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Integrating Machine Learning in the Brookhaven Control System with Badger

The Brookhaven Pre-injector Accelerator Facility, which serves RHIC, NSRL, BLIP, and the future EIC, requires occasional tuning of its transfer beam line optics by control room operators to optimize parameters like beam current and emittance. Machine learning (ML) can significantly speed up this tuning process by helping operators quickly identify optimal settings. To facilitate this, ML algorithms must be seamlessly integrated into the control system and accessed through a consistent, familiar interface. We explore this approach using the Badger software stack, which provides a user interface built atop Xopt, a comprehensive package of advanced ML optimization algorithms. This paper presents our experience in developing Badger plug-ins for transfer beam line optimization and interfacing with multinet, a non-EPICS control system, to streamline tuning and enhance operational efficiency.

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