Energy Dependence of the Total Cross Section for the pp $\to$ pp η' Reaction

close to the Kinematical Threshold

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The first published total cross section values for the $pp \to pp\eta'$ reaction near the kinematical threshold [1, 2] triggered a large interest in explaining the unknown dynamics of the η' meson creation in the proton–proton collision [3–8]. The data enabled also first inferences about the proton–η' interaction. A steep decrease of the total cross section when approaching the kinematical threshold, indicated that this interaction might be repulsive [9].

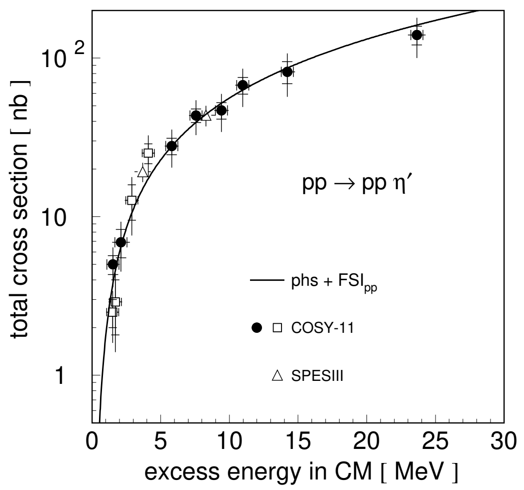

Figure 1: Total cross section of the $pp \to pp\eta'$ reaction as a function of the center–of–mass excess energy. Open triangles and squares are from references [1] and [2], respectively. Filled circles indicate the results of the analysis of the COSY–11 measurements performed in 1998 [10]. Statistical and systematical errors are separated by dashes. The solid line depicts calculations of the total cross section assuming the primary production amplitude to be constant and only proton–proton interactions to take place in the exit channel. The proton–proton scattering amplitude was computed according to the formulas from reference [11]. The obtained energy dependence agrees well with the Fäldt and Wilkin model [12].

Here we report new results obtained from the analysis of the data [10] taken in 1998 with a stochastically cooled proton beam at the Cooler Synchrotron COSY. Total cross sections for the $pp \to pp\eta'$ reaction were determined at eight different excess energy values ranging between Q = 1.53 MeV and Q = 23.64 MeV. The total integrated luminosity obtained during the two weeks of beam time amounted to 1.4 pb^{-1}.
Figure 1 shows the compilation of all available data for the near–threshold η' meson production via the $pp \to pp\eta'$ reaction. The new results, presented as filled circles, are well described by the integral of the phase–space volume weighted with the squared proton–proton scattering amplitude. This indicates that the influence of the proton–η' FSI on the energy dependence of the total cross section is too weak to be seen within the up–to–date experimental accuracy. Thus, in view of the new results, former speculations on the repulsive interaction between the η' meson and the proton appear to be doubtful.
The determination of differential cross sections would be very useful to learn more about the proton–η' interaction.

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