Comparative studies of the low energy $pp\eta$ and $pp\eta'$ systems with the COSY-11 detector.

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A qualitative phenomenological analysis of the determined differential squared invariant proton-proton and proton-η mass distributions for the $pp \to pp\eta$ reaction measured by the COSY-11 collaboration at an excess energy of 15.5 MeV [1] revealed an enhancement of the population density at the kinematical region corresponding to a small proton-η momentum. The observed enhacement could be explained by the significant role of the proton-η interaction [2, 3] in the final state, or by an admixture of the higher waves during the η production at the excess energy of 15.5 MeV [4], or by a possibile energy dependence of the production amplitude [5]. Those possibilities motivated the high statistics $pp \to pp\eta'$ reaction measurement in order to determine the distribution of events over the phase space at the same excess energy, equal to 15.5 MeV. The comparison of differential distributions of proton-proton and proton-meson invariant masses for the η and η′ production could help to judge between postulated explanations of observed effect and allow for a quantitative estimation between the proton-η and the proton-η′ interaction.

The $pp \to pp\eta'$ reaction has been measured using the COSY-11 detector setup [6]. The experiment was based on the measurement of two protons in the exit channel and the unobserved meson was identified using the missing mass technique. The analysis of the data was described in several referenceces [7, 8, 9], and here we would like the present the final distributions of the square of the proton-proton (s_{pp}) and proton-meson (s_{pmeson}) invariant masses as a result of that analysis.

We compared the distributions of the square of the proton-proton (s_{pp}) and proton-meson (s_{pmeson}) invariant masses determined for the $pp \to pp\eta$ and $pp \to pp\eta'$ reactions in figure 1. In both panels of the figure, it is seen that the experimental points of the $pp \to pp\eta$ measurement are in agreement with those from the $pp \to pp\eta'$ reaction within the statistical errors.

Unexpectedly, the shapes do not differ, showing the enhancement at the same values of the square of the proton-proton (s_{pp}) invariant mass.

If indeed the η′-proton interaction is much smaller than the η-proton as inferred from the excitation function, then the spectra being presented in this report rather exclude the hypothesis that the enhancement is due to the proton-meson interaction.

The final interpretation of the results is in progress.

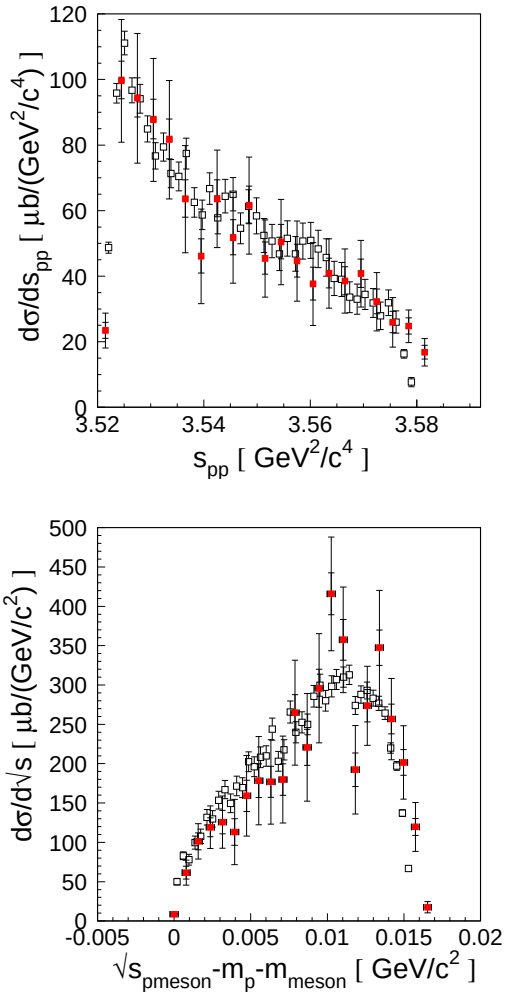

Fig. 1: The comparison of the distributions of the square of the proton-proton (s_{pp}) and proton-meson (s_{pmeson}) invariant masses determined experimentaly for the $pp \to pp\eta$ (full red squares) and $pp \to pp\eta'$ (open squares) reactions. The distributions of the η′ data were normalized to these of the η.

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