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An Autoencoder-based Online Data Quality Monitoring for CMS ECAL

Thursday, 27 October 2022 17:20 (20 minutes)

The online Data Quality Monitoring (DQM) system of the CMS electromagnetic calorimeter (ECAL) is a vital operations tool that allows ECAL experts to quickly identify, localize, and diagnose a broad range of detector issues that would otherwise hinder physics-quality data taking. Although the existing ECAL DQM system has been continuously updated to respond to new problems, it remains one step behind new and never-before-seen issues. As the ECAL electronics continue to age, previously rare and obscure failure modes have become more common, emphasizing the need for a more robust anomaly detection system. Using unsupervised deep learning, a real-time autoencoder-based anomaly detection system is developed that is able to detect ECAL anomalies unseen in past data. After accounting for spatiotemporal variations in the response of the ECAL, the new system is able to efficiently detect anomalies while maintaining an estimated false discovery rate between 10^{-2} to 10^{-4}, besting existing benchmarks by several orders of magnitude. The real-world performance of the system is validated using anomalies found in 2018 data taking and with early data taken from 2022 collisions.

Significance

This presentation will show results from the Ecal Endcaps not previously presented and new results from early Run 3 data which shows the live performance of the auto encoder DQM system which was trained on Run 2 data.

References

Previously presented at APS April 2022 meeting: https://meetings.aps.org/Meeting/APR22/Session/X09.5

Experiment context, if any

CMS

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