

Small Thin Gap Chamber High Voltage Investigation for the New Small Wheels

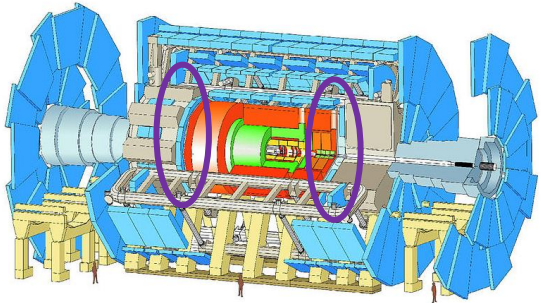
Aimee Dubuque

08/08/2024

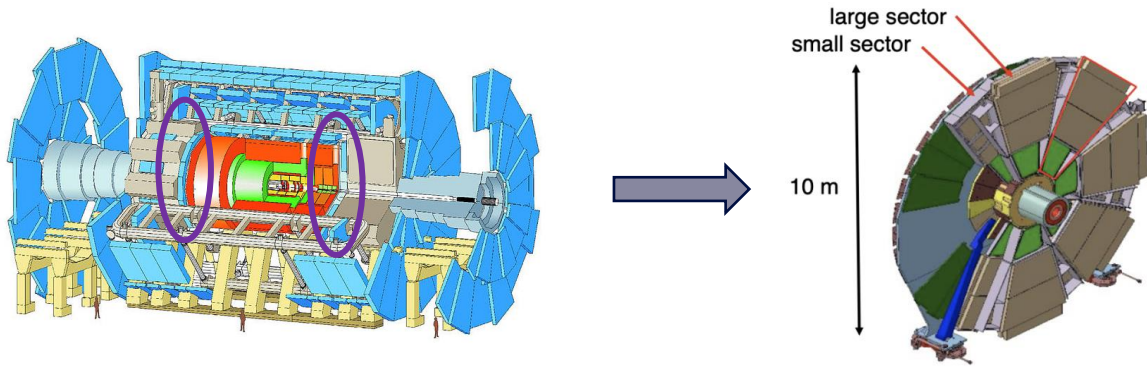
Overview

1. **Technical background**
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4. **Side A and C comparison**
5. **Current data investigation: Building a database**
6. **Cumulative charge measurements: Ageing test comparisons**
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9. **Summary**

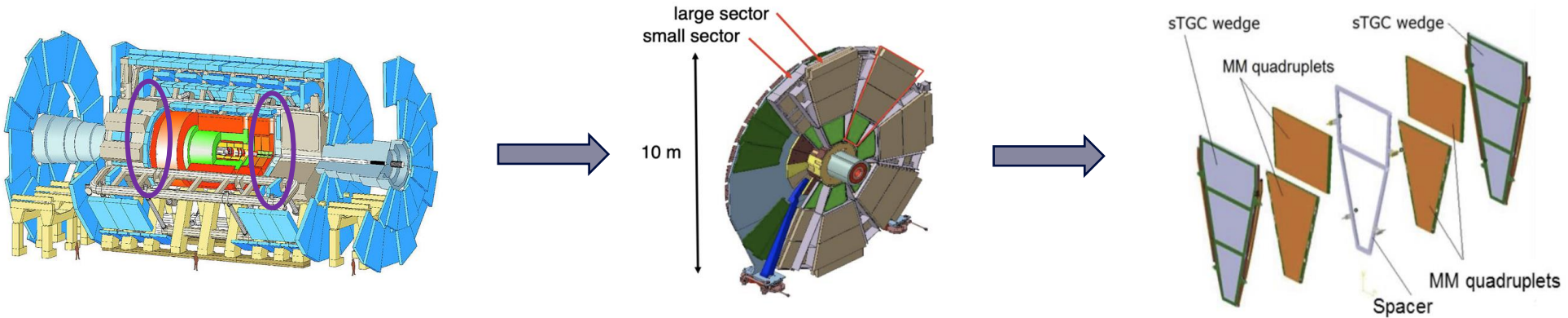
New Small Wheels



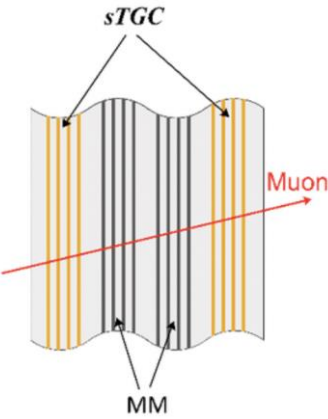
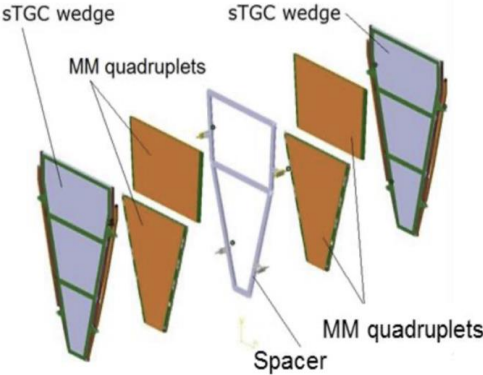
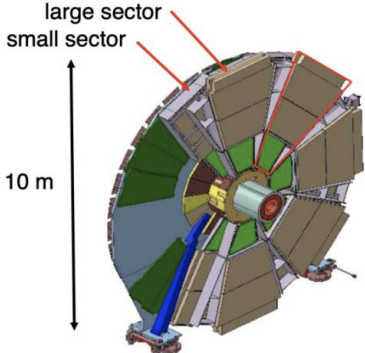
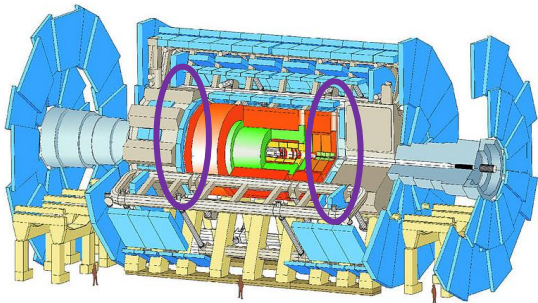
New Small Wheels



