



Beam Energy Dependence of Directed Flow of Pions and Kaons in Au+Au Collisions from STAR

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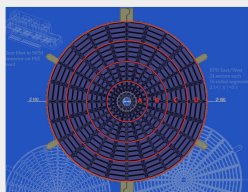
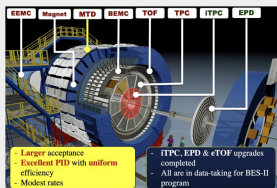


Abstract

The v_1 is sensitive to the equation of state of nuclear matter, making it a useful probe for studying the phase transition. Results from RHIC Beam Energy Scan-I (BES-I) program on directed flow show that the proton and net-proton slope parameter $\frac{dv_1}{dy}|_{y=0}$ exhibits a minimum between 11.5 and 19.6 GeV. The observed minimum for protons and net protons resembles the predicted “soft point collapse” of flow and is a possible signature of a first-order phase transition between hadronic matter and a deconfined phase.

In this poster, we will present measurements of the directed flow of π^+ , π^- in Au+Au collisions at $\sqrt{s_{NN}} = 9.2, 11.5, 14.6, 17.3, 19.6$ GeV and K^+ , K^- in Au+Au collisions at $\sqrt{s_{NN}} = 7.7, 9.2, 11.5, 14.6, 17.3, 19.6$ GeV from the RHIC Beam Energy Scan-II (BES-II) program. The rapidity dependence of v_1 , as well as the energy dependence of the v_1 slope, will be discussed.

Experimental setup



The STAR Detector

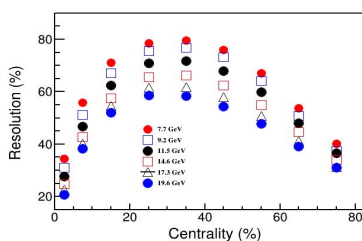
- 2π azimuthal coverage
- Large acceptance
- Excellent PID

The TPC and TOF are used for particle identification; EPD is used for event plane reconstruction;

EPD

- Larger event plane resolution
- Acceptance at $2.1 < |\eta| < 5.1$

Full event plane resolution (1st order)



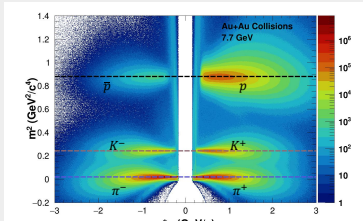
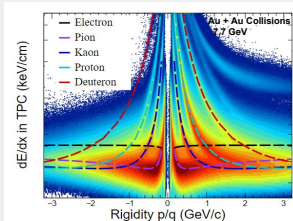
Resolution as a function of centrality across various collision energies.

EPD provides larger event plane resolution.

$$R_{1,sub} = \sqrt{\langle \cos(\psi_1^{fast} - \psi_1^{west}) \rangle}$$

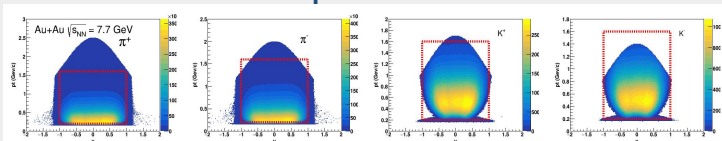
$$R_{1,full} = R(\sqrt{2}R_{sub})$$

Particle Identification



Combination of TPC and TOF provide excellent particle identification capability.

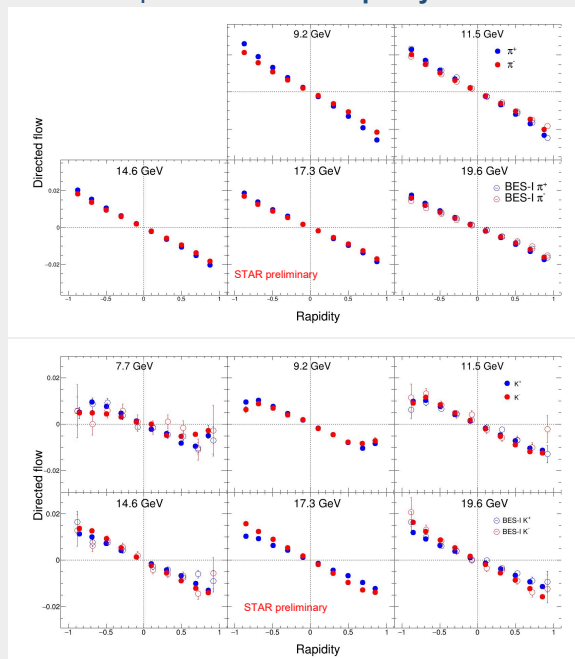
Acceptance



$$\pi^\pm: 0.2 < p_t < 1.6 \text{ GeV}/c \quad -1 < y < 1$$

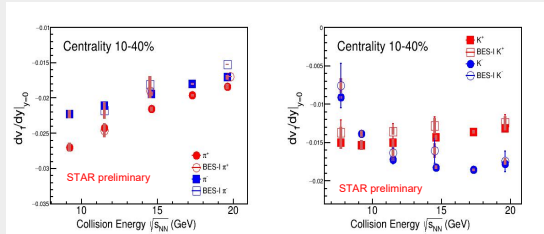
$$K^\pm: 0.2 < p_t < 1.6 \text{ GeV}/c \quad -1 < y < 1$$

v_1 as function of rapidity



The v_1 of π^+ is slightly higher than v_1 of π^- .

Energy Dependence of dv_1/dy



Fitting function:
 $v_1(y) = \left(\frac{dv_1}{dy}\right)_y$
Fitting range:
 $-0.8 < y < 0.8$

As the energy increases, the v_1 slope of π^+ and π^- gradually converge.

Summary

- v_1 measurements of Pions in Au+Au collisions at 9.2-19.6 GeV and Kaons in Au+Au collisions at 7.7-19.6 GeV.
- The v_1 of π^+ is slightly higher than v_1 of π^- . As the energy increases, the v_1 slope of π^+ and π^- gradually converge.

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