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The start-to-end beam dynamics simulation study and its application in the high-intensity cyclotron of CIAE

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The neutron yield of the neutron source based on the 18MeV/1mA high-intensity cyclotron developed by the China Institute of Atomic Energy (CIAE) has reached 7×10ˆ13 n/s and has been successfully applied in high-resolution neutron imaging and Boron Neutron Capture Therapy (BNCT) experiments. Precise and quantitative start-to-end beam dynamics simulations facilitate a better understanding of the complex beam dynamics behavior of high-intensity beams, which is one of the key technologies for high-intensity cyclotrons. The beam dynamics simulation technology for cyclotrons is relatively mature. However, it is typically implemented independently in each subsystem. During the simulation process, assumed initial conditions are introduced multiple times, making it difficult to obtain quantitative results and carry out a global optimization design of beam dynamics. Start-to-end beam dynamics simulation is used in the 18MeV/1mA high-intensity cyclotron. It quantitatively simulates the beam dynamics behavior of high-intensity beams in each subsystem, including the injection line, spiral inflector, central region, acceleration region, extraction region, and uniform beam transport line.

Footnotes

Funding Agency

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Yes

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