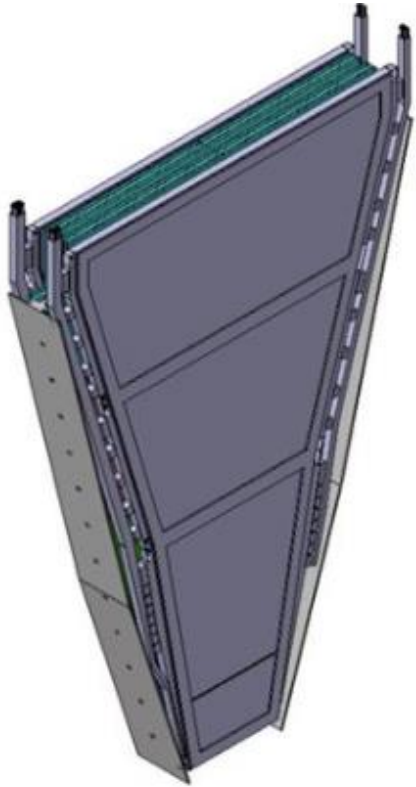
New Small Wheels



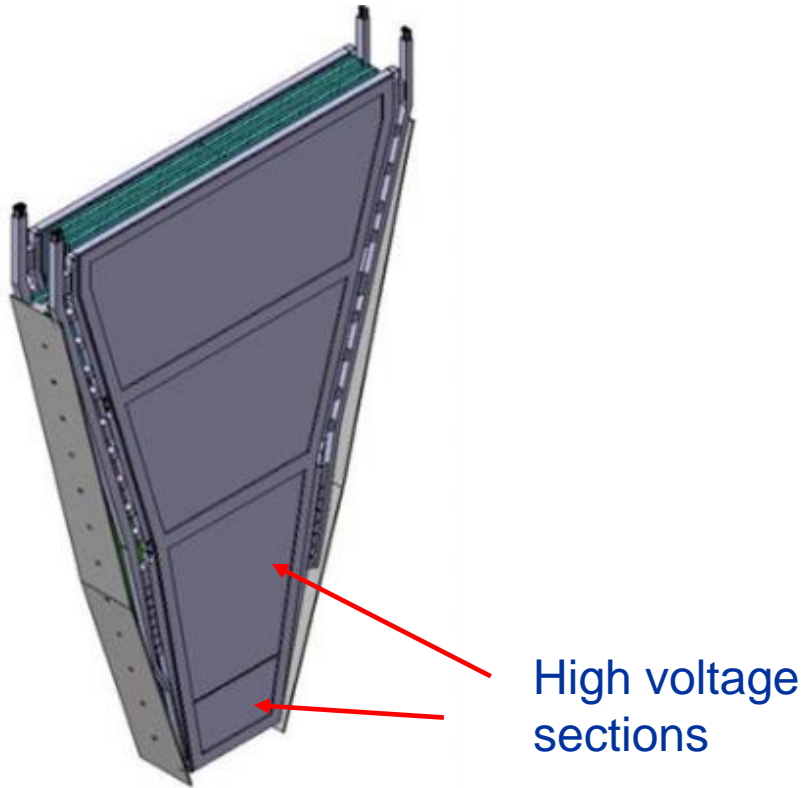
New Small Wheels



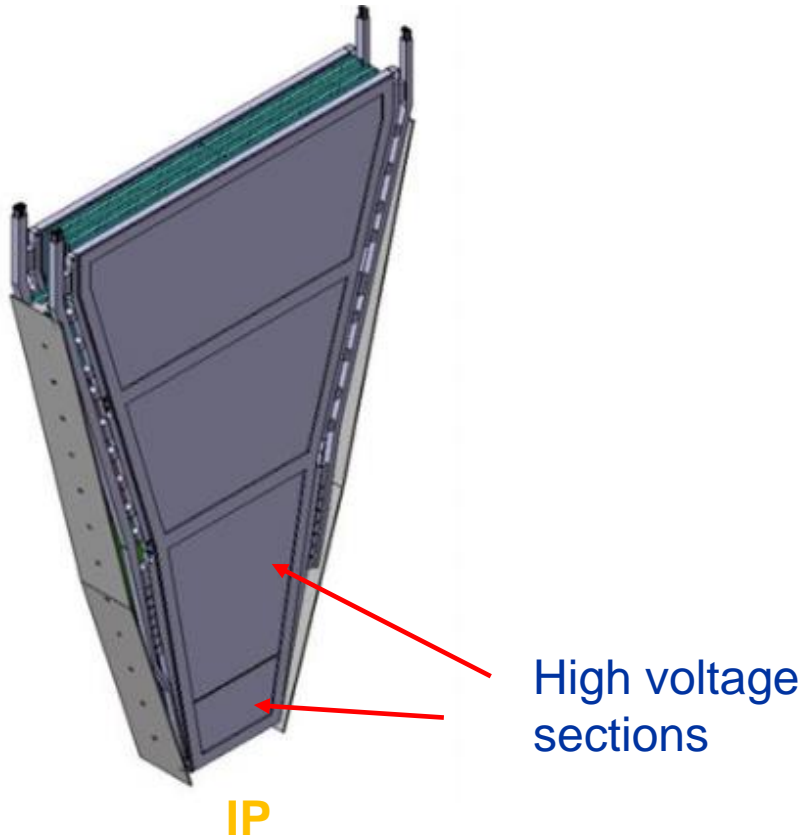
Small Thin Gap Chambers



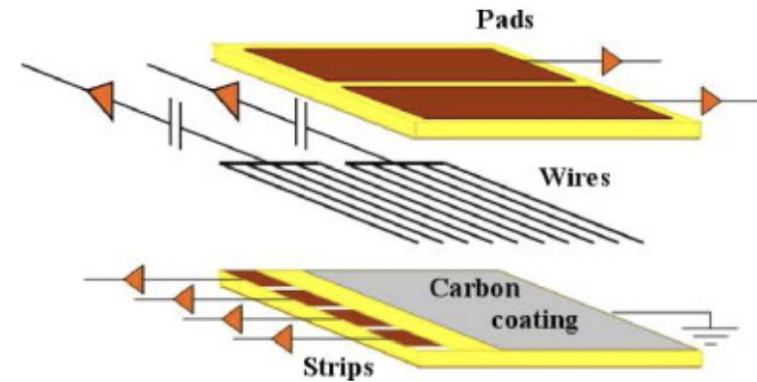
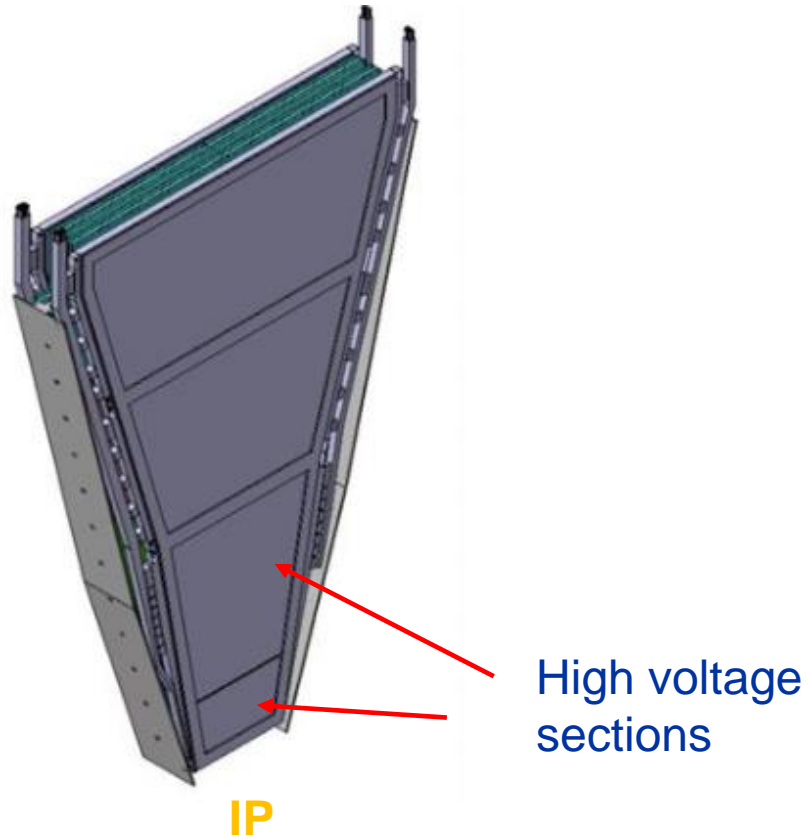
Small Thin Gap Chambers



Small Thin Gap Chambers



