Near Threshold Production of ω Mesons in the $pp \to pp\omega$ Reaction

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Studies on the ω meson production in the proton-proton scattering provide valuable information on the properties of this vector meson and relevant production processes in the elementary nucleon-nucleon interaction. Recent calculations on the $pp \to pp\omega$ reaction [1] demonstrate a significant influence of different production mechanisms on the angular disribution of the emitted ω mesons. Data for the reaction channel $pp \to pp\,X$ taken at COSY-11 at beam momenta of 3.292 GeV/c, 3.311 GeV/c and 3.356 GeV/c have been analyzed in view of the ω meson production [2]. The excess energies coverd by this data are Q = 202.3 MeV, 208.3 MeV and 222.5 MeV. The event selection was performed by accepting events with two identified protons. The four-momentum determination of positively charged ejectiles yields a full event reconstruction for the reaction type $pp \to ppX$, and the X-particle system can be identified using the missing mass method. Therefore, kinematical distributions of all reaction ejectiles can be studied in detail.

In Fig.1 the resulting angular distributions for three different beam momenta are shown. The quoted error bars include statistical and systematical errors except contributions from overall systematical uncertainties (e.g. luminosity determination). Obviously, the observed distributions, which for symmetry reasons have to be symmetric about $\cos\theta^*(\omega) = 0$, indicate the presence of higher partial waves than pure s-wave.

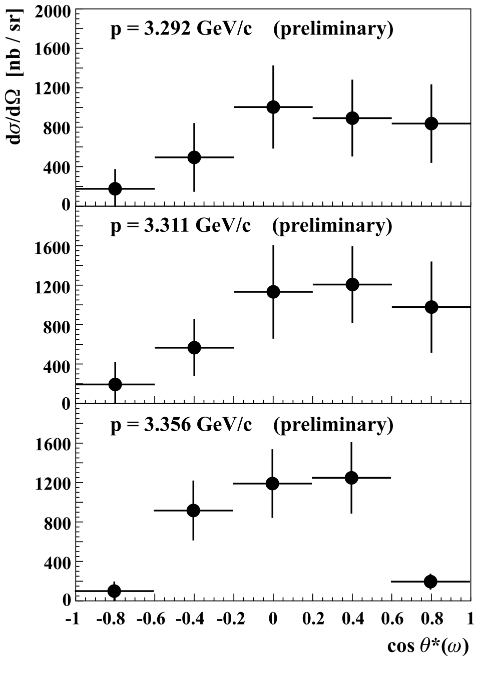

Figure 1: Angular distribution of the emitted ω mesons in the center of mass system for the reaction $pp \to pp\omega$ at Q = 202.3 MeV, Q = 208.3 MeV and Q = 222.5 MeV.

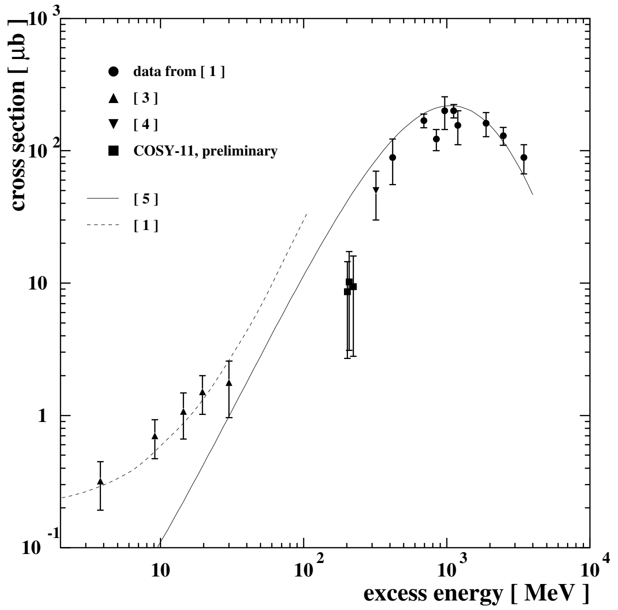

Figure 2: Total cross sections of the reaction $pp \to pp\omega$ as function of the excess energy Q. The curves are explained in the text.

In Fig.2 the resulting total cross sections (filled squares) are compared with other existing data [1,3,4]. The solid line indicates a parametrisation of the excitation function of the $pp \to pp\omega$ reaction on basis of a one-pion exchange model [5]. While the high energy data can fairly be described by this calculations, distinct deviations at lower excess energies (Q $\leq$ 400 MeV) are visible, which might partly be caused by the neglected final state interactions. The dashed line of Fig.2 represents results of investigations on the ω meson production within a meson-exchange model taking into account contributions of the π, ρ and ω exchange as well as the NN final state interaction [1]. These calculations are valid for excess energies below Q $\sim$ 100 MeV and describe the low energy data fairly well. However, a complete calculation describing the available data in the whole range of displayed excess energies is still missing.

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