

Measurements of Directed Flow of Protons and Anti-Protons in RHIC Beam Energy Scan II by STAR

Directed flow of particles is an important feature seen in heavy-ion collisions and is a sensitive probe of the equation of state (EoS) of the matter produced in the collisions. Model calculations have predicted that directed flow could be a sensitive probe of the softening of the EoS associated with a first order phase transition. Directed flow of protons and anti-protons are also of interest as they offer sensitivity to both the contributions from the transported quarks and also the medium generated component from the produced quarks. Measurements of proton and net proton directed flow from BES-I have shown that there is a non-monotonous dependence on collision energy. We will present measurements of the directed flow of protons and antiprotons from the collision energies of 7.7, 9.2, 11.5, 14.6, 17.3, 19.6, and 27 GeV Au+Au collisions, using high statistics BES-II data from STAR. The new results give us much higher precision than BES-I from larger datasets and detector upgrades. We will also present a decomposition of proton directed flow into a medium generated component and a component (v_1^{excess}) attributed to transported protons. The $d v_1^{\text{excess}} / dy'$ ($y'=y/y_{\text{beam}}$) is found to be constant between collision energies from 200 GeV to ~ 11.5 GeV, but to increase below that. Measurements will be compared to different model calculations and implications to the understanding of the QCD phase structure and softening of the EoS of the medium will be discussed.