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Investigations of losses on the CERN SPS flat bottom with HL-LHC type beams

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The High-Luminosity LHC (HL-LHC) project at CERN aims at doubling the beam intensity and the brightness. To achieve this unprecedented performance, the LHC injectors were upgraded during the Long Shutdown 2 (2019-2021) to overcome limitations such as space charge and beam instabilities. Despite these upgrades, the reduction of beam loss on the flat bottom in the Super Proton Synchrotron (SPS) to reach the target beam parameters remains a challenge, avoiding unnecessary activation. Losses are due to several factors: uncaptured beam in the SPS due to the bunch rotation in the Proton Synchrotron (PS) prior to the transfer, large transient beam loading during multiple SPS injections, and transverse tails reaching aperture limitations. Investigations were conducted with HL-LHC beam parameters, aiming at disentangling the different sources of losses and defining specific observables. Finally, refining the optimal beam parameters for improved transfer between PS and SPS is the objective of the study, as well as the possible need for new hardware such as an additional RF system for beam stability and capture or a dedicated collimation system.

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Footnotes

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