INTERNSHIP PROGRESS REPORT

Development of HGCal DQM

By : Mijail Tokarev

Supervisors: Amina Zghiche,
Alexandre Zabi

Laboratoire Leprince Ringuet | 2025

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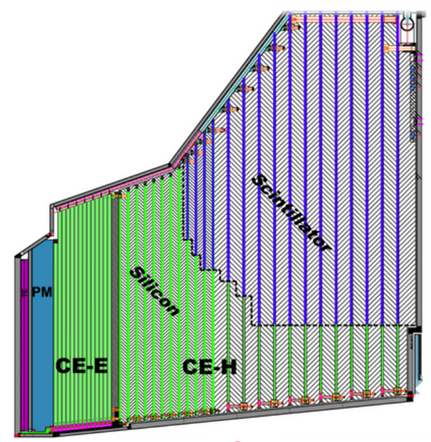
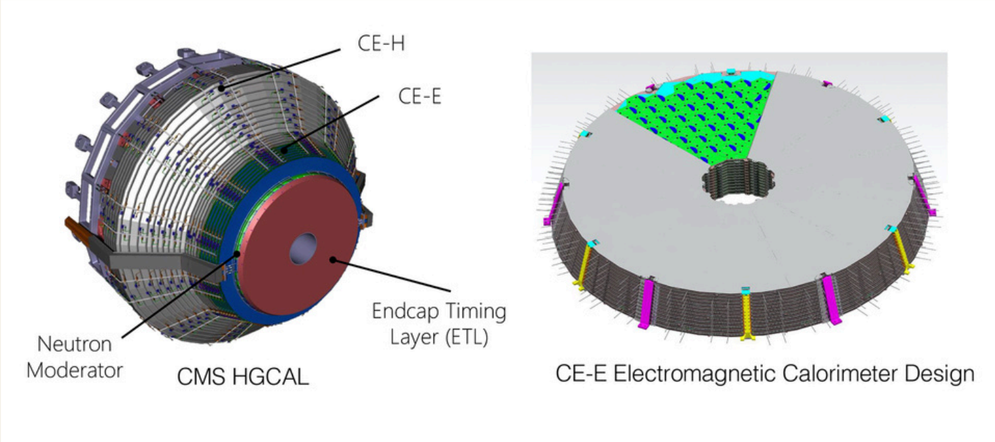
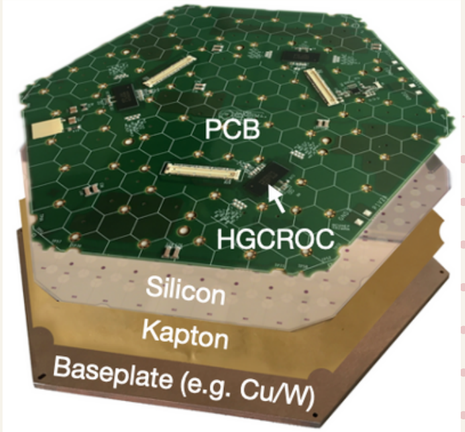
WHAT IS HGCAL

The High Granularity Calorimeter is a new sampling electronic and hadronic calorimeter build to replace the current end-caps of the CMS experiment.

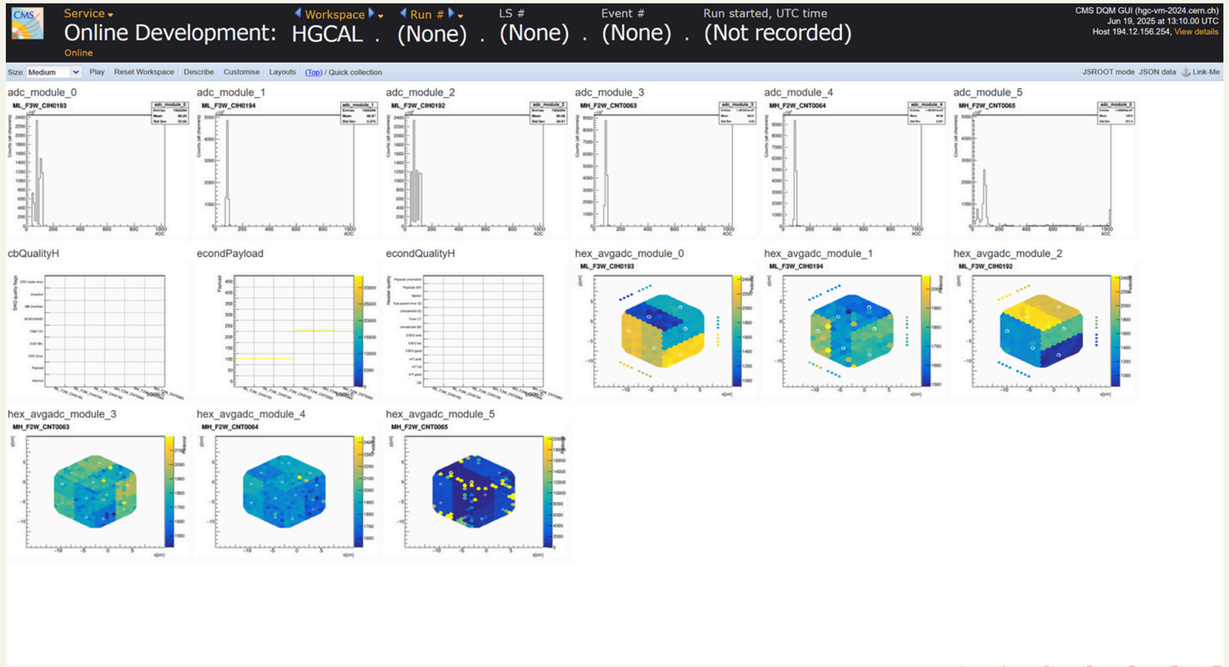






WHAT IS THE DQM

The Data Quality Monitoring is an interface to supervise the functioning of the detector by displaying values such as the mean ADC voltage in the modules.



