

ML-Based Phase Space Reconstruction for Loss Reduction at the PS-to-SPS Transfer

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

The beam intensity in the injector chain at CERN has been nearly doubled as part of the upgrades for the High-Luminosity LHC (HL-LHC). This presents multiple operational challenges. A critical bottleneck is the uncaptured beam created during the transfer from the Proton Synchrotron (PS) to the Super Proton Synchrotron (SPS). Tomographic reconstruction of the longitudinal distribution during bunch compression in the PS has been shown to be effective for predicting losses in the SPS and optimizing PS extraction timing. However, its computational demands currently prohibit live multi-bunch analysis. A machine learning approach to reconstruct the longitudinal phase space from bunch profile data during bunch compression in the PS to enable real-time analysis of bunch trains is presented. This supervised neural network provides the basis for a tool that could autonomously optimize RF parameters to minimize losses due to uncaptured beam in the SPS.

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