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Automated optimization of accelerator settings at GSI

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The complexity of the GSI/FAIR accelerator facility demands a high level of automation in order to maximize time for physics experiments. Accelerator laboratories world-wide are exploring a large variety of techniques to achieve this, from classical optimization to reinforcement learning. This paper reports on the first results of using Geoff at GSI for automatic optimization of various beam manipulations. Geoff (Generic Optimization Framework & Frontend) is an open-source framework that harmonizes access to the above automation techniques and simplifies the transition towards and between them. It is maintained as part of the EURO-LABS project in cooperation between CERN and GSI. In dedicated beam experiments, the beam loss of the multi-turn injection into the SIS18 synchrotron has been reduced from 40% to 10% in about 15 minutes, where manual adjustment can take up to 2 hours. Geoff has also been used successfully at the GSI Fragment Separator (FRS) for beam steering. Further experimental activities include closed orbit correction for specific broken-symmetry high-transition-energy SIS18 optics with Bayesian optimization in comparison to traditional SVD-based correction.

Footnotes

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