

# Small-Strip Thin Gap Chamber High Voltage Investigation for the New Small Wheels

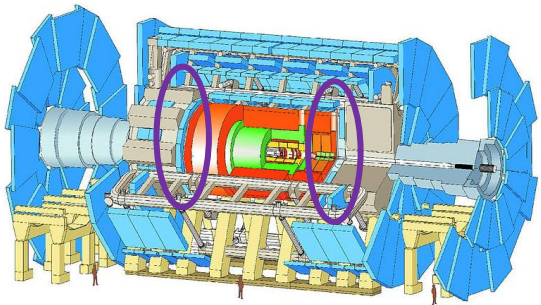
Aimee Dubuque

08/08/2024

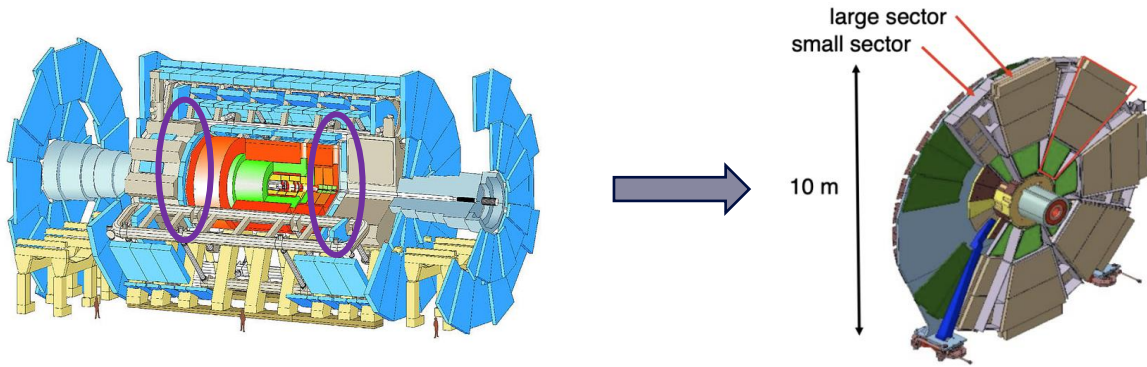
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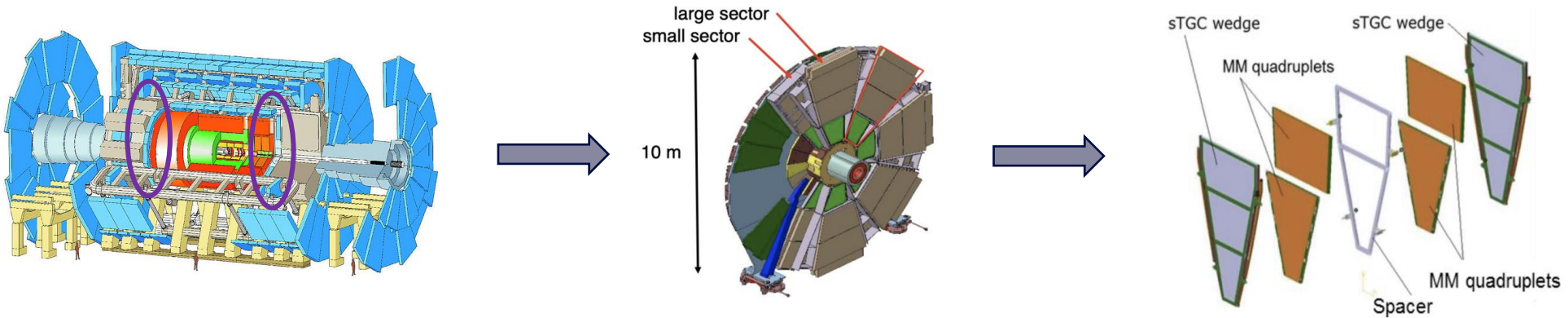
# New Small Wheels



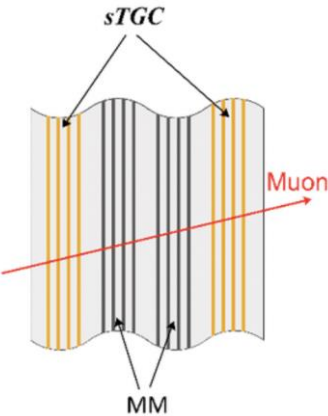
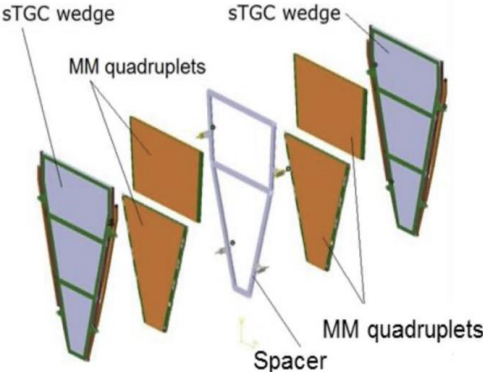
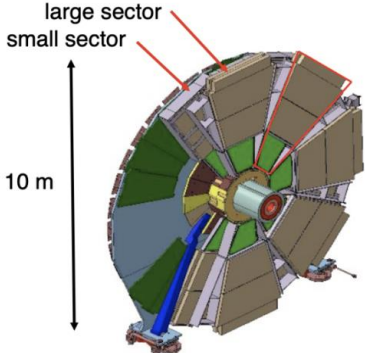
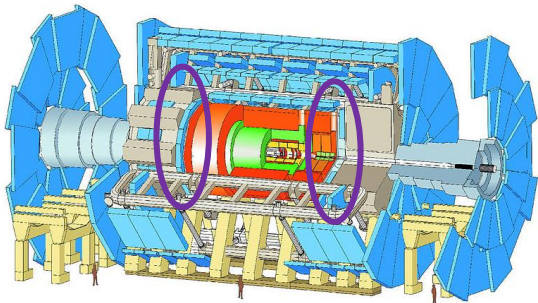
# New Small Wheels