OVERVIEW OF MY WORK SO FAR

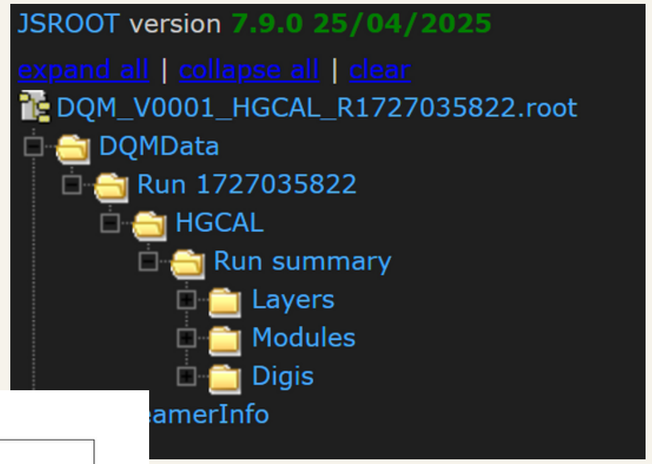
- Creation of geometrical templates
- Implementation of the templates into the DQM “slow stream”
- Independence of Fast and Slow streams of DQM
- Works on the TPG data unpacking and indexing

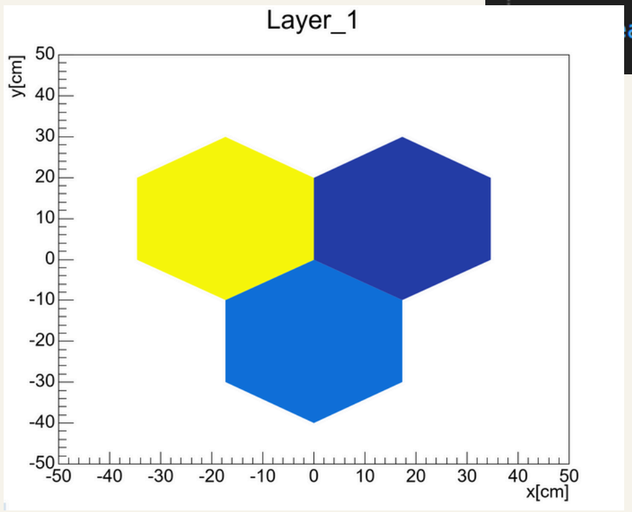
STATUS QUO

1. The implementation was hard coded to visualize the 2024 test beam data.

2. Not scalable: The layout of the DQM did not lend itself for a detector of O(30k) modules.

