

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

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Collaboration

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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 $pp \rightarrow pp\pi^0$, $pp \rightarrow pn\pi^+$ [2-3-4], $pp \rightarrow pp\pi^+\pi^-$, $pn \rightarrow pn\pi^+\pi^-$ [5], $pn \rightarrow d\pi^+\pi^-$ 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 $pp \rightarrow pp\pi^+\pi^-$ channel at 3.5 GeV, using results from $pp \rightarrow pp\pi^0$, $pp \rightarrow pn\pi^+$ [3] and $pp \rightarrow pK\Lambda$ [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. $R \rightarrow Ne^+e^-$) and the mesonic decay with subsequent dielectron production.

[1] G. Agakishiev et al., Eur. Phys. J. A41, 243-277 (2009).

[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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