Background

Modern particle accelerator facilities face increasing demands on their operational performance and generate large amounts of data. These datasets can be difficult to visualize and may contain complex relationships that are challenging to understand. Additionally, as the demand on accelerator operations increases, so does the need for “augmented intelligence” – the ability to extract richer information from current data sources. To meet these needs, we propose to develop a web-based toolbox for the development of smart-alarm systems and the analysis of large complex datasets. This toolbox creates a common platform for analysis and simulation. By providing meaningful tools to the operators, scientists, and engineers, we will help particle accelerator facilities improve their operational efficiency and ensure supply meets demand.

Scope of Work

This project will develop fault detection algorithms using the CEBAF polarized electron source. The CEBAF injector is particularly well-suited test for testing these algorithms due to the relative ease of data collection and the wide range of different fault scenarios. In order to build our "smart alarm" system we will work with expert operators to generate a labeled dataset. We will then develop a ML based alarm system that will be tested on the machine during year 2.

Tasks

Year 1: Collect data from the CEBAF polarized electron source. This dataset will consist of tuning errors due to the laser position on the cathode, the beam transport optics, the Wien Filters, the chopper and bunching cavities, and the capture cavity. The data will be collected during the end of the first year by JLab scientists and operators, with assistance from RadiaSoft.

Year 2: Test smart alarm application on the CEBAF injector during beam operations. During the second year of the project we will develop a graphical interface for our classifier tools that can be tested during operation. At the completion of this task we will have an operational smart alarm system that provides real time classification of the machine state for the CEBAF injector.