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Injection optimization via reinforcement learning at the cooler synchrotron COSY

Wednesday, 10 May 2023 16:30 (2 hours)

It is crucial to have a particle beam with high intensity and small emittance in a timely manner. The main challenges restraining the availability of the beam to the user and limiting the beam intensity in storage rings are a lengthy optimization process, and the injection losses. The setup of the Injection Beam Line (IBL) depends on a large number of configurations in a complex, non-linear, and time-dependent way. Reinforcement Learning (RL) methods have shown great potential in optimizing various complex systems. However, unlike other optimization methods, RL agents are sample inefficient and have to be to be trained in simulation before running them on the real IBL. In this research, we train RL agents to learn the optimal injection strategy of the IBL for the Cooler Synchrotron (COSY) at Forschungszentrum Jülich. We address the challenge of sim-to-real transfer, where the RL agent trained in simulation does not perform well in the real world, by incorporating domain randomization. The goal is to increase the beam intensity inside COSY while decreasing the setup time required. This method has the potential to be applied in future accelerators like the FAIR facility.

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Footnotes

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Yes

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