

Status report on the uDAQ System for TAMBO-4

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- **Introduction**
- **Troubleshooting History**
- **Recent Results**
- **Summary & Future Works**

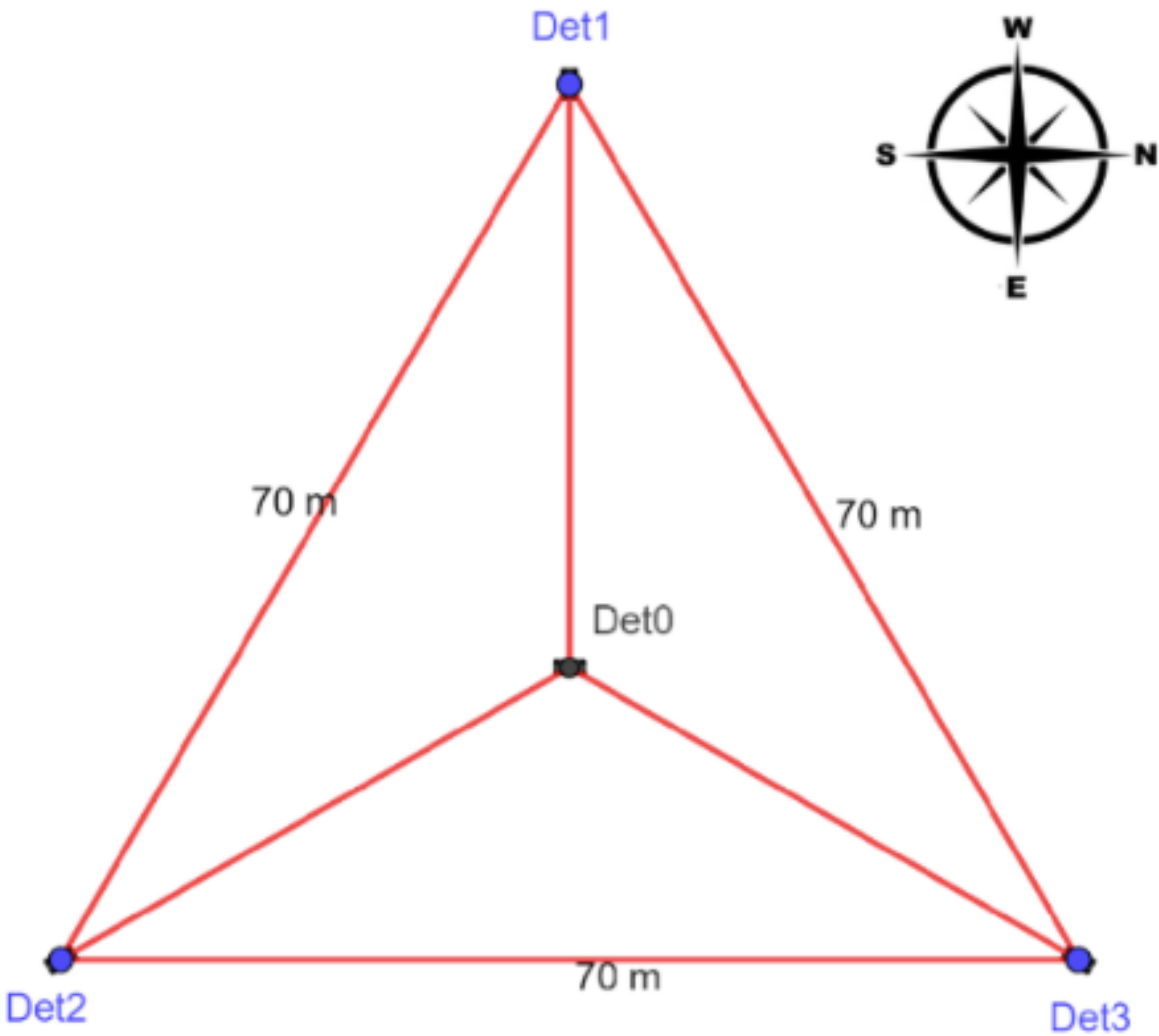
01 Experimental setup & System overview



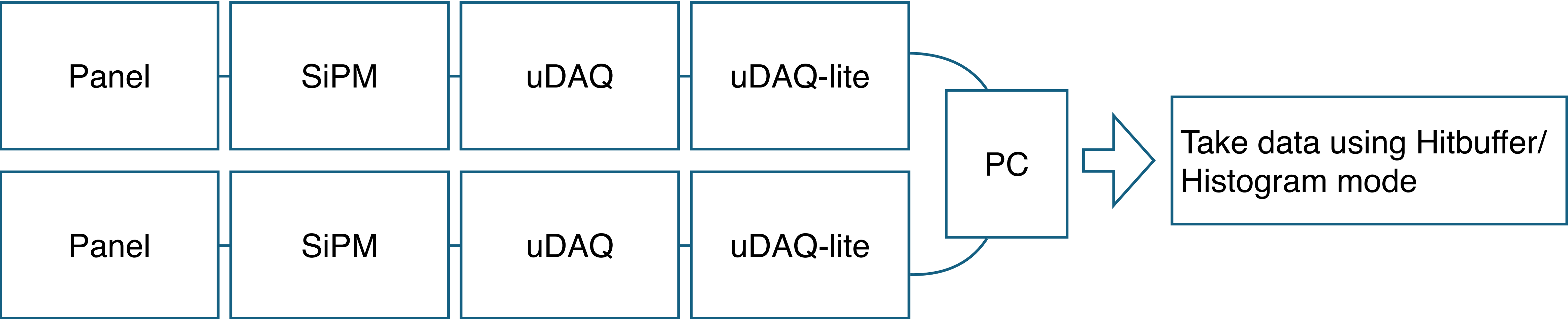
Panel separation (m): 70 m relative to the vertices, and 40 m from the central detector to the vertex detectors

Geometric configuration of the 4 panels: equilateral triangle (3 panels) with one panel at the centroid.

	Built-in SiPM Bias Control	Low Power & Panel-Mountable	Single-Cable Scalability	Data Payload Optimization
uDAQ	On-board 5–80V DAC & sensors	~500mW, direct panel mounting	One CAT-6 for power, time, comms up	~1ns time & charge only, light data
RedPitaya	Requires external modules	High power, bulky setup	Complex wiring for time/power	Full waveform, heavy data



TAMBO-4 detector array



Hitbuffer mode : .bin + .json, every data

Comprehensive Mode (Slow/Heavy)
Records comprehensive data(ADC, time stamp, etc.)

Histogram mode : .dat, only counts for each ADC

Streamlined Mode (Fast/Light)
Records only ADC counts

02 Data Transmission Limit



Hardware Limit: The uDAQ baud rate is 1,000,000, providing an effective bandwidth of ~100 kB/s.

Observation: Exceeding this data transmission limit causes the system to freeze and ignore incoming commands.

Mitigation: Implemented a safety limit by strictly setting a maximum event count per subrun.

Conclusion: Prevents data overflow and maintains stable communication with the DAQ system.



