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Microbunching instability analysis of the three-stage magnetic compressor scheme at SHINE

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In order to improve the stability of the accelerator system and to have the ability to further compress the electron beam, the space for installing a third magnetic compressor was reserved at the beginning of the physical design of SHINE. However, the three-stage compression of the microbunching instability is prone to cause the three-stage cascade amplification, and therefore it is necessary to analyse it in order to reduce the hazards to the quality of the beam. In this study, a theoretical analysis of the system MBI evolution of the SHINE three-stage magnetic compression scheme is firstly carried out by solving the three-stage iterative solution of the Volterra integral equation. Based on this theoretical model, the dependence terms with high correlation with the system MBI gain are identified, and after parameter scanning, the working point of lower MBI gain is determined. Compared with the two-stage compression of the conventional scheme, it was shown that the MBI gain caused by the LSC effect did not grow further, and the simulation results of the 3D numerical software proved the accuracy of the theoretical derivation.

Footnotes

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