Small Thin Gap Chambers



Project Motivation

Problem

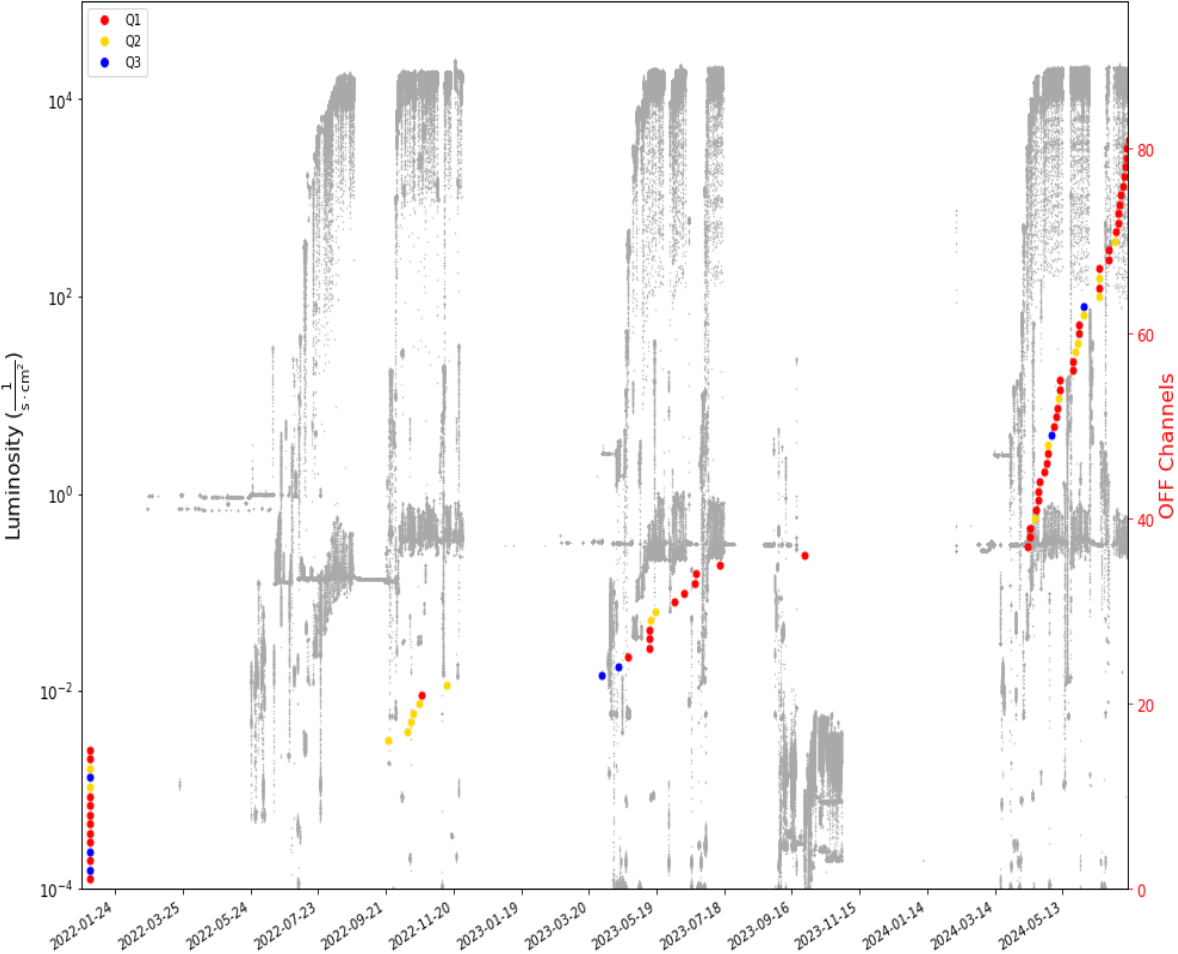
- The Small Thin Gap Chambers (sTGC) in the New Small Wheel (NSW) are failing/dying at a fast rate
 - This is evident in spikes in current, dead channels, etc.
 - This affects data taking, reliability and overall efficiency of the detector