Set the maximum events counts(safety limit)

```
INFO: running subrun 10 of 10
INFO: collecting data for 3 seconds (Max 100000 events)...
INFO: trigger rate = 1132.6 Hz
set_livetime_enable 0
auxdac 1 0

SUCCESS: wrote data to [run_0000011]
```

```
stop_run
run stopped
hist_dump 0
hist_dump 1
hist_dump 2
get_run_statistics
INFO: running subrun 4 of 100
run 1 0 0
waiting 3 seconds...
stopping run...
stop_run
?INVALID COMMAND

stop_run
?INVALID COMMAND

stop_run
?INVALID COMMAND

stop_run
[
stop_run
?INVALID COMMAND

stop_run

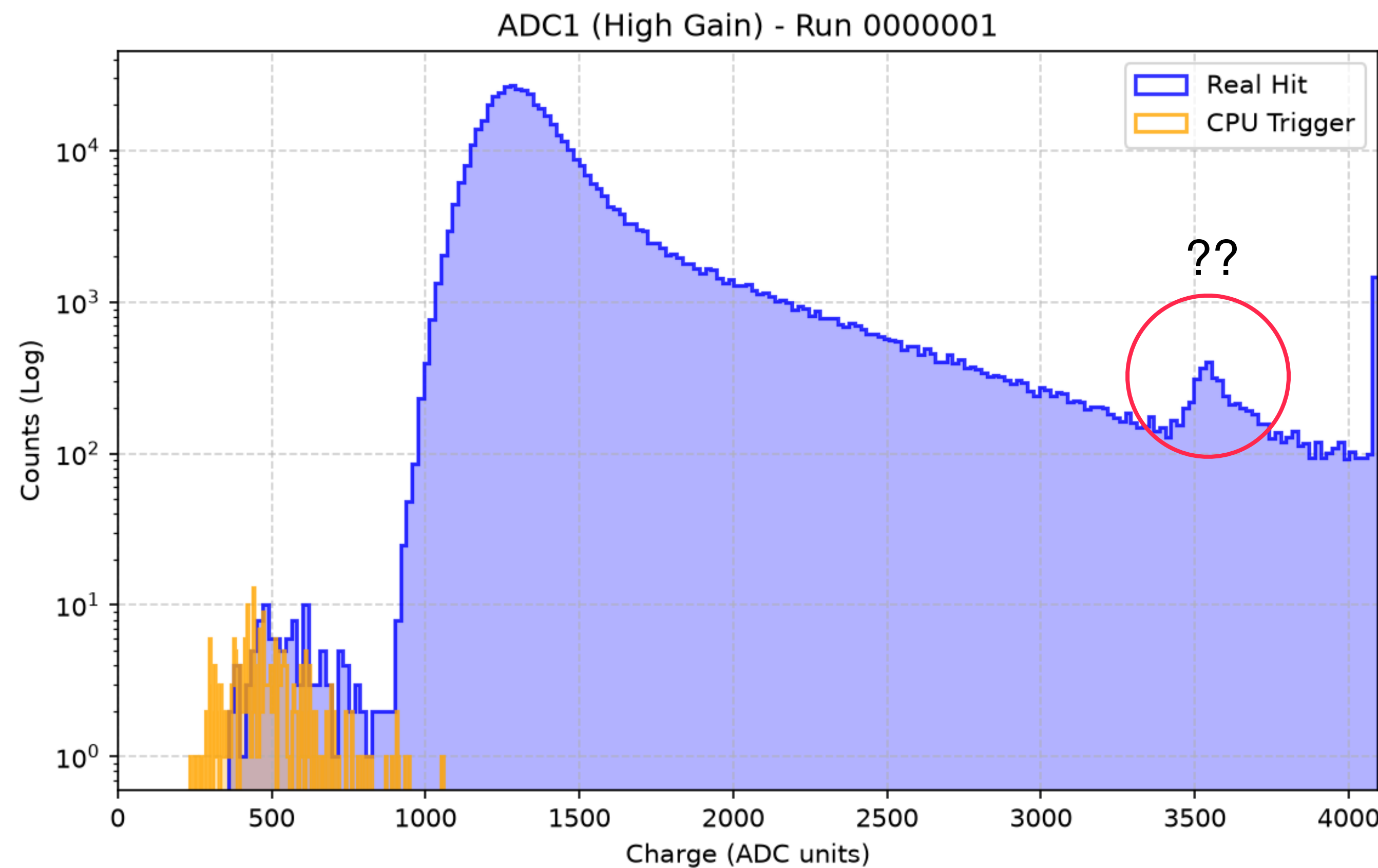
stop_run

stop_run
?INVALID COMMAND

stop_run
?INVALID COMMAND

stop_run
```

