Contribution ID: **539** Type: **Poster**

Improving the Quality Control of new detector components using Machine-Learning-based Anomaly Detection techniques

New detector concepts are necessary in order to uncover the physics Beyond the Standard Model. As the need for optimal detector performance increases, ensuring the best Quality Control (QC) for the new components is more important than ever. Among the aspects of detector QC, the Visual Inspection of components is a major procedure both in term of time and complexity. This is especially the case when the number of measurement channels is expected to increase as the resolution of detectors is improving.

I propose a new framework for the Visual Inspection of new detector components based on ML-based Anomaly Detection techniques. Since it relies on the analysis of high resolution component images, AI techniques inspired by Computer Vision algorithms are good candidates to improve this process. This framework is implemented and tested in the context of the production of the new Inner Tracker (ITk) to be deployed in the ATLAS experiment for the High Luminosity upgrade. The objective is to improve the efficiency and reliability of the Visual Inspection of components, ensuring a better overall quality of the future detector while shortening the analysis time of the images. I will show the latest results and developments, as well as the future prospects offered by such a framework.

Secondary track

T16 - AI for HEP (special topic 2025)

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Session Classification: Poster T11

Track Classification: T11 - Detectors