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Performance evaluation of multi-wire drift chambers for spin-correlation coefficient measurements in deuteron-proton elastic scattering/重陽子ー陽子弾性散乱のスピン相関係数測定に向けたマルチワイヤ ー ドリフトチェンバーの性能評価

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The nuclear force that forms the nuclei is described as interactions between nucleons. The three-nucleon force (3NF) acting among three nucleons is essential to provide descriptions for various nuclear phenomena with high precision. Among the components of the 3NF, the spin-dependent part is still insufficiently understood [1]. To investigate spin-dependent parts of 3NFs, we are planning the measurement of the complete set of spin correlation coefficients, where a polarized deuteron beam is applied on a polarized proton solid target. The measured observables are compared with the rigorous numerical calculations to pin down the 3NF effects.
In the experiment the scattered deuterons and recoil protons from deuteron-proton elastic scattering are measured at the wide angles of 14°–54° in the laboratory system. The detector system consists of the multi-wire drift chambers (MWDCs) and the plastic scintillators. The MWDCs are used to reconstruct the trajectories of the scattered deuterons and recoil protons. The plastic scintillators provide coincidence triggers to ensure the simultaneous detection of the scattered deuteron and recoil proton, which allows the identification of d-p elastic scattering events.
In this study, we evaluated the performance of the MWDCs by measuring their detection efficiency and position resolution. The detection efficiency was evaluated using a ^{90}Sr β source. The voltage ratio applied to the cathode and anode wires was optimized to achieve the best operational condition. The position resolution was measured using cosmic rays, which have higher mass and energy and are less affected by multiple scattering.

References

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