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## Machine Learning models to enhance CMS Pixel Barrel Data Quality

The CMS Pixel Detector in Run 3 (about 2 thousand silicon modules) has a fundamental role in tracking and vertexing. Given the detector's aging and potential operational incidents, constant monitoring of its components is essential to ensure the highest data quality. Typically, the Offline Data Quality Monitoring for the CMS Tracker relies on the human inspection of hundreds of histograms, to classify data as Good or Bad for physics analyses. However, this process is prone to human error, such as oversights, misinterpretations, or subjective assessments. Additionally, the GUI which collects the histograms, provides an integrated view across all the run (hours of data-taking), making it difficult to spot short and localized errors. In 2024, CMS has deployed the DIALS platform, with a GUI hosting few selected histograms for each LumiSection (LS): 1 LS is about 23 seconds of data-taking. With LS-level data, it is now possible to complement the human checks with Machine Learning (ML): this approach allows the automatization with ML models and enables data quality checks at LS-level. Specifically, AutoEncoder models developed for the CMS Pixel Barrel have successfully identified short anomalies (about 1 minute) hidden within hours of data, which were previously missed by the human inspection. These LS with anomalies in the Pixel Barrel (with a significant effect on Tracking) have been discarded, improving the overall data quality, with a minimal impact on the integrated luminosity. Integrating ML models into the Data Quality workflow has significantly improved anomaly detection, resulting in more effective and reliable data certification during Run 3.

### Would you like to be considered for an oral presentation?

No

**Author:** ASCIOTI, Maria Elena (Universita e INFN, Perugia (IT))

**Presenter:** ASCIOTI, Maria Elena (Universita e INFN, Perugia (IT))

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