POLYTECH
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PHENIX

Production of K(892)^{*0} mesons in ^{3}HeAu collisions at $\sqrt{s_{NN}}$ = 200 GeV

Vladislav Borisov

Yu. Mitrankov, Ya.A.Berdnikov, D. Kotov, A.Ya.Berdnikov

Peter the Great Saint-Petersburg Polytechnic University

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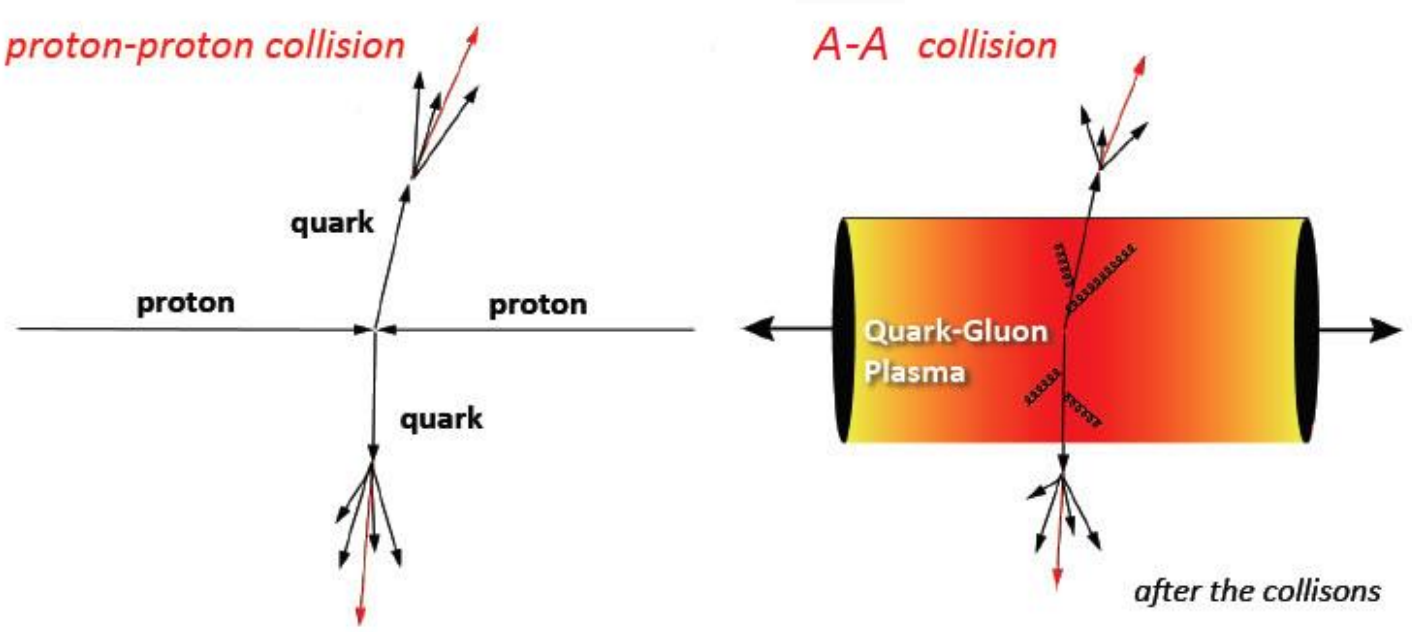
Motivation

Signs of QGP formation: *Jet quenching*



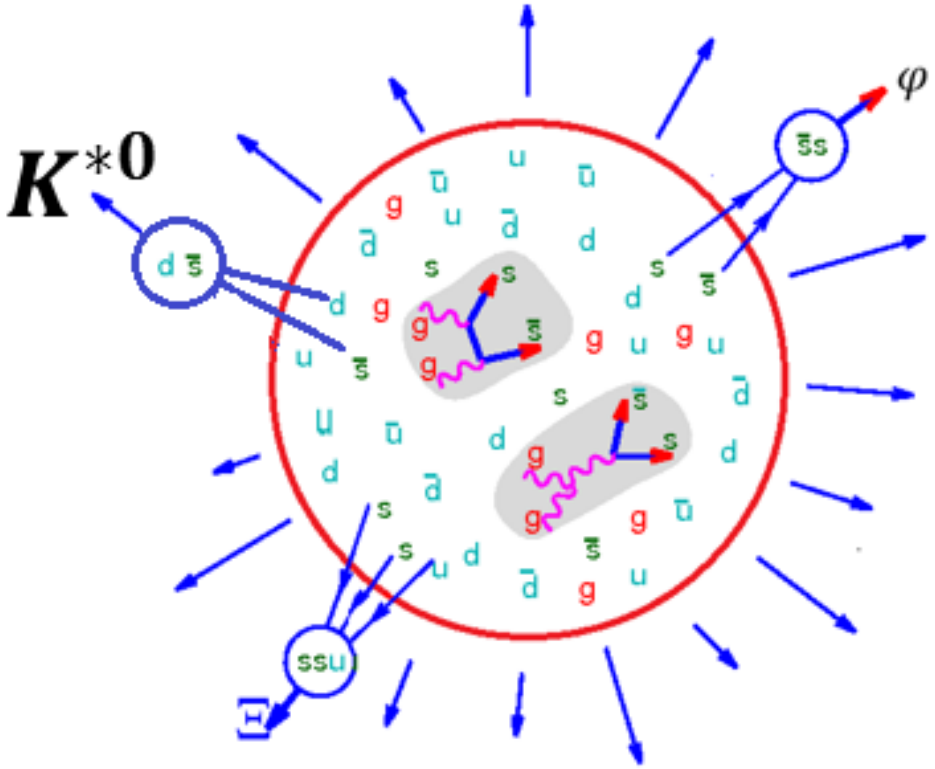
Cold Nuclear Matter?