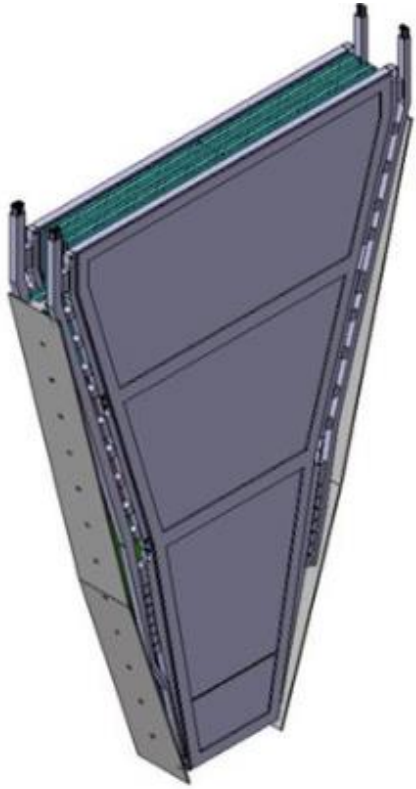
# New Small Wheels



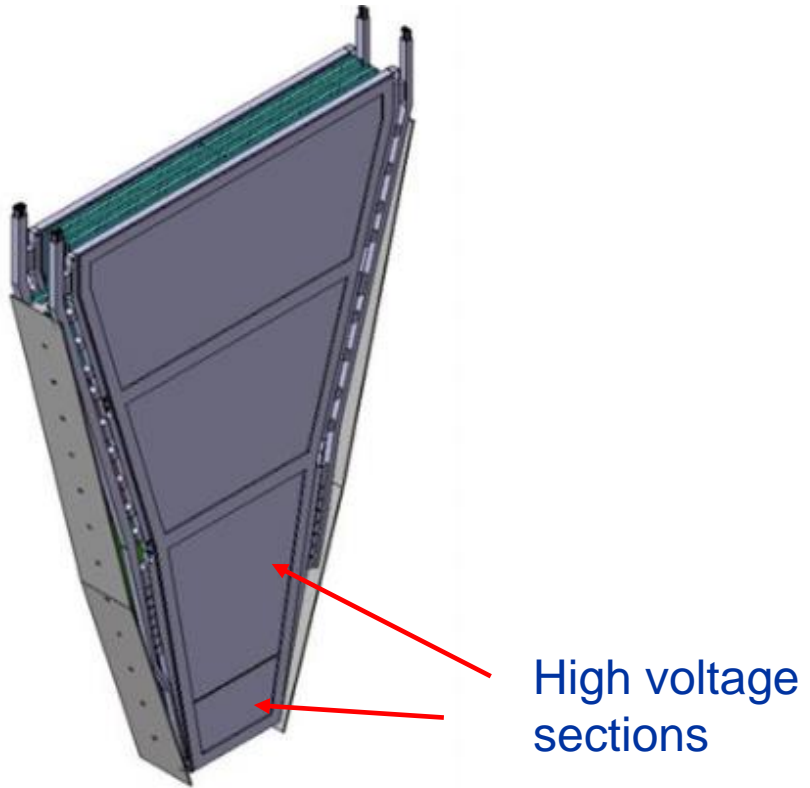
# New Small Wheels



# Small-Strip Thin Gap Chambers

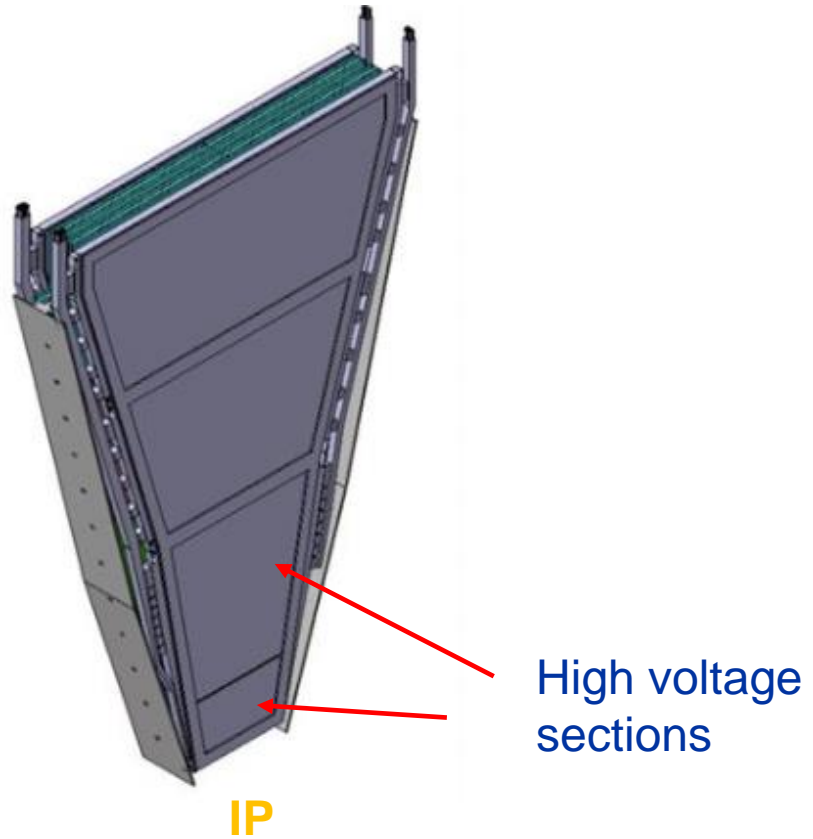


# Small-Strip Thin Gap Chambers

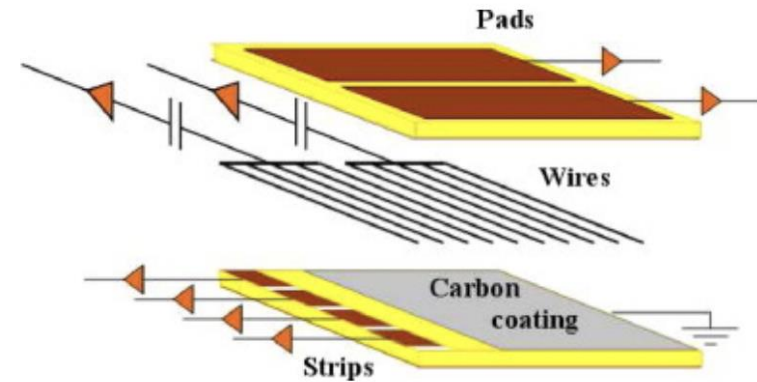
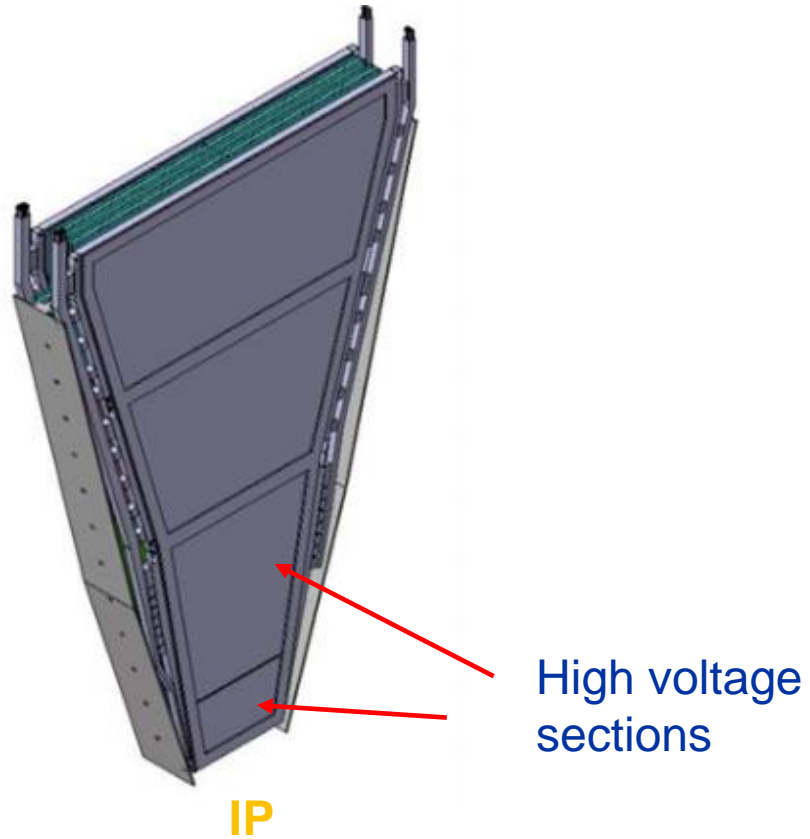




