Measurement of proton elastic scattering of ^{44}Ti in the TRIP-MESA project

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In the TRIP use case,[1] the MESA project is dedicated to the measurements of elastic scattering of protons, deutrons, and α-particles with radioactive ion beams via inverse kinematics. In this paper, we report proton elastic scattering of ^{44}Ti measured in the TRIP24-01-01 experiment.

The schematic of the beamline is shown in Fig. 1. The TRIP24-01-01 experiment was performed in May 2024. In this experiment, the proton elastic scatterings of ^{44}Ti and ^{50}Ca[5] were measured with ESPRI[2] detectors and the ΔE-ΔE-E type telescope array DELTA[3] at the F12 focal plane. The ^{44}Ti beam was produced via projectile fragmentation of ^{70}Zn primary beam at 345 MeV/nucleon in a ^{9}Be target with a thickness of 10 mm. The isotopes were separated using BigRIPS and transported to F12. Secondary beams were identified using time-of-flight (TOF), magnetic rigidity $B\rho$, and energy deposit (ΔE) information. TOF information was obtained with plastic scintillators placed at F3 and F7. $B\rho$ was determined from a position measurement with parallel plate avalanche counters (PPACs) placed at F3 and F5. An ionization chamber placed at F3 and F7 provided the ΔE information. A gaseous N_2 scintillation detector was used to measure timing. Projectiles were tracked with two beam drift chambers (BDCs) placed downstream of the N_2 scintillation detector. A solid hydrogen target (SHT) was used as the proton target for ESPRI detectors. The recoil protons from SHT were measured with a recoil proton spectrometer (RPS). A BDC3 and the DELTA chamber were placed downstream of the SHT. For measurement with the DELTA, four targets were prepared: CH2 (50 μm thickness), carbon (25 μm thickness) for the background measurement, empty for the tuning, and mask target for the calibration of the DELTA chamber position. The recoil protons from these targets were measured with the DELTA. The gaseous Xe scintillation detector[4] and $LaBr_3$ (Ce) scintillator were installed downstream of the DELTA chamber for particle identification.

The DELTA measurement results are shown in Fig. 2. The x-axis indicates the scattering angle of the recoil particles, and the y-axis indicates the energy loss of

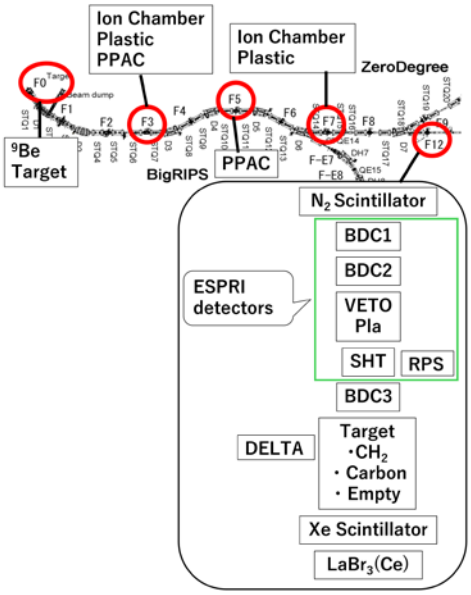

Fig. 1. Schematic of beamline and detectors to measure proton elastic scattering.

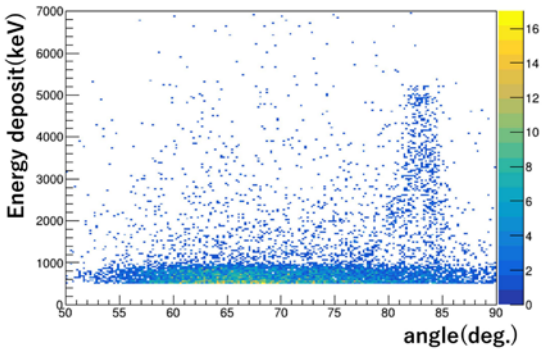

Fig. 2. Correlations between the recoil angle and energy deposit.

recoil protons in second ΔE detector. We preliminary obtained a clear locus for correlations between the recoil angle and energy deposit. This is confirmed that the proton elastic scattering was correctly obtained with the DELTA. Analysis with ESPRI detectors and further detailed data analysis are in progress.

References

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