Motivation

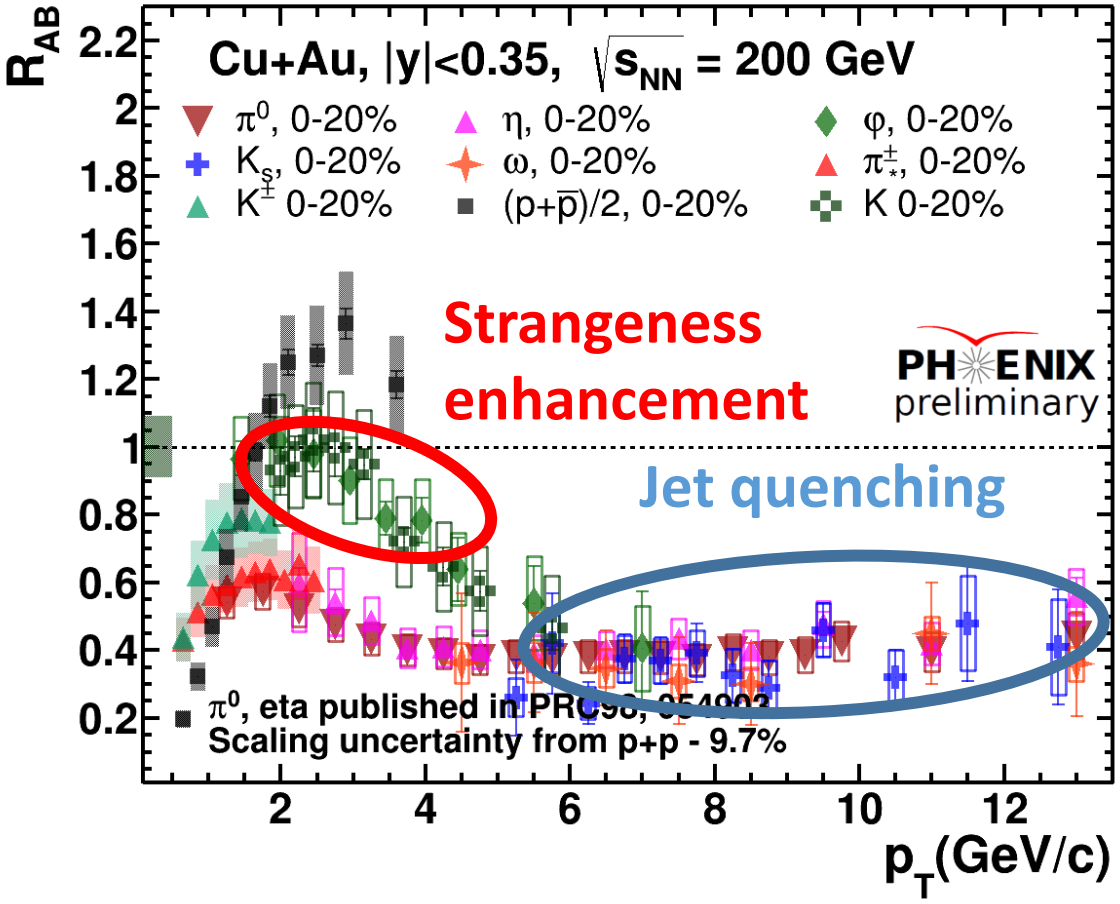
Signs of QGP formation: *Strangeness enhancement*