Goal

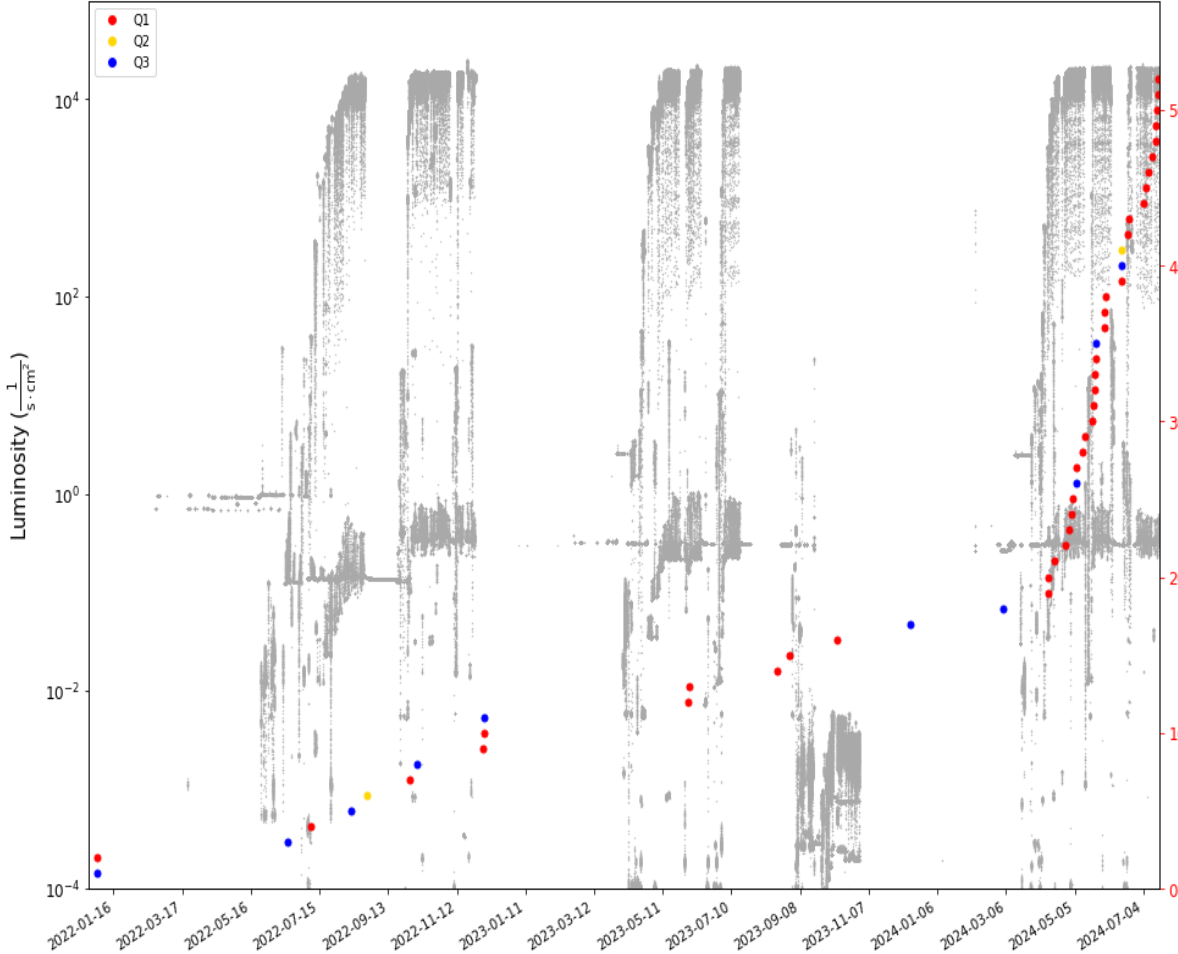
- Visualize the problem
- Find any patterns that might clue us towards what is happening within these chambers
- Build a database of current data for failed channels

