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Generating super-Gaussian distribution and uniform sliced energy spread bunch for EIC strong hadron cooling

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Strong Hadron Cooling (SHC), utilizing the coherent electron cooling scheme, has been extensively investigated for the Electron Ion Collider (EIC). Throughout our cooling optimization studies, we realized that a Super-Gaussian electron bunch offers enhanced performance in comparison to a Gaussian bunch. Our approach involves initiating the electron beam distribution in a double peak form, transitioning them into a Super-Gaussian distribution due to the longitudinal space charge. Subsequently, a chicane within the linac section compresses the bunch to meet the required bunch length. We tuned a third harmonic cavity amplitude to reduce the nonlinear term of the chicane. Moreover, given the low initial current leading to a small but non-uniform slice energy spread, we evaluated utilizing laser heating techniques to achieve a uniformly distributed slice energy spread. In this report, we discuss the concepts and simulation results.

Footnotes

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