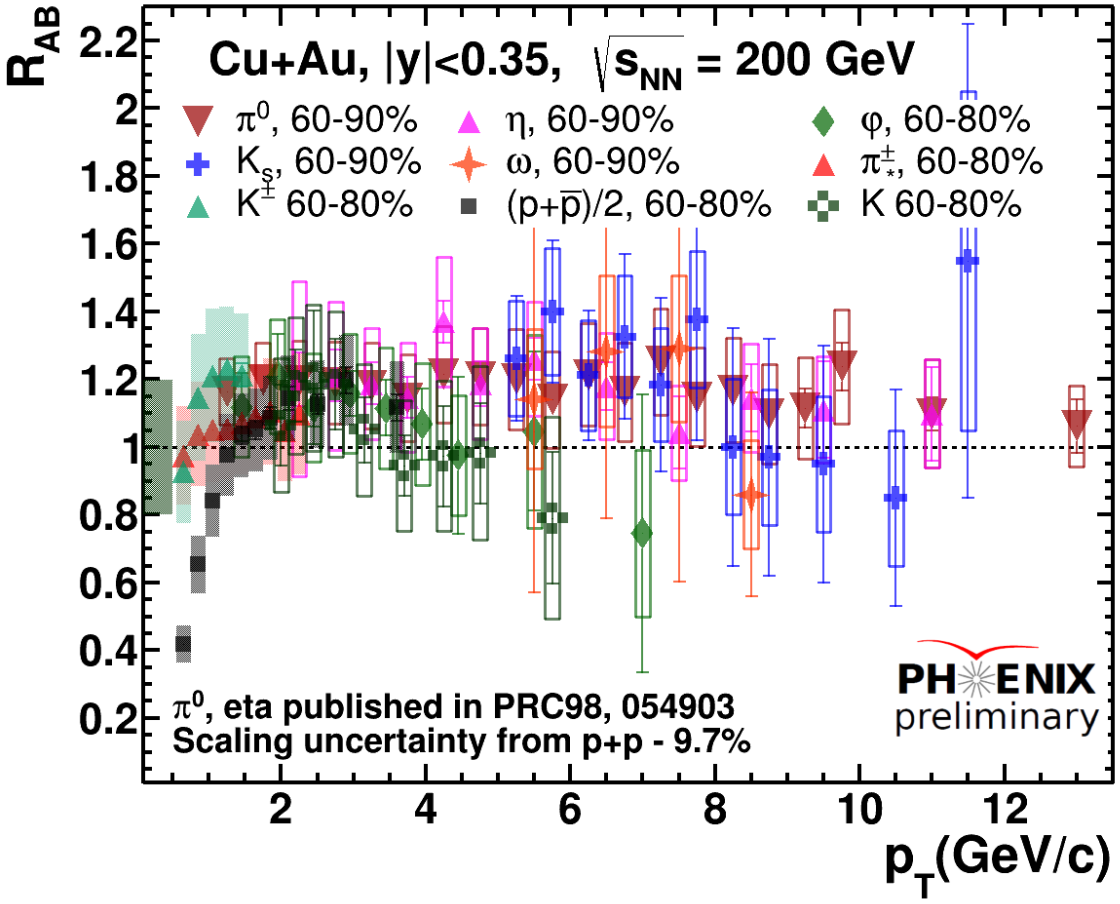
$K^{*0} \rightarrow (K\pi)^{\pm}$-meson

Quark content	$d\bar{s}(\bar{d}s)$
Mass, (MeV/c^2)	891.66±0.26
Lifetime, fm/c	4.16



Motivation


Cu+Au, |y|<0.35, $\sqrt{s_{NN}}$ = 200 GeV
R_{AB}
π^0, 0-20%
η, 0-20%
φ, 0-20%
K_S^0, 0-20%
ω, 0-20%
$\pi^{\pm}_{*}$, 0-20%
$K^{\pm}$ 0-20%
$(p+\bar{p})/2$, 0-20%
K 0-20%
Strangeness enhancement
Jet quenching
PHENIX preliminary
π^0, eta published in PRC98, 054903
Scaling uncertainty from p+p - 9.7%
p_T(GeV/c)