3. Fast stream data (Errors, EconD payloads) was not implemented or it took structures created by the slow stream.





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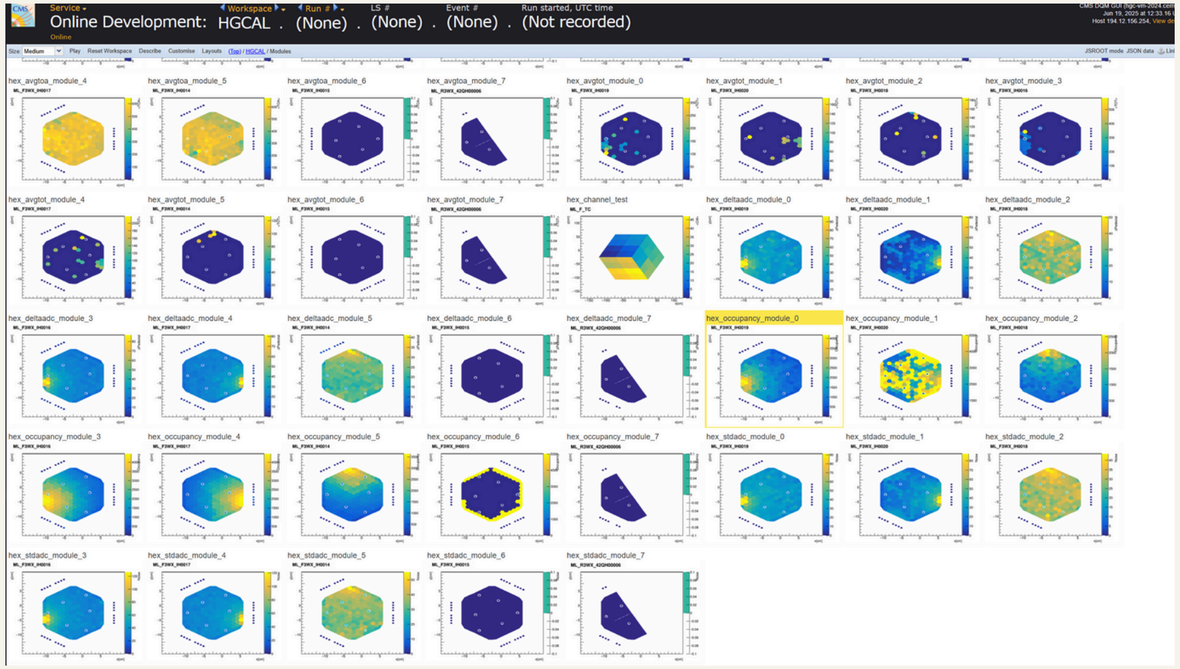
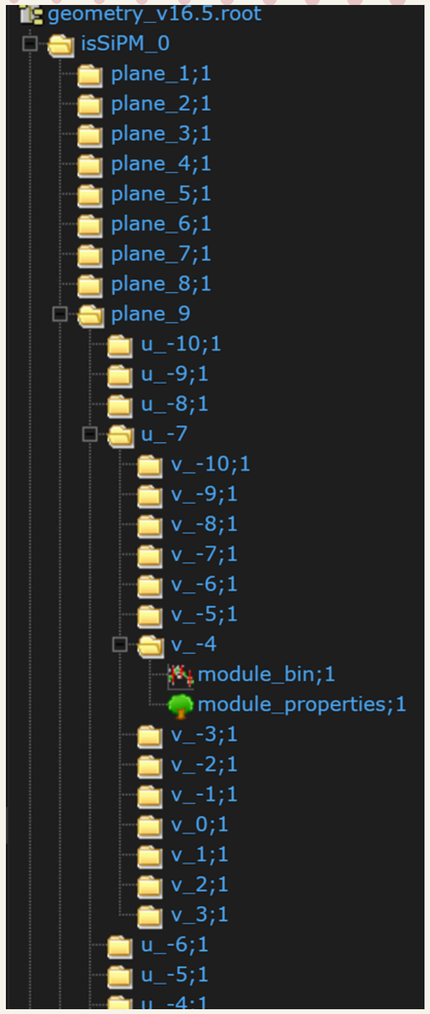
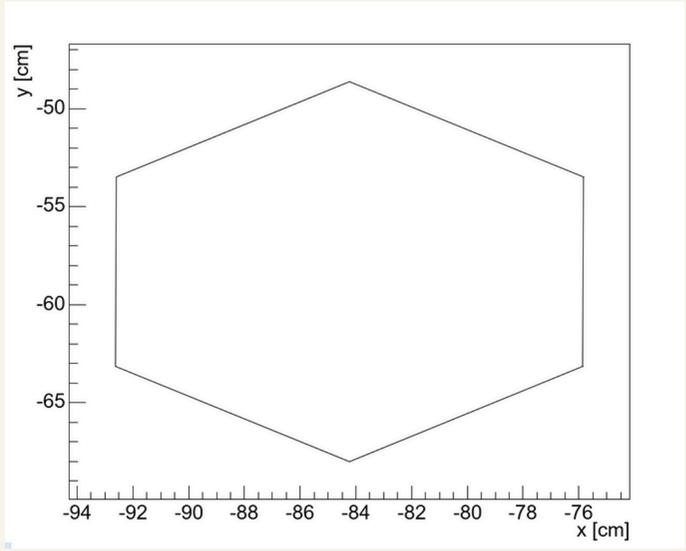


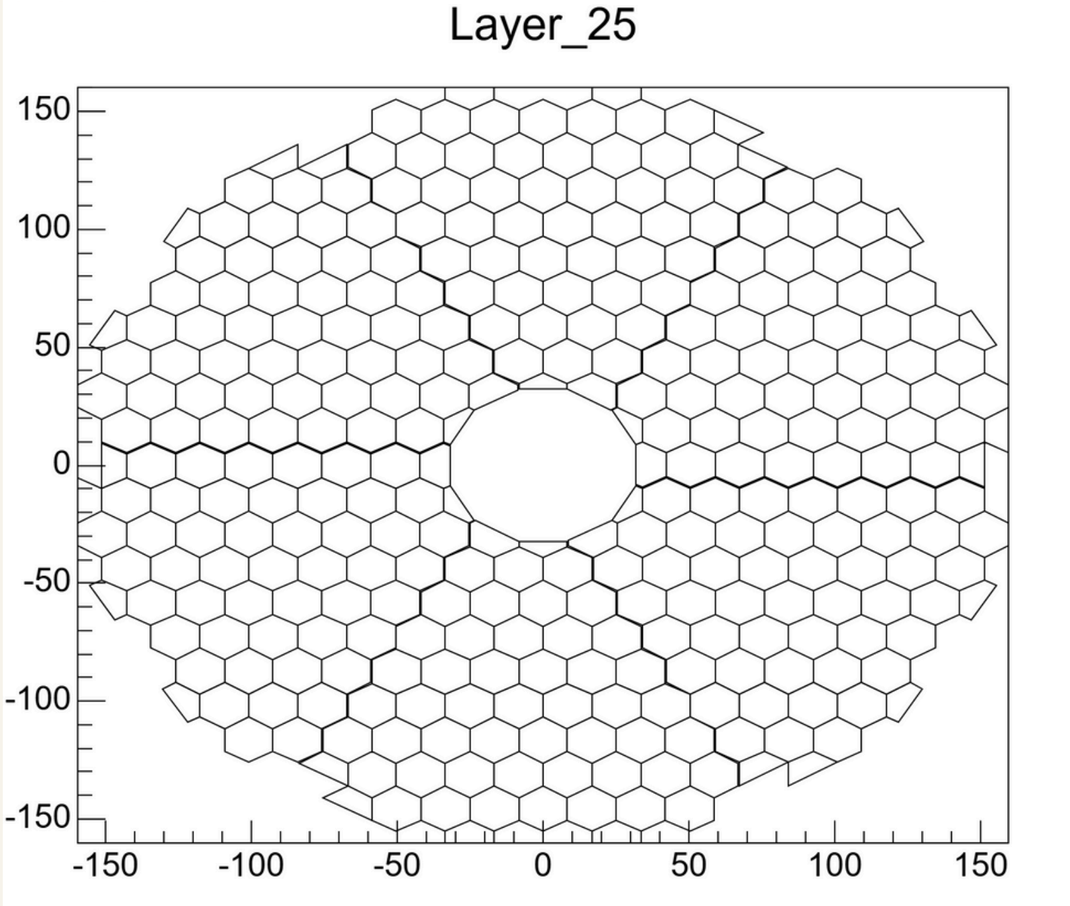
GEOMETRY TEMPLATES





Implemented a template global geometry file that works in tandem with the module locator in order to plot the data in a geometrical manner.

