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Characterisation of transverse beam losses at the SPS and first steps for a collimation system design

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The High-Luminosity LHC (HL-LHC) project foresees nearly doubling the design beam intensity of CERN's Large Hadron Collider (LHC). A particularly pressing issue for this is the observation of significant beam losses at the flat bottom in the Super Proton Synchrotron (SPS) that delivers these beams to the LHC. These losses arise from multiple factors: uncaptured beam losses that are generated during the bunch rotation in the Proton Synchrotron (PS) prior to transfer; large transient beam loading effects during multi-turn SPS injections; and the diffusion of over-populated transverse tails, which reach the aperture limitations. To better understand these losses, dedicated beam measurements were performed in the SPS. These studies aimed to disentangle the various loss mechanisms, with a focus on the tail populations and potential correlations between transverse and off-momentum tails. This paper presents the results of these measurements and discusses the potential need for new hardware, specifically a dedicated collimation system, to address these challenges.

Footnotes

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