Measurements of the total cross section of the reaction $pp \rightarrow ppK^+K^-$ were performed at the cooler synchrotron COSY near the kinematical threshold by the COSY-11 collaboration [1, 2], and for higher energies by the ANKE collaboration [3]. This reaction channel was studied also by the DISTO collaboration [4] at $Q = 114$ MeV at the SATURN accelerator. The results indicate that near threshold data points lie significantly above theoretical expectations.

The enhancement may be due to the influence of $K^+K^-$ or $Kp$ interactions which were neglected in the calculations. This interaction should manifest itself also in the distributions of the differential cross-sections [5]. A significant effect observed for the excitation function for the $pp \rightarrow ppK^+K^-$ reaction encourages us to carry out the analysis of double differential cross sections in spite of the fact that the available statistics is quite low. In our investigation we use experimental data obtained from two COSY-11 measurements at excess energies of $Q = 10$ MeV (27 events) and 28 MeV (30 events) [2]. At present we are, however, at the early stage of the analysis.

For three particles in the final state the process of analysing data by plotting them in the space of two internal parameters is a very convenient way to study the interaction. It was originated by Dalitz in a nonrelativistic application. In the original paper [6] Dalitz let the distances to the sides of an equilateral triangle be the energies of the three particles in the center-of-mass system. Another convenient coordinate is the squared invariant masses of the two-body subsystems. Using such coordinates we obtain event distributions bounded by a well defined smooth closed curve [7]. The area of the Dalitz Plot is proportional to the phase space volume. Moreover, for no dynamics and the absence of any final state interaction, the occupation of the Dalitz plot would be fully homogeneous because the creation in any phase space interval would be defined smooth closed curve [7]. The area of the Dalitz Plot is not proportional to the phase space volume. It is worth mentioning that the event density in the Goldhaber plot is not homogeneous and goes to zero on the entire boundary of the plot given by following equations: $M_{12} + M_{34} = E$, $M_{12} = m_1 + m_2$, $M_{34} = m_3 + m_4$ [7].

So far we conducted Monte Carlo simulations of the $pp \rightarrow ppK^+K^-$ reaction [11] using a FORTRAN-based code, called GENBOD [12]. The simulations were first made assuming that there is no final state interaction, then the $pp$-FSI was included [13]. The $pp$-FSI was taken into account as weights proportional to the inverse of a squared Jost-function of the Bonn potential [14]. In order to compare these spectra with the experimental distributions we need to correct them for the acceptance and detection efficiency of the COSY-11 facility. This will be the next step of the ongoing investigations.

References:


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