The anisotropic flow of K_S^0 and Λ in Au+Au collisions at $\sqrt{S_{NN}}$ = 3.9 GeV from STAR

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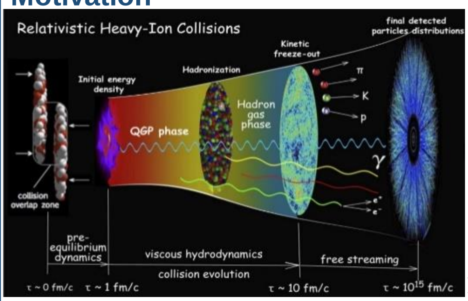
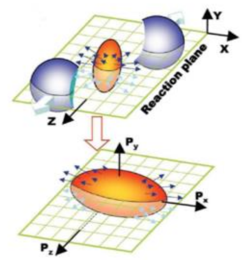
Abstract

The directed flow (v_1) and elliptic flow (v_2) are the first two Fourier expansion coefficients of azimuthal distributions of produced particles in heavy-ion collisions. Measurements of identified particle v_1 and v_2 is one of the most informative ways in studying the properties of hot and dense nuclear matter created in heavy-ion collisions.

In this poster, directed flow and elliptic flow of identified hadrons (K_S^0 and Λ) in $\sqrt{S_{NN}}$ = 3.9 GeV Au+Au collisions, data collected by the STAR experiment in the second phase of the beam energy scan (BES-II), will be presented. We will show v_2 as a function of rapidity and p_T for these particles in 0-10% and 10-40% centrality bins. In addition, v_1 slope measured as a function of p_T window will be shown.

Motivation



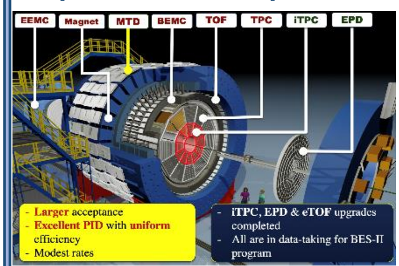


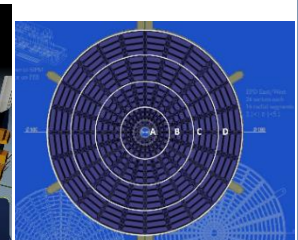
- The first two Fourier expansion coefficients are directed flow and elliptic flow

$$E\frac{d^3N}{d^3p} = \frac{d^2N}{2\pi dy p_T dp_T}\left[1 + 2\sum_{n=1}^{\infty}(v_n \cos(n(\phi_p - \Psi_r)))\right]$$

A. M. Poskanzer and S. A. Voloshin. PRC 58,1671(1998)

Experimental Setup

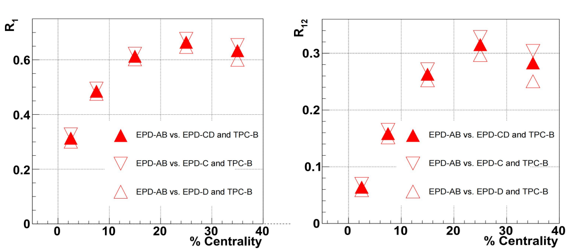




- The TPC,TOF, and EPD are main detectors used for particle identification and event plane reconstruction

Analysis Procedure

- **Event Plane Resolution**



$$R_1 = \sqrt{\frac{\langle\cos(\Psi_1^a - \Psi_1^b)\rangle\langle\cos(\Psi_1^a - \Psi_1^c)\rangle}{\langle\cos(\Psi_1^b - \Psi_1^c)\rangle}}$$

$$R_1 = \frac{\sqrt{\pi}}{2\sqrt{2}}\chi_1 \exp(-\chi_1^2/4) \times [I_0(\chi_1^2/4) + I_1(\chi_1^2/4)]$$

$$R_{12} = \frac{\sqrt{\pi}}{2\sqrt{2}}\chi_1 \exp(-\chi_1^2/4) \times [I_{1/2}(\chi_1^2/4) + I_{3/2}(\chi_1^2/4)]$$

