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Trajectory steering for DC beams at the CERN SPS using reinforcement learning based on intensity measurements

Thursday 5 June 2025 15:30 (2 hours)

The slow extracted beams at the CERN Super Proton Synchrotron (SPS) are transported over several 100 m long transfer lines to three targets in the CERN North Area Experimental Hall. The experiments need intensity fluctuations to be entirely eliminated over the roughly 5 s particle spill, requiring full debunching of the extracted beams. In this environment, secondary emission monitors (SEMs) have to replace the conventional beam position monitoring systems that rely on RF structure, with the intensity difference on split secondary emission foils used to indicate the beam position. Traditional trajectory correction algorithms however fail when the beam ends up on a single foil. This paper summarises successful first tests with reinforcement learning (RL) to learn to correct the trajectory based on foil intensity measurements. The RL agents were trained in simulation and then successfully transferred to the real accelerator environment. Results of the application of the trained RL agents for the alignment of moveable split foils in front of the targets will also be presented.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

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Author: KAIN, Verena (European Organization for Nuclear Research)

Co-authors: SCHENK, Michael (Ecole Polytechnique Fédérale de Lausanne); BRUCHON, Niky (European Organization for Nuclear Research)

Presenter: KAIN, Verena (European Organization for Nuclear Research)

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