

Crystal Channelling Optimisation in the LHC Using Reinforcement Learning

Tuesday, 31 March 2026 12:00 (2 hours)

The Large Hadron Collider (LHC) requires a collimation system to ensure safe operation with both proton and heavy-ion beams. As of 2023, a crystal collimation scheme using bent silicon crystals was introduced to improve the collimation efficiency for heavy-ion beams. However, drifts in the crystal angular position led to the loss of cleaning performance during physics fills. These drifts are thought to derive from mechanical deformation of the goniometer due to heating caused by beam impedance effects. A quadratic-fit based optimiser was deployed to compensate for such drifts using feedback from beam loss monitors. This paper details the simulation environment to train reinforcement learning agents to maintain the optimal channelling position with increased reliability and reduced convergence time, and presents the latest results obtained with lead ion beams.

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