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Reinforcement learning approaches for parameter tuning in particle accelerators

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Recent developments at the INFN laboratories in Legnaro have demonstrated the effectiveness of Bayesian optimization in automating the tuning process of particle accelerators, yielding substantial improvements in beam quality, significantly reducing setup times, and shortening recovery times following interruptions. Despite these advances, the high-dimensional parameter space defined by numerous sensors and actuators continues to pose challenges for fast and reliable convergence to optimal configurations. This paper proposes a machine learning-based framework that combines surrogate modeling of the accelerator with reinforcement learning strategies for closed-loop optimization, with the goal of further accelerating commissioning procedures and enhancing beam performance.

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Footnotes

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