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Studies of beams with non-factorizable transverse beam distributions at the CERN PSB

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Beam profile measurements in the LHC injector complex show heavy tails in both transverse planes. From these profile measurements, it is not possible to determine if the underlying 4D phase space distribution is statistically independent. A measurement campaign in the CERN PSB was carried out to introduce cross plane dependence in bunched beams in controlled conditions, in view of characterizing the operational beam distributions. The results of the measurement campaign demonstrate how heavy tails can be created via coupled resonance excitation of the lattice in the presence of space charge in accordance with predictions from the fixed line theory. The coupled resonance introduces dependence between the transverse planes of the 4D particle distribution, as demonstrated by beam profile measurements for different levels of scraping in one transverse plane.

Footnotes

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