

Investigation of the Reaction $pd \rightarrow p_{\text{spec}}d\pi^0$ at ANKE*

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The production of π^0 -mesons in proton-neutron collisions was studied as a test measurement at ANKE by one day data taking during a two-weeks beam time in July/August 2002. Since there are no free neutron targets, a deuterium cluster target was used to purvey quasifree neutrons using spectator kinematics. The reaction was investigated near threshold at a beam momentum of $p_{\text{beam}} = 0.835$ GeV/c which enabled to cover an excess energy range of $Q = 0 - 20$ MeV.

The events of the reaction channel to be analyzed were identified by measuring the deuteron in the scintillation hodoscope of the forward wall of ANKE in coincidence with the detection of the corresponding spectator proton in a silicon detector telescope. After track and momentum reconstruction using the information from the two forward MWPCs, the energy loss behaviour according to the Bethe-Bloch Formula allowed for particle identification by means of an “energy-loss-versus-momentum” plot, see Fig. 1.

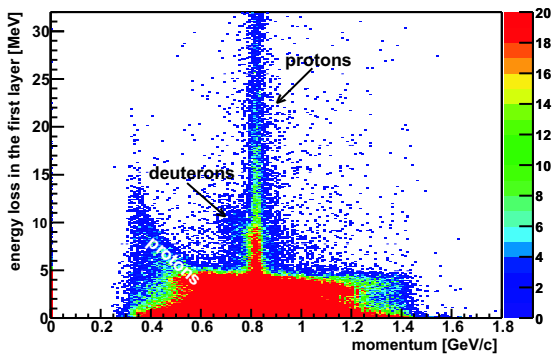


Fig. 1: Energy loss of the particles detected in the first layer of the scintillation hodoscope versus their momenta.

An additional condition for deuteron identification is based on their higher energy losses in both scintillator layers, see Fig. 2).

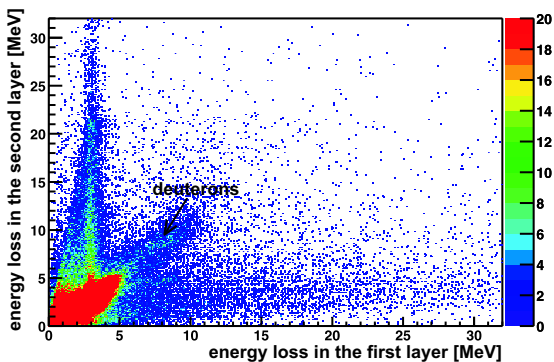


Fig. 2: Energy loss in the second layer of the scintillation hodoscope versus the energy loss in the first one.

The π^0 -mesons have then been reconstructed from the missing mass of the detected particles, see Fig. 3.

The missing mass analysis has been made for several Q -bins (see Fig. 4). The width of 10 MeV for each Q -bin results from the resolution in Q that can be achieved.

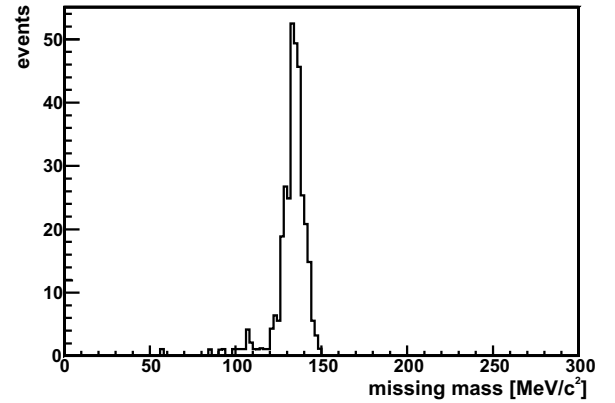


Fig. 3: Missing mass distribution of detected deuterons at a beam momentum of $p_{\text{beam}} = 0.835$ GeV/c

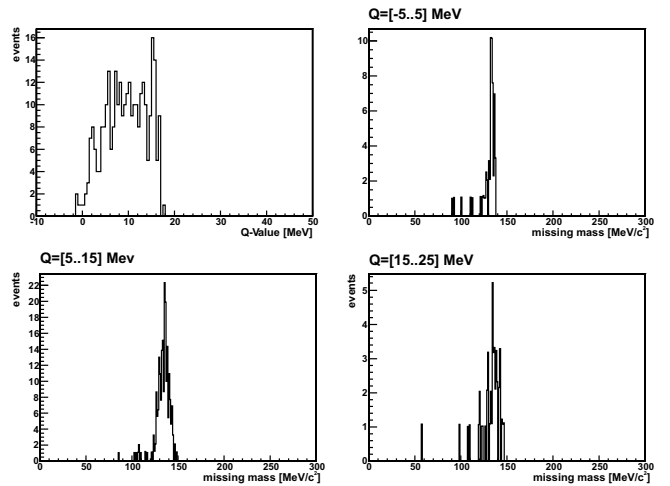


Fig. 4: Range of covered excitation energies Q and missing mass distributions for different Q -bins.

Due to the limited statistics of this test measurement, it was not possible to determine the fraction of misidentified or lost deuterons using the $\Delta E \cdot \beta^2$ -method as described in [1] which is needed to determine total cross sections. However, the feasibility to measure the π^0 -production in proton-neutron interactions at ANKE could be shown.

References:

- [1] N. Lang *et al.*, *ibidem*, *Measurements on the reaction $pd \rightarrow p_{\text{spec}}d\eta$ at ANKE*;

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* supported by FZ-Jülich