A_{xx} measurements for the $pn \to \{pp\}_s\pi$- reaction at $T_d = 706\ MeV$ at ANKE

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A kinematically complete double polarization measurement of the $pn \to \{pp\}_s\pi^-$ process near the threshold has been performed recently at the ANKE-COSY spectrometer. The experiment aimed to determine the spin correlation coefficients $A_{x,x}$ and $A_{y,y}$ in this process. The results taking in conjuction with values for vector analyzing power A_y and differential cross section $d\sigma/d\Omega$ will facilitate further development of χPT in this sector.

The transversely vector polarized deuteron beam and the hydrogen internal polarized ANKE target were used in the experiment. The target consisted of Atomic Beam Source (ABS), storage cell and Lamb shift polarimeter. The cell material (20 μ of Al and 5 μ of teflon) provided the most appreciable background, the shape of which in the missing-mass spectra was obtained from dedicated measurements with N_2 in the cell and with the empty cell.

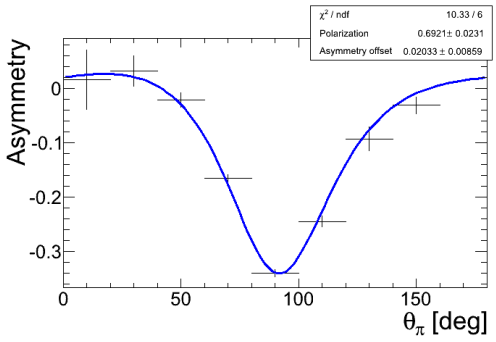

Fig. 1: Determination of the ABS polarization, $P_{ABS} = 69 \pm 2\%$

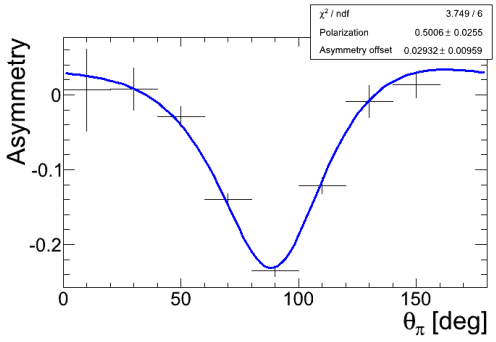

Fig. 2: Determination of the beam polarization, $P_{beam} = 50 \pm 3\%$

Polarimetry was done using the quasi-free $np \to d\pi^0$ process. For independent determination of the values of the beam and target polarization for spin orientation up and down, samples of data with unpolarized beam or target were taken. The process was selected by deuterons and protons-spectators in ANKE Forward Detecror (FD) and the identification of pd-pairs was carried out by differences of TOF [1]. The criterium for process identification was based on the missing mass. Scaling the A_y known from SAID phase-shift analysis predictions [2] to fit the experimental asymmetry (see Fig. 1, Fig. 2) one can get the values for the ABS and beam polarizations.

The final di-protons from the $pd \to \{pp\}_s p_s \pi^-$ process were detected at ANKE Positive Detector (PD), the spectator protons - at FD. Particles were identified by the differences of TOF. The reaction was picked out using a cut for excitation energy of di-protons ($E_{pp} < 3MeV$) and by the missing mass for the three protons.

One can write down the assimetry as:

$$\xi = \frac{\Sigma_1 - \Sigma_2}{\Sigma_1 + \Sigma_2} = PQ(A_{xx}\sin^2\phi + A_{yy}\cos^2\phi)$$

where $\Sigma_1 = N\uparrow\uparrow + N\downarrow\downarrow$ and $\Sigma_2 = N\uparrow\downarrow + N\downarrow\uparrow$. Dependence of ξ/PQ on $cos(\phi)^2$ for certain θ bins allows to determine the value of A_{yy} when the $cos(\phi)^2 = 1$. The theory gives the prediction for $A_{y,y} = 1$ [3]. While it is consistent with the data $A_{y,y}$ was fixed in the fit to get more precise values of $A_{x,x}$ at $cos(\phi)^2 = 0$. The results for $A_{x,x}$ are presented in Fig. 3.

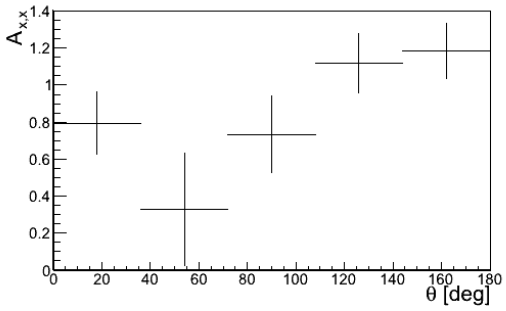

Fig. 3: $A_{x,x}$ as a function of θ_π in the $pn \to \{pp\}_s\pi^-$ process at 353 MeV

References:

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