GEOMETRY TEMPLATES



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IMPLEMENTATION INTO DQM

Geometry

Using this geometry template now with the help of the module locator I can plot the data coming from the locator in the correct geometrical position.

Readability

To improve navigation in this DQM it’s structure was redesigned to be from general to detailed.

GEOMETRY

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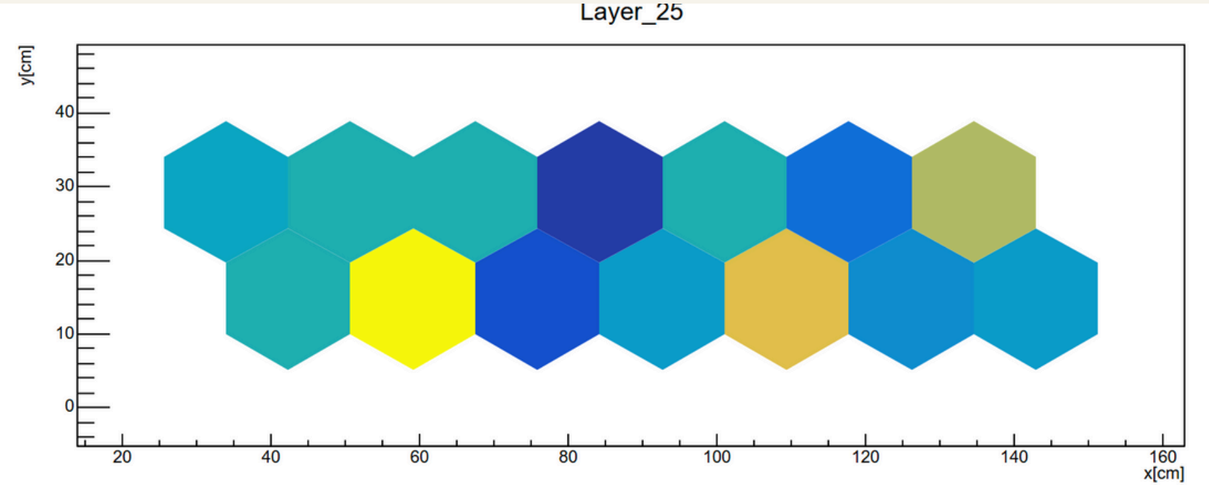

