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Early prediction of system failures at Los Alamos Nuclear Science Center

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Accelerators are complex systems composed of tens of thousands of individual components requiring continuous maintenance. Aging facilities such as LANSCE face an increased rate of equipment failures, resulting in costly unscheduled shutdowns for maintenance. Early identification and localization of problems along the accelerator can mitigate future failures during scheduled maintenance periods rather than emergency shutdowns. This approach will significantly enhance the facility's reliability and increase beam availability for users. We have developed a mathematical formalism to analyze all available data for a LANSCE subsystem and generate signals indicating abnormal operation. The system accounts for hidden internal correlations between various parameters. This predicted deviation from the norm is supported by historical records in log files. We report progress on developing an anomaly detection system for LANSCE by expanding predictions to all subsystems, increase LANSCE's data archiving capability by an order of magnitude, and developing algorithms to provide operators with signals indicating developing abnormalities and pinpointing problematic beamline elements.

Footnotes

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