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

Directed flow of particles is a sensitive probe of the equation of state (EoS) of the matter produced in heavy-ion collisions and could be a sensitive probe of the softening of the EoS associated with a first order phase transition according to model calculations. 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 anti-protons from the collision energies of 7.7, 9.2, 11.5, 14.5, 17.3, 19.6, and 27 GeV Au+Au collisions, using high statistics BES-II data from STAR. We will also present a decomposition of proton directed flow into a medium generated component and an excess component (v_1 excess) attributed to transported protons. The v_1 excess component is found to show a simple scaling from a center of mass energy of 200 GeV to ~10 GeV, but to break scaling below 10 GeV. The new results have significantly reduced uncertainties compared to those from BES-I and also allow differential measurements in centrality and transverse momentum. Measurements will be compared to different model calculations and implications to the understanding of the QCD phase structure and EoS of the medium will be discussed.