DE-SPACE
Debreceni Egyetem
Űrkutatási program

High p_T identified hadrons in large and small systems measured in PHENIX

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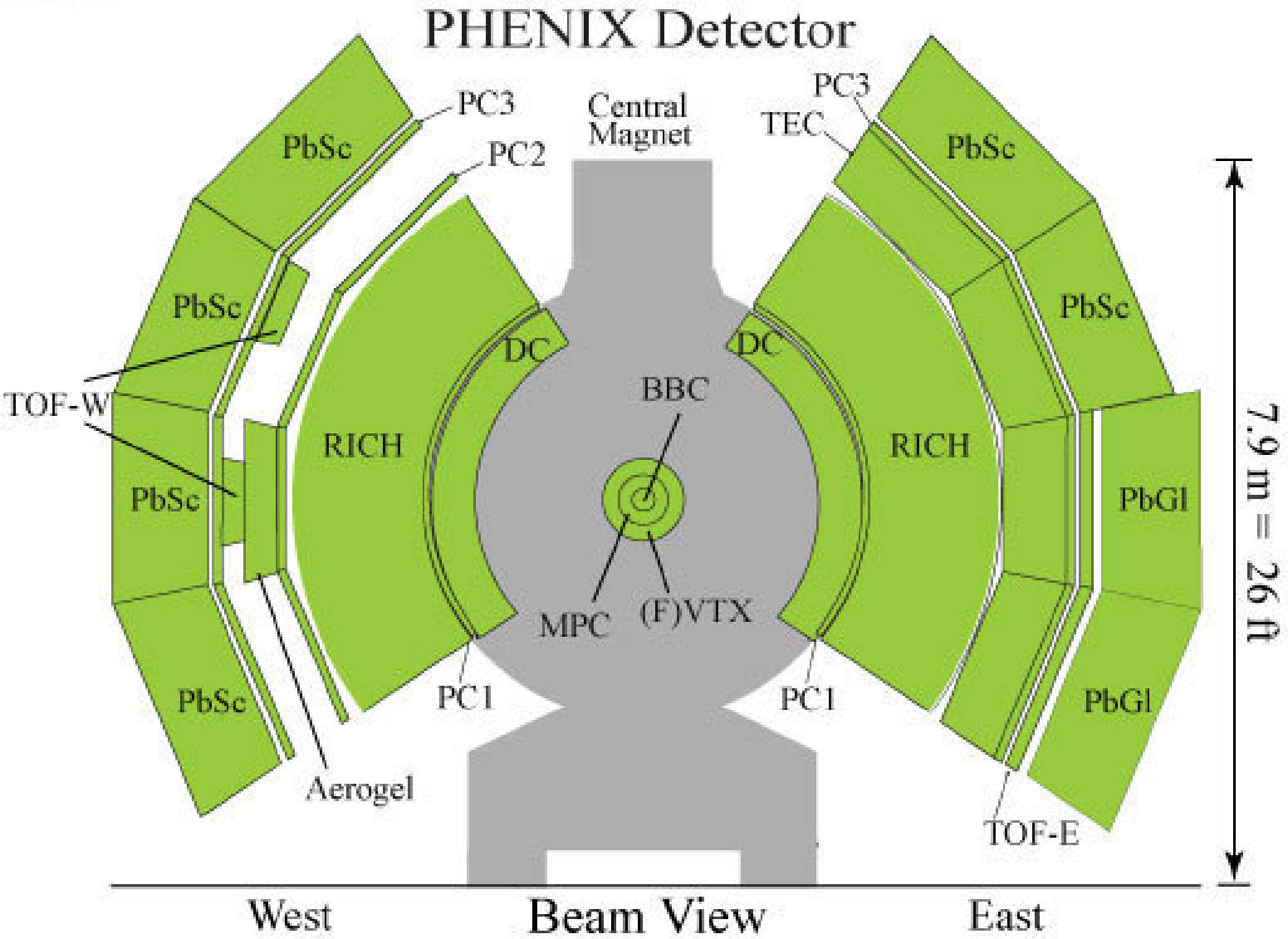
Content

