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GEANT4 simulations on wire scanners and Faraday cup design for PIP-II

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The PIP-II accelerator upgrade at Fermilab represents a groundbreaking leap forward in high-energy physics research. This ambitious initiative involves enhancing Fermilab's accelerator complex by replacing the current linear accelerator with a warm front end (WFE) capable of accelerating H⁻ beams up to 2.1 MeV. Subsequently, a superconducting linac further accelerates these beams up to 800 MeV. To precisely measure the transverse beam profile, a combination of traditional wire scanners at the WFE section and Laser wire scanners along the superconducting linac section are planned for implementation. This investigation centers on studies of H⁻ beam interactions with wire scanners and refining the Faraday cup design for the PIP-II Laser wire scanners by utilizing GEANT4, a Monte Carlo simulation toolkit. Leveraging this method enables a comprehensive analysis of particle trajectories, energy deposition, secondary electron emission, backscattering, etc., facilitating optimization through adjustments to cup geometries, materials, and placement to maximize its efficacy in beam diagnostics.

Footnotes

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