2 - 26 Experimental Measurement of ^{12}N, ^{13}O on ^{nat}Pb Elastic Scattering Above the Coulomb Barriers

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Elastic scattering is an ideal tool to study the information of the exotic structure and reaction mechanism of the weakly bound nuclei. A great deal of elastic scattering experiments have been performed for neutron halo nuclei, such as ^{6}He, ^{11}Li and ^{11}Be[1]. However, elastic scattering data for proton halo nuclei above the Coulomb barrier are still scarce. ^{13}O and ^{12}N, with small separation energies, are good candidates of proton halo nuclei. The ^{13}O and ^{12}N induced elastic scattering is experimentally investigated.

The measurements were carried out using the ^{13}O, ^{12}N and ^{11}C beams provided by RIBLL[2, 3]. The secondary beams of radioactive isotopes were produced by the fragmentation of (60 MeV/u) ^{16}O primary beam on a 3 000 mm Be target and separated by RIBLL. The energies of the secondary beams, at the physical target, were 296, 246, and 173 MeV for ^{13}O, ^{12}N, and ^{11}C, respectively. Self supporting foils of ^{nat}Pb with a thickness of 4.2 mg/cm^2 was used. The target had the following isotopic composition: ^{208}Pb 52.3%, ^{207}Pb 22.6%, ^{206}Pb 23.6% and ^{204}Pb 1.48%. The spot size of beam on target was about 30 mm in diameter. Time-of-flight (TOF) with a flight path of 17 m was used for the beam particle identification. The typical TOF spectra for the secondary beams are shown in Fig. 1. The secondary beams can be clearly identified in the offline data analysis by applying cuts the TOF spectra.

A schematic lay-out of the experiment setup is shown in Fig. 2. Two position-sensitive Parallel-Plate Avalanche Counters (PPACs) with a position resolution of 1 mm were used to reconstruct the position and incident angle of the incoming beam at the target event by event. Each PPAC has 50 gold-plated tungsten wires, 20 μm in diameter, in both X and Y directions and therefore the sensitive area is 50 mm×50 mm. The scattered particles were detected by four sets of $\Delta E-E$ detector telescopes. Each telescope consists of one double-sided silicon strip ΔE detector (DSSD) of 150 μm in thickness and 16 mm×16 mm in area, and one Quarter Silicon Detector (QSD) of 1 000 μm in thickness and 50 mm×50 mm in area. Each DSSD has 16 strips on both sides and the orientations are perpendicular to each other. The DSSDs were used to determine the energy loss and the position of the particles passing through the detector with an accuracy of 1 mm×1 mm. The QSDs were used to detect the remaining energy.

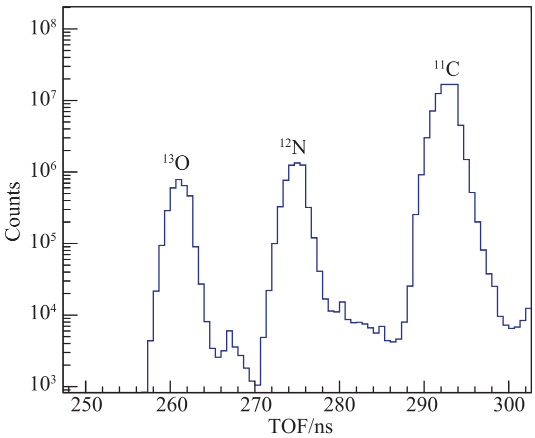

Fig. 1 (color online) A typical spectrum of time of flight (TOF).

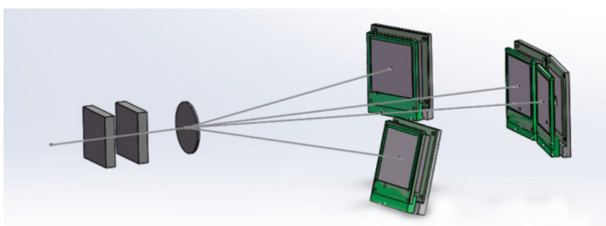

Fig. 2 (color online) Schematic view of the experimental setup.

A Monte Carlo simulation will be performed to evaluate the absolute differential cross sections[4, 5]. The extracting of elastic scattering differential cross section and further physical analysis are in progress.

References

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