The reaction d+p→^{3}He+π^0 close to the η production threshold at ANKE*

M. Papenbrock[1], A. Khoukaz[1], T. Mersmann[1], M. Mielke[1], and T. Rausmann[1] for the ANKE-Collaboration

In January 05 the reaction d+p→^{3}He+η was studied at the ANKE experimental setup [1]. Due to the fact that the reaction of interest was measured by detection of the ^{3}He nuclei and reconstruction of the η meson via the missing mass technique, data on the π^0 production near the η threshold was additionally obtained with the same trigger. Here we present data obtained at an excess energy of Q = 20 MeV relative to the η threshold, corresponding to Q = 427 MeV with respect to the π^0 threshold.

The ^{3}He nuclei were identified as described in [2]. The extracted transversal versus longitudinal momentum plot in the center of mass system exhibits momentum ellipses for both the exit channels ^{3}He+η and ^{3}He+π^0 [2]. As can be seen in figure 1a), acceptance for the latter reaction is given only for forward and backward scattered ^{3}He nuclei in the center of mass system. Therefore, figures 1b) and c) are restricted to momenta, where the events of the exit channel ^{3}He+π^0 are expected. The plots were filled with the reciprocal value of the transversal momentum as an event weight, as explained in [2]. For forward scattered ^{3}He nuclei, a distribution of events of this reaction is visible on the momentum ellipse (fig. 1b). Since the differential cross section of this channel for backward scattered ^{3}He nuclei is at least one order of magnitude smaller than the one for forward scattered nuclei [3], no entries are visible in the corresponding plot (fig. 1c).

Figure 2 shows the center of mass momentum of the ^{3}He nuclei for different $\cos(\vartheta^{CMS}_{^3He})$ intervalls. For $\cos(\vartheta^{CMS}_{^3He}) < 0$, no clear peak of the π^0 production is visible. In contrast, for $\cos(\vartheta^{CMS}_{^3He}) > 0$, clear π^0 signals on top of background distributions, arising from multi pion production and misidentified protons from breakup reactions are visible.

To describe and to subtract this background, the CMS momenta for simulations of two background reactions as well as of the π^0 production is plotted in figure 1d). The generated events are distributed according to phase space. However, in experiment the angular distribution for the ^{3}He nuclei in the reaction channel d+p→^{3}He+$\pi+\pi$ is not isotropic, but increases with $\cos(\vartheta^{CMS}_{^3He})$.

After a careful background subtraction it will be possible to extract differential cross section information for the reaction d+p→^{3}He+π^0.

References:

[1] A. Khoukaz, T. Mersmann, *Investigation of the ^{3}He η final state in the reaction d+p→^{3}He+η at ANKE*, COSY-Proposal, 2004

[2] T. Mersmann et al., ibidem, *Investigation of the ^{3}He η Final State in dp-Reaction d+p→^{3}He+η at ANKE*

[3] C. Kerboul *et al.*, Phys. Lett. B **181** (1986) 28.

[1] Institut für Kernphysik Westfälische Wilhelms-Universität, 48149 Münster, Germany

* Supported by FZ-Jüelich FFE

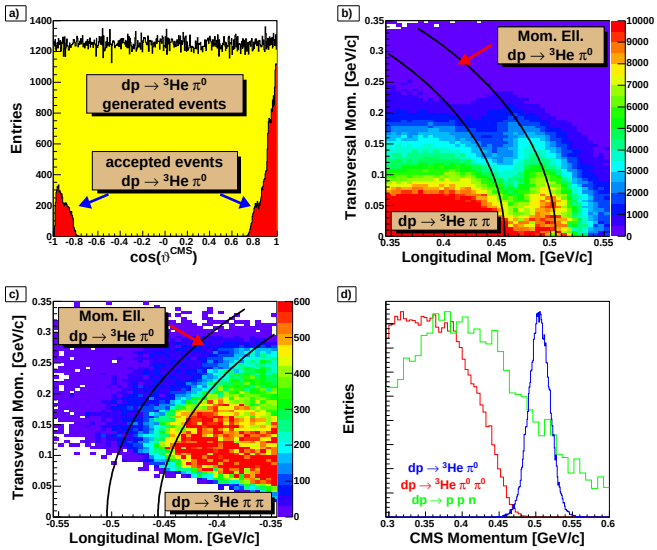

Fig. 1: a) Acceptance of the ANKE detector for the reaction d+p→^{3}He+π^0 (Monte-Carlo simulations).
b) c) Preliminary ^{3}He momentum plots to identify the momentum ellipse of the exit channel ^{3}He+π^0.
d) Center of mass momenta for the named reactions, accepted by the ANKE detector (Monte-Carlo simulations, scaled arbitrarily).

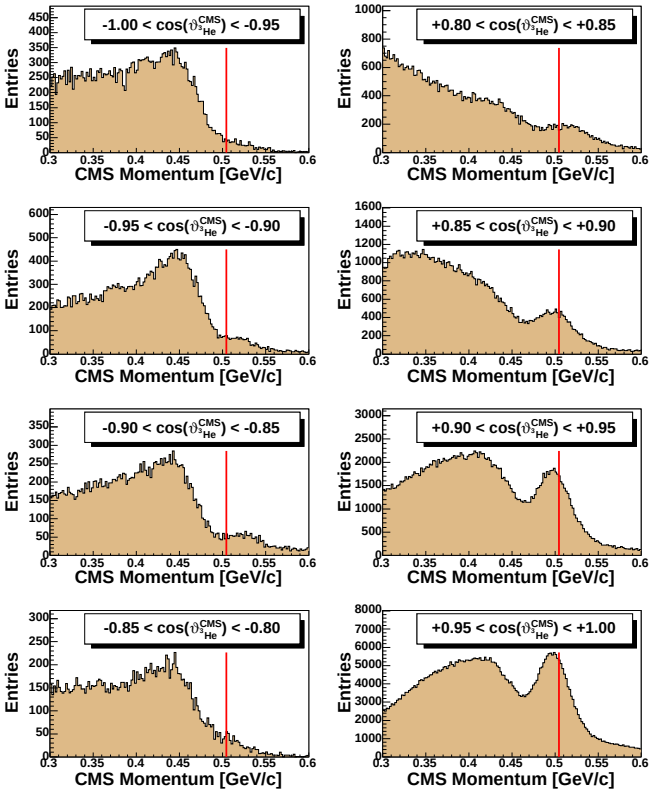

Fig. 2: Center of mass momentum distribution of detected ^{3}He nuclei for different $\cos(\vartheta^{CMS}_{^3He})$ intervals.
The vertical lines indicate the expected position of signals from the π^0 production.