Kaon production in Au+Au collisions at high baryon density from STAR BES-II experiments

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Abstract

Strange hadrons have been suggested as sensitive probes for the medium properties of nuclear matter created in heavy-ion collisions. Dense baryon-rich medium is formed during collisions at center-of-mass energies of a few-GeV. Since strange hadrons are produced near or below the threshold, their phase space distribution and yield ratio may provide strong constraints on the equation of state (EoS) of high baryon density matter..

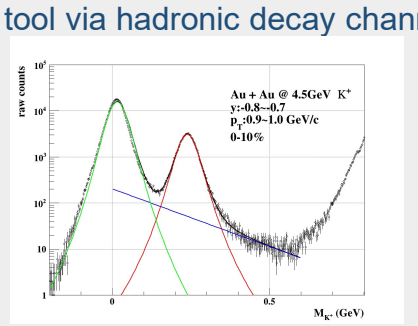
In this poster, we will present measurements of Kaon production in Au+Au collisions at $\sqrt{s_{NN}}$ = 3.2, 3.5, 3.9, 4.5, 5.2 and 6.2 GeV with the fixed-target (FXT) mode from STAR BES-II experiment. The transverse momentum spectra and rapidity densities of $K^{\pm}$ and K^0_S will be presented as functions of collision centrality at FXT energies. The K^{*0} reconstruction technique will be introduced, which validate the possibility to measure the K^{*0} production in Au+Au collisions at high baryon density.

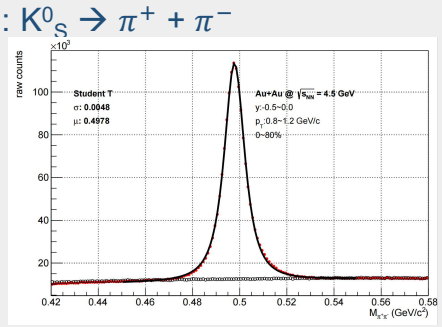
Motivation

- Charged and neutral Kaons are measured at near-threshold production energy at STAR FXT energies, and they are complementary to other (multi-)strange hadrons to study the properties of created QCD matter.
- K^{*0} is a resonance, its decay daughters may undergo in-medium effects, like re-scattering and regeneration. The yield ratios of $K^{*0}/K^{\pm}$ can help us investigate these effects.

$K^{\pm}$ Identification and K^0_S Reconstruction

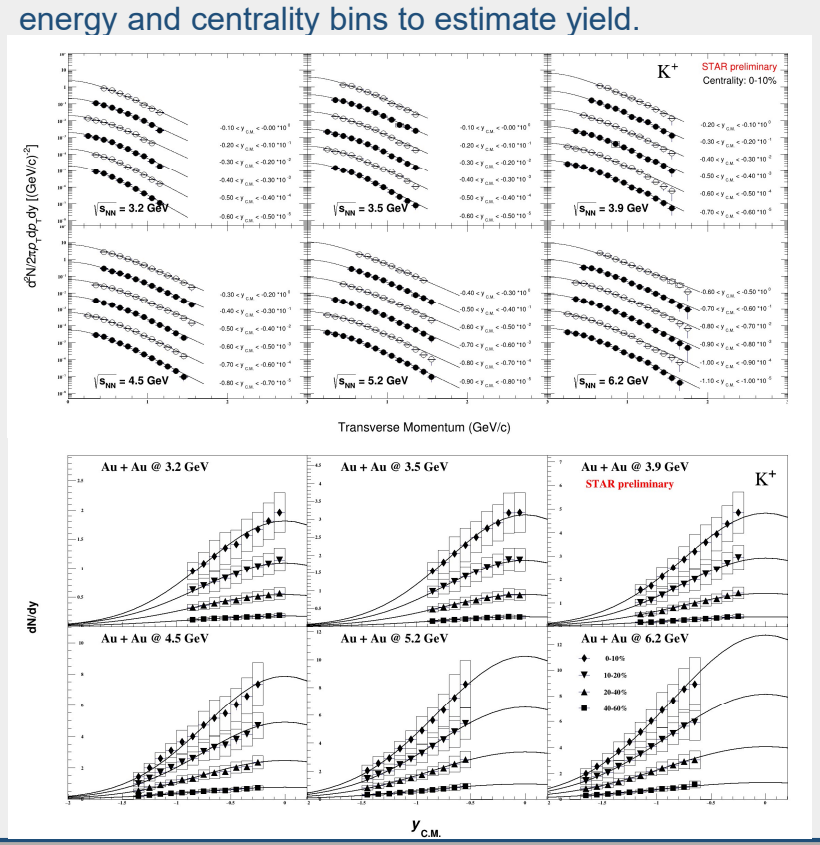
- TPC (dE/dx) and barrel TOF (β) are used for charged Kaon and pion identification.
- K^0_S are reconstructed by invariant mass method with KF Particle tool via hadronic decay channel: $K^0_S \rightarrow \pi^+ + \pi^-$

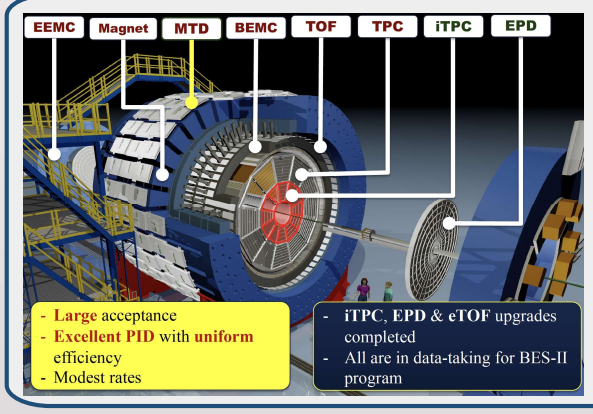




Charged Kaon p_T Spectra and dN/dy

- Corrected p_T spectra are fitted with m_T exponential function to extrapolate to unmeasured range.
- dN/dy distribution fitted with single Gaussion function for different energy and centrality bins to estimate yield.