OFF Channels and Luminosity

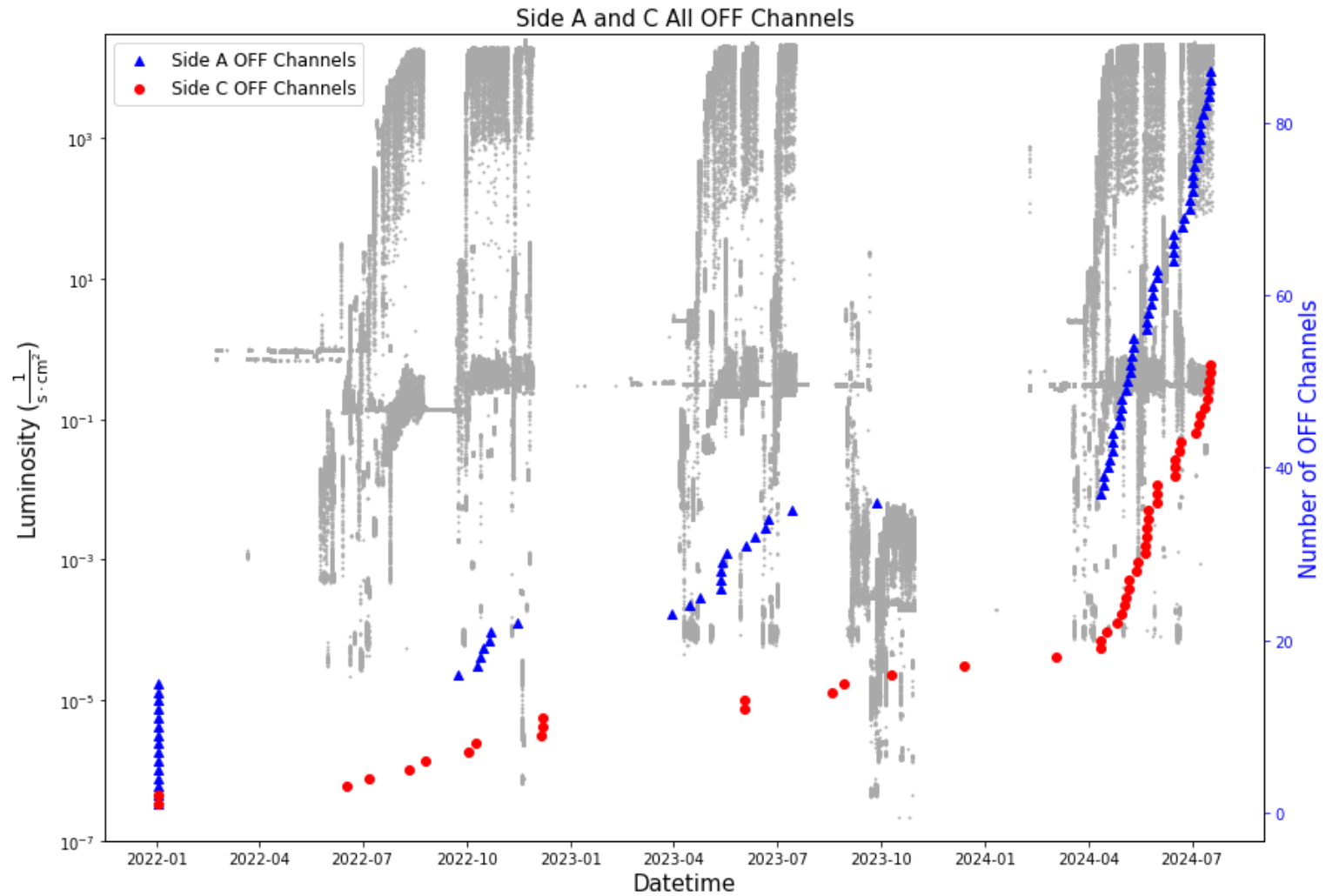
Luminosity and OFF Channels Count Comparison (Side A)



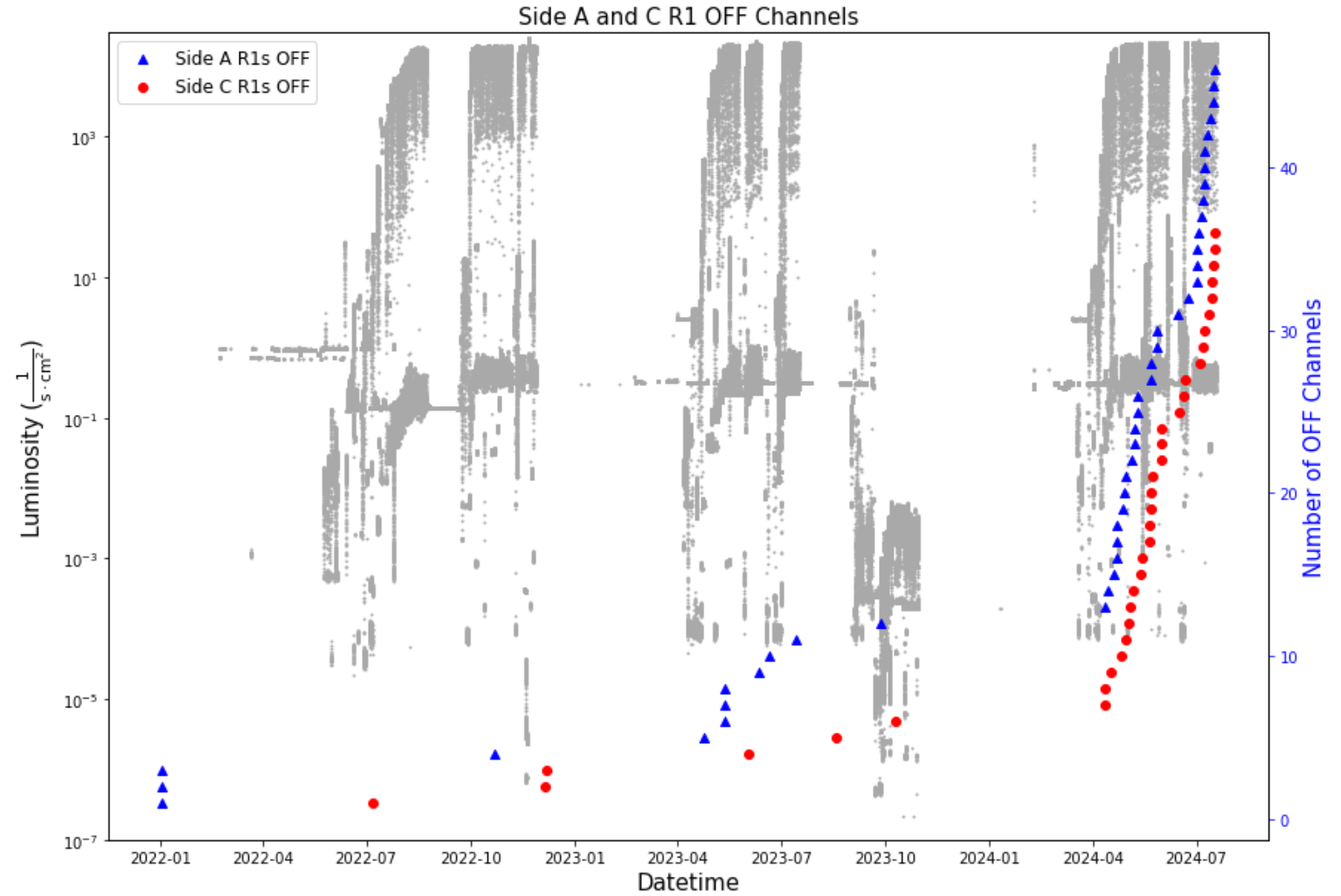
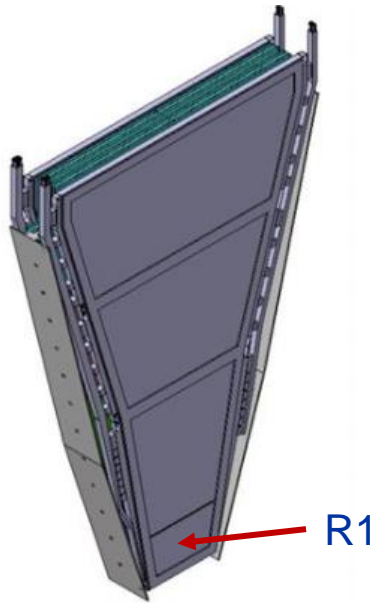
Luminosity and OFF Channels Count Comparison (Side C)



