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

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At the COSY–11 facility measurements on the reaction $pp \rightarrow ppK^+K^-$ have been performed. Up to now, the COSY–11 collaboration has determined upper limits on the total cross section at several beam energies close to threshold [1–3].

In the last two years additional data with higher statistics have been taken. At an excess energy of Q= +17 MeV a significant number of events has been observed, which can be identified with the final state $pp \rightarrow ppK^+K^-$.

At the COSY–11 detection system the four–momenta of positively charged particles are experimentally determined. For the reaction $pp \rightarrow ppK^+K^-$ the missing mass of the ppK^+–system corresponds to the mass of the K^-–meson. In reactions of the type $pp \rightarrow ppK^+X$ one proton and particle(s) X may originate from the decay of a previously produced hyperon Y in $pp \rightarrow pK^+Y \rightarrow pK^+pX$. In this case, the missing mass distribution with respect to the ppK^+–system shows up as a broad distribution, ending at the kinematic limit.

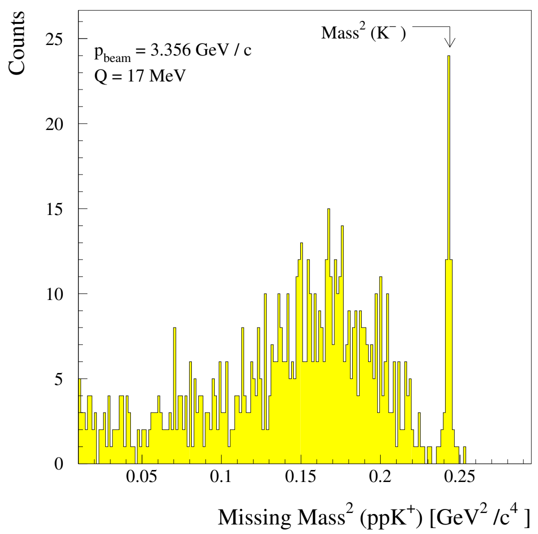

Figure 1: Squared missing mass spectrum.

In figure 1 the squared missing mass of the system ppK^+ is shown. A significant signal at the squared mass of the K^-–meson can clearly be separated from the background. Additionally, with reduced acceptance the missing K^-–meson can be detected by a scintillator and a silicon pad detector.

With the new data the total cross section for the $pp \rightarrow ppK^+K^-$ reaction 17 MeV above threshold and an additional upper limit at an excess energy of Q= 3 MeV have been extracted and are shown as very preliminary estimates in figure 2. The error is a very conservative guess.

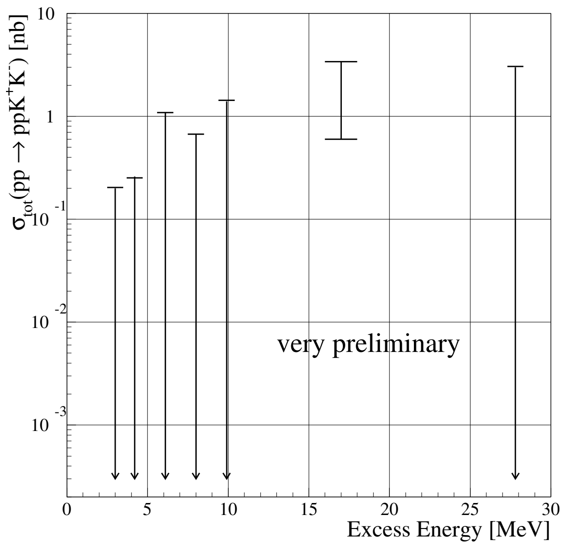

Figure 2: Upper limits on the total cross section for the reaction $pp \rightarrow ppK^+K^-$ at a confidence level of 95%. The limit at Q= 3 MeV and the conservatively estimated cross section range at Q= 17 MeV are very preliminary.

References:

[1] M. Wolke, PhD thesis, Rheinische Friedrich–Wilhelms–Universität Bonn (1997); Annual Report 1996, IKP, Forschungszentrum Jülich, Jül–3365 (1997) 42

[2] T. Lister, PhD thesis, Westfälische Wilhelms–Universität Münster (1998)

[3] Annual Report 1998, IKP, Forschungszentrum Jülich, Jül–3640 (1999) 36

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