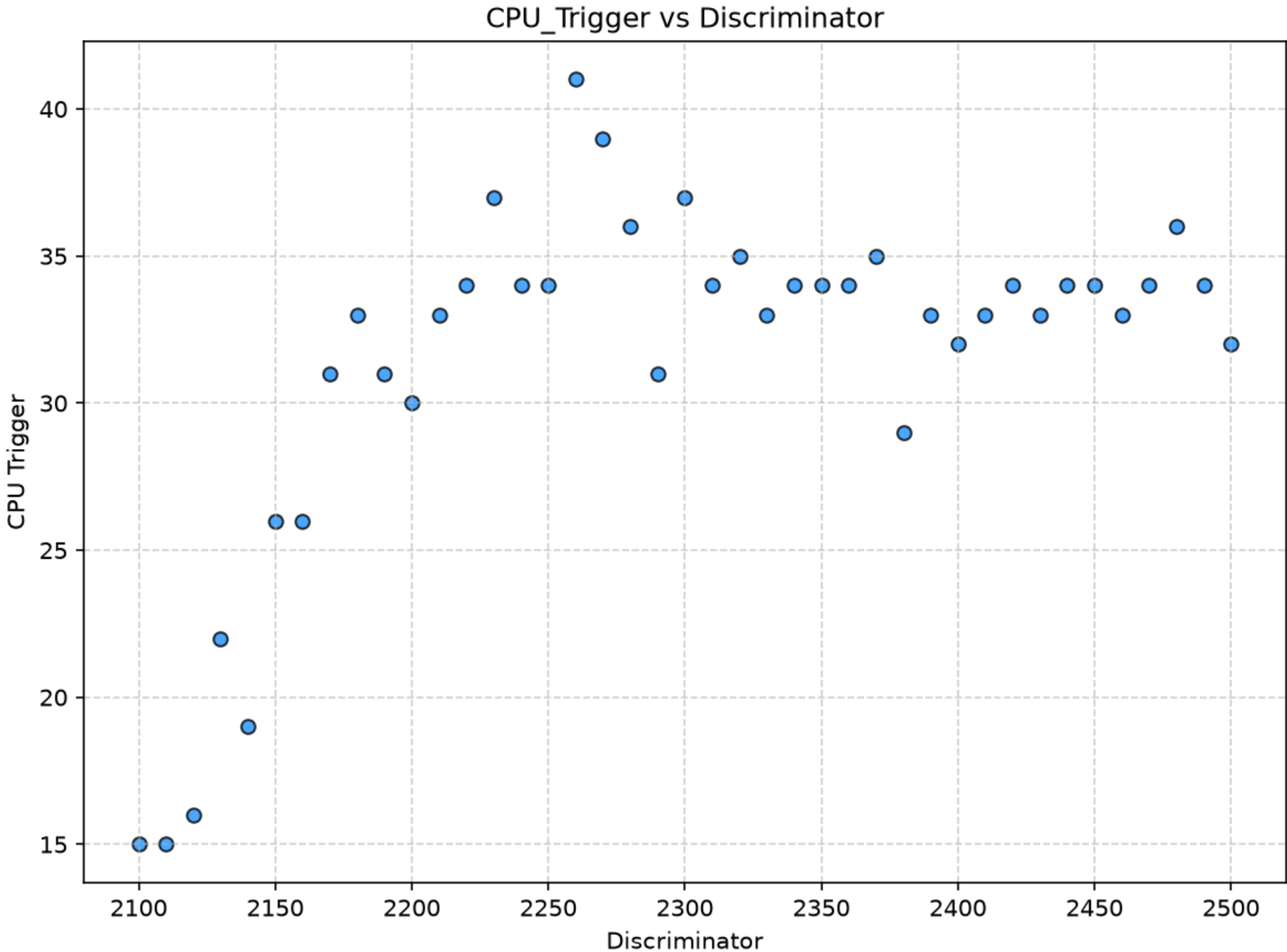
Observation: Anomalous peak near ~3500 ADC