Cu+Au, |y|<0.35, $\sqrt{s_{NN}}$ = 200 GeV
R_{AB}
π^0, 60-90%
η, 60-90%
φ, 60-80%
K_S^0, 60-90%
ω, 60-90%
$\pi^{\pm}_{*}$, 60-80%
$K^{\pm}$ 60-80%
$(p+\bar{p})/2$, 60-80%
K 60-80%
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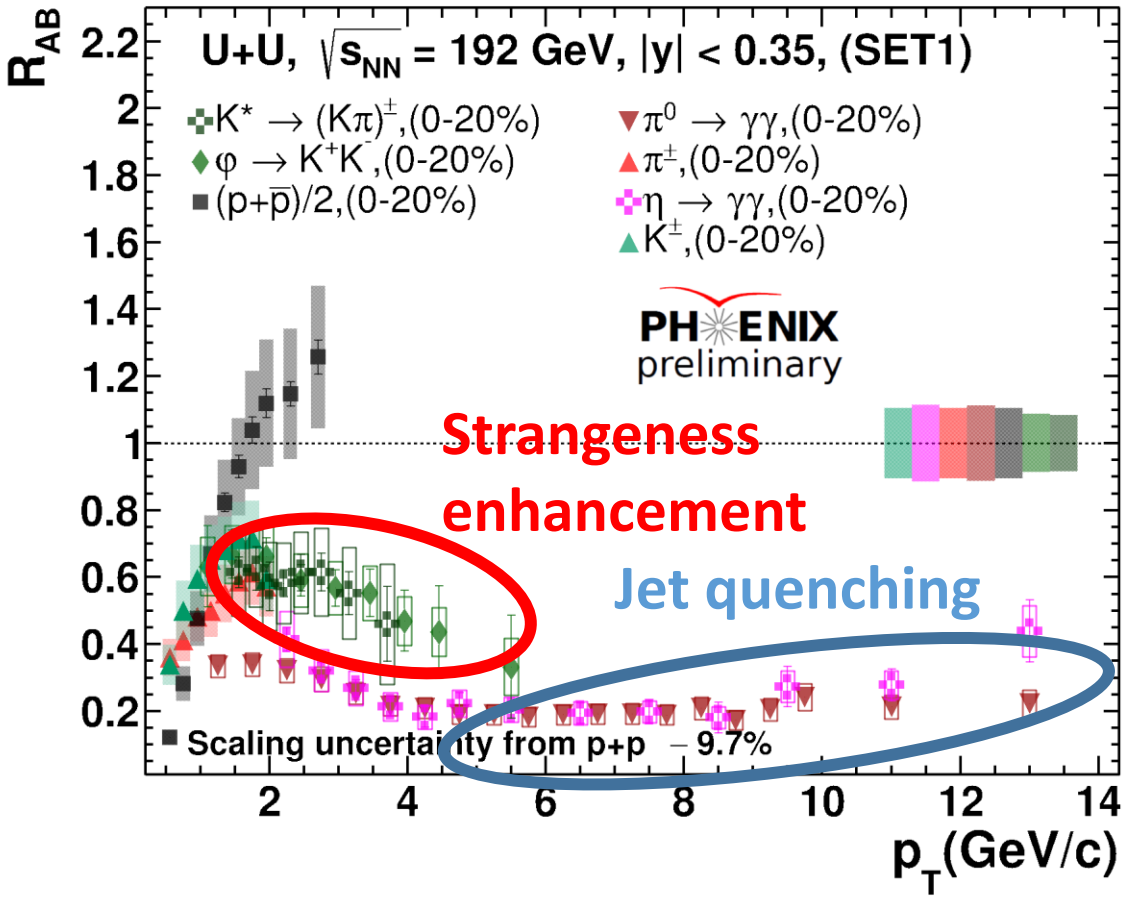
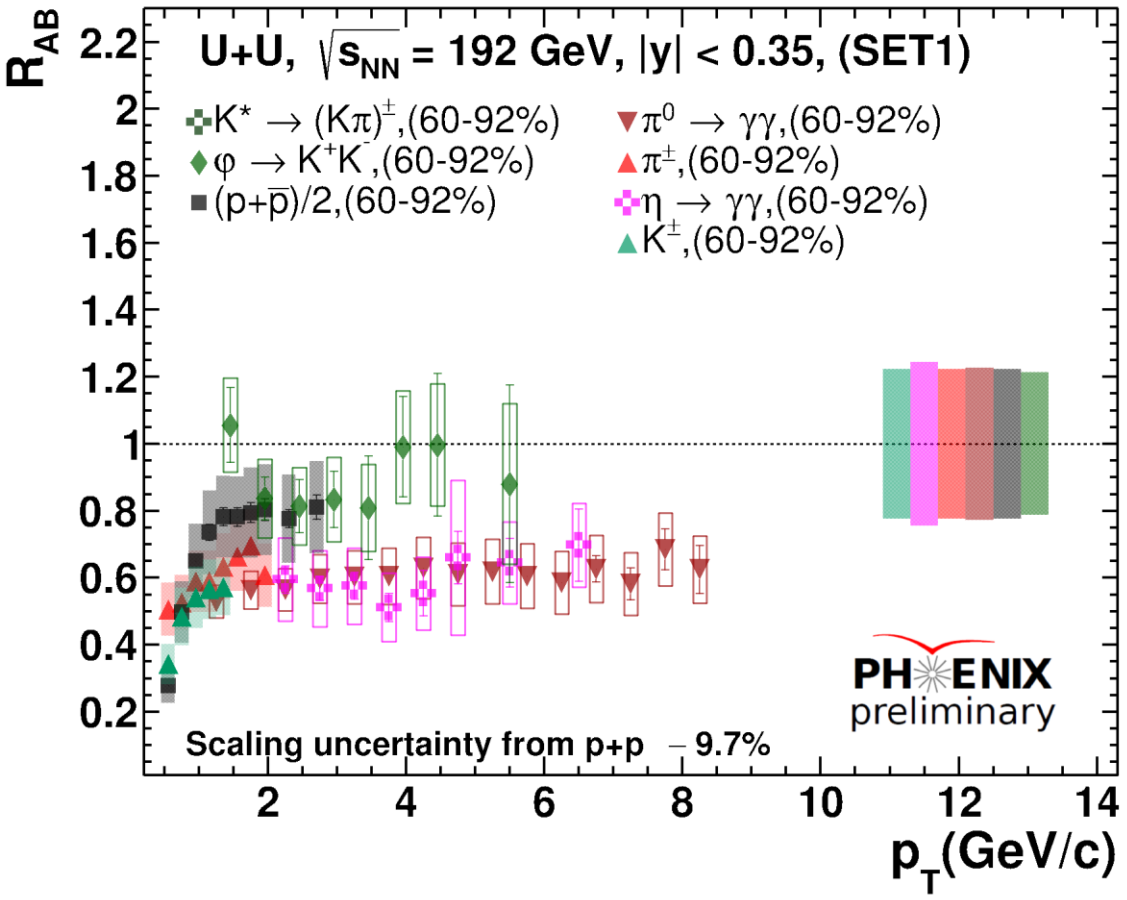
p_T(GeV/c)

Motivation

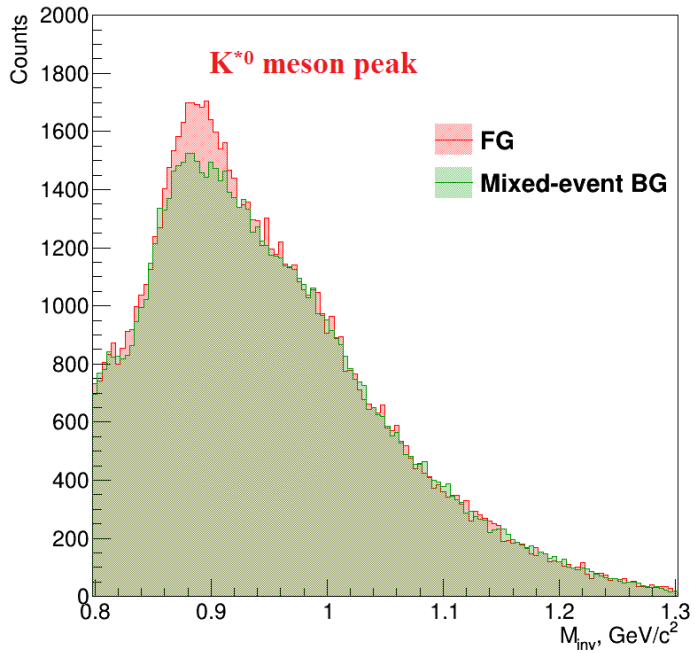

U+U, $\sqrt{s_{NN}}$ = 192 GeV, |y| < 0.35, (SET1)
R_{AB}
$K^* \rightarrow (K\pi)^{\pm}$,(0-20%)
$\varphi \rightarrow K^+K^-$,(0-20%)
$(p+\bar{p})/2$,(0-20%)
$\pi^0 \rightarrow \gamma\gamma$,(0-20%)
$\pi^{\pm}$,(0-20%)
$\eta \rightarrow \gamma\gamma$,(0-20%)
$K^{\pm}$,(0-20%)
PHENIX preliminary
Strangeness enhancement
Jet quenching
Scaling uncertainty from p+p – 9.7%
p_T(GeV/c)