# Small-Strip Thin Gap Chambers



# Small-Strip Thin Gap Chambers



# Project Motivation

## Problem

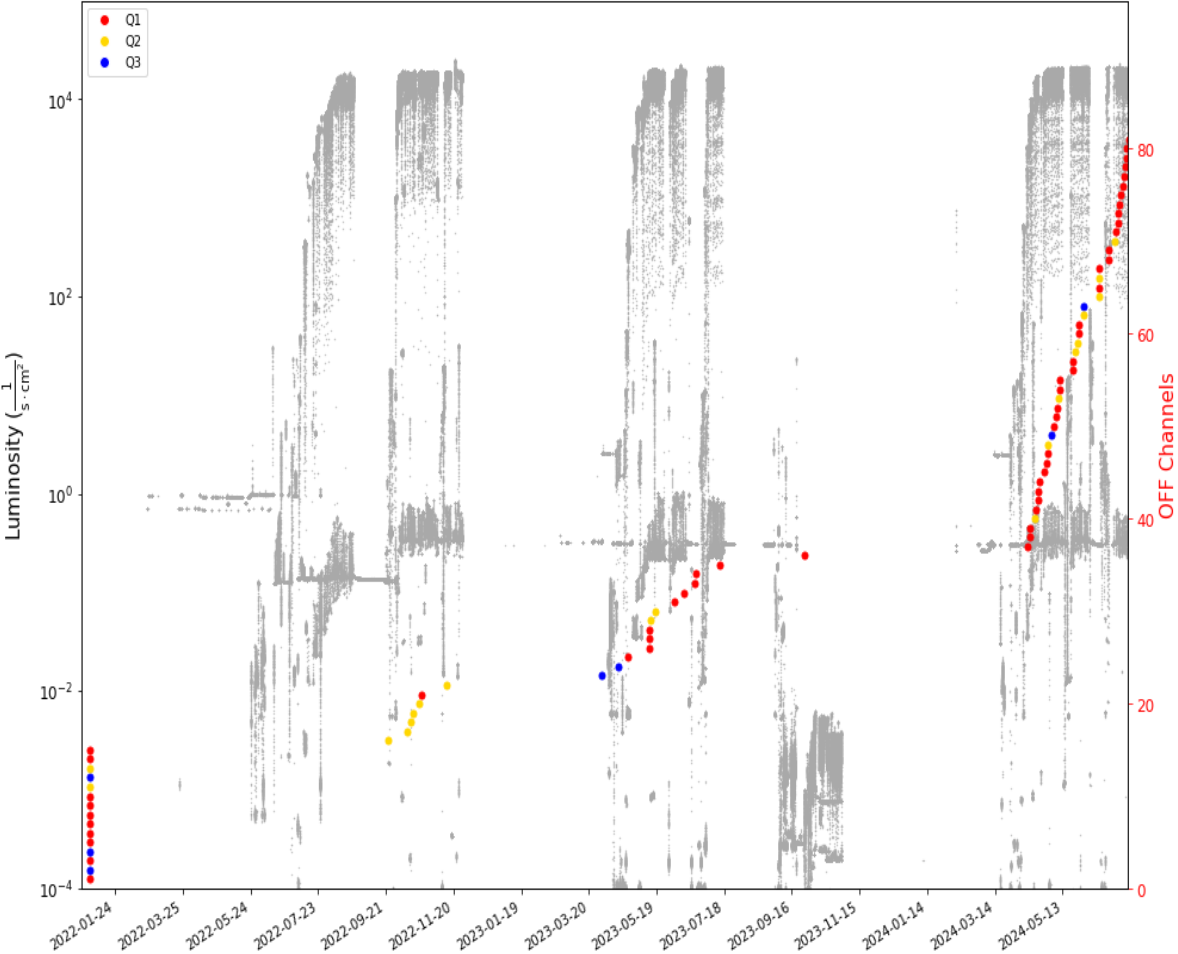
- The Small-Strip Thin Gap Chambers (sTGC ) in the New Small Wheel (NSW) are failing/dying at a fast rate
  - This is evident in spikes in current, dead channels, etc.
  - This affects data taking, reliability and overall efficiency of the detector

