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Studies of inclusive production of protons and charged pions and semi-exclusive channels in π−+C collisions at 0.7 GeV/c with HADES

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At beam energies of a few AGeV the pion production dominates the inelastic NN cross section. At these energies the pion dynamics is crucial to describe the evolution of heavy-ion collisions and drives the thermal properties of nuclear medium. Pion-nucleus scattering is an ideal tool to study properties of baryonic resonances in the nuclear medium.
Previous experiments extensively studied the Δ(1232) resonance region [1,2] and were performed mostly with positive pions focusing on total cross section measurements, including pion absorption or scattering and charge exchange reactions. By contrast, experimental information at higher energies, in particular in the second resonance region (N*(1440),N*(1520),N*(1535), ...) and beyond, is still scarce. Such data are, however, essential as a benchmark for the description of heavy-ion reactions in dense hadronic matter at a few AGeV as will be explored at e.g. the FAIR facility.
In addition, differential pion and proton spectra from pion-induced reactions are highly relevant for the validation and further development of transport and cascade models. This is particularly important since cascade approaches are also widely used in applications such as GEANT4 e.g. by long base line neutrino experiments such as DUNE and T2K.
In this talk I will focus on the analysis of the π−+C data collected with the High Acceptance Di-Electron Spectrometer (HADES) [3], using the pion beam at the GSI facility at an incident pion momentum of 0.7 GeV/c. Pion and proton differential spectra have been measured in various exit channel topologies (inclusive, pπ−, pπ+, pp, π+π−,..., ππpp) and are compared to predictions of the INCL++ cascade [4] and of a set of transport models (SMASH [5], JAM2/RQMD.rmf [6], GIBUU [7]).
The results provide stringent tests of the model description of quasi-elastic scattering, multi-pion production, re-scattering, and pion absorption.

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Collaboration

HADES

Primary author: CIEPAŁ, Izabela (Institute of Nuclear Physics PAS)

Co-author: RAMSTEIN, Béatrice (IJCLab)

Presenter: CIEPAŁ, Izabela (Institute of Nuclear Physics PAS)

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