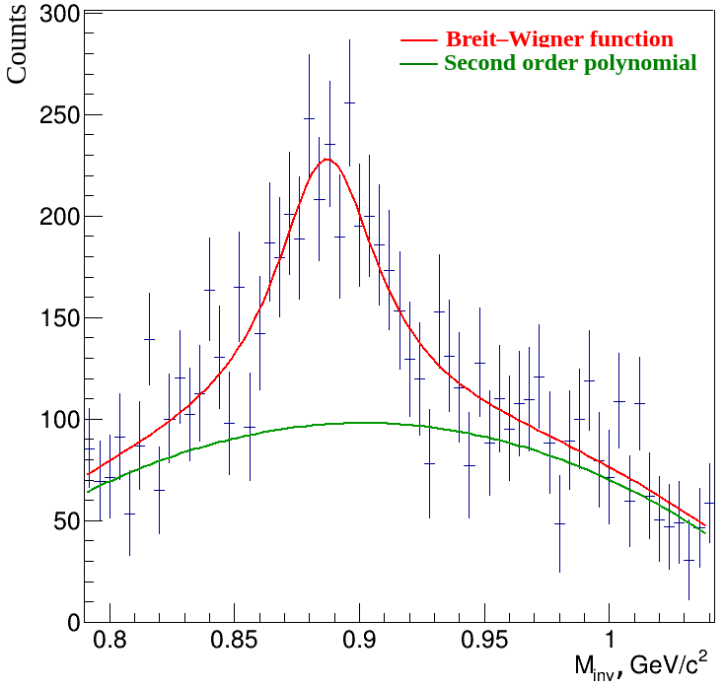

U+U, $\sqrt{s_{NN}}$ = 192 GeV, |y| < 0.35, (SET1)
R_{AB}
$K^* \rightarrow (K\pi)^{\pm}$,(60-92%)
$\varphi \rightarrow K^+K^-$,(60-92%)
$(p+\bar{p})/2$,(60-92%)
$\pi^0 \rightarrow \gamma\gamma$,(60-92%)
$\pi^{\pm}$,(60-92%)
$\eta \rightarrow \gamma\gamma$,(60-92%)
$K^{\pm}$,(60-92%)
PHENIX preliminary
Scaling uncertainty from p+p – 9.7%
p_T(GeV/c)

Raw yield extraction

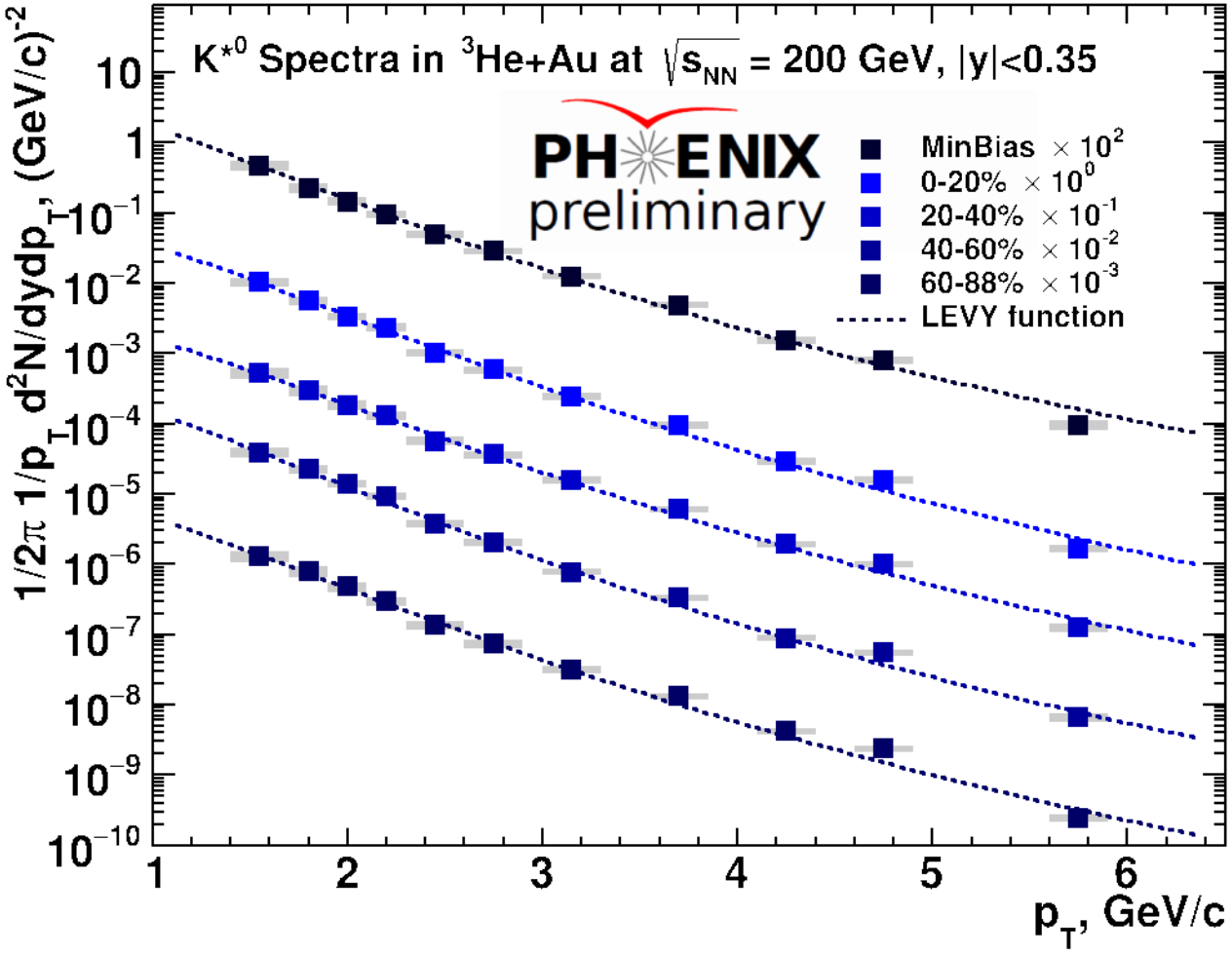
The K^{*0} -meson yields were extracted via invariant mass histogram

