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Study of baryonic resonances and the ρ meson production in the reaction $pp \to pp\pi^+\pi^-$ at 3.5 GeV with HADES

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Collaboration

HADES Collaboration

Abstract content

Pion production in NN collisions is one of the sources of information on the NN interaction and on the contribution of nucleon resonances. In particular, two-pion production in the few energy range, carries information both on $\pi\pi$ dynamics and on single and double baryon excitation. The High Acceptance Di-Electron Spectrometer (HADES)[1] installed at GSI Helmholtz-Zentrum für Schwerionenforschung in Darmstadt, designed to investigate dielectron production in heavy-ion collisions in the range of kinetic beam energies 1-2 A GeV is also an excellent detector for charged hadron detection, due to its tracking capabilities. Recently, differential and integrated cross sections for the reactions $pp \to pp\pi^0$, $pp \to pn\pi^+$ [2-3-4], $pp \to pp\pi^+\pi^-$, $pn \to pn\pi^+\pi^-$ [5], $pn \to d\pi^+\pi^-$ have been investigated with HADES at kinetic energies 1.25, 2.2 and 3.5 GeV. This talk will focus on the analysis of the $pp \to pp\pi^+\pi^-$ channel at 3.5 GeV, using results from $pp \to pp\pi^0$, $pp \to pn\pi^+$ [3] and $pp \to pK\Lambda$ [6] measured at the same energy by HADES. The contributions of the excitation of one or two baryonic resonances with masses up to 1.9 GeV and of the ρ production can be quantified. The results are compared with two theoretical models [7-8]. The results of this study provide strong constraints on the pion production mechanisms and on the various resonance contributions $(\Delta(1232), N^*(1440), ...)$, as well as on the double resonance excitation and the direct ρ production. These aspects are closely related to the interpretation of the dielectron spectra measured by the HADES collaboration. Baryonic resonances are indeed important sources of dileptons through two mechanisms: the Dalitz decay (e.g. $R \to Ne^+e^-$) and the mesonic decay with subsequent dielectron production.

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[2] G. Agakishiev et al. Eur.Phys.J. A48 (2012) 74.
[3] G. Agakishiev et al. Eur.Phys.J. A50 (2014) 82.
[4] G. Agakishiev et al. , Eur.Phys.J. A51 (2015), 137.
[5] G. Agakishiev et al., Phys.Lett. B750 (2015) 184.
[6] G. Agakishiev et al. Phys.Lett. B742 (2015) 242-248.

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