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Influence Analysis of Dipole Magnet Design and Beam Collimation in the High-Precision Energy Spectrometry System

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The high-precision energy spectrometer, as a key electron beam diagnostic device, is capable of accurately measuring the energy distribution of electron beams, thereby providing essential data for optimizing electron beam injector performance. Simultaneously, the upstream beam collimation also influences the measurement accuracy of the spectrometer. In this context, electron beam injectors operating in the MeV range were examined, and an energy spectrometry system based on the magnetic deflection method—valued for its straightforward operational principle and ease of implementation—was constructed. An energy measurement model for MeV-scale electron beam injectors was developed, focusing on the impact of the dipole magnet—a key component—and the upstream beam collimation on both the beam deflection trajectory and energy resolution. The results indicate that the optimized dipole magnet design and the refined analysis of beam collimation substantially enhance the measurement precision of the energy spectrometry system, providing robust technical support for the high-precision energy diagnosis of electron beams with energies of several MeV.

Footnotes

Funding Agency

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