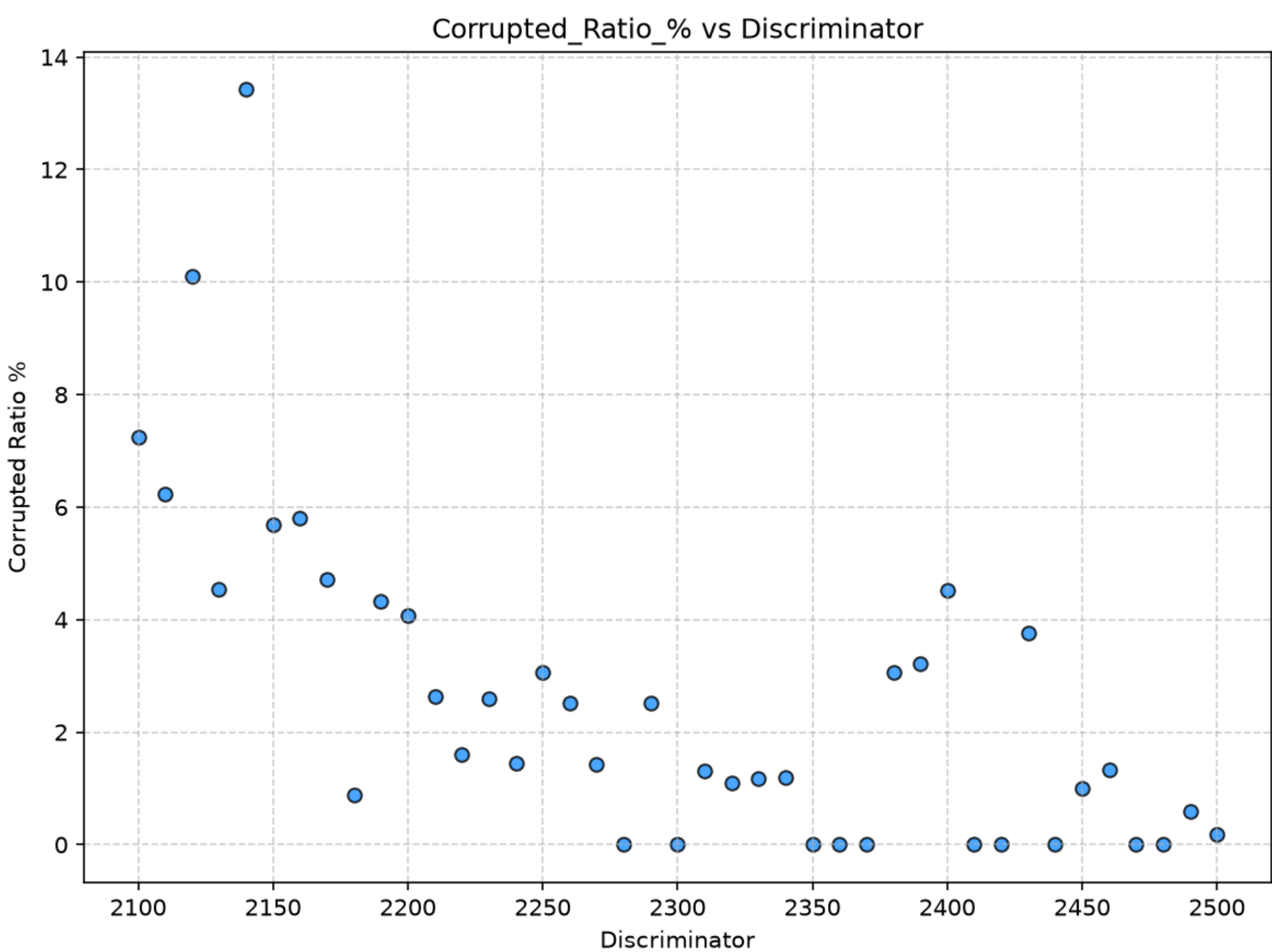
Identification: Electronics artifact from channel saturation. When input pulses nearly saturate a channel, the output ADC value defaults to ~3500.

Conclusion: Not a physical muon signal, nor a critical DAQ error.

CPU Trigger vs. Discriminator (30s)



Corrupted ratio vs. Discriminator (30s)



Observation: Binary mis-alignment and missing CPU triggers during data acquisition.

Root Cause: Likely related to the inherent data transmission bandwidth limits of the uDAQ system.

Mitigation: Adjusted trigger thresholds to restrict the total volume of incoming data.

Conclusion: This temporary measure stabilizes the DAQ by preventing corrupted transmission.

02 Environmental Sensitivity(Ongoing)

Observation: Intermittent operational failures in small panels, whereas large panels operate stably.

Key Differences: The primary structural difference, aside from size, is the presence of an aluminium shielding cage.

