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Application of Bayesian optimization to BtA injection at BNL

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Drifting optimal settings and changing working conditions force accelerator operators to keep re-tuning control systems. At BNL, the RHIC injector complex accelerates many different ion species by varying a multitude of control knobs. In this report, we investigate the use of Bayesian optimization (BO) of the Booster-to-AGS (BtA) transfer line to maximize the beam brightness in the AGS. The most suitable magnets were chosen by an investigation of the betatron phase advance to facilitate an efficient BO process, using up to 4 steering magnets and up to 4 quadrupoles. To quantify the beam intensity, we used an integrated current transformer, while the beam emittance was estimated via an Ionization Profile Monitor (IPM). It was demonstrated that the chosen magnets effectively recovered a high intensity beam from a poorly tuned configuration, using an Xopt implementation of BO, without increasing the beam profile. A new electron-collecting IPM is being configured with better systematics and lower noise compared to the current ion-collecting IPM, which can further improve this process.

Footnotes

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