

Performance study of electron spectrometer for SCRIT experiments

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We constructed the Self-Confining Radioactive Ion Target (SCRIT) electron scattering facility¹⁾ to perform electron scattering experiments for short-lived unstable nuclei. Such experiments have been long desired but unrealized thus far because of the difficulties in preparing a thick target from such short-lived nuclei. SCRIT is a novel technique to achieve a sufficiently high luminosity to perform electron scattering experiments by trapping the target ions along the electron beam. After successful commissioning experiments with stable targets,²⁾ we started to prepare for an experiment with an unstable nuclear target.

The SCRIT electrode was replaced with a new one that has a larger cross section and less material around the trapping region, in addition to providing a much more uniform electric potential. Simultaneously, three identical carbon foils with a thickness of 35 μm were installed as fixed targets at the center and both edges of the SCRIT electrodes, respectively, to evaluate the performance of the electron spectrometer, window-frame spectrometer for electron scattering (WiSES). The carbon targets can be moved out of the electron-beam axis when they are not in use. For WiSES, the drift chamber in front of the spectrometer magnet was replaced with a new one with both vertical and horizontal wires to reconstruct the horizontal and vertical trajectory information of scattered electrons simulta-

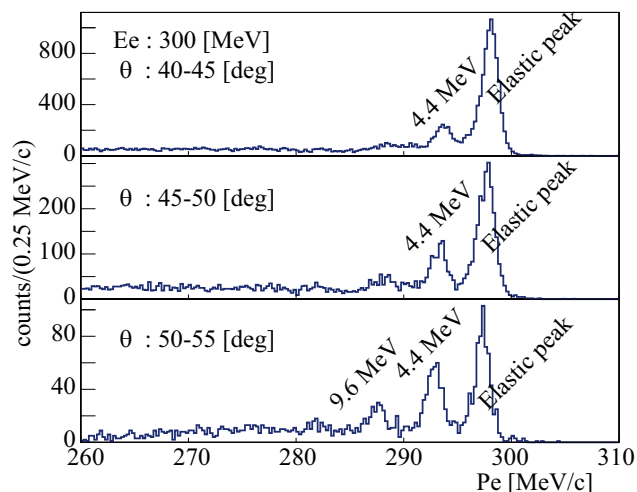


Fig. 1. Reconstructed momentum spectra of scattered electrons for different scattering-angle regions.

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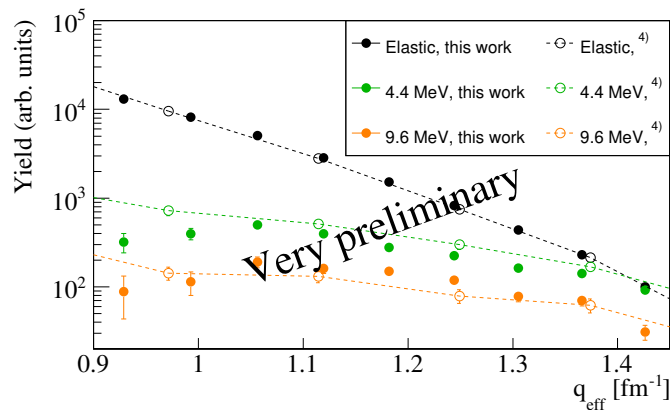


Fig. 2. Yield distributions with varying effective momentum transfer after acceptance corrections. Filled circles indicate preliminary results from this work. Opened circles are from Ref. 4).

neously. In addition, a magnetic-field measurement was performed to study the momentum resolution of WiSES.

In 2019, we performed a series of electron-scattering experiments with carbon targets to evaluate the acceptance and momentum resolution of the spectrometer after the measurement of the magnetic-field distribution of the spectrometer magnet. The status of the field measurement is reported elsewhere.³⁾

Figure 1 shows reconstructed momentum spectra from the center of targets for an electron beam energy of 300 MeV and three scattering angle regions: 40°–45°, 45°–50°, and 50°–55°. One elastic peak and two inelastic peaks are clearly observed. Figure 2 shows yield distributions with varying effective momentum transfer after acceptance corrections. In the present analysis, only the radiation tail from the elastic peak is taken into account for counting the yields. Moreover, the acceptances for the elastic and inelastic events are assumed to be the same. Although the distributions of the elastic events are consistent between this work and a previous experiment,⁴⁾ those of the inelastic events show finite discrepancies.

Further analysis is ongoing to evaluate the performance of the spectrometer.

References

- 1) M. Wakasugi *et al.*, Phys. Rev. Lett. **100**, 164801 (2008).
- 2) K. Tsukada *et al.*, Phys. Rev. Lett. **118**, 262501 (2017).
- 3) H. Wauke *et al.*, in this report.
- 4) J. H. Fregeau *et al.*, Phys. Rev. **104**, 225 (1956).