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New data on the differential cross-section on dp-elastic scattering at 880 MeV obtained at Nuclotron

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Abstract. The results on the cross-section of dp-elastic scattering reaction obtained at 880 MeV at internal target of Nuclotron are presented. The measurements have been performed using CH_2 and C targets and kinematic coincidence of signals from scintillation counters. The cross-section data are compared with theoretical predictions and results of previous experiments.

1 Introduction

The study of the deuteron-proton elastic scattering has a longtime story. The first nucleon-deuteron experiments were performed already in the 1950's [1-7]. Differential cross-section and nucleon analyzing powers [5-7] were measured at few hundred MeV. Nowadays this reaction is still the subject of the investigations [8-10].

The goal of present investigation is to measure the cross-section of dp-elastic scattering at the energy 880 MeV using the kinematic coincidences of deuteron and proton with plastic scintillation counters. Measurements were performed using polyethylene and carbon targets and procedure of CH_2-C time difference spectra subtraction [10, 11]. The data are compaired with the calculation of relativistic multiple scattering model [12].

2 Experiment at internal target station at Nuclotron.

The experimental setup for dp-elastic scattering study at Internal Target Station (ITS) consists of 4 detectors (P, D ,PP-L ,PP-R), located at the horisontal plane. The signals from the P and D detectors give proton and deuteron coincidences for dp-elastic and quasi-elastic reactions, PP-L and PP-R register protons from pp-quasi-elastic reaction. This reaction is used as the relative intensity monitor of the interacting beam with the target for calculation of cross-section of dp-elastic scattering reaction. This monitor can be used also for polarization measurements, because PP-detectors are located at 90 ^{o} in c.m.s. and non-sensitive to the beam polarization.

3 Data analysis.

The typical amplitude and timing spectra obtained at the 880 MeV and polyethylene target are presented in Fig.1. The measurements on carbon target were also performed to estimate the carbon

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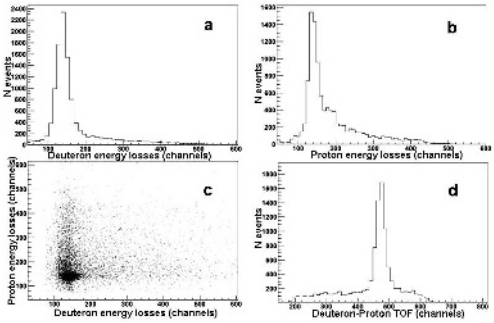

Fig. 1. Data obtained with polyethylene target at 880 MeV: distributions of the amplitudes for scattered deuterons (a) and recoil protons (b). The correlation of the amplitudes (c) time difference between signals for proton and deuteron detectors (d).

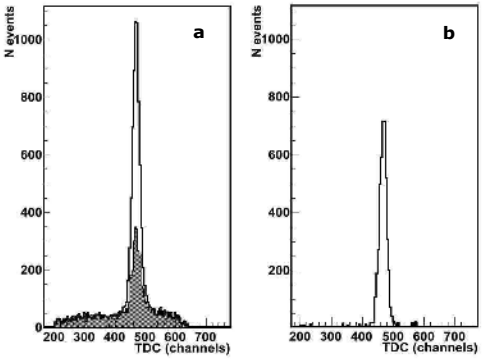

Fig. 2. Procedure of CH_2-C subtraction (a) and result of subtraction (b). White spectra- are the CH_2 data, gray- are the C data.

contribution from the polyethylene target. The first stage of dp-elastic scattering events selection is the applying of the temprorary gates on the deuteron-proton time difference spectra to see the behaviour of the ADC data. Gates are equal 4 sigma both sides from MPV and determinated by Gaussian+constant fit. The second stage of the analysis is the applying of the criteria on the signal amplitudes correlation from the deuteron and proton detectors.The same graphical cut was imposed for the data obtained with the carbon target. The graphical criteria for PP detectors are the same for each angle, because PP detectors weren't moved. The graphical criteria for D and P detectors are different depending on the scattering angle. The relative normalization of time difference spectra from carbon and polyethelyne targets was obtained from the ratio of the background events placed on the left and right from the peak. It is possible because background in CH_2 spectra corresponds carbon contribution in CH_2 data. Time difference spectra from CH_2 and C targets were fitted by the sum of gaussian and constant. The ratio of the obtained constants was considered as a normalization factor. The procedure of the of the CH_2-C normalized time difference spectra subtraction [10, 11] for 880 MeV is presented in Fig.2. The relative normalisation of the dp-elastic scattering data was performed using pp-quasielastic scattering data.

4 Results of the cross-section measurement.

Angular dependences of the dp-elastic scattering cross-section obtained at 880 MeV are presented by the solid symbols in Fig.3. The experimental data obtained at Nuclotron are normalised to the theoretical calculation performed within relativistic multiple scattering model [12] at the 60^o c.m.c. given by the solid curve. These calculations take into account the single scattering one-nucleon exchange and double scattering terms. The dashed curves are obtained by the consideration of only single scattering and the nucleon exchange. The shape of the angular dependence of the relatively normalised data obtained data at Nuclotron agree with the behaviour of the previously obtained data [13, 14].

5 Conclusion.

The results of the cross-section measurement using CH_2-C subtraction in dp-elastic scattering at the energy 880 MeV have been obtained. The angular dependence has been obtained using relative normalisation to pp-quasielastic scattering at 90^o c.m.s. The data demonstrates a good agreement with results of previous experiments at all deuteron scattering angles. The deviation of the theoretical predictions (relativistic multiple scattering model) with the experimental data are observed at the deuteron scattering angles above 100^o c.m.

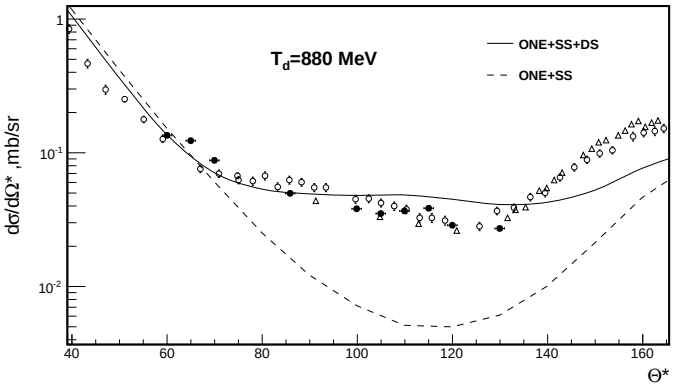

Fig. 3. The differential cross-section of dp-elastic scattering reaction at the deuteron energy of 880 MeV obtained at Nuclotron is show by solid circles. Open circles and triangles are the data taken from [14, 13], respectively. The solid and dashed curves are the results of the calculations within relativistic multyple scattering [12] with and without considering of the double scattering term, respectively.

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