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Bayesian optimization for beam centroid correction at ISAC

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Tuning of radioactive beams in a post-accelerator facility such as TRIUMF's ISAC involves a considerable amount of overhead and often leads to tunes which diverge from the theoretical optimum for the system, introducing undesirable effects such as aberrations or chromatic couplings. We hereby present the development and application of a Bayesian Optimization algorithm for corrective transverse steering of the low-energy electrostatic beam transport optics; specifically through the polarizer beamline, which contains a 2-metre section where beam can be electrically neutralized, to the beta-NMR experiment. This work holds promise for enhancing the efficiency and reliability of beam delivery at ISAC, supporting TRIUMF's scientific mission. Current developments involve multi-objective Bayesian Optimization using beam profile monitors and eventual integration of other diagnostic devices, such as CCD cameras. The developments presented herein aim to enable autonomous tuning methods, facilitating user-friendly operation by operators.

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