

## Other Means to Increase the SPS 25 ns Performance - Longitudinal Plane

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At the end of the LHC run 2 in 2012 the 25 ns beam with an intensity of  $1.3 \times 10^{11}$  p/b was successfully accelerated in the SPS. Further significant increase of bunch intensity in the SPS requires that all LIU baseline upgrades are in place (for 200 MHz and 800 MHz RF systems and e-cloud mitigation), but even then the bunch intensity could be limited below the HL-LHC value of  $2.5 \times 10^{11}$  by beam-loading and longitudinal beam instabilities. In this paper other means to increase the 25 ns beam performance are considered. In particular, we study the potential gain in stability for bunches with larger longitudinal emittance at the SPS extraction, possible in the scenario with a 200 MHz RF system in the LHC. The expected longitudinal limitations (coupled-bunch instability, loss of Landau damping, microwave instability and RF power during the ramp) are analysed for a single and double RF operation and different optics (Q20, Q26 and intermediate one). Bunch rotation before extraction to the LHC is also addressed as a potential technique to decrease capture losses of long bunches in the LHC. Finally, the proposal for the related Machine Development sessions is also presented.

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