Side A and C Comparison

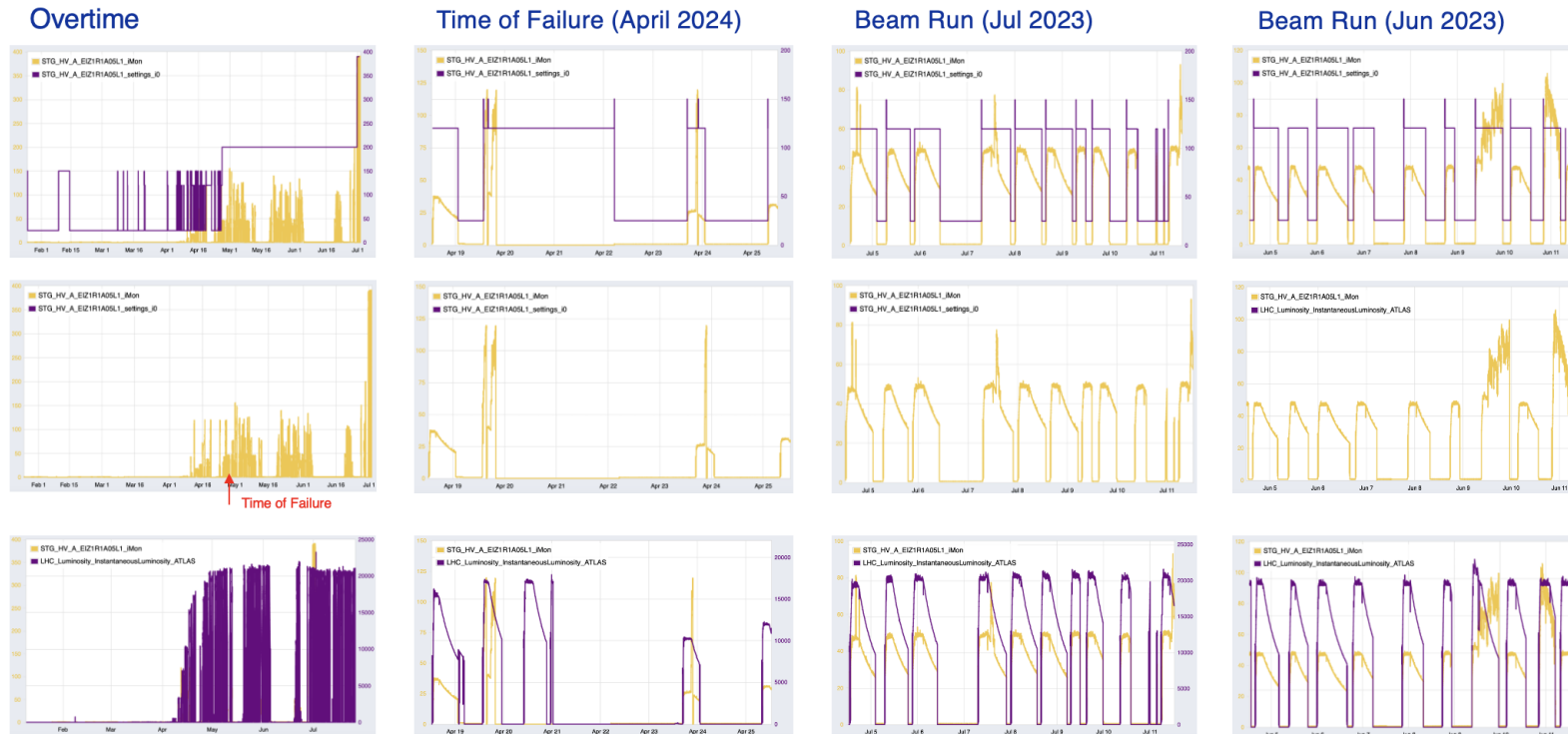


Side A and C Comparison



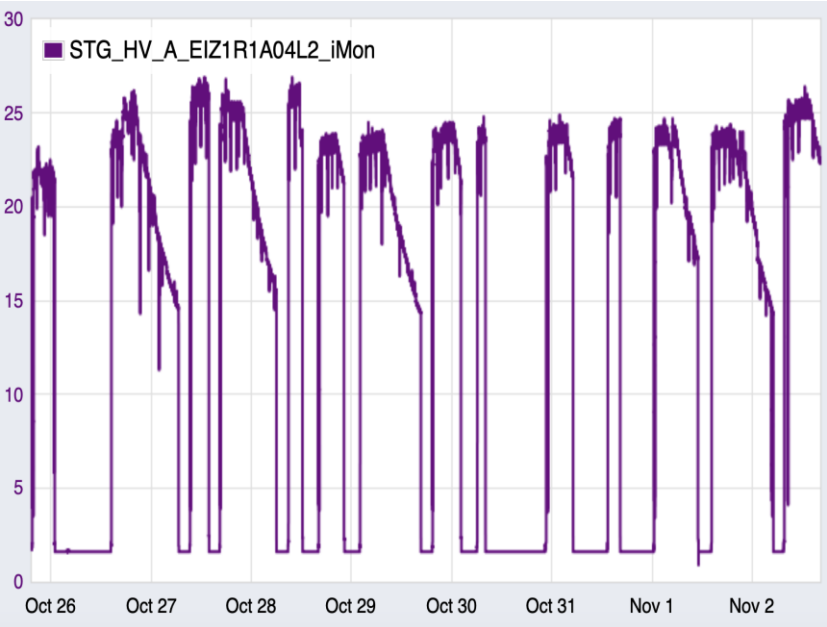
Current Spikes for Individual Channels

- Building up a database for OFF channels
 - Look at current data for each OFF channel within a week of failure and for two beam runs prior to failure