STAR Detector

Time Projection Chamber (TPC)

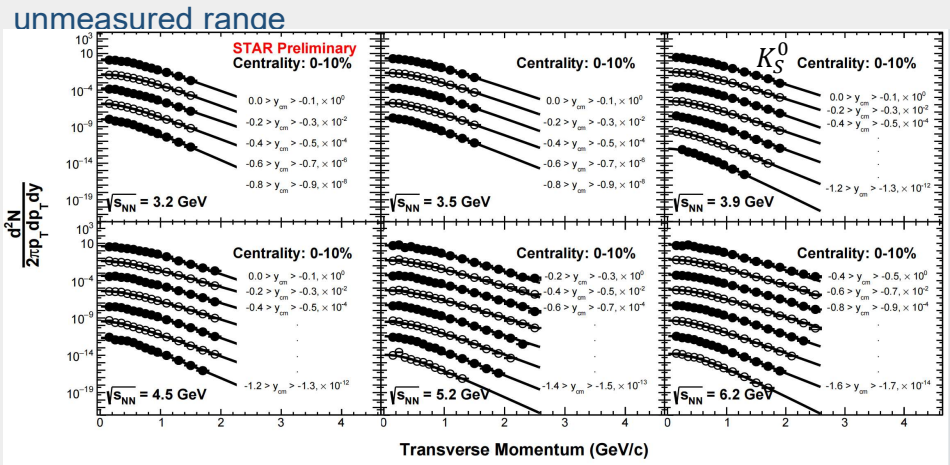
- Charged particle tracking
- Momentum reconstruction
- Particle Identification
- $-2.0 < \eta < 0$ (FXT mode)

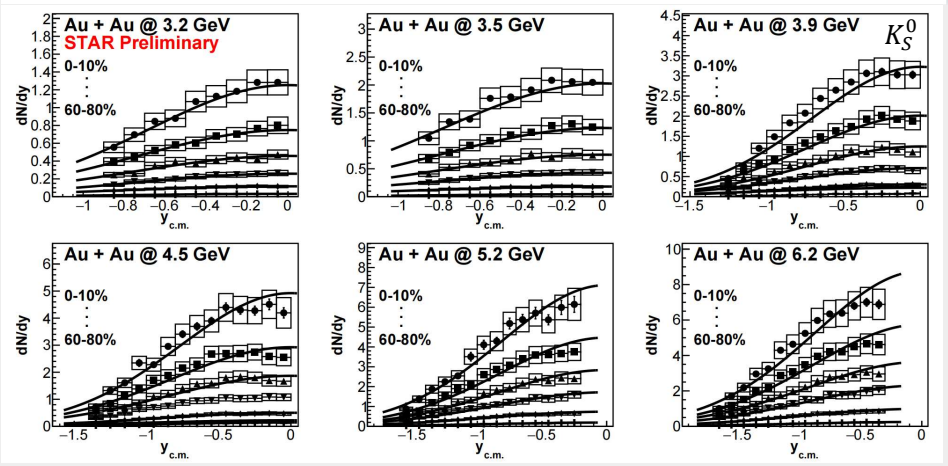
barrel Time-of-Flight (bTOF)

- Particle Identification
- $-1.5 < \eta < 0$ (FXT mode)

Neutral Kaon p_T Spectra and dN/dy

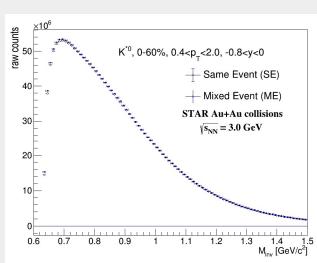
- Blast wave function was used to fit p_T spectra to extrapolate to unmeasured range

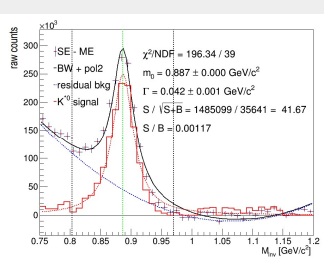


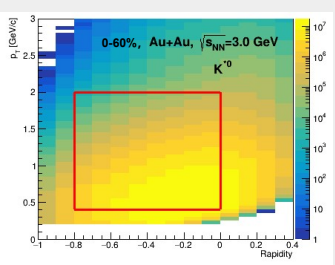


K^{*0} Reconstruction Technique

- K*0 resonances are reconstructed by invariant mass method via hadronic decay channel: $K^{*0} \rightarrow K^+ + \pi^-$
- Mixing-event method used to estimate combinatorial background.







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The STAR Collaboration