Analysing powers for $\vec{d}p \to \{pp\}_s\Delta^0$ reaction at $T_d = 1.6$, 1.8 and 2.27 GeV*

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Recent deuteron-proton experiments at ANKE clearly show a possibility to extend the study of the $\vec{d}p \to \{pp\}_s n$ reaction into the pion-production regime and investigate the excitation of the $\Delta(1232)$ isobar in the $\vec{d}p \to \{pp\}_s\Delta^0$ process.
By selecting the two final protons with low excitation energy, typically $E_{pp} < 3$ MeV, the emerging diproton is dominantly in the $^1S_0$ state. In impulse approximation this reaction can be considered as $np \to p\Delta^0$ scattering with spectator proton. In such conditions these measurements would correspond to a spin transfer from the initial neutron to the final proton. Hence, a valuable information on an elementary $\vec{n}p \to \vec{p}\Delta^0$ process can be extracted.

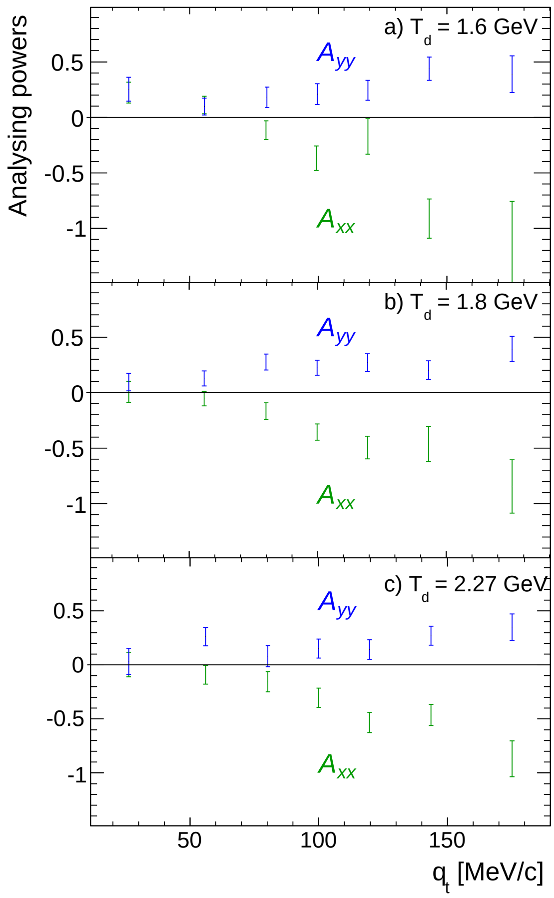

Fig. 1: A_{xx} and A_{yy} tensor analysing powers at three deuteron beam energies. The mass region of $1.19 < M_x < 1.35$ GeV/c^2 is used.

Measurements of the analysing powers for this reaction require a precise polarimetry. Previous studies of the $\vec{d}p \to \{pp\}_s n$ reaction at ANKE and also the well investigated polarisation export technique at COSY have made this task easier. The beam polarisation is measured at $T_d = 1.2$ GeV, where the tensor analysing powers are well known and used for the $\vec{d}p \to \{pp\}_s\Delta^0$ reaction study at higher energies.
During the cross section analyses it became obvious, that at low mass region, near πN threshold, another mechanism makes a significant contribution in the $dp \to \{pp\}X$ process in addition to the direct delta production [see highlights of the IKP annual report 2011]. The latter is considered to be a one-pion exchange between the incident neutron and the proton target. There are several assumptions about the possible mechanisms, that can make the contribution in the $dp \to \{pp\}X$ cross section and their quantitative evaluation is needed. This work is in progress.

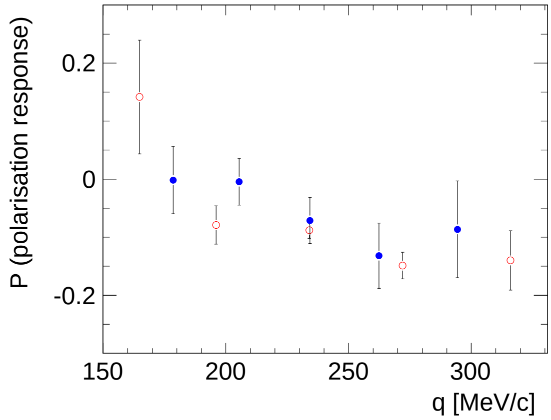

Fig. 2: The comparison of the ANKE results at $T_d = 2.27$ GeV (blue points) with those of Saclay at $T_d = 2.0$ GeV (red circles). Data are presented with respect of the momentum transfer.

Until the relative contributions of the different driving mechanisms (and their possible interferences) is sorted out, one can only assume that at high M_x the direct Δ production dominates. We show only such data in Fig. 1. Tensor analysing powers are evaluated as functions of the transverse momentum transfer q_t. In the forward direction, $q_t = 0$ and one must then have $A_{xx} = A_{yy}$ because there is no way of separating the x and y directions. The behavior of both observables is similar at all three energies. However, it is important to note the differences from the charge-exchange with neutron channel: the signs are opposite to those of the $\vec{d}p \to \{pp\}_s n$ reaction and they tend to be very small at $q_t = 0$. These will prove to be valuable constraints on the modeling of the $np \to p\Delta^0$ amplitudes, once we have identified the relative contributions of the different driving mechanisms.
In order to check the reliability of the ANKE results, these were compared with the Saclay data at 2 GeV. Though, in the Saclay experiments it was not possible to separate the two tensor analysing powers and at each production angle they could only evaluate a linear combination of the analysing powers that they called P (*Polarisation response*). P has been reconstructed from the ANKE data as well and compared with the results obtained at Saclay (see Fig. 2). The overall agreement is encouraging.

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