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Transverse instabilities at injection energy in the CERN-SPS: lessons learned during high intensity studies

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Several studies have been performed in the 2021 and 2022 runs to build a better understanding of the behaviour of the accelerator with high intensity beams. Transverse beam instabilities at injection energy are known from previous measurements and simulations to be a potential limitation to reach the LHC Injectors Upgrade (LIU) target beam intensity. This paper summarizes the limitations introduced by transverse instabilities and the experience gained during 2021 and 2022 runs. Special emphasis will be given to the vertical coupled-bunch instability predicted by simulations and observed for the first time after the Long Shutdown 2 (LS2) during the 2021 run. This instability together with the horizontal one, which has been deeply characterized before LS2, is expected to impose constraints on the chromaticity, octupole current and tune working point. The stabilization strategy at the LIU intensity has been demonstrated during the 2022 run. Beam lifetime and quality for the explored operational settings will also be discussed.

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Footnotes

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Yes

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