Analysing power A_y in the reaction $\vec{p}p \to ppη$ at COSY-11

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Over the past few years, total cross sections [1–6] as well as differential observables [7–10] have been measured at various experimental facilities for the η meson production. Several models with different assumptions for the production mechanism of the η meson can describe these experimental results equally well. Therefore, further data are necessary to judge on the quality of the models. Here, polarisation observables provide new information about the production mechanism due to their strong sensitivity on higher partial waves.

The COSY-11 collaboration has performed a measurement of the analysing power A_y [11] at an excess energy $Q = 40\,\mathrm{MeV}$. The analysis procedure was already described in details in [11, 12]. The averaged polarisation during this one week run was measured at the internal experiment EDDA [13] and amounted $\approx 50\%$. Table 1 lists the final results of the averaged[1] analysing power $\bar{A}_y$ in dependence on the polar angle θ_q^* of the η meson in the center of mass system (CMS).

$\cos\theta_q^*$	$\bar{A}_y$
-0.75	0.19± 0.21
-0.25	-0.02 ± 0.09
0.25	0.05 ± 0.06
0.75	-0.05 ± 0.06

Table 1: Analysing power as a function of the polar angle θ_q^* of the η meson in the CMS.

From these results it is possible to extract interferences of partial wave amplitudes. The detailed derivation is given in [11] where the total angular dependence of the spin-dependent cross section is the same as in case of the $pp \to pp\pi^0$ reaction [14]. Finally, the G_1^{y0} as the (PsPp) and the sum of H_1^{y0} and I^{y0} corresponding to $(\mathrm{Pp})^2$ and (SsSd) could be extracted. Capital letters denote the relative angular momentum of the two outgoing protons in their rest system and the small letters the one of the η in the CMS. We obtained:

$$\begin{aligned} G_1^{y0} &= (0.03 \pm 0.004)\,\mu\mathrm{b} \\ H_1^{y0} + I^{y0} &= (-0.005 \pm 0.005)\,\mu\mathrm{b}\,. \end{aligned}$$

A comparison of these results with predictions from Fäldt and Wilkin [15] (dotted line) and two calculations from Nakayama, Speth and Lee [16] (solid and dashed line) in the framework of one boson exchange models is shown in figure 1. From differential cross section data the authors of ref. [15] conclude a dominant vector meson exchange in the η production while the full model calculations (solid line) in [16] are based on a dominant π and η exchange. The dashed curve represents the reduction of this model to a vector dominance via the exclusion of the π and η exchange. It seems that the data slighlty favours the calculations within the vector dominance at $Q = 40\,\mathrm{MeV}$ although the quality of the data is not yet good enough to give a qualitative statement. New data at $Q = 40\,\mathrm{MeV}$ with higher statistics and polarisation was taken in September 2002 [17] and it can be expected that the errors will be reduced by more than a factor of 2.

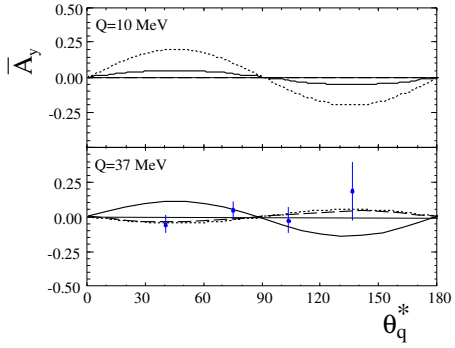

Fig. 1: Comparison of the data on the analysing power with predicitions from [15] (dotted line) and [16] (solid and dashed line).

Furthermore, the different model predicitions on the energy dependence $A_y(Q)$ (see e.g. upper part in figure 1) give the motivation to study this behaviour. Measurements at $Q = 2$, 10 and 25 MeV will be performed in the first half of 2003 [18]. With this new set of data a much more detailed analysis of the analysing power as a function of even more of the kinematical variables will give new input for a better understanding of the production of the η meson.

[1] The details concerning 'averaged' should be reviewed in [11].

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