Excitation function of the $pp \to ppK^+K^-$ reaction near threshold

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The COSY-11 collaboration extended the rather small existing database [1–3] on the $pp \to ppK^+K^-$ reaction near the production threshold by two measurements at excess energies of $Q = 10$ and 28 MeV, both lying below the ϕ-meson threshold. The total cross section at $Q = 17$ MeV [1] significantly exceeds the expectations for a pure non-relativistic phase space. Besides the known strong proton-proton final state interaction, such an effect could be caused by additional interactions in the proton-kaon systems. The K^+K^- system is linked with the nature of the scalar resonances a_0/f_0. These resonances are described as $q\bar{q}$ states [4], $qq\bar{q}\bar{q}$ states [5], $K\bar{K}$ molecules [6,7], hybrid $q\bar{q}$/meson-meson systems [8] or even quarkless gluonic hadrons [9]. The strength of the K^+K^- interaction plays an important role [7] in the understanding of these resonances, which can be studied in the elementary $K\bar{K}$ production in pp collisions.

For both energies, the calibration was improved and the final analysis was performed. The explicit details of the analysis can be found elsewhere, e. g. [3, 10, 11].

After the identification of two protons and a K^+, a clear signal in the missing mass spectrum at the kaon mass is observed for both energies (as an example see figure 1 at $Q = 28$ MeV). Before final cross sections will

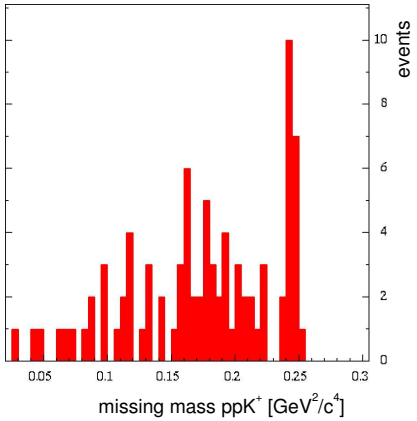

Fig. 1: Squared missing mass of the ppK^+-system with an additional demand for a hit in the dipole scintillator for $Q = 28$ MeV.

be presented, last detailed studies of different experimental parameters like the beam width and the beam momentum spread have to be performed. They can be reconstructed by looking at different experimental observables (see for example [12]), e.g. invariant and missing masses, in order to optimize the agreement between the data and the Monte-Carlo studies which are needed for studying the detection efficiency.

The luminosity has been extracted via a simultaneous measurement of the elastic pp scattering. Together with the detection efficiency, first preliminary cross sections for both excess energies were calculated. The excitation function is shown in figure 2 together with some theoretical predictions. It is obvious, that the cross section exceeds all lines towards lower energies. It remains an open question if the discrepancy will be solved by accounting for the pp and pK interaction simultaneously. Furthermore, the four-body final state has to be incorporated correctly whereas the dash-dotted line as a first attempt just includes the pp-FSI deduced for the three body final state. To further study the degree of this

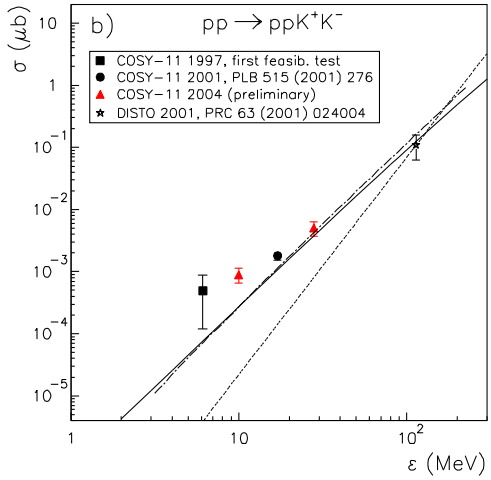

Fig. 2: Excitation of the reaction $pp \to ppK^+K^-$ with the new preliminary data at $Q = 10$ and 28 MeV. The dashed line is the pure non-relativistic phase space ($\propto Q^{\frac{7}{2}}$), the solid line is a calculation without the pp-FSI but an energy dependent matrix element [13] and the dash-dotted line results from a parametrization of the pp-FSI.

strong rise, a new measurement at 6 MeV [14] will be performed soon in order to increase the existing statistics at this energy of only two counts.

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