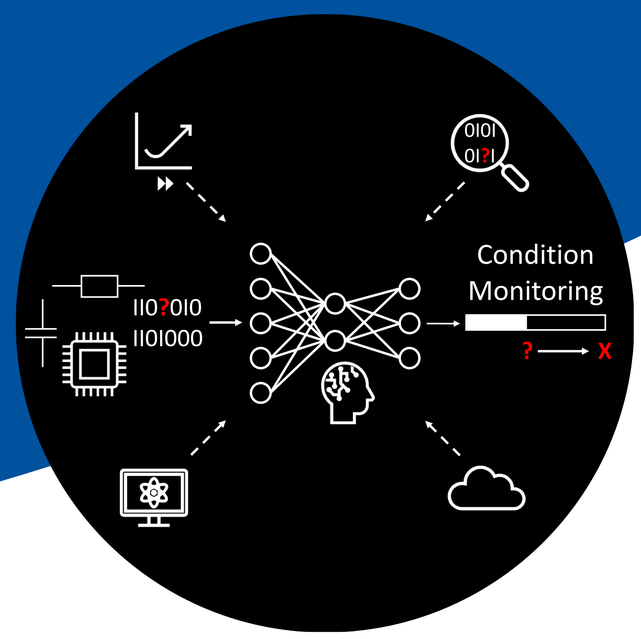
UNI STUTTGART

Reliability Department

Data-driven condition monitoring of electronic systems



Motivation

Safety-critical electronic systems must meet high requirement levels in terms of reliability and availability. Predictive maintenance strategies help avoiding unexpected failures and ensuring high reliability and availability over the entire lifetime of the system. Data-driven methods enable simultaneous condition monitoring of decentralized systems with numerous units. Knowing the system‘s specific health then allows scheduling targeted maintenance actions. This is particularly challenging for electronic systems, as the characteristics relevant for condition montoring are often highly complex.

Project objectives

Machine learning algorithms allow detection of anomalous data events in historical datasets collected during operation of electronic systems. To make detected anomalies useful for predictive maintenance strategies it is crucial to link the detected events to the systems condition and degradation. By integrating physical system knowledge into machine learning algorithms, failure precursors relevant to condition monitoring are identified and made detectable in data sets. This is done by analyzing the evolution of system characteristics prior to failures, enabling an assessment of anomalies with respect to system health.

Application

The European Organization for Nuclear Research (CERN) builds, maintains, and operates a variety of particle accelerators and experiments that might generate ionizing radiation. To protect people and the environment from unjustified exposure, radiation monitoring systems, such as CROME, are used to continuously monitor the hazard levels. As an occupational safety system, it is crucial to keep the failure rates of CROME devices at an extremely low level through appropriate maintenance measures. Here, data-driven methods enable simultaneous condition monitoring of all units located along the accelerator chain to schedule predictive maintenance actions.

Figure 1: Radiation monitoring system CROME at CERN. [Graphic: © CERN]

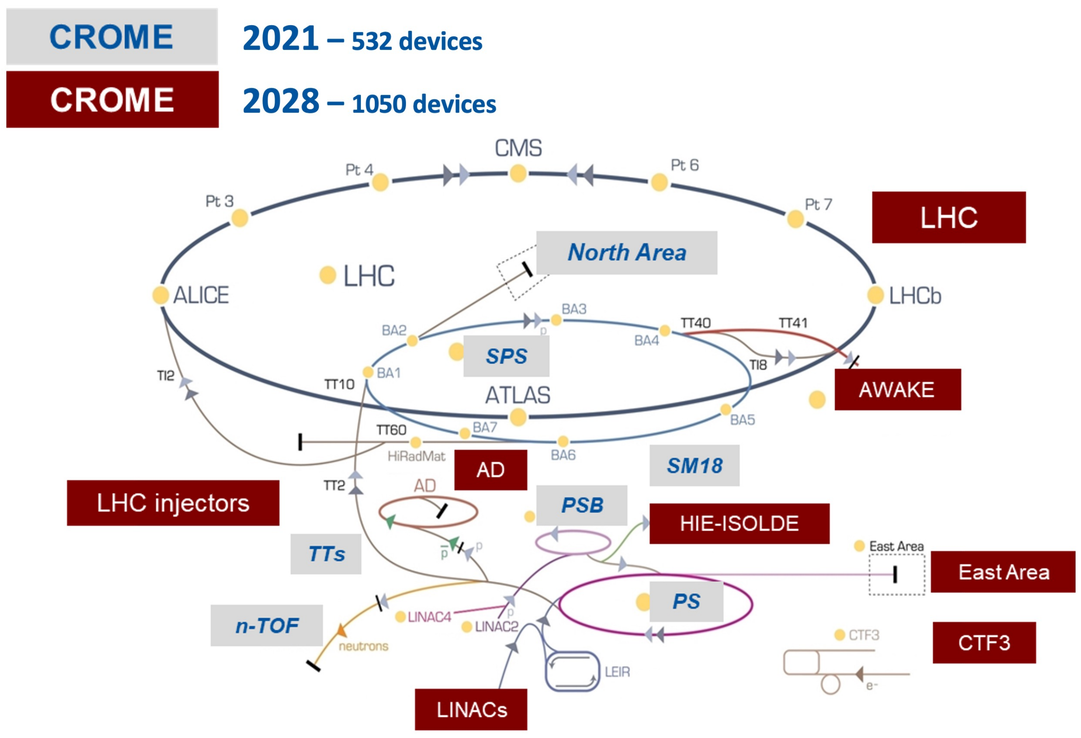


Figure 2: Schematic illustration of particle accelerator and experiment complex at CERN. Highlighted areas show current or planned usage of the CROME system. [Graphic: © CERN]

Cooperation with:

CERN | HSE Occupational Health & Safety and Environmental Protection unit

University of Stuttgart
Institute of Machine Components
www.ima.uni-stuttgart.de

felix.waldhauser@ima.uni-stuttgart.de
Institute of Machine Components
Reliability Department

Pfaffenwaldring 9, 70569 Stuttgart, Germany

SPONSORED BY THE
Federal Ministry of Education and Research