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correlation of the intensity of the MMG detector in ATLAS with the luminosity of the LHC.

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Summary

In this work, we studied the evolution of the current delivered by an ATLAS micromegas detector (MMG) over a 24-hour period, in relation to its luminosity. We took a module with 5 PCBs and 4 layers.

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1 Introduction

ATLAS is a gigantic particle detector used to observe the particle collisions produced by the LHC. ATLAS is designed to explore a wide range of physical phenomena. It is made up of several layers of sub-detectors that analyze the different properties of the particles created in the LHC's high-energy collisions. These sub-detectors include a trace detector, calorimeters and a muon spectrometer.
The muon spectrometer is a Micromegas detector designed to record muon trajectories with high spatial and temporal accuracy.
In this project, we are studying the variation of the recorded current intensity as a function of the luminosity of the LHC for a module composed of different layers.
In the first part we study how intensity follows luminosity for one layer across the 5 PCBs. Then in the second part we'll see how current is put into the 4 layers for a given PCB.

2 Presentation of MMG of ATLAS

The Micromegas (Micro-Mesh Gaseous Structure) detector plays a crucial role in the ATLAS experiment at CERN as part of the New Small Whell system (NSW). there are 16 sectors in each NSW : 8 small and 8 large.

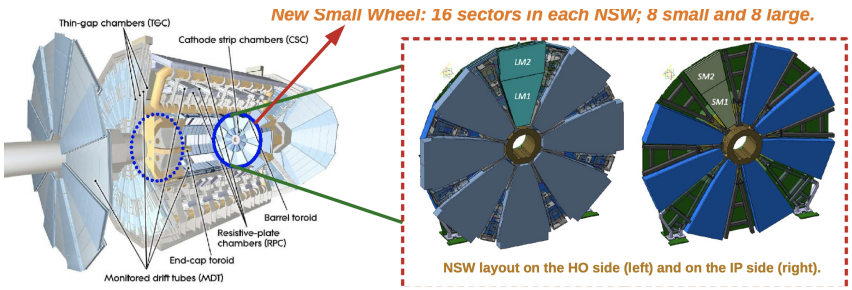


Figure 1: NSW

In each sector we have two MMG beteween two sTGC as shown in figure 2

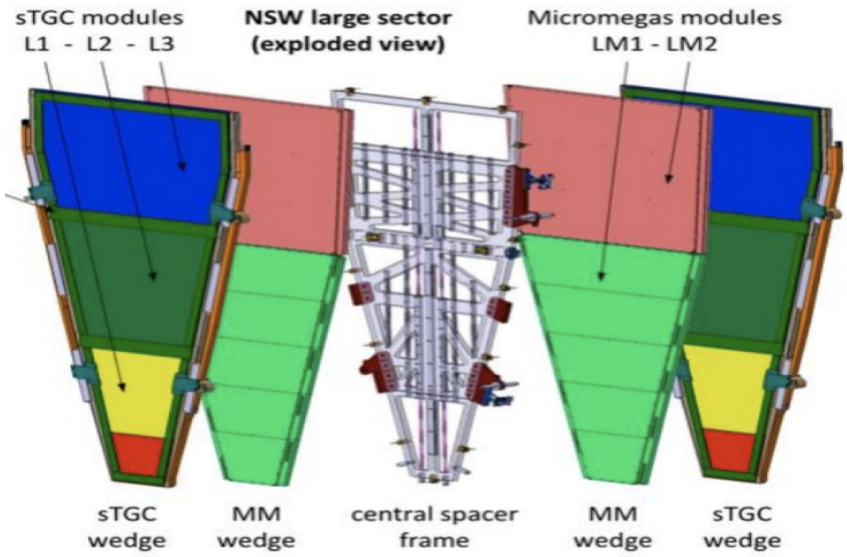


Figure 2: sector of NSW

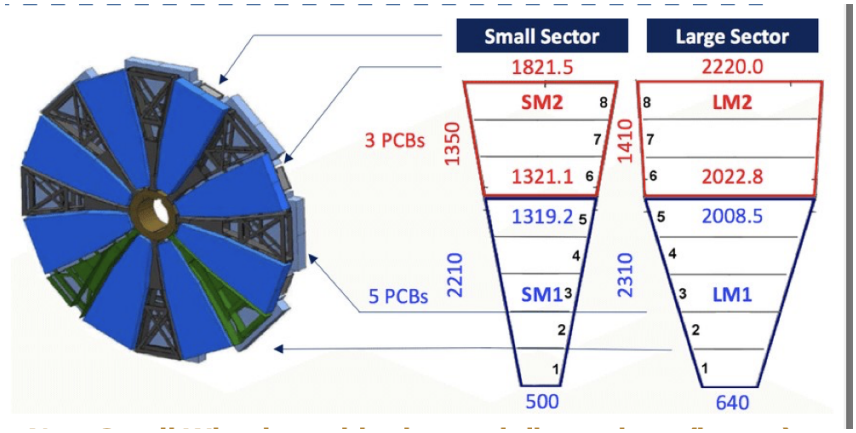


Figure 3: MMG

Each sector of micromegas is devided by two the red part that has 3 PCBs and the blue part has 5 PCBs.

3 comparison of different plots on a module

In this project, we have taken as an example a module from the sector shown in blue in figure 3 called EIZ2R1A04 . This module is made up of a readout panel and a drift panel. For the readout panel, we have 5 PCBs in each of the module's 4 layers.[1]

3.1 intensity variation for a layer across the readout panel and drift panel

As we have 4 layers, we therefore have 4 scenarios, for each of which we plot the current intensity in the readout panel and the drift.

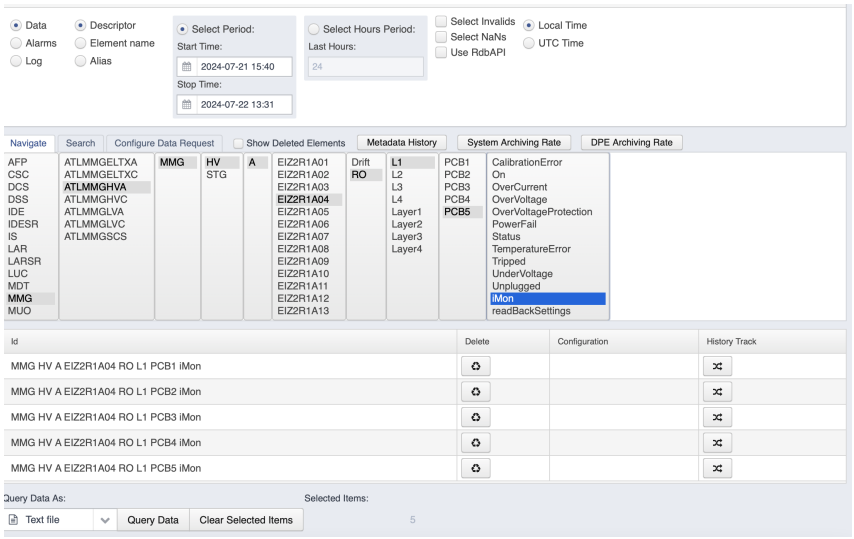
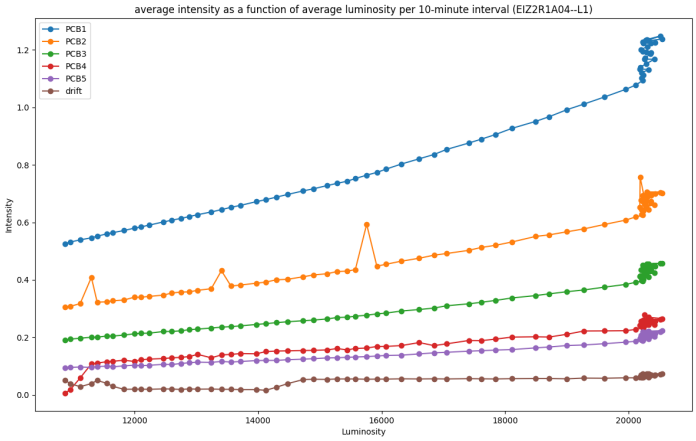
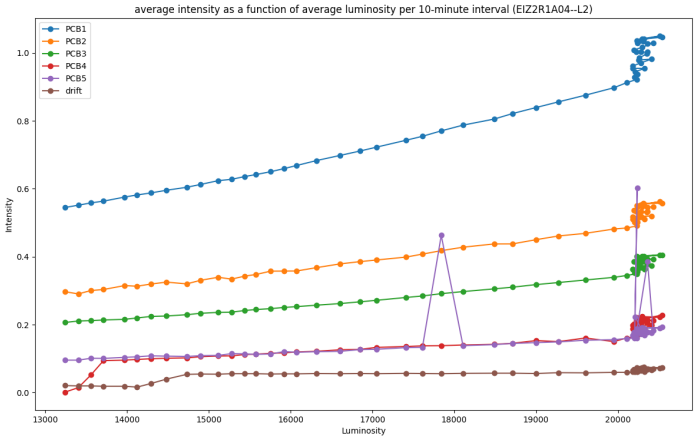