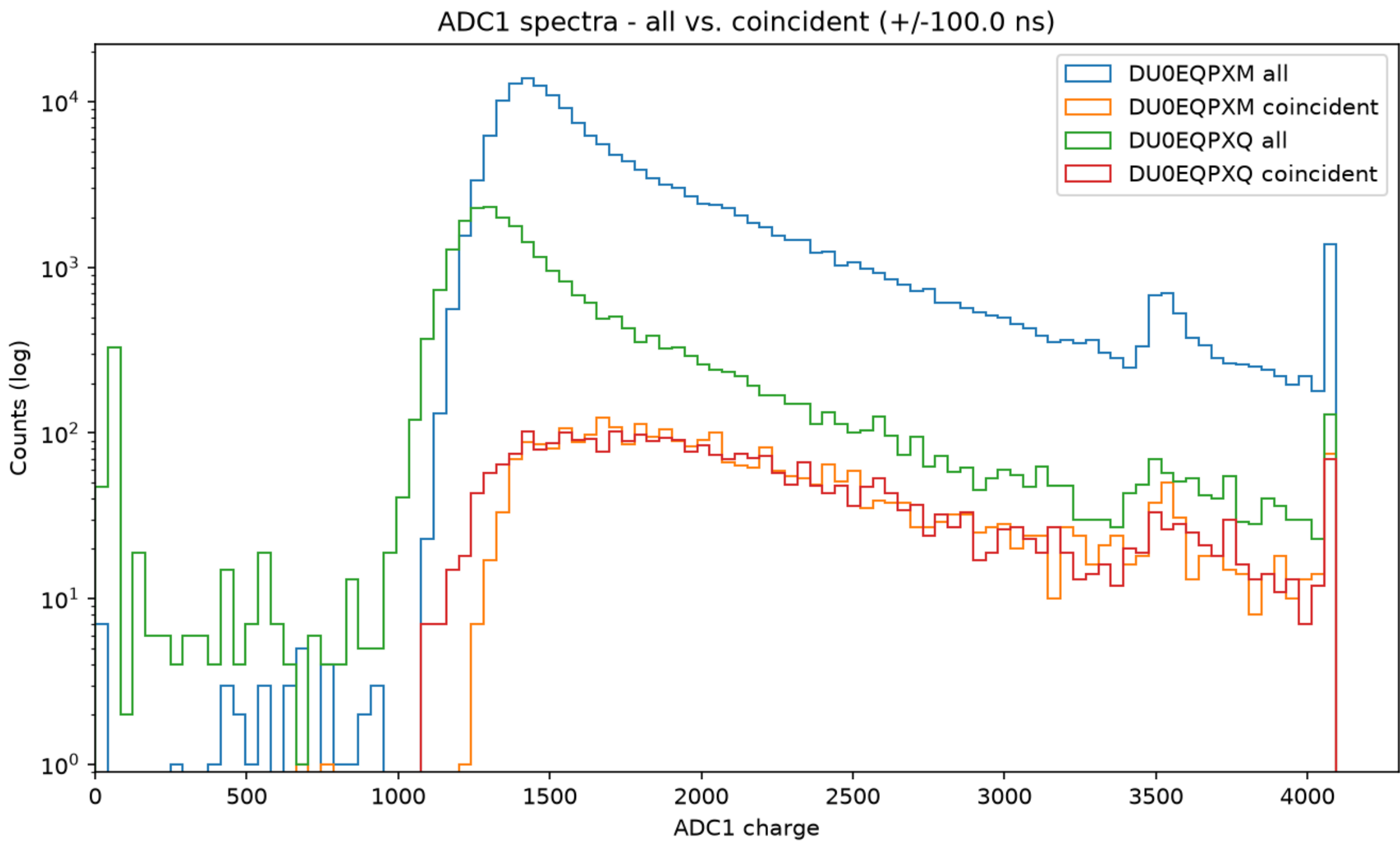


Hypothesis: The uDAQ system might be highly sensitive to external environmental noise. The shielding on large panels likely mitigates this issue.

