








Uncertainty aware anomaly detection to predict errant beam pulses in the SNS accelerator

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High-power particle accelerators are complex machines with thousands of pieces of equipment that are frequently running at the cutting edge of technology. In order to improve the day-to-day operations and maximize the delivery of the science, new analytical techniques are being explored for anomaly detection, classification, and prognostications. As such, we describe the application of an uncertainty aware Machine Learning method, the Siamese neural network model, to predict upcoming errant beam pulses using the data from a single monitoring device. By predicting the upcoming failure, we can stop the accelerator before damage occurs. We describe the accelerator operation, related Machine Learning research, the prediction performance required to abort beam while maintaining operations, the monitoring device and its data, and the Siamese method and its results. These results show that the researched method can be applied to improve accelerator operations.