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MPD potential for resonance property measurements in Xe+W collisions at 2.5A GeV at NICA

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The study of nuclear matter formed in relativistic heavy-ion collisions is one of the key tasks in high-energy physics. In addition to the quark-gluon plasma produced in such colliding systems, the hadron gas phase that represents the final stage of the collision is of particular interest. Investigation of resonance production in relativistic heavy-ion collisions serves as a primary tool for analyzing this hadronic phase. Due to their short lifetimes, resonances act as indicators of the dynamic equilibrium between rescattering and regeneration processes. Furthermore, their production allows for the investigation of a wide range of physical effects, such as the possible restoration of chiral symmetry, strangeness enhancement, baryon anomaly at intermediate transverse momenta, flavor dependence of parton energy loss at high momenta, and others. Currently, the most intriguing region of the QCD matter phase diagram, where the critical point and a first-order phase transition are expected to be discovered, lies within the area of high net-baryon densities and moderate temperatures (at $\sqrt{s_{NN}} = 2-15$ GeV). The Nuclotron-based Ion Collider fAcility (NICA), a superconducting proton and heavy-ion collider under construction at JINR (Dubna), along with the Multi-Purpose Detector (MPD) experiment, is specifically aimed at exploring this region by studying the nuclear medium formed in relativistic heavy-ion collisions at low temperatures and high net-baryon densities. According to the current schedule, some of the first runs at the NICA accelerator complex will involve xenon nucleus (Xe) collisions with a fixed tungsten (W) target at an incident beam kinetic energy of $E_{kin} = 2.5A$ GeV. In this work, the feasibility of the MPD detector operating in the fixed-target mode to measure the characteristics of meson resonances was investigated. The study was performed for Xe+W collisions at an energy of 2.5 GeV/nucleon. Since the MPD detector is currently in its preparation phase for commissioning, all processes from the initial nuclear collision to the detector response were reproduced using Monte Carlo simulations. Based on the results of this work, the acceptance regions in rapidity, transverse momentum, and event centrality accessible for physics analysis were determined.

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Primary author(s) : BERDNIKOV, Yaroslav (Peter the Great St. Petersburg Polytechnic University); IVANISHCHEV, Dmitry (NRC «Kurchatov Institute» - PNPI, SPbPU); KOTOV, Dmitry (Peter the Great St. Petersburg Polytechnic University); MALAEV, Mikhail (SPbPU, NRC «Kurchatov Institute» - PNPI); RIABOV, Yuriy (NRC «Kurchatov Institute» - PNPI)

Presenter(s) : IVANISHCHEV, Dmitry (NRC «Kurchatov Institute» - PNPI, SPbPU)

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