- Combinatorial background was estimated with mixed event technique;
- Normalized at $M_{inv} > 1.10$ GeV/c^2 and subtracted;
- Residual background fitted with second order polynomial;
- Fitting – Breit-Wigner convoluted with Gaussian function plus parabola;
- The K^{*0} yield is calculated as the sum of the bins in the histogram inside the invariant mass window $M_{K*0} \pm 2\sigma$ less the integrated polynomial background over the same mass window.





Transverse momentum spectra of K^{*0} -meson



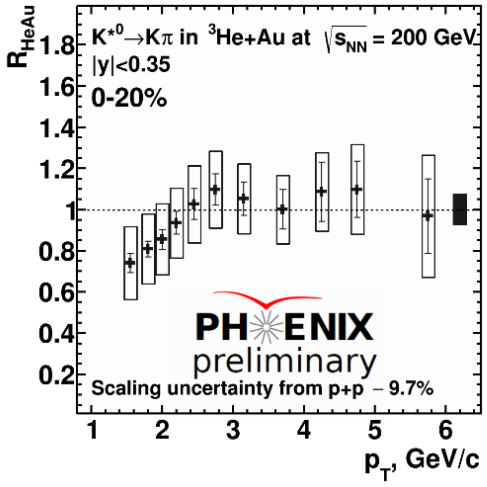
$$\frac{1}{2\pi p_T}\frac{d^2N}{dp_T dy} = \frac{1}{2\pi p_T}\frac{1}{2}\frac{1}{N_{evt}\,Br}\frac{1}{\varepsilon_{eff}(p_T)}\frac{N(\Delta p_T)}{\Delta p_T \Delta y}$$

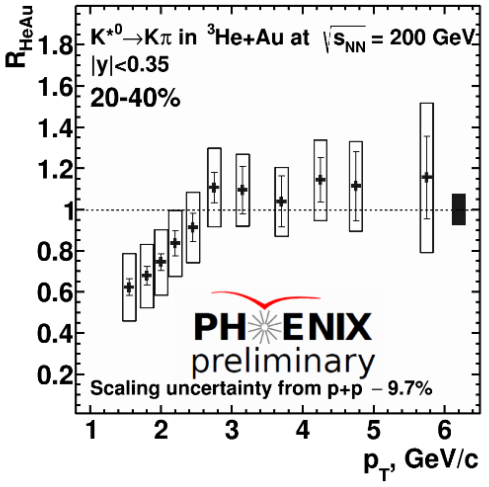
- $N(\Delta p_T)$ – the number of observed mesons
- p_T – transverse momentum K^{*0}-mesons
- Δp_T – transverse momentum bin
- $\varepsilon_{eff}(p_T)$ – reconstruction efficiency
- $Br = 0.67$ – branching ratios of $K^{*0}(\overline{K^{*0}}) \rightarrow K^{\pm} + \pi^{\mp}$ decays
- $\frac{1}{2}$ points to the average of K^{*0} and $\overline{K^{*0}}$

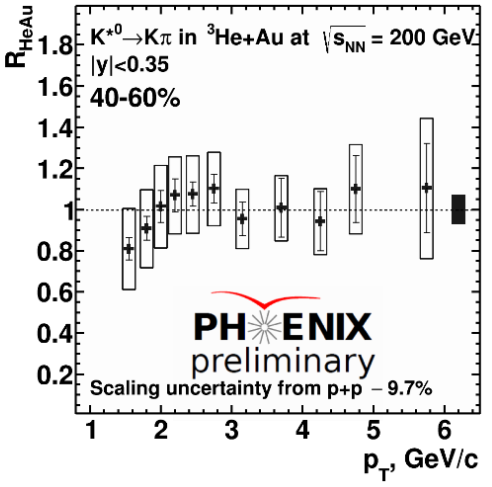
- The invariant p_T distributions of the K^{*0} -meson was measured at $1.55 < p_T < 5.75$ for He+Au for 5 centrality bins.
- Dashed lines – fits with LEVY

Nuclear modification factors

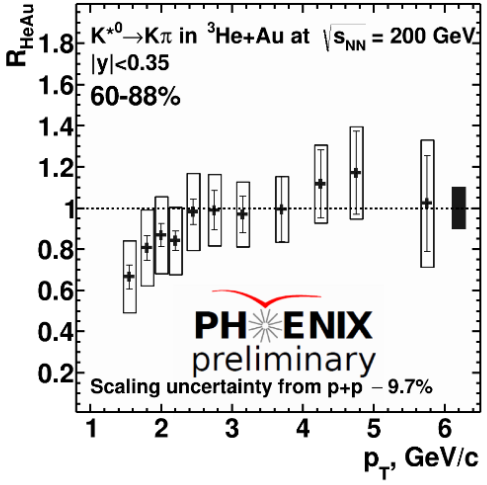
$$R_{HeAu}(p_T) = \frac{c_{bias}}{N_{coll}/\sigma_{pp}^{inel}} \frac{d^2N_{HeAu}(p_T)/dydp_T}{d^2\sigma_{pp}/dydp_T}$$