Figure 4: collecting data from the DDV tool

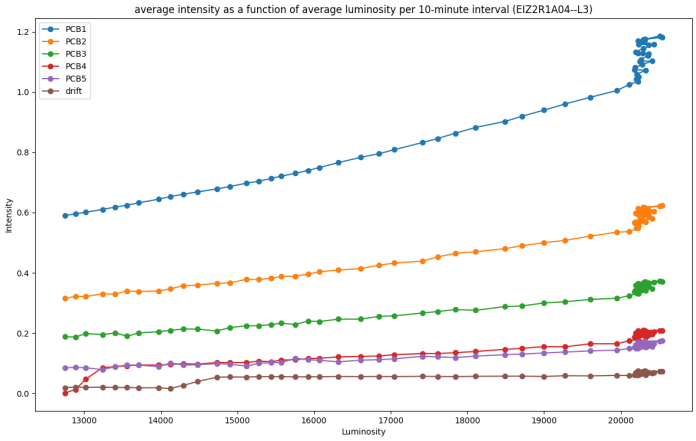
This tool enables us to collect data on both intensity and luminosity over a given period.



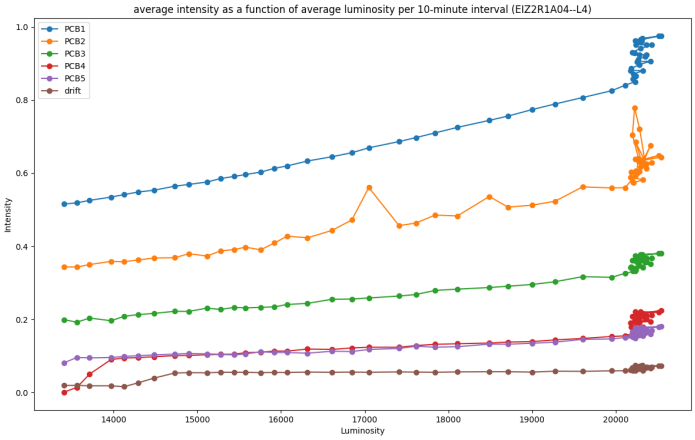
(a) Figure 1



(b) Figure 2



(c) Figure 3



(d) Figure 4

What we notice from these figures is that the intensity in PCB 1 (in blue) dominates in all layers, then decreases as we move from PCB 1 to PCB 5. However, the plots have almost the same behavior in all 4 figures. The intensity in the drift panel remains low compared to the others.

3.2 Following the current intensity through the different layers for a given PCB

In this section, we study the variation in the current intensity across the 4 module layers for each PCB.

