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Measurement for p–^{3}He elastic scattering with a 65 MeV polarized proton beam

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One of the most important topics of nuclear physics is to describe various nuclear phenomena based on the nucleon-nucleon interactions combined with three-nucleon forces (3NFs). 3NFs are key elements to understand various nuclear phenomena, e.g. binding energies of light mass nuclei [1] and the equation of state of nuclear matter [2]. In the last decades, the study of 3NFs effects has been extensively performed in deuteron–proton (*dp*) scattering at intermediate energies (E/A 60 MeV). Rigorous numerical Faddeev calculations of the 3N scattering by using NN potentials as well as 3NFs models have made it possible to compare the data to the theoretical calculations. Consequently, the first evidence of 3NFs effects has been found in the dp scattering system [3]. As an extension of 3NFs study, it should be interesting to see how 3NFs act in p–^{3}He scattering system. In this system, one could study 3NFs effects in 4N scattering. Also one could approach to 3NFs with the channels of the total iso-spin $T = 3/2$.
In order to study 3NFs effects in p–^{3}He elastic scattering, we performed the measurement of the cross section and the proton analyzing power A_y at 65 MeV with a polarized proton beam at Research Center for Nuclear Physics (RCNP), Osaka University. The gaseous ^{3}He target was bombarded by a polarized proton beam, and scattered protons were detected by using the $E - \Delta E$ detectors which consisted of plastic and NaI(Tl) scintillators. Measured angles were $20^\circ - 165^\circ$ in the laboratory system ($26.9^\circ - 170.1^\circ$ in the center of mass system). The typical beam polarizations were 50 % throughout the experiment. We also measured the cross section for *pp* elastic scattering with the same experimental setup in order to estimate the overall systematic uncertainties.
In the conference, we will report on the obtained data combined with the theoretical calculations.
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