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Magnetic cycle optimisation in the CERN PS booster

Tuesday 3 June 2025 16:00 (2 hours)

The PS Booster is the first synchrotron in the CERN proton accelerator complex, which delivers both high-brightness and high-intensity beams. Injection to the Booster is at a kinetic energy of 160 MeV, therefore space charge is a main limiting factors for beam quality. Maximising the longitudinal emittance and adding a second, and sometimes third, RF harmonic are measures to decrease the line density and so reduce the effect of space charge. Nonetheless, beam loss and transverse emittance growth are still unavoidable at low energy. Recent studies have been focused on the possibility of adapting the magnetic cycle to further reduce the impact of space charge. With a faster ramp, the time spent in a high space charge regime is reduced but the available RF voltage limits the bucket area. Alternatively, with a slower acceleration the RF bucket area and longitudinal emittance can be increased, which will reduce the magnitude of the space charge detuning, but more time will be spent at low energy. This contribution explores the effects of different magnetic cycles on the beam and the possibility of further optimising the booster acceleration.

Footnotes

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