## Goal

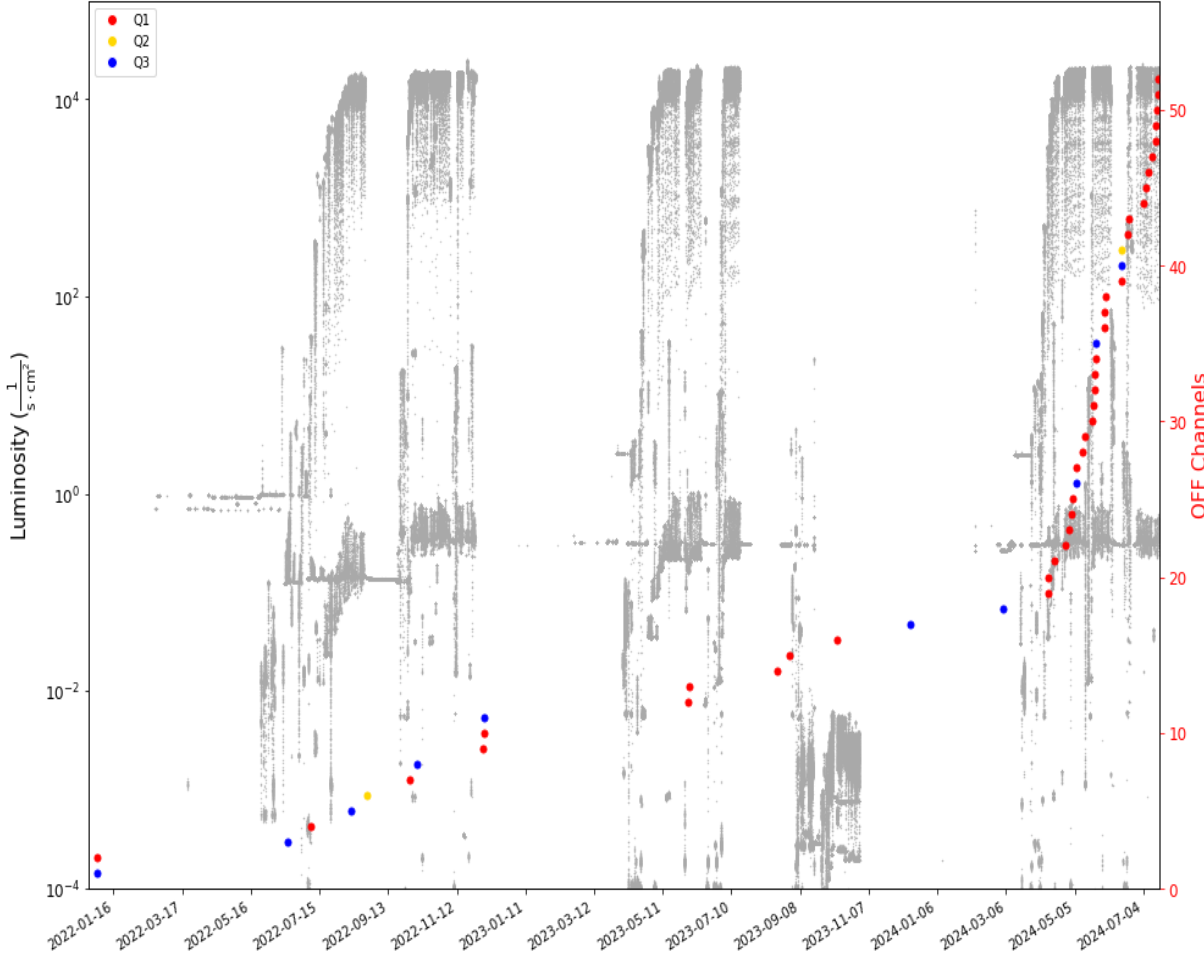
- Visualize the problem
- Find any patterns that might clue us towards what is happening within these chambers
- Build a database of current data for failed channels

