

Study of the $d - \eta$ interaction via the $dp \rightarrow dp\eta$ reaction

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In January 2003 the COSY-11 collaboration performed measurements of the near-threshold η meson production in the $dp \rightarrow dp\eta$ reaction [1]. The aim of the experiment was the investigation of the $d - \eta$ interaction on the basis of the energy dependence of the total reaction cross section and a Dalitz plot analysis for the final state particles. The study of the $d - \eta$ interaction is of special interest due to the possible existence of $\eta - d$ quasi-bound states [2].

Measurements were performed for four excess energies in the range from 0.2 MeV to 9.6 MeV using a deuteron beam scattered on a proton target. The COSY-11 detection acceptance for such measurements is about ten times larger than in the case of a proton beam scattered on a deuteron target. The momenta of the outgoing protons and deuterons were registered with the COSY-11 detection system and the η -mesons were identified via the missing mass method.

In the first step of the data analysis the identification of detected particles was performed on the basis of time-of-flight (TOF) measurements combined with the determination of the particle momenta. Figure 1 presents TOF vs. momentum distribution for the experimental data with clearly visible bands corresponding to protons, deuterons and ${}^3\text{He}$.

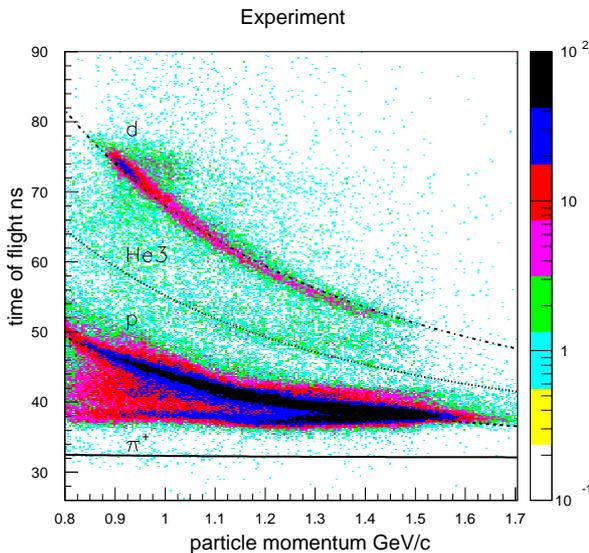


Fig. 1: Dependence of time-of-flight vs. particle momenta for the raw data set.

For the luminosity monitoring during the experiment the elastic $d - p$ - as well as quasi free $p - p$ and $pp \rightarrow d\pi^+$ scattering was registered. The scattered particles were detected in coincidence using the drift chambers for the forward going particles and the silicon pad detectors for the recoil ones. Figure 2 shows the transversal versus longitudinal momentum distribution for particles measured in the drift chambers. The superimposed lines correspond to the kinematical ellipses for protons from the $p - p$ quasi-elastic scattering (larger ellipse) and deuterons from the $pp \rightarrow d\pi^+$ reactions

(smaller ellipse). The smearing of the data around the expected lines is partly due to the presence of the Fermi motion of protons in deuterons and partly due to the limited experimental resolution. The data cover only a fraction of the kinematically allowed region due to the limited acceptance of the COSY-11 detection system. So far performed analysis indicates that we can clearly identify the quasi free $pp \rightarrow pp$ and $pp \rightarrow d\pi^+$ reactions.

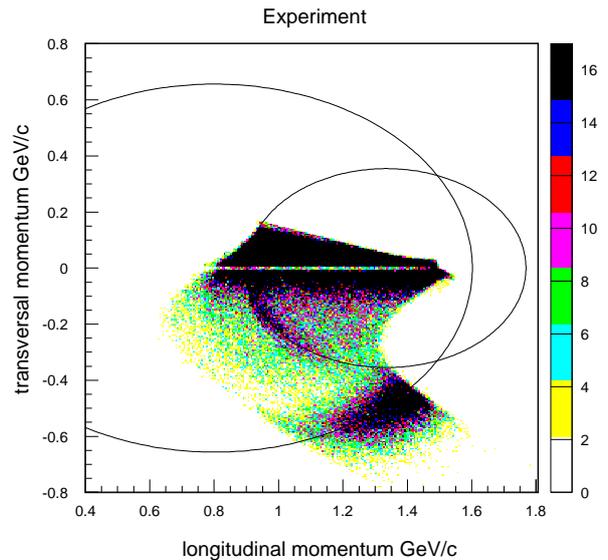


Fig. 2: Transversal vs. longitudinal momenta distribution for particles registered in the COSY-11 drift chambers.

The data analysis will be continued and, in particular, the two η production channels of interest:

$$dp \rightarrow dp\eta \text{ and } dp \rightarrow {}^3\text{He} \eta$$

will be considered explicitly.

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