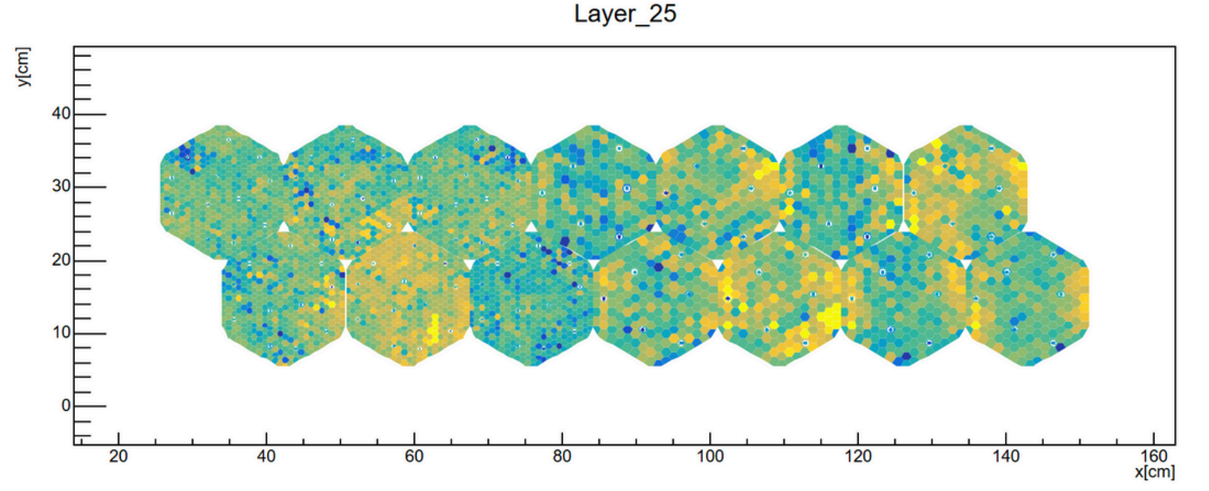

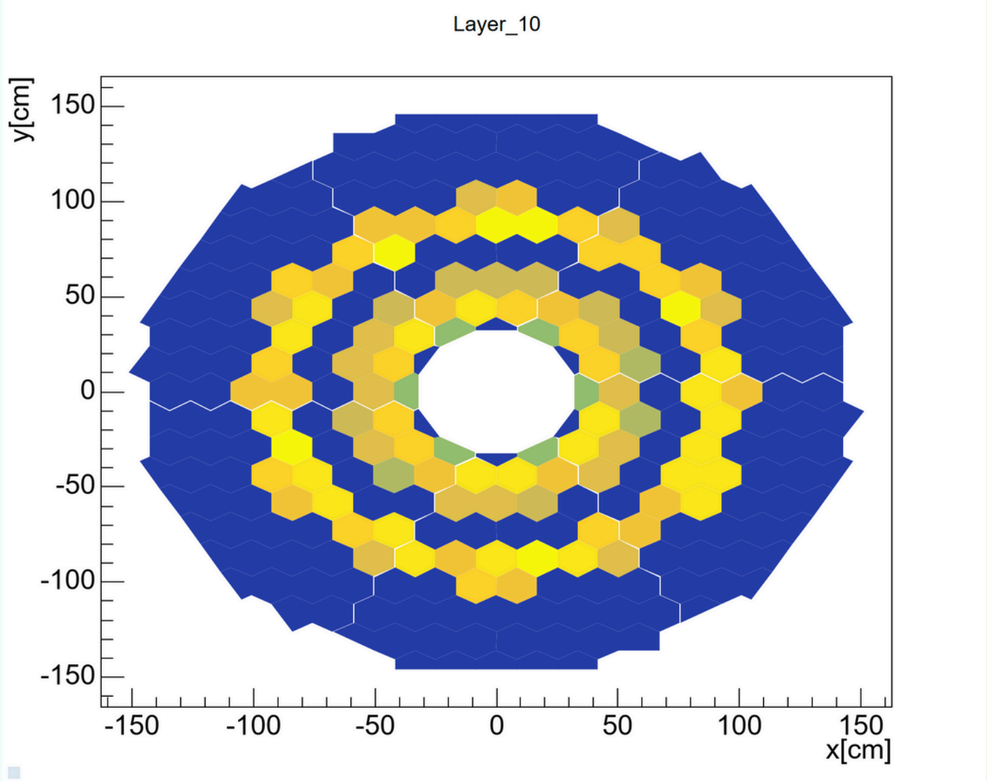

NAVIGATION

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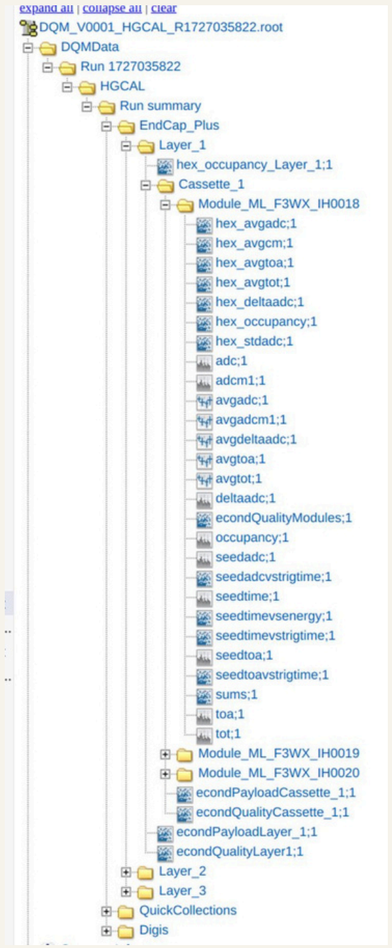