# OFF Channels and Luminosity

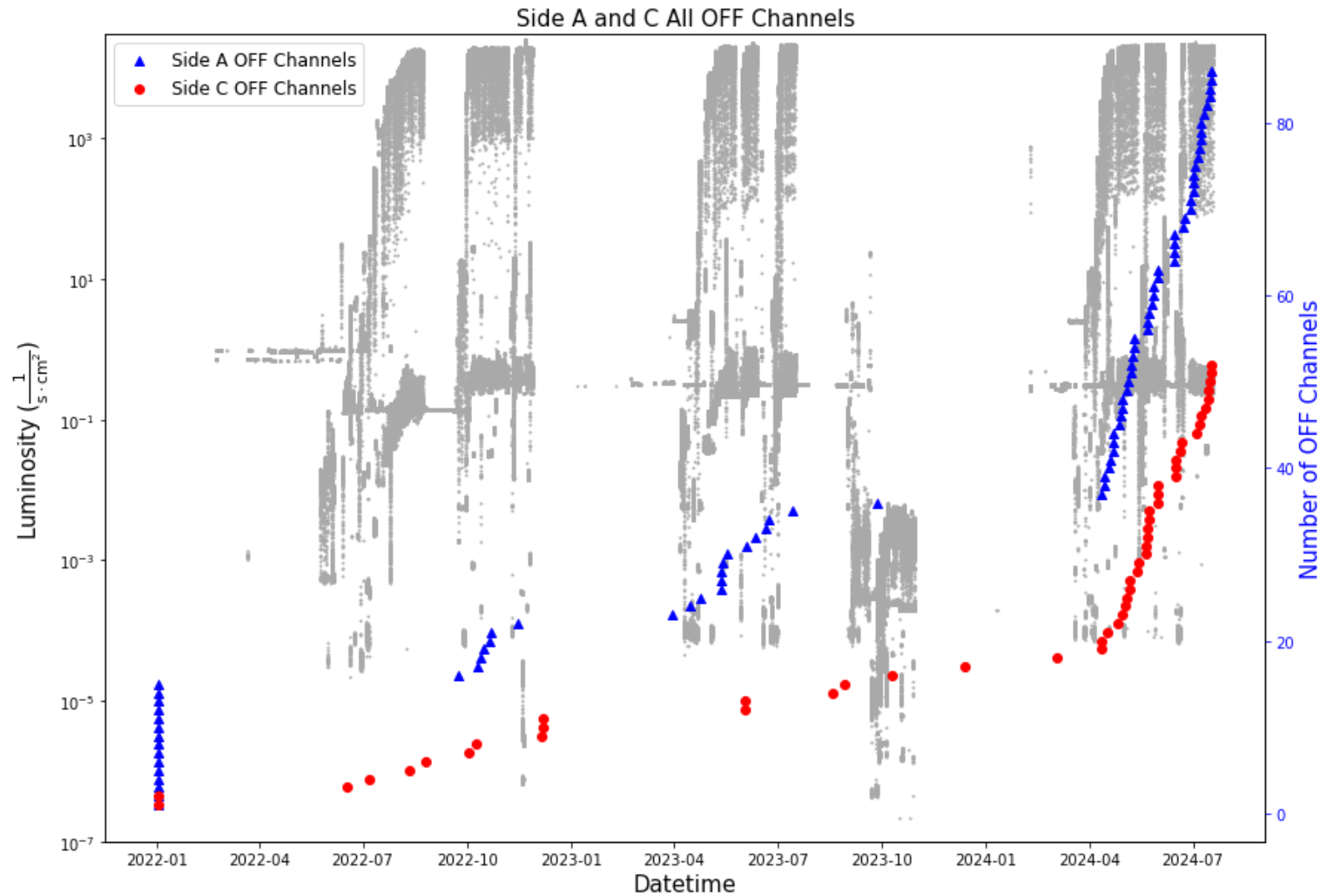
Luminosity and OFF Channels Count Comparison (Side A)



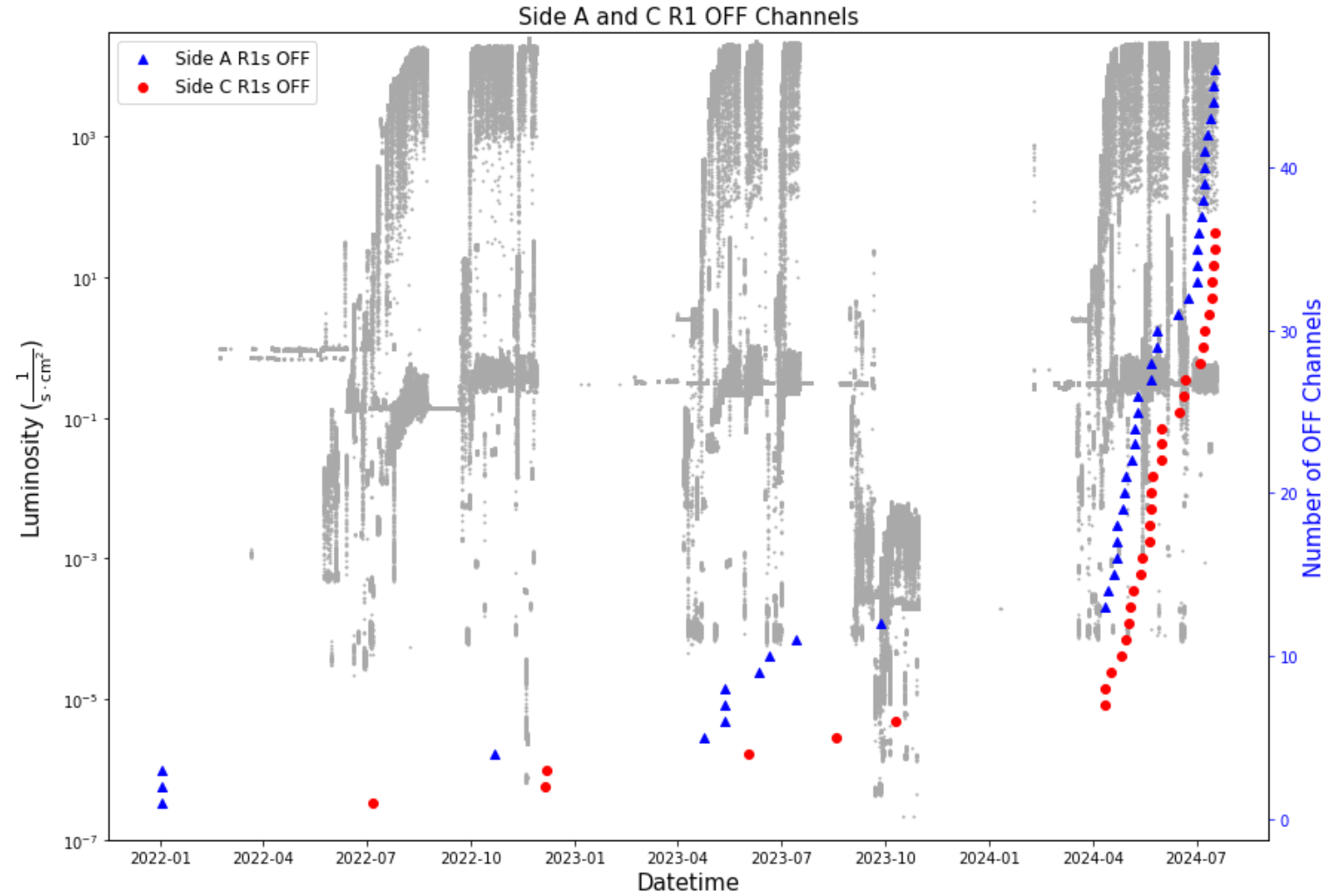
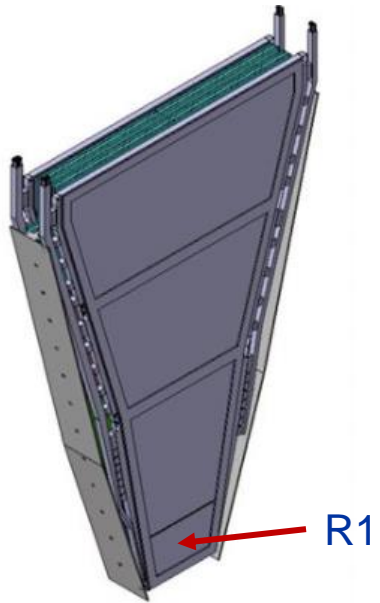
Luminosity and OFF Channels Count Comparison (Side C)



