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Kicker pulse generator anomaly detection for reliability improvements through advanced machine learning

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Reliability, availability and maintainability are parameters that determine if a large-scale accelerator system can be operated in a sustainable and cost effective manner. Beam transfer equipment such as kicker systems are critical components with potential significant impact on global performance of the entire machine complex. Identifying the root cause of a malfunction can be a challenging and tedious task due to the always increasing complexity of such systems. Manual extraction and analysis of this information seems excluded for a future collider with more systems and an even higher complexity.
The use of Artificial Intelligence (AI) models can assist in this task leveraging existing frameworks and libraries for machine learning. A collaboration between CERN and the University of Leuven (KU Leuven) was founded to conduct such a research for an existing data set. A subset of historical data from the LHC logging database is used and logged data of the LHC injection kicker magnet pulse generators has been chosen as a first case study. The goal is to apply supervised and unsupervised learning techniques from open-source libraries such as the Scikit-learn Python library to extract useful features to create a model that detects anomalies without human interaction, both on historical data as live data from the equipment. The status and outlook of this research are presented.

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