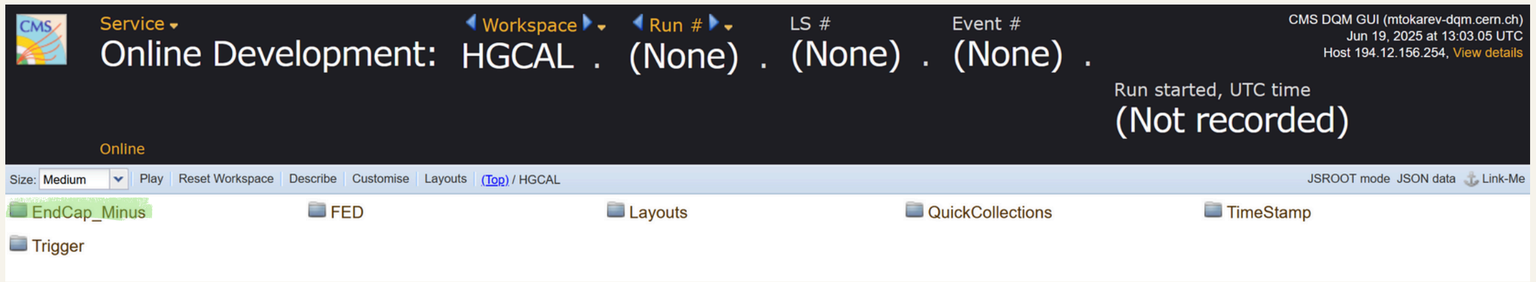

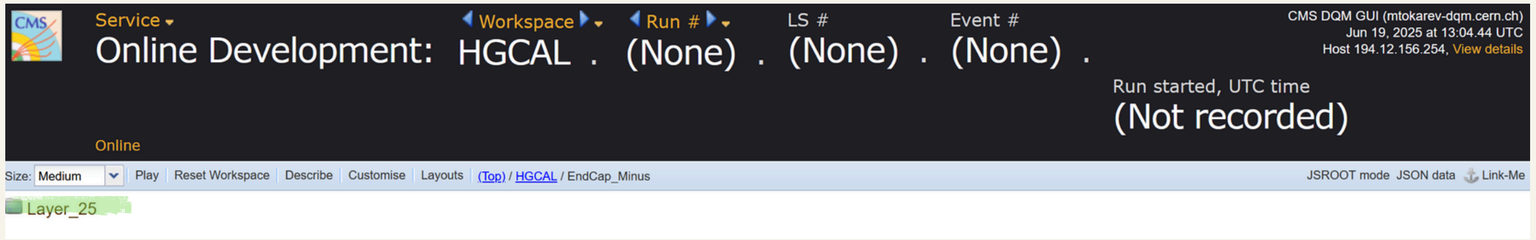

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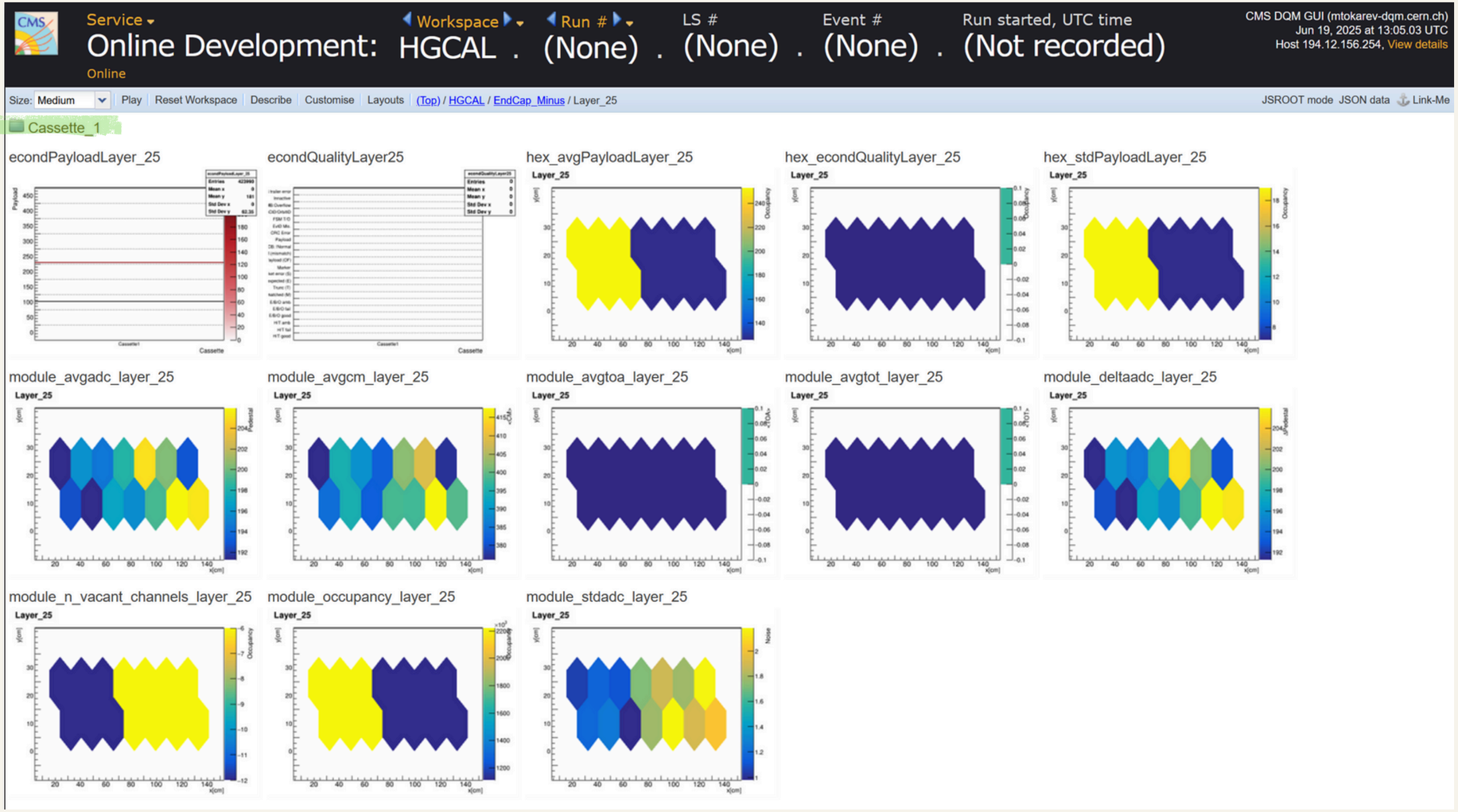

