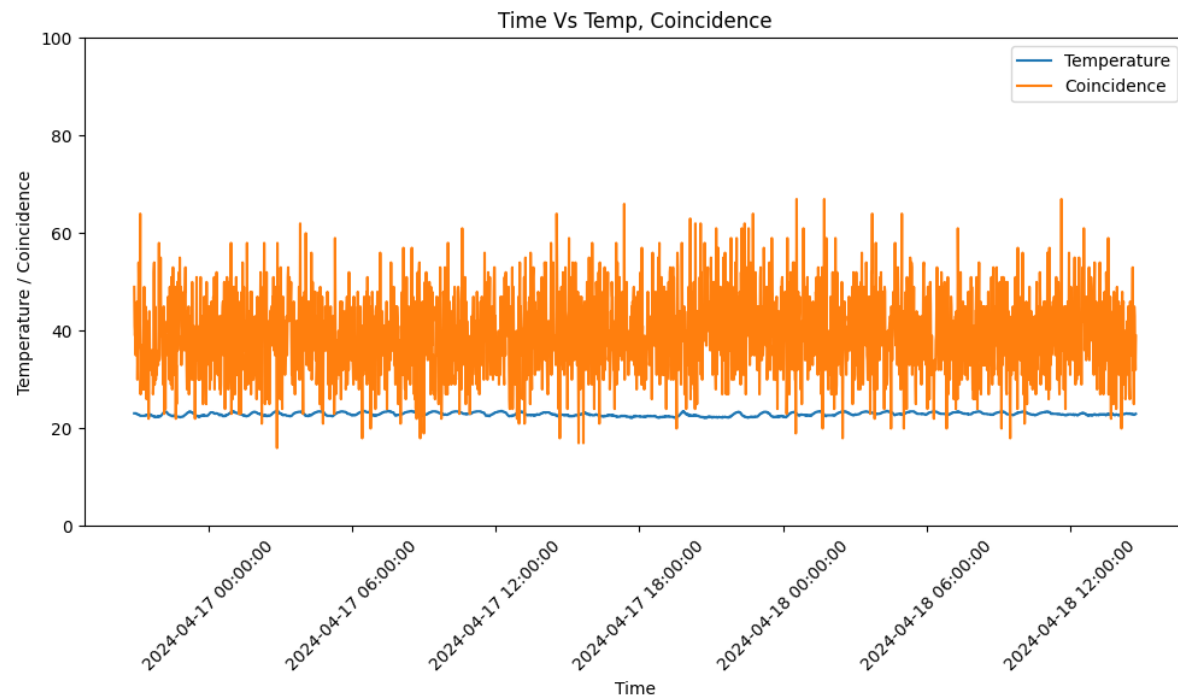
Back-end software for  
Benchtop testing

```

PITT+YUE8@DESKTOP-U4UE9A0 MINGW64 /d/Yuvaraj/Projects/Muon_detector/WCW_Readout
$ python muon_readout.py
Enter COM PORT NO: 3
Connected to COM3 at 115200 baud.
Enter the Signal Threshold(20,50,100,200)mV : 100
Enter the Monitoring Period(10,60,900,1800,3600)Seconds:60
Enter the Data_Type(0,1,2):1
2024-05-09-12-34-41 0.28 0.24 84 150 0 22.60 96952.00 96949.00 371.05 371.65 89.78
2024-05-09-12-35-42 0.25 0.26 95 145 0 22.70 96945.00 96952.00 370.96 370.36 89.66
2024-05-09-12-36-42 0.18 0.21 82 118 0 22.70 96954.00 96952.00 370.44 370.53 89.53
2024-05-09-12-37-42 0.22 0.15 84 146 0 22.60 96950.00 96943.00 371.05 370.61 89.84
2024-05-09-12-38-42 0.12 0.12 88 115 0 22.70 96960.00 96959.00 370.18 369.84 90.14
2024-05-09-12-39-42 0.32 0.27 94 135 0 22.70 96954.00 96955.00 370.27 370.87 89.44
2024-05-09-12-40-42 0.16 0.24 106 120 0 22.80 96956.00 96955.00 370.61 370.18 89.86
2024-05-09-12-41-42 0.17 0.25 94 116 0 22.80 96955.00 96950.00 370.27 370.27 89.74
    
```