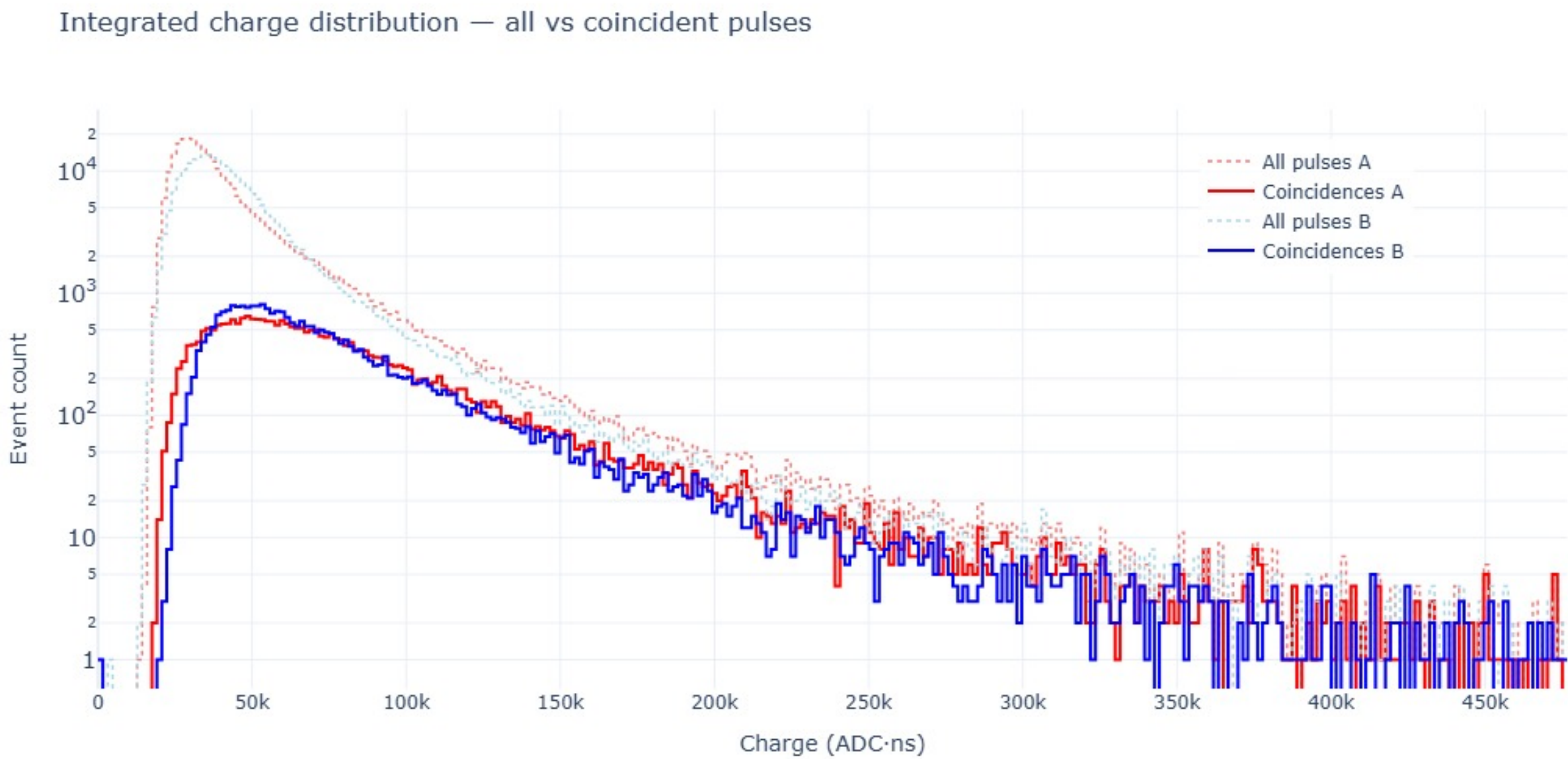
03 Recent results



We might find muon peak using coincidences of 2 big panels.