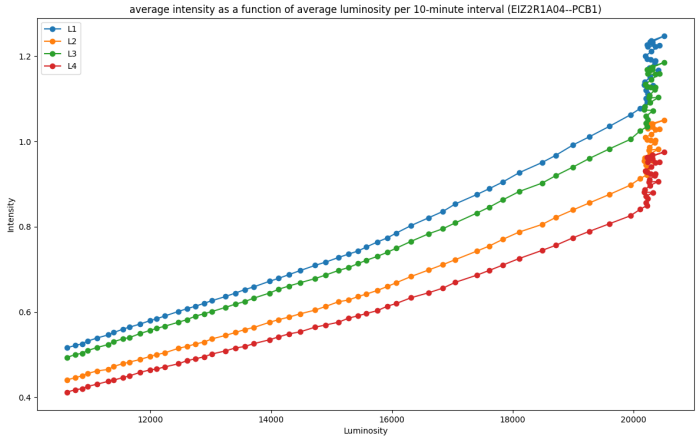


Figure 5: current in the PCB1

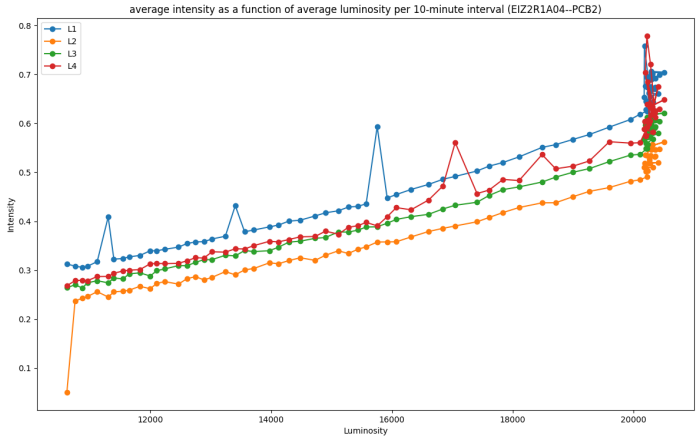


Figure 6: current in the PCB2

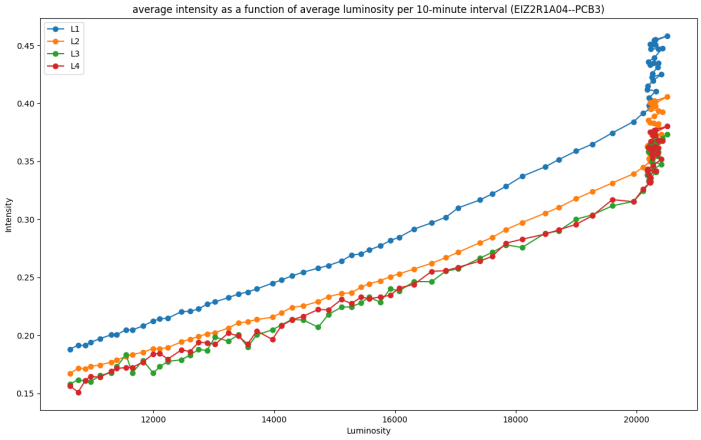


Figure 7: current in the PCB3

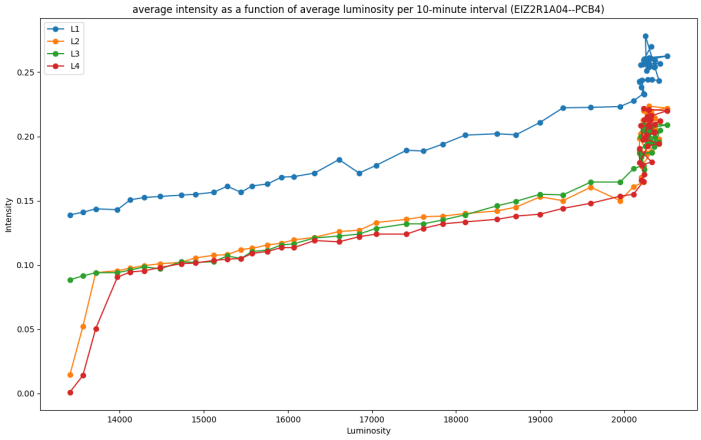


Figure 8: current in the PCB4

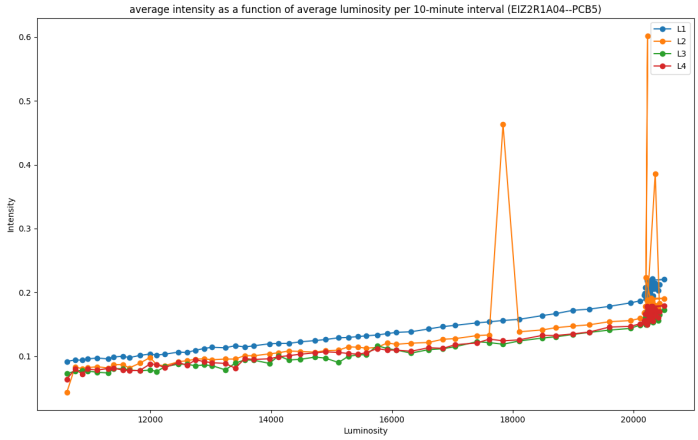


Figure 9: current in the PCB5

We note that the intensity of the current is highest in PCB1 and decreases towards the other PCBs.

4 Conclusions

The first 4 cases we observed show a good increase in intensity with increasing luminosity, suggesting that more particles interact with the detector as luminosity increases. In addition, the last 5 figures show that particles interact most in the first layer of a module.

References

[1] Manisha Manisha. The Micromegas detectors for ATLAS New Small Wheel upgrade. Technical report, CERN, Geneva, 2020. 14 December, 2020: Conference start date.