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Automatic data processing for prompt calibration of the CMS ECAL

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The CMS ECAL has achieved an impressive performance during the LHC Run1 and Run2. In both runs, the ultimate performance has been reached after a lengthy calibration procedure required to correct ageing-induced changes in the response of the channels. The CMS ECAL will continue its operation far beyond the ongoing LHC Run3: its barrel section will be upgraded for the LHC Phase-2 and it will be operated for the entire duration of the High Luminosity HLC program. With the increase of instantaneous luminosity, the ageing effects will increase, and so will the required frequency of calibrations: it is therefore crucial for the CMS ECAL community to reduce the time and resources needed for this task, in order to ensure with limited personpower a smooth operation and excellent performance on the long term. A new system has been developed during the LHC second long shut down to automatically execute the calibration workflows on a daily basis during the data taking. The new system is based on industry standard tools (Openshift, Jenkins, Influxdb, and Grafana) and provides a general interface to orchestrate standalone workflows written in different programming languages. It also provides interfaces to other existing CMS systems to steer the processing of selected data streams and to upload newly computed calibration into the database used for the data processing for physics analyses. The new system is designed with the ambitious goal of cutting the time needed to provide the best possible performance for physics analyses by one order of magnitude. The system offers an extensive suite of diagnostic tools that provide a constant monitoring of its status as well as the option to send alerts in case of problems. In this talk, the general structure of the system will be presented, along with the results from the first year of operation. The detail of the monitoring and alert system will also be discussed.

Significance

The presentation will discuss a profound change in how detector calibration is performed (on the computational side) in the CMS ECAL. Despite continuos and autonomous calibration system are wide spread in HEP experiments, with this work we pushed the automation boundaries to include the high level refinements that are usually computed only after data-taking. Another crucial aspect is the versatility of the system, which provide simple interface to integrate existing calibration workflows rather than requiring a complete re-writing of existing code. As such the system can be easily ported to other experiments.
The system is currently in the commissioning phase, the experience we have been gaining during this first year of operation will pave the way for the design of a more general system for the calibration of the CMS detector during HL-LHC.

References

Experiment context, if any

CMS, LHC

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