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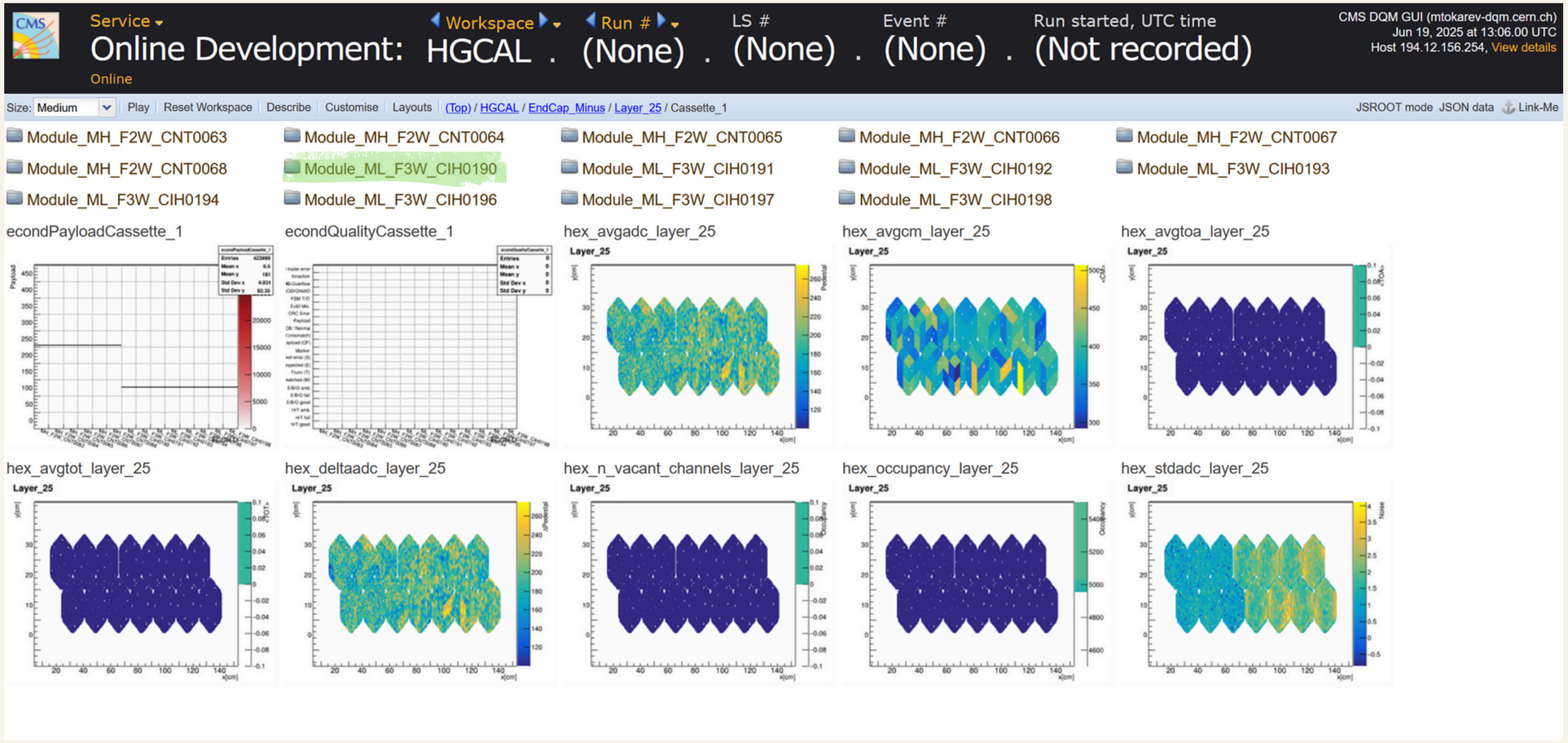
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Online
Workspace
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LS #
Event #
Run started, UTC time
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Jun 19, 2025 at 13:06.00 UTC
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Size: Medium
Play
Reset Workspace
Describe
Customise
Layouts
(Top) / HGCAL / EndCap_Minus / Layer_25 / Cassette_1
JSROOT mode
JSON data
Link-Me
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Module_MH_F2W_CNT0064
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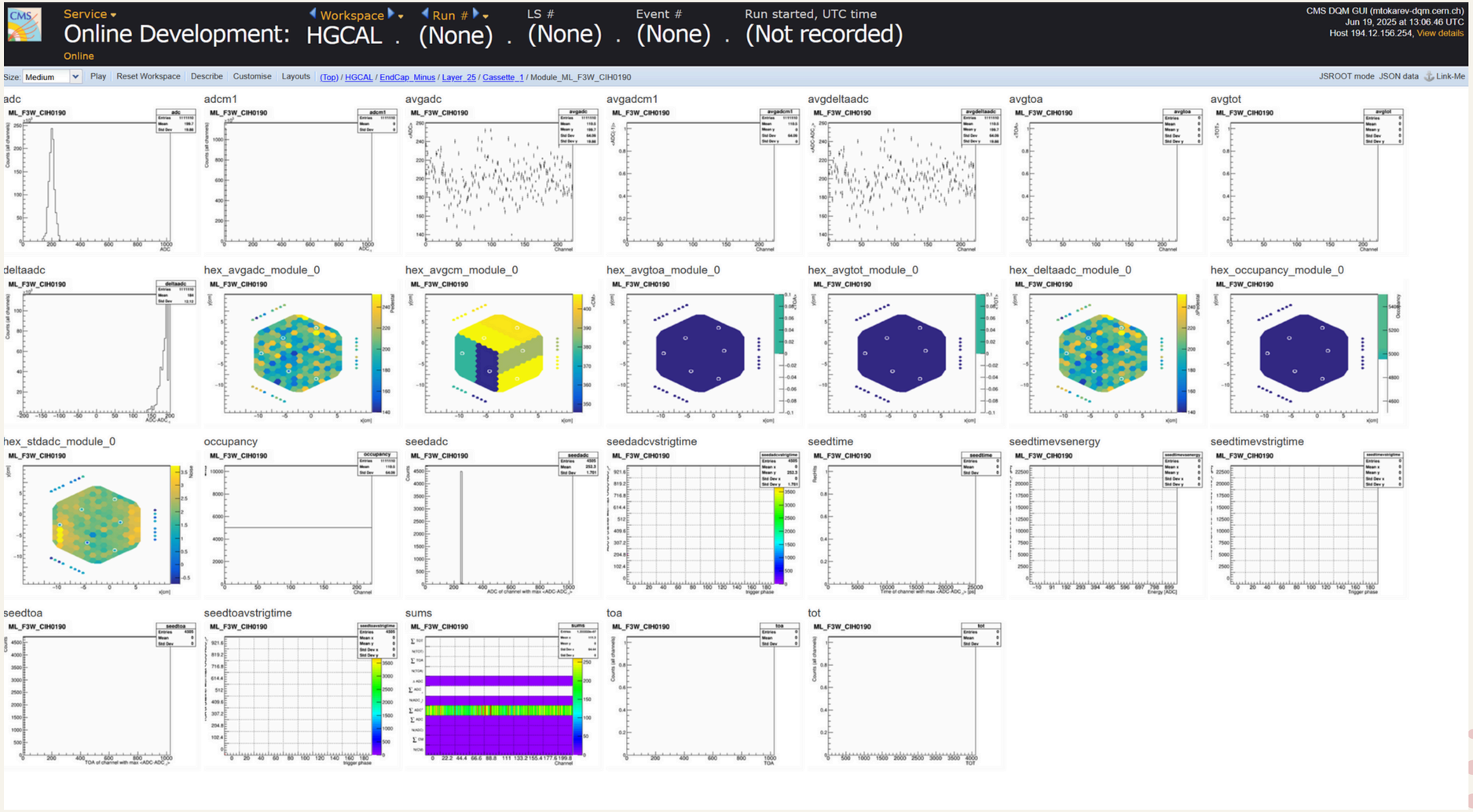
NAVIGATION