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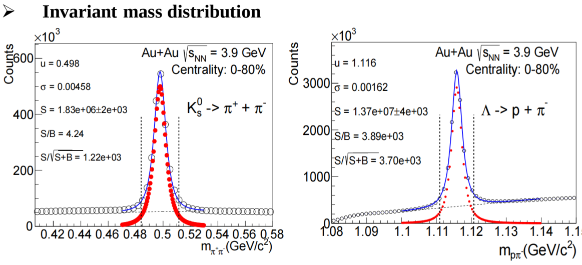
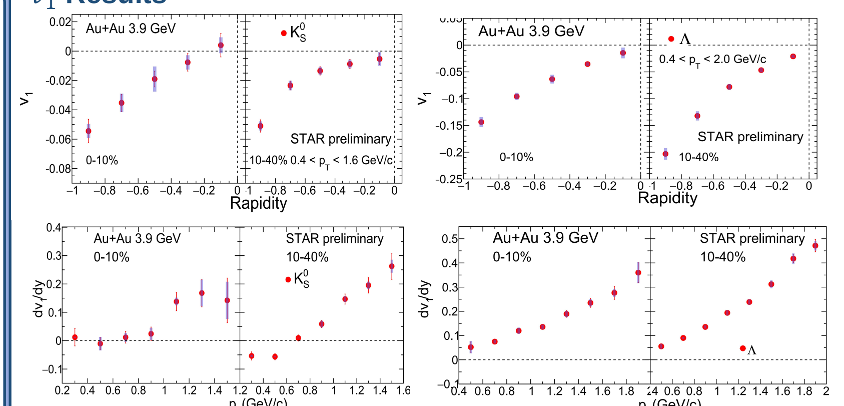
- **Invariant mass distribution**



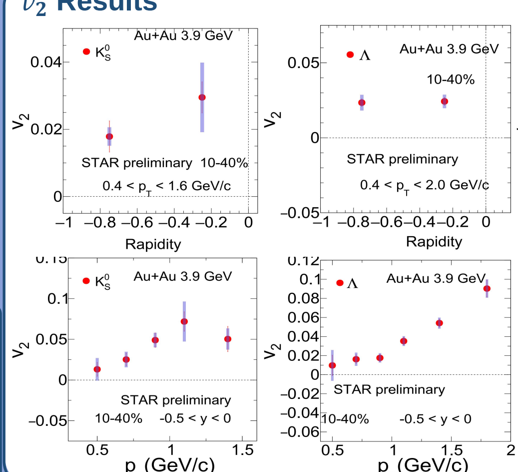
- **Invariant mass method used to extract v_n**

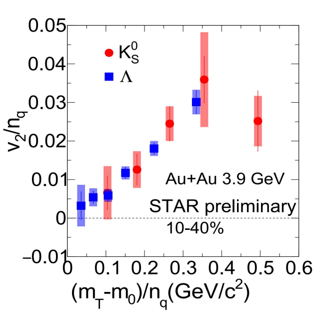
v_1 Results



- Small anti-flow for K_S^0 at low p_T (< 0.7 GeV), positive slope at higher p_T.
- Λ v_1 slope is positive at all p_T.

v_2 Results





- Positive v_2 for both K_S^0 and Λ at all measured p_T and rapidity at 3.9 GeV.
- K_S^0 and Λ v_2 shows NCQ scaling at 3.9GeV.

Summary and Outlook

- K_S^0 and Λ $v_1(y)$, v_1 slopes as a function of p_T and v_2 are measured
- Outlook: Explore the QCD phase diagram with identified particle v_1 and v_2 in BES-II

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The STAR Collaboration
https://drupal.star.bnl.gov/STAR/presentations

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