 - Current behavior can tell us what is happening in the detector



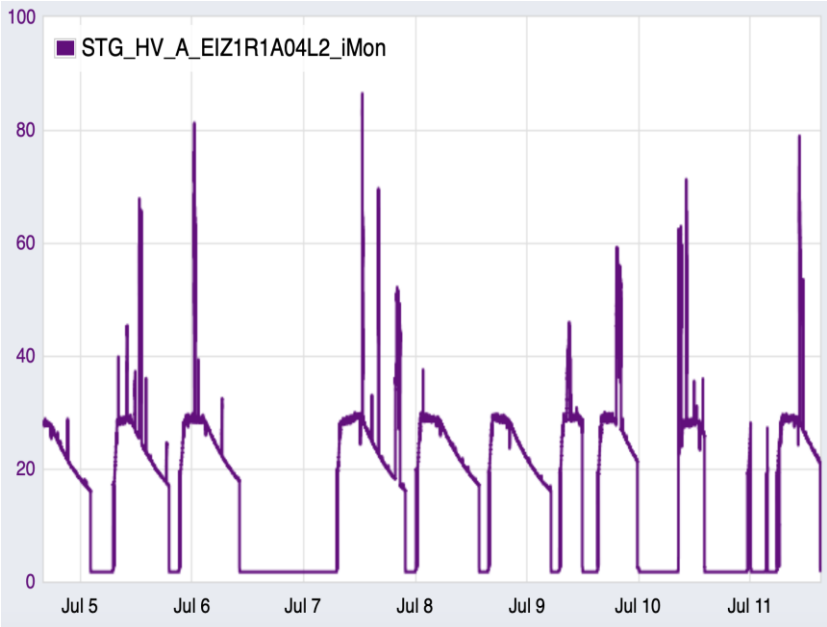
Current Pattern Example: OFF Channel

Beam Run (Oct 2022)



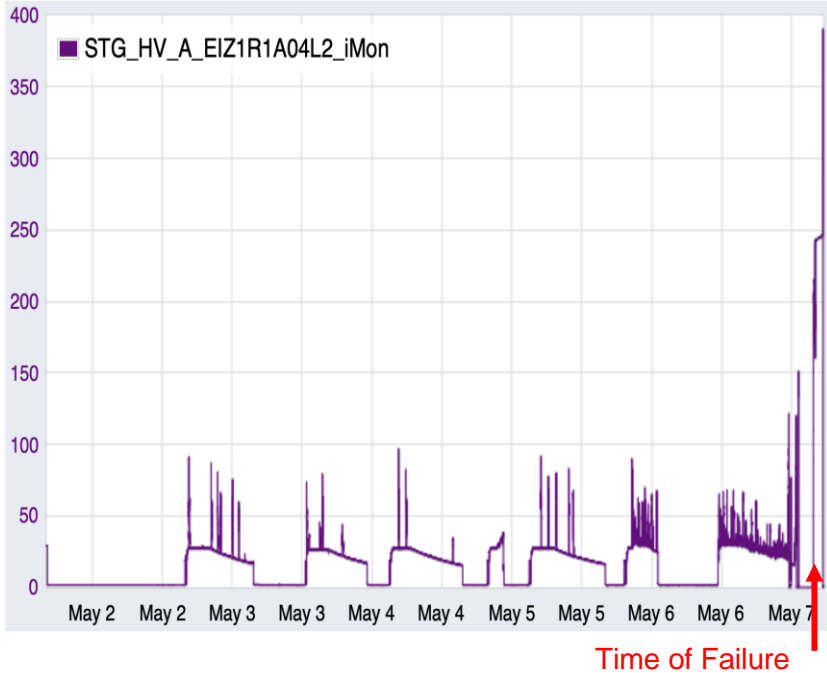
Consistently flat current shape

Beam Run (Jul 2023)



