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Investigating quantum interference in Drell-Söding process in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR

Relativistic heavy-ion collisions offer a unique environment for exploring quantum interference at an unprecedented femtometer scale through photon-nuclear interactions in photoproduction. In exclusive $\pi^+\pi^-$ production, the resonance and continuum $\pi^+\pi^-$ components arise from distinct production mechanisms in the γA interaction. The continuum $\pi^+\pi^-$ photoproduction is dominated by Drell-Söding process, in which a virtual π^+/π^- is diffraction-scattered on the nucleus. The $\sim 5\%$ difference in the elastic scattering cross sections of $\pi^- A$ and $\pi^+ A$ around a γp center-of-mass energy of approximately 12 GeV in photoproduction in 200 GeV Au+Au collisions may result in destructive interference. In contrast to ρ^0 photoproduction, the Entanglement Enabled Spin Interference (EESI) in Drell-Söding process may differ due to the absence of the intermediate ρ^0 and the specific dynamics of the virtual pion-nucleus interaction.

In this poster, we will present the first measurement of the diffractive p_T spectrum and the spin interference pattern through $A_2\phi$ for the Drell-Söding process in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR. The results indicate an obvious difference in p_T spectrum compared to ρ^0 photoproduction. We also observe $A_2\phi$ with no clear mass dependence for $p_T < 0.1$ GeV/c and a notably stronger interference at the same $M_{\pi^+\pi^-}$ in the Drell-Söding process compared to ρ^0 photoproduction, which provides a unique opportunity to explore the effect of production mechanism on the EESI.

Category

Experiment

Collaboration (if applicable)

STAR Collaboration

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