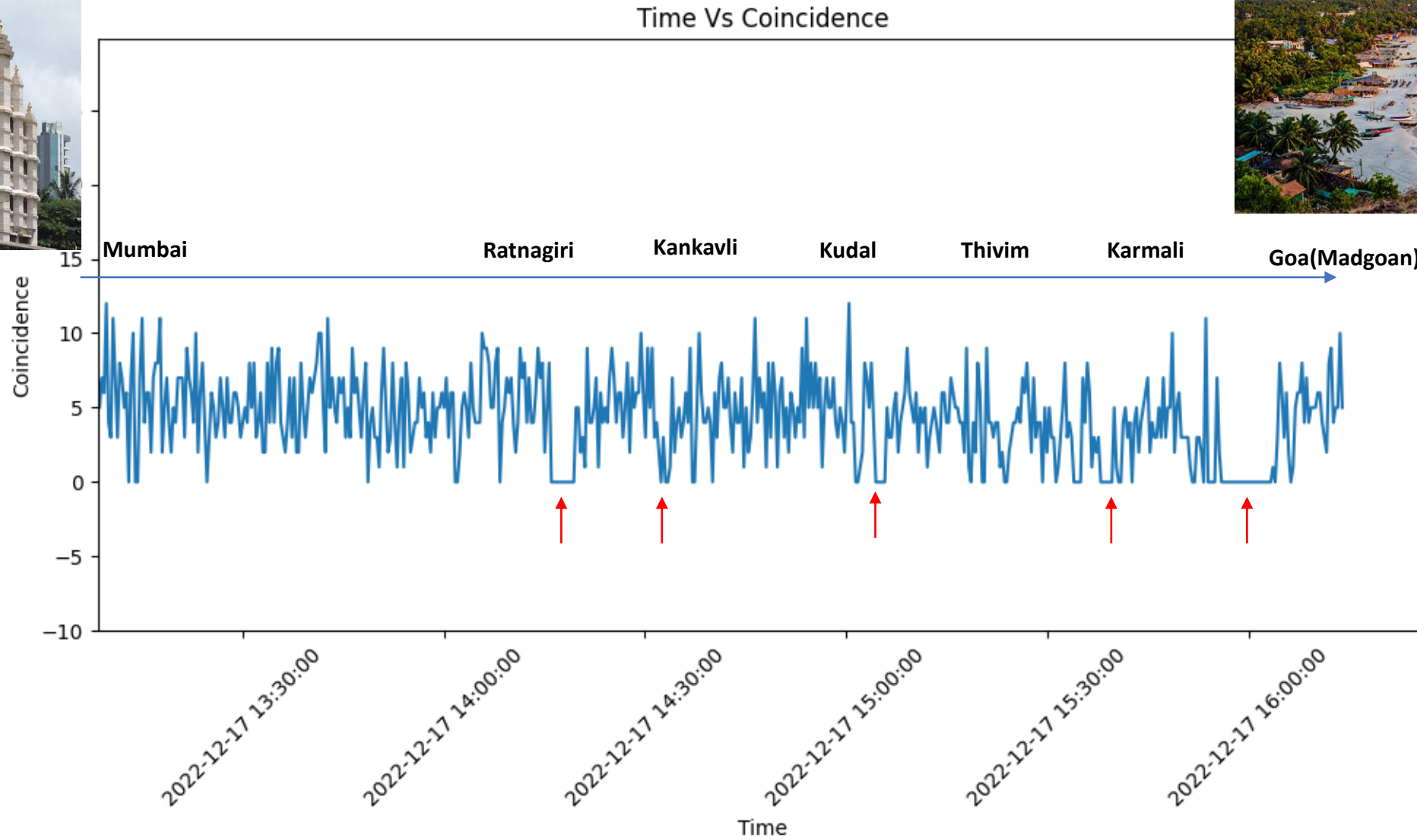
Run Control

# Results Part 1

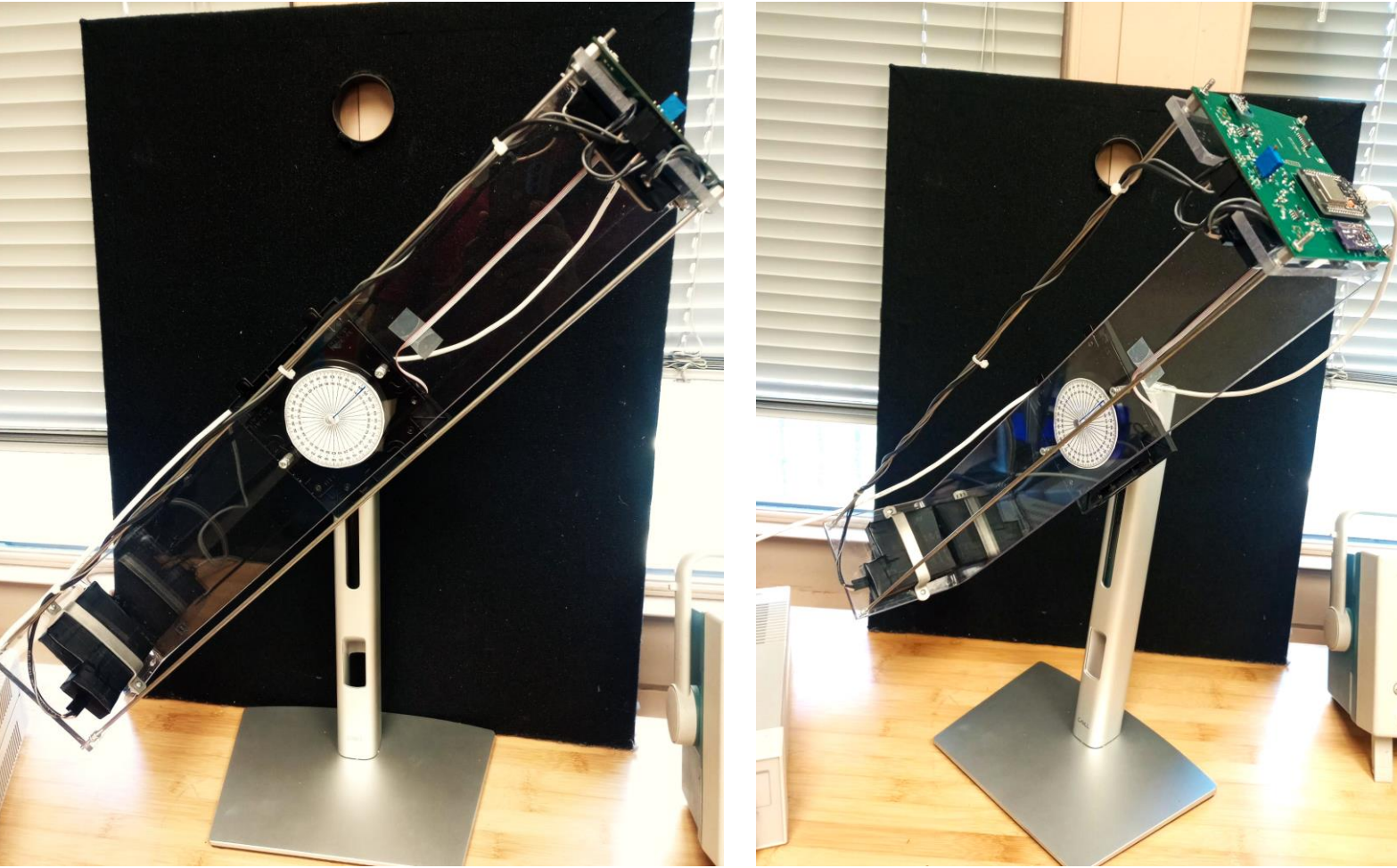




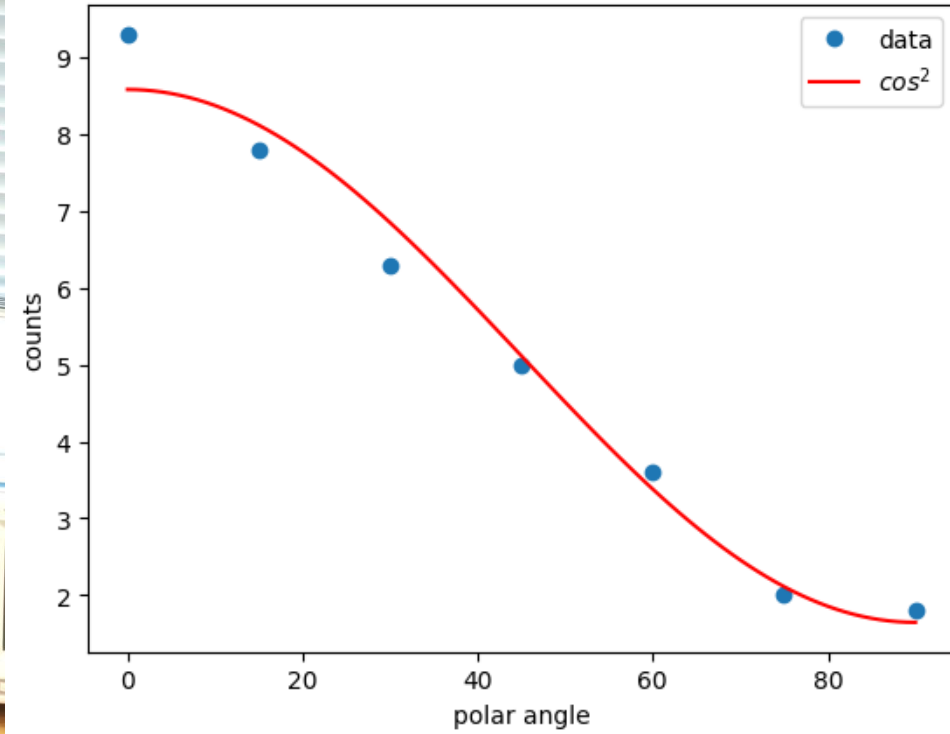
# Results Part 2: Muon Flux under Tunnel



# Results Part 3 : Angular Distribution



Detector Assembly to keep Detectors 50cm Apart



Prof. Danko, Istvan Zsolt, Instruction Lab  
University of Pittsburgh