Many instances of current spikes

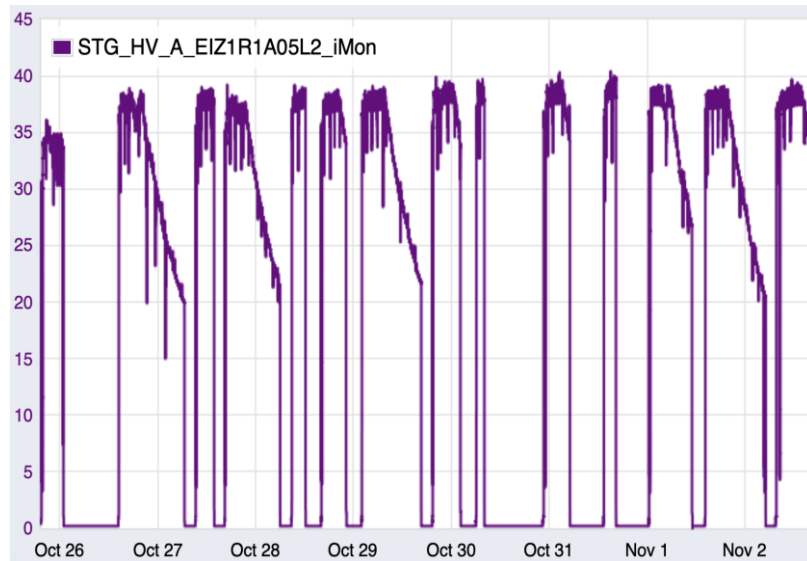
Time of Failure (May 2024)



Consistent spikes before failure

Current Pattern Example: Good Channel

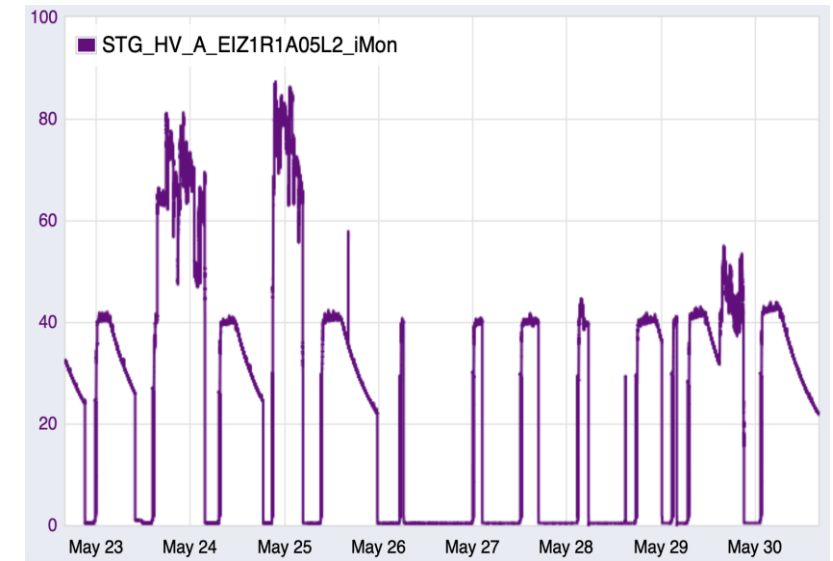
Beam Run (Oct 2022)



Beam Run (Jun 2023)



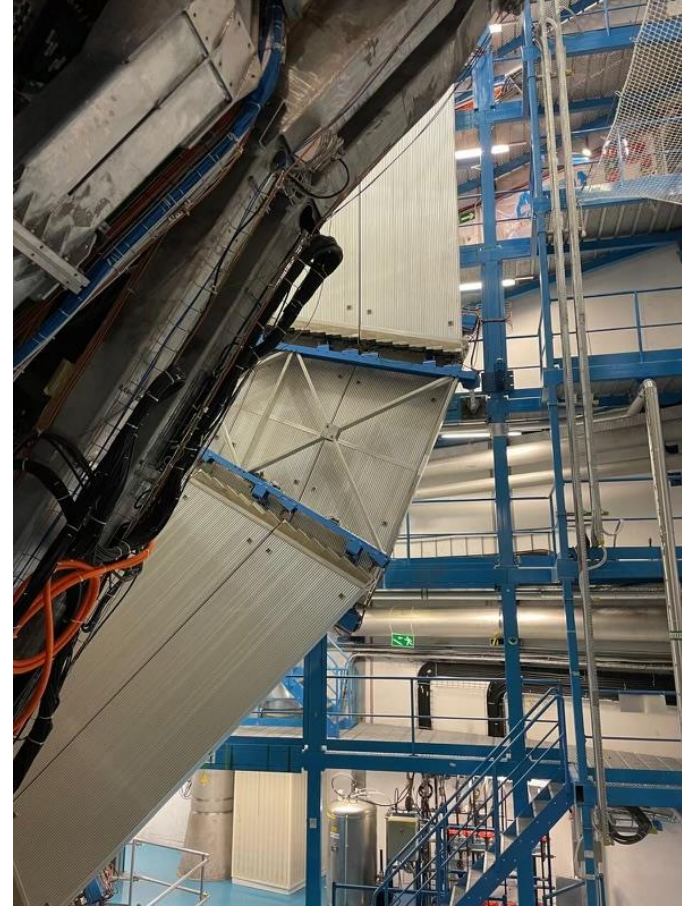
Beam Run (May 2024)



Other Hardware/Operations Activities



ATLAS Control Room



ATLAS Cavern

Summary

Current Patterns

1. Understanding how current spikes progress and we approach time of failure can help us make predictions about currently good channels
2. Taking a closer look helps us to understand the type of error we are seeing (burning, graphite coming off, etc.)

Visualizing the trend in OFF channels

1. Failure of channels seems to be correlated with operation – is luminosity a cause?
2. The significant difference in number of channels OFF between sides is explained by the numerous failed channels at the beginning of 2022
3. Side A and C are likely experiencing the same issue due to their similar behavior, despite previous beliefs that side A was experiencing more problems due to increased background

Future Work

1. Ageing Test
2. Accumulated charge measurements
3. Efficiency Scans



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