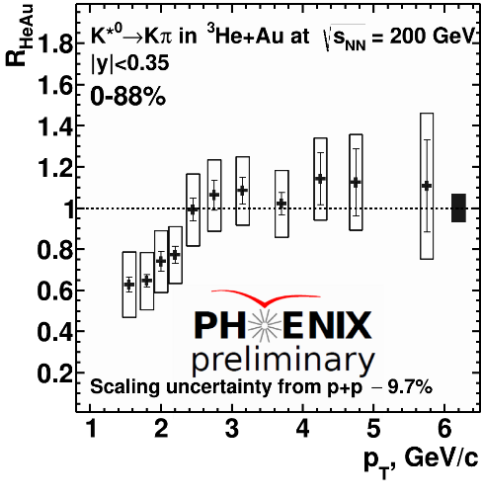




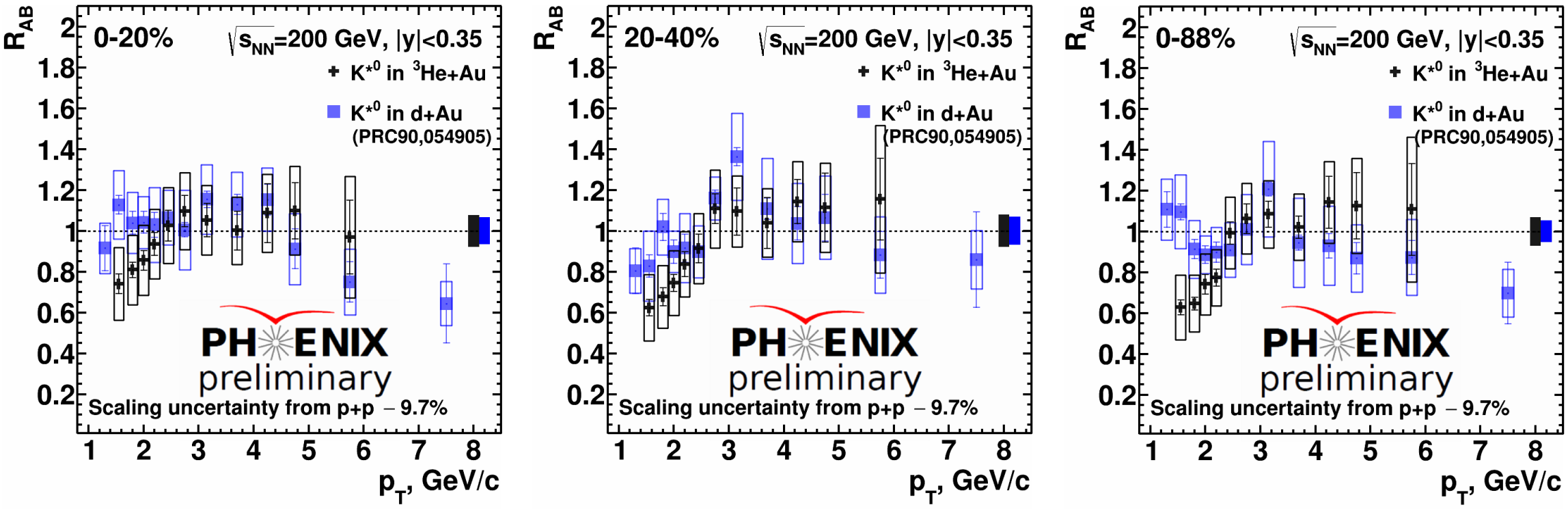


- $d^2N_{HeAu}(p_T)/dydp_T$ – the K^{*0} yield in ^{3}He+Au collisions for selected centrality bin;
- $d^2\sigma_{pp}/dydp_T$ – the cross-section in *pp* collisions;
- c_{bias} – the bias factor;
- N_{coll} – the average number of binary collisions per event in ^{3}He+Au collisions;
- σ_{pp}^{inel} – the total inelastic cross-section.