## Conclusion

- Aim to Support Cosmic shower experimental Studies and Schools involvement in Cosmic ray experiments.
- Suitable for setting up small and large telescope arrays and simplify deployment and maintenance.
- Inbuilt GPS and LoRa supports data synchronization across wide area.
- Battery or Solar or Grid Powered.
- Currently 3 units (2 Detector + 1 Base Station) of this detector was developed.

## Special Thanks

Electronics Shop  
(University of Pittsburgh)

Dhanalakshmi Krishnamurthy  
(Funding and Onsite Measurements)

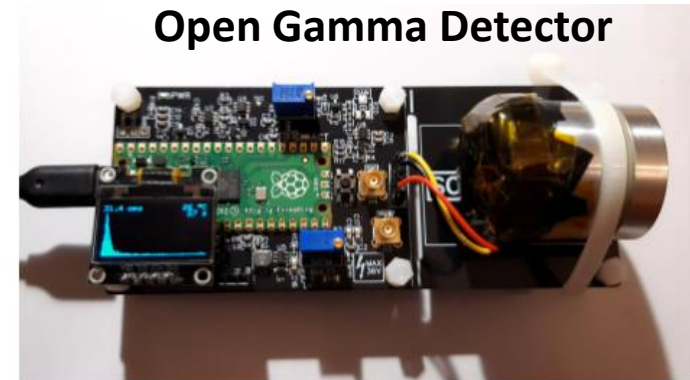
## Inspiration and Credits

MIT Cosmic Watch Program



<http://www.cosmicwatch.lns.mit.edu/>

### Open Gamma Detector



<https://github.com/OpenGammaProject>