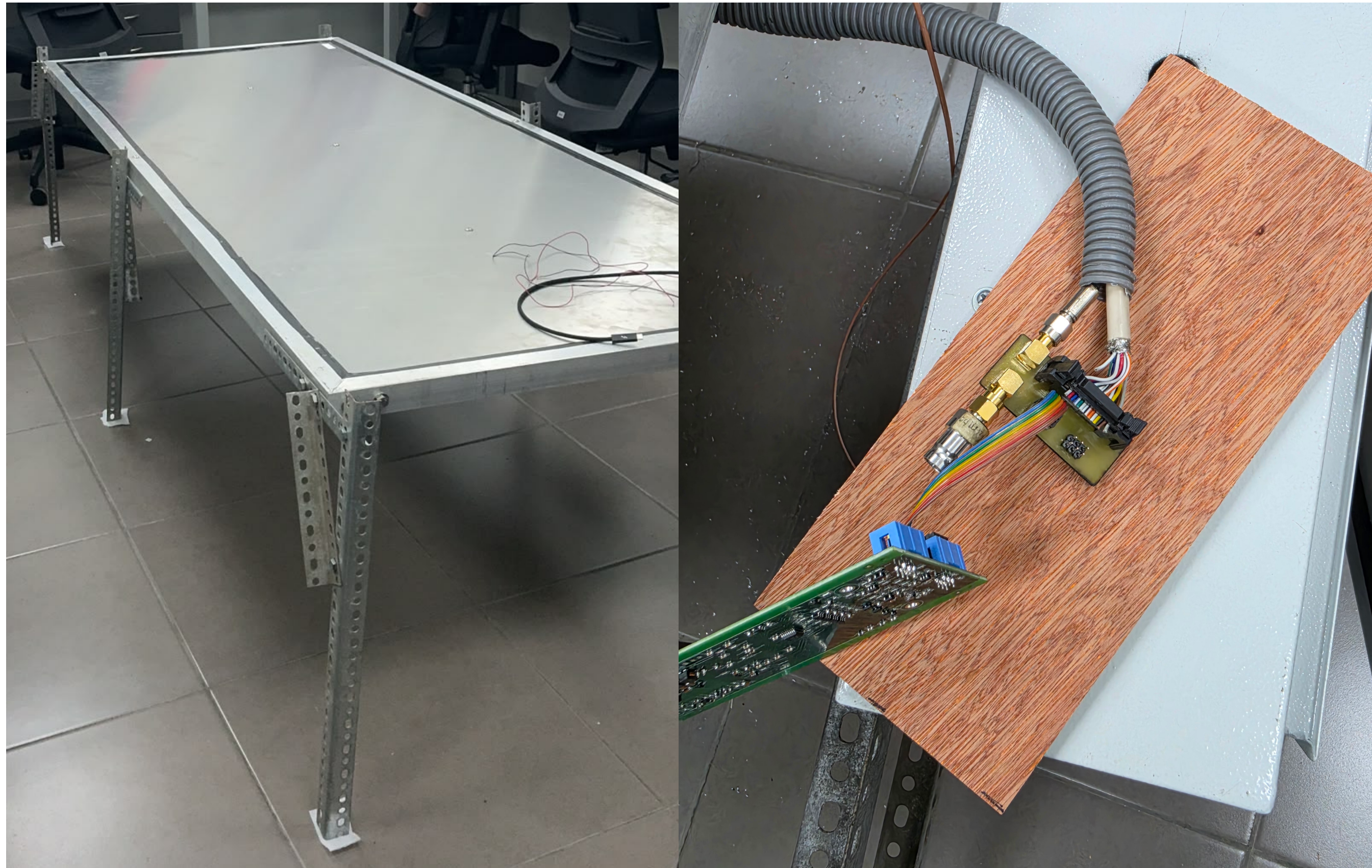
Muon peak using coincidences with RedPitaya



We are trying to find muon peak with small panels also and studying data transmission limit(DAQ stability)

03 Recent results

Troubleshooting on remaining problems and new panel setup



New shielding & support setup

New cable setup

Advantages of uDAQ:

- Compact and portable compared to the RedPitaya system

Troubleshooting Summary:

Addressed initial operational challenges:

- Data transmission limit
- Anomalous peak (electronics artifact)
- DAQ stability
- Environmental sensitivity

Ongoing & Future Work:

- Optimizing the setup to observe a clear muon coincidence peak.
- Improving overall panel performance and shielding.

Thank you very much for your attention!

BACK UP