Studies on the Reaction pp $\rightarrow$ ppK$^+$K$^-$ close to Threshold at the COSY-11 Facility

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The reaction $pp \rightarrow ppK^+K^-$ has been studied at the COSY-11 installation at a beam momentum of p=3.356 GeV/c [1, 2]. Since the four-momenta of the three positively charged particles can be experimentally determined, the K$^-$-meson can be identified via the missing mass method.

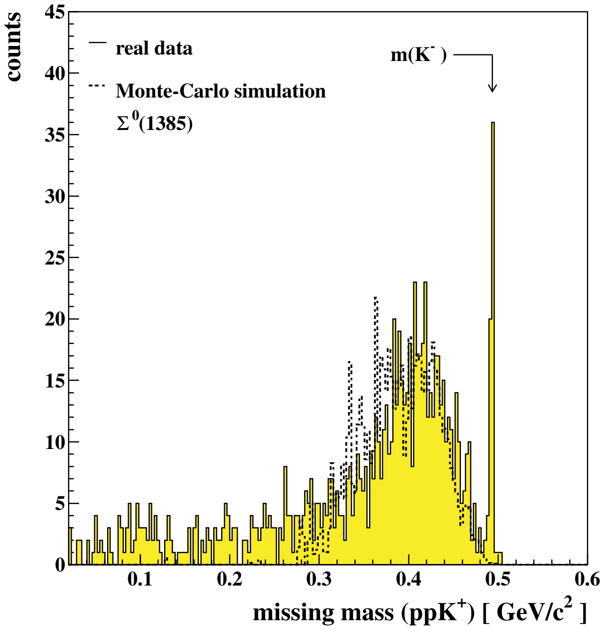

Figure 1: Missing mass spectrum of the data (solid line) as well as that derived from Monte-Carlo simulations on the $\Sigma^0(1385)$ (dashed line).

In Fig. 1 the missing mass of the system ppK^+ is shown. A significant signal at the mass of the K^--meson can clearly be separated from the background. This background can be explained by the production of the heavy hyperons $\Sigma^0(1385)$ and $\Lambda(1405)$ via $pp \rightarrow pK^+\Sigma^0(1385)/\Lambda(1405) \rightarrow ppK^+X$. The distribution derived from simulations on the $\Sigma^0(1385)$ is also included in Fig. 1 and fits to the data within statistics. In total, 61 events are identified as $pp \rightarrow ppK^+K^-$ final state, with only a very small background contamination. These identified K^+K^- events may originate from the free as well as from the resonant production via the scalar resonances $f_0(980)$ and $a_0(980)$.

The obtained distributions of the relative angles of the kaon-antikaon, proton-kaon, proton-antikaon and proton-proton systems are presented in Fig. 2, normalized to simulations, assuming a pure free K^+K^--production including the pp-FSI as well as effects from the Coulomb interaction [3]. Within the error bars, these distributions are consistent with an isotropic emission of the particles and give no clear hint for neither a contribution of higher partial waves nor for further final state interactions.

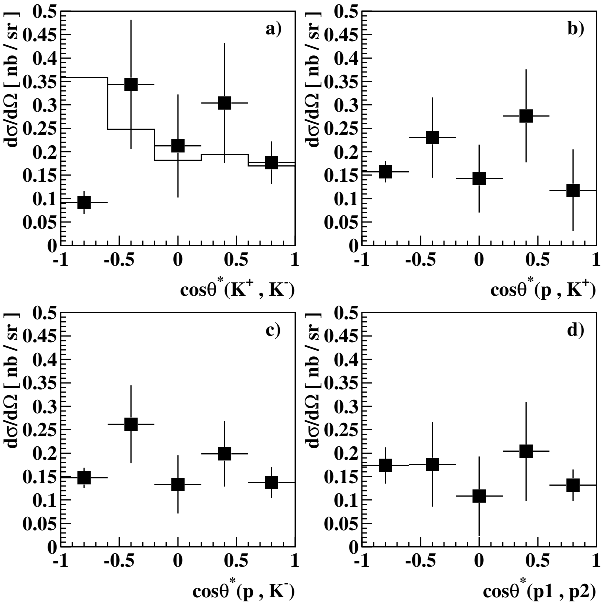

Figure 2: Relative angles of the kaon-antikaon, proton-kaon, proton-antikaon and proton-proton subsystem.

Assuming a pure resonant production via the $f_0(980) \rightarrow K^+K^-$, the angular distribution in (a) is expected to show a shape indicated by the solid line. Since the data do not show such a behaviour, we conclude that the free production dominates the K^+K^- production strongly and that the production via the resonances plays only a minor role.

A preliminary absolute cross section at a beam momentum of p=3.356 GeV/c, corresponding to an excess energy of Q=17 MeV with respect to the free K^+K^- production, is determinded to be [4]:

$$\sigma = 1.80\,nb \pm 0.27\,nb\,(stat.) \pm^{0.28}_{0.35}\,nb\,(syst.).$$

References

[1] Annual Report 1999, IKP, Forschungszentrum Jülich, **Jül-3744**, 41 (2000)

[2] Annual Report 1998/99, IKP, Westfälische Wilhelms-Universität Münster, 20 (2000)

[3] G. Fäldt and C. Wilkin, Phys. Lett. B 382, 209 (1996)

[4] C. Quentmeier, doctoral thesis (in preparation), Westfälische Wilhelms-Universität Münster (2001)

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