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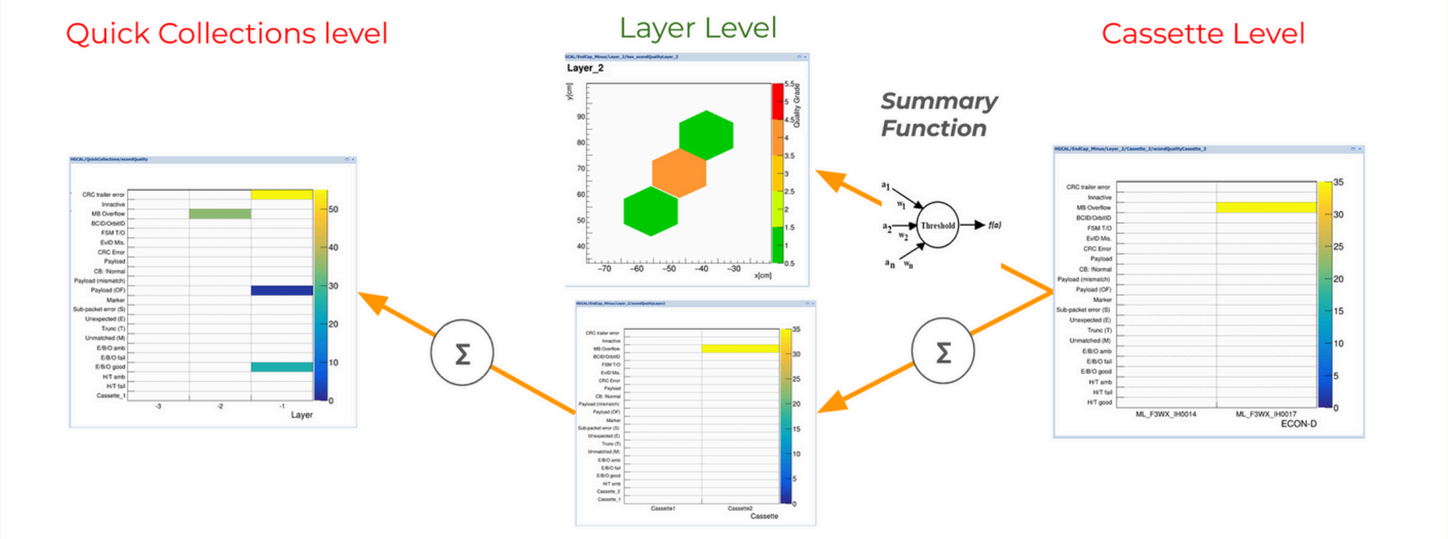
INDEPENDENCE OF FAST AND SLOW STREAMS

While I was working on the Slow stream data visualization, there was a development of the Fast stream DQM, which collects the overview data for each module without having to process each channel of the detector. Therefore a merge was done ensuring that it could run independently as this Fast stream is the precursor to the Online DQM.

ERROR MONITORING PROPAGATION IN DQM

During this merger, a data propagation system was being developed for the fast stream, so that we cout summarize the lower level module plots into the cassette and the layer plots.



TRIGGER PRIMITIVES GENERATORS

As the data volume of the LHC experiments is too large, trigger systems are used to only save the physics-ly interesting events, the first step of this trigger being the trigger primitive, which in HGCal, gives a quick summary of the energy deposited in each module and it's location.

TRIGGER PRIMITIVES DQM

More recently we move into the DQM system for the HGCal TPG, because, as with the DAQ, this system is hard coded in many places to accept the data from the 2024 beam tests.

FIRST STEPS TOWARDS TPG DQM

The first step to unwrap the Trigger Primitive Generation (TPG) data is to create a module mapper which will read a set of configuration files and give and index to each module and channel in the system.

Cell Mapper

Takes a Cell Map with the cells of each module type and generates an index for each cell.

Module Indexer

Takes a module locator with the electronic and geometric coordinated of the modules in the setup and generates an index for each module and cell.

TO BE DONE

1. Finish and test the TPG moduleIndexer
2. Edit the unpacking as to make use of the indexer
3. Use the unpacked data with the indexer to generate DQM files for TPG data
4. Generate wafer template files for the Trigger Channels.

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THANK YOU

Presented By : Mijail Tokarev

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