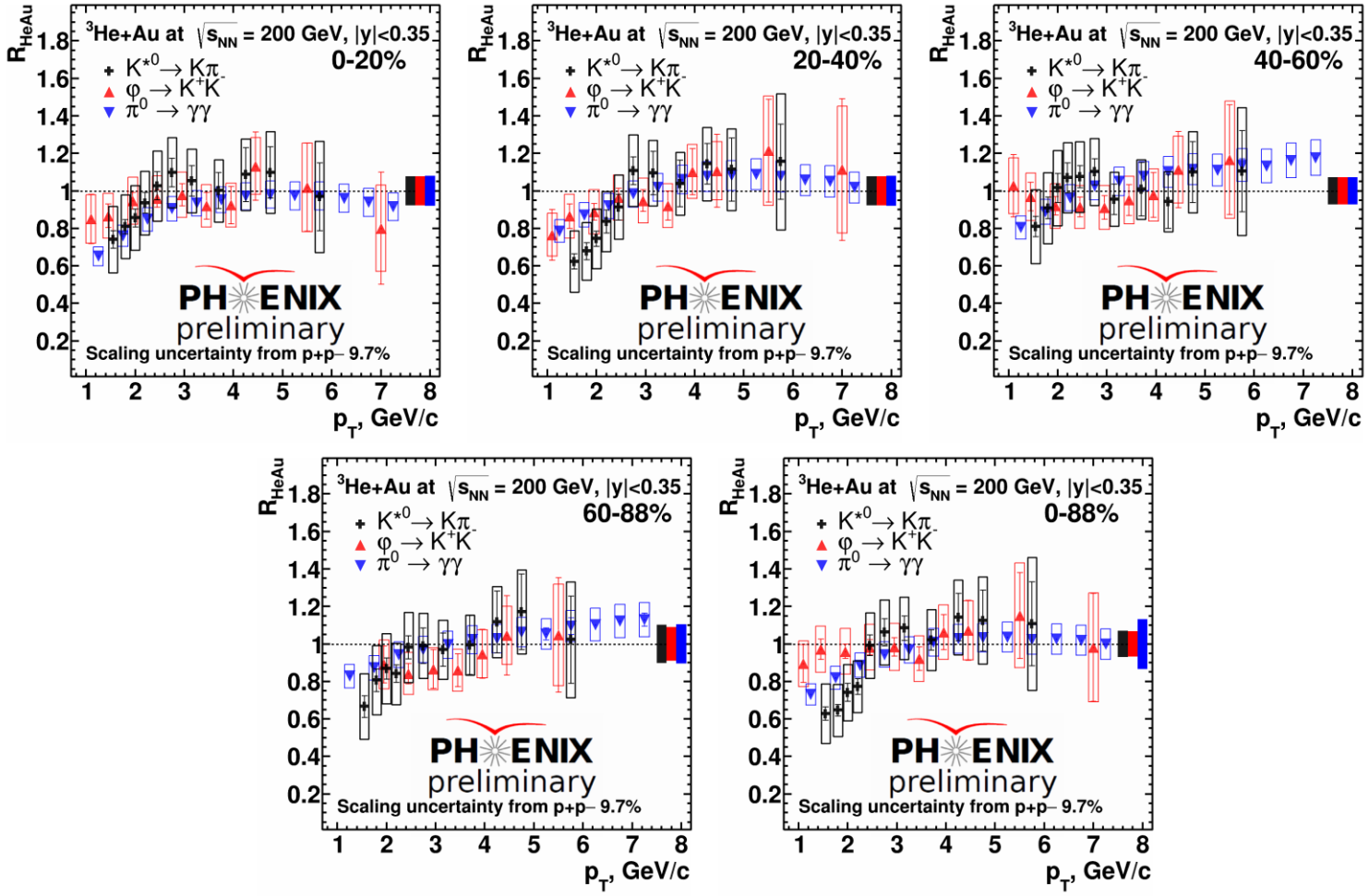


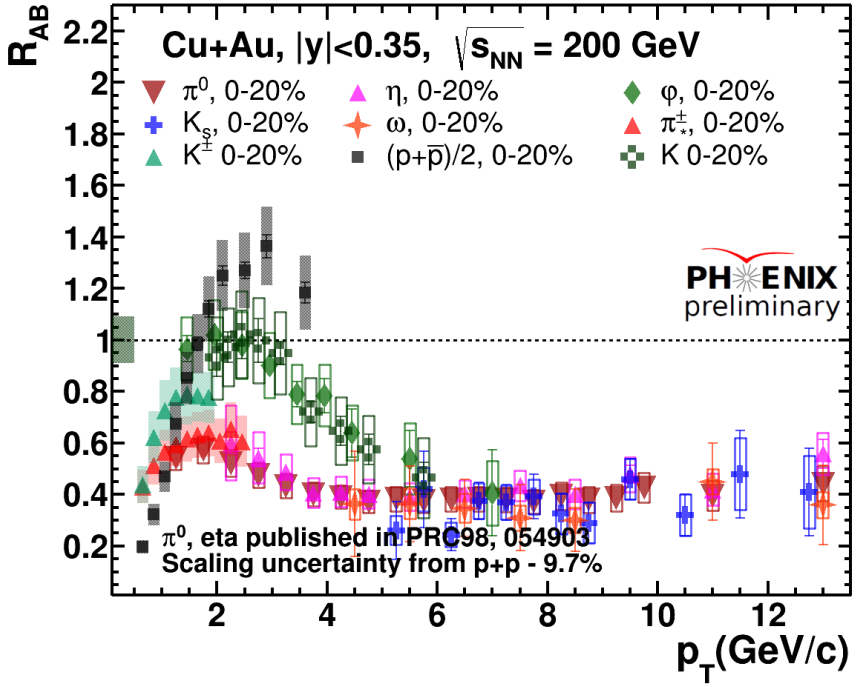
R_{AB} of K^{*0} in d+Au & He+Au @200 GeV



The K^{*0}-meson nuclear modification factors in d+Au and ^{3}He+Au in intermediate and high p_T range in the central collisions and MB the results are in a good agreement

R_{AB} of K^{*0}, φ & π^0 in He+Au@200 GeV





The K^{*0}-meson and φ, π^0-mesons nuclear modification factors in ^{3}He+Au in all centralities values exhibit similar shape

Results

- In all centralities in intermediate and high p_T range K^{*0} R_{AB} seems to be equal to unity in He+Au collisions;
- The K^{*0}, φ and π^0-mesons nuclear modification factors in He+Au collisions in all centralities values are in agreement within uncertainties;
  - **That might indicate that cold nuclear effects are not responsible for the differences between K^{*0}, φ and π^0 seen in heavy ion collisions;**
- In central and MB collisions K^{*0} R_{AB} in He+Au and d+Au collisions are in agreement within uncertainties;

These results can provide additional constraints for the models that try to explain CNM effects

Thank you for attention!