



Contribution ID: 88 Contribution code: THFA02

Type: Flash Poster Presentation

Applying radio frequency noise for longitudinal blow-up of debunched beam in the Large Hadron Collider

Thursday, October 23, 2025 2:05 PM (5 minutes)

The High-Luminosity upgrade of the Large Hadron Collider targets a yearly integrated luminosity of 300 fb^{-1} . Following several hardware upgrades, the bunch intensity is foreseen to be raised to $2.2 \cdot 10^{11}$ protons per bunch. The resulting beam loading poses a challenge for the main radio frequency (RF) system of the LHC. The limited RF capture voltage and an enlarged fraction of unbunched beam can not be avoided, leading to start-of-ramp losses that exceed the dump threshold. This contribution explores how to reduce these losses by injecting phase noise into the LHC RF system during the flat bottom. This band-limited RF noise can diffuse the particles outside the separatrix to higher momentum offsets. Together with the LHC collimation system, in principle, this method could help to clean out the debunched particles. An extensive campaign of simulations using the Beam Longitudinal Dynamics (BLonD) code has been performed to tune the frequency band of excitation and to predict the resulting cleaning efficiency of the proton beam in the Large Hadron Collider.

Footnotes

Research supported by the HL-LHC project.

Funding Agency

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Yes

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Session Classification: THFA WGs flash talks

Track Classification: WGA:Beam Dynamics in Rings