

Numerical analysis for beam current profile in compact beam simulator for heavy-ion inertial fusion

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Space-charge-dominated beam physics is a critical research topic in a heavy-ion inertial fusion (HIF) system [1], because the beam parameters are far from the heavy-ion beam produced by the conventional particle accelerator complex [2].

The large size of the heavy-ion accelerator is the main problem for the researches and developments. Consequently, compact beam simulators using electrons were developed to study the beam dynamics [3-6]. Not only the experiment but also the numerical analysis with multi-particle tracking was carried out [7-11]. In the topic, longitudinal pulse compression is remarkable point in the final stage of HIF driver.

In this study, numerical simulations are carried out to analyze the beam current profile in the compact beam simulator. The one-dimensional multi-particle tracking based on the particle-in-cell method predicted the relation between the beam current profile and the phase space distribution during the longitudinal pulse compression [12]. The three-dimensional multi-particle tracking based on the particle-particle method is carried out to study the beam dynamics during the longitudinal pulse compression in this study. The calculation box is adjusted to the experimental setup [3-5]. The initial beam current is changed in the range of the emittance-dominated and the space-charge-dominated conditions. The calculation results show the distortion of the beam current profile after the longitudinal pulse compression.

References

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