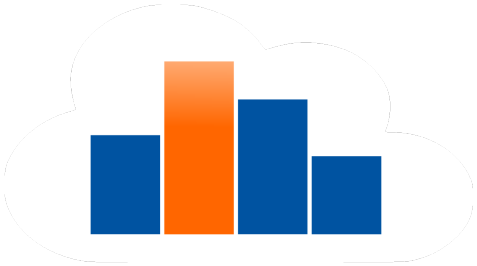

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Application of SWAN to the LHC Signal Monitoring Project

Friday, 11 October 2019 15:00 (20 minutes)

The Large Hadron Collider is a complex machine composed of many interconnected systems serving a broad scientific community. Although its performance has been a considerable achievement, there have been already several cases of hardware deterioration. An early detection of fault precursors reduces the fault severity and facilitates maintenance planning. To this end, LHC undergoes a rigorous testing during the Hardware Commissioning campaigns prior to restarting operation. However, LHC systems are not extensively monitored during operation while the signals representing LHC systems have been continuously logged. Hence, there is a lot of data in terms of volume and variety which can be used to gather information about reference values of signals for the most critical systems. Signal features engineered this way will serve as a feedback on the performance evaluation design decisions and support the predictive maintenance.

The LHC Signal Monitoring project aims at monitoring signals in order to detect deviation from standard operating values. In other words, we aim at introducing predictive maintenance capabilities for LHC. The project scope includes superconducting circuits (magnets, busbars, power converters, protection devices, etc.). To this end, the project is divided into three stages: signal exploration, signal analysis, and signal monitoring. The first two stages involve accessing various signal databases (Post Mortem, CALS, NXCALS) and numerous iterations of feature extraction and signal processing algorithms for which SWAN is a suitable environment.

In this contribution, we will present selected notebooks and share our experience in using SWAN by a team of engineers analysing electrical signals of superconducting circuits. An important aspect of the collaborative environment is our software stack enabling versioning of code, automatic testing, generation of documentation, and packing of our API.

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