# Side A and C Comparison

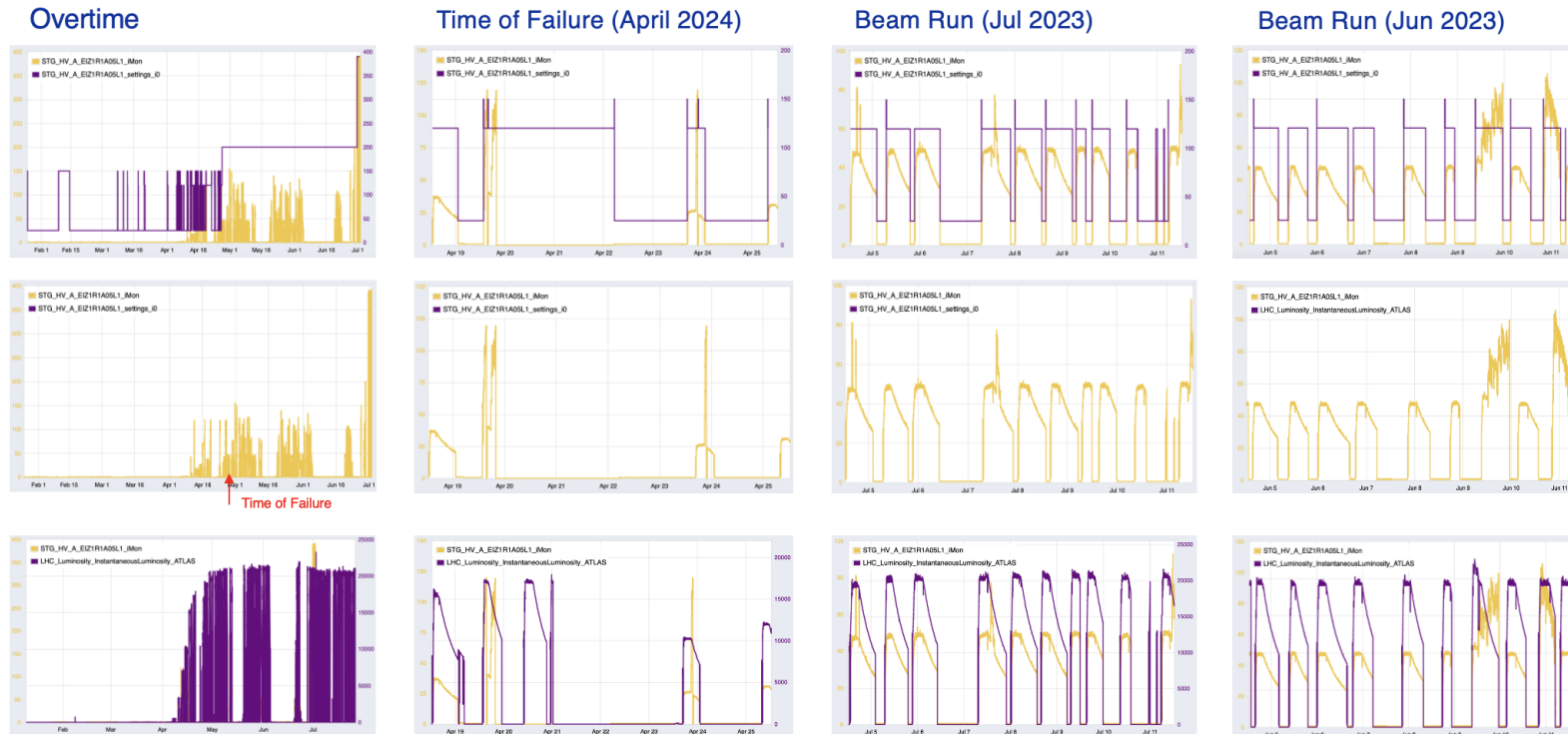


# Side A and C Comparison



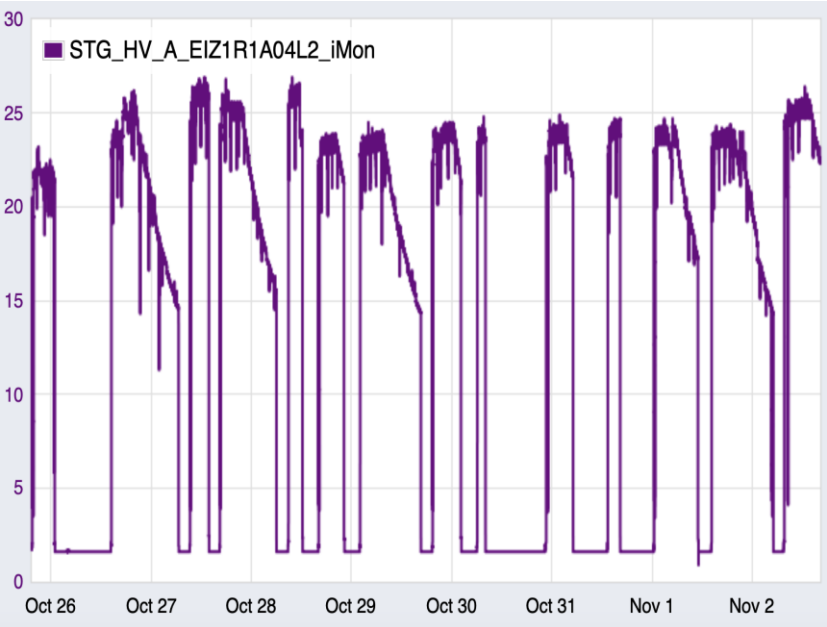
# Current Spikes for Individual Channels

- 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



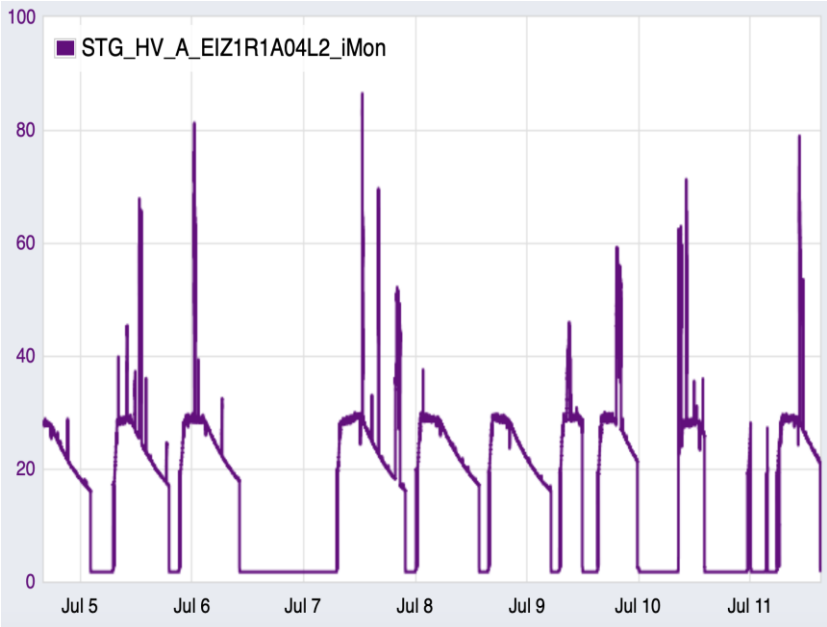
# Current Pattern Example: OFF Channel

Beam Run (Oct 2022)



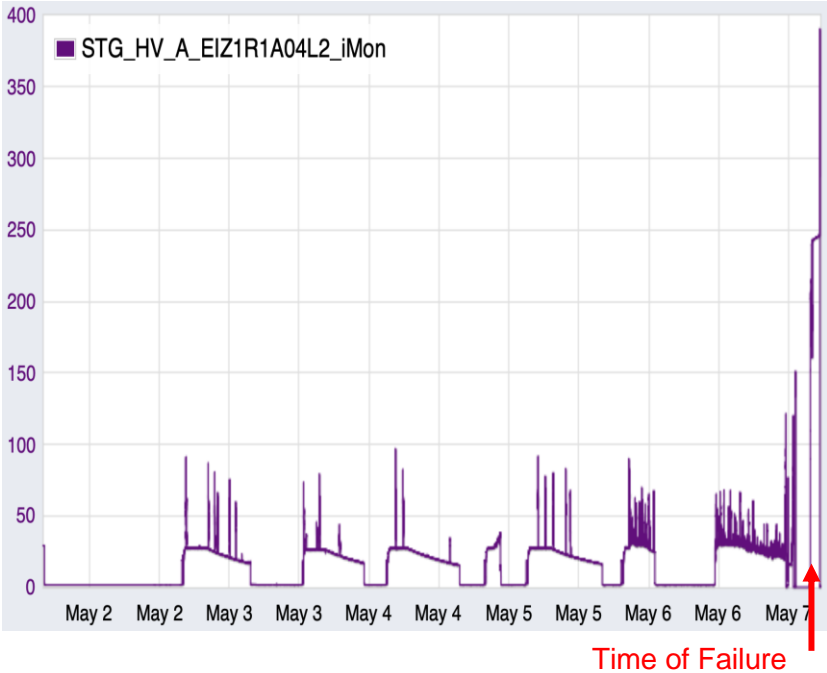
Consistently flat current shape

Beam Run (Jul 2023)



Many instances of current spikes

Time of Failure (May 2024)

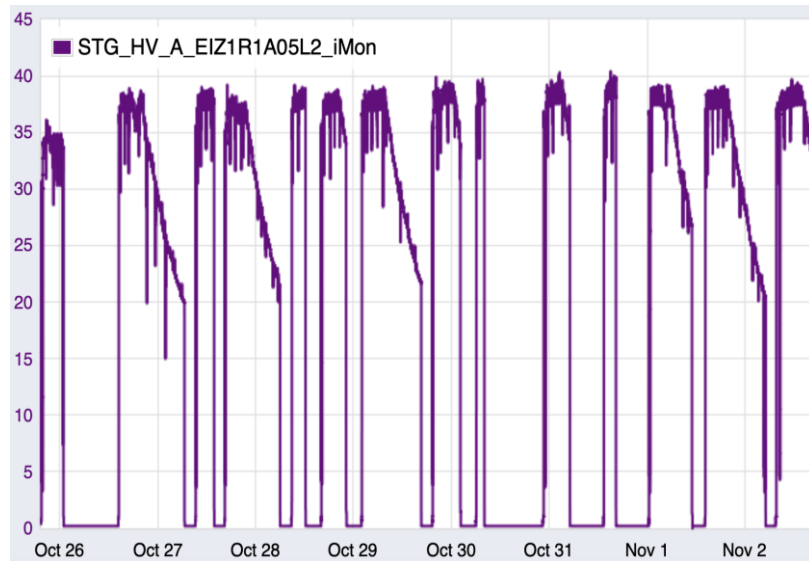


Consistent spikes before failure

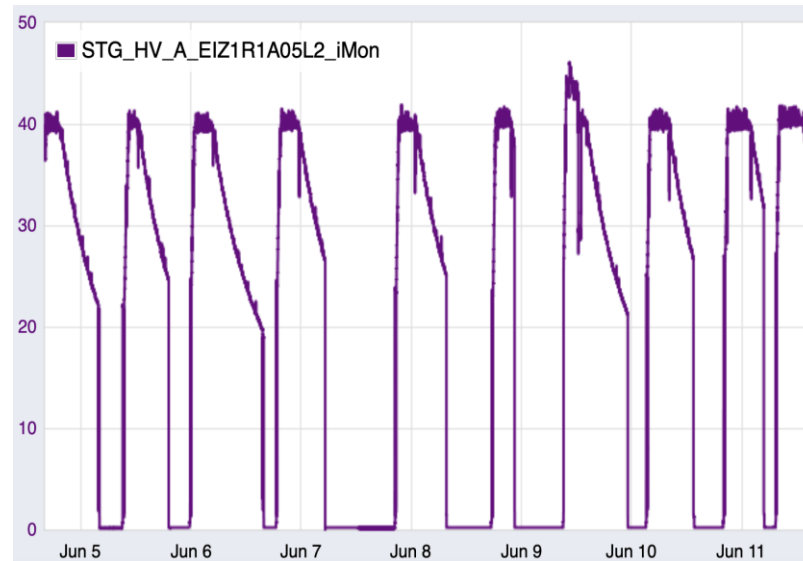


# Current Pattern Example: Good Channel

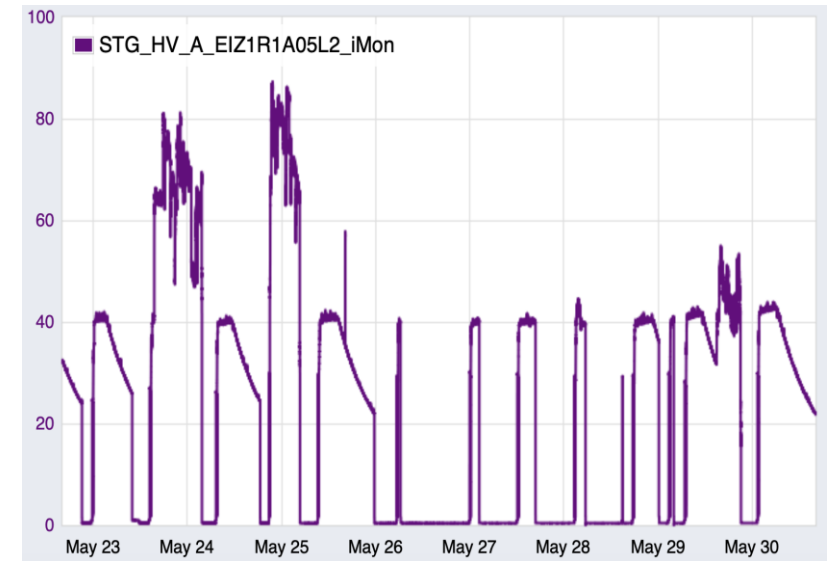
Beam Run (Oct 2022)



Beam Run (Jun 2023)



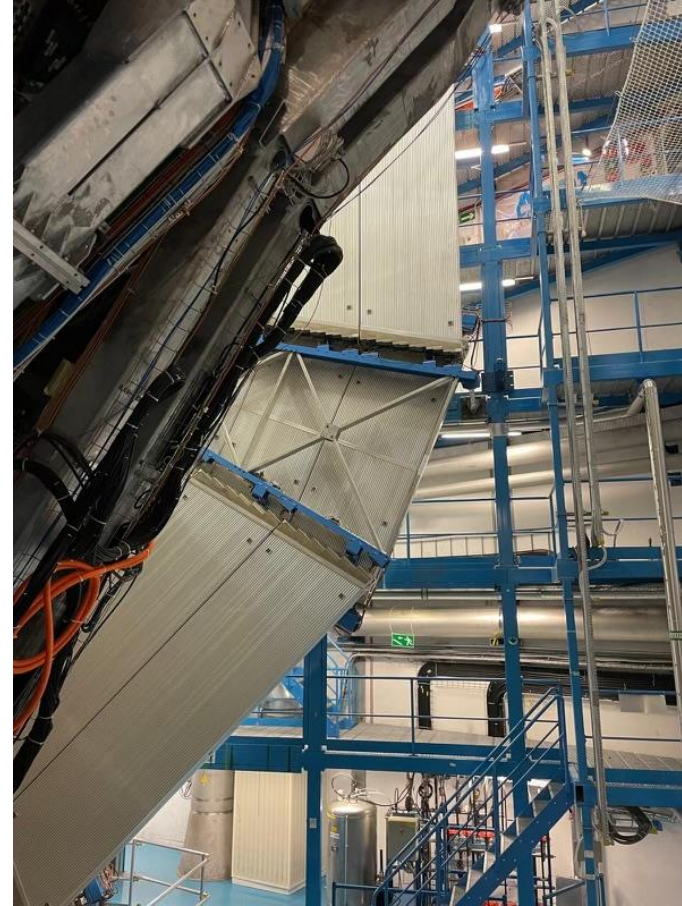
Beam Run (May 2024)



# 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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# References

1. Lefebvre, B. (2018). *Characterization studies of small-strip Thin Gap Chambers for the ATLAS Upgrade* [CERN Thesis, McGill University]. <https://cds.cern.ch/record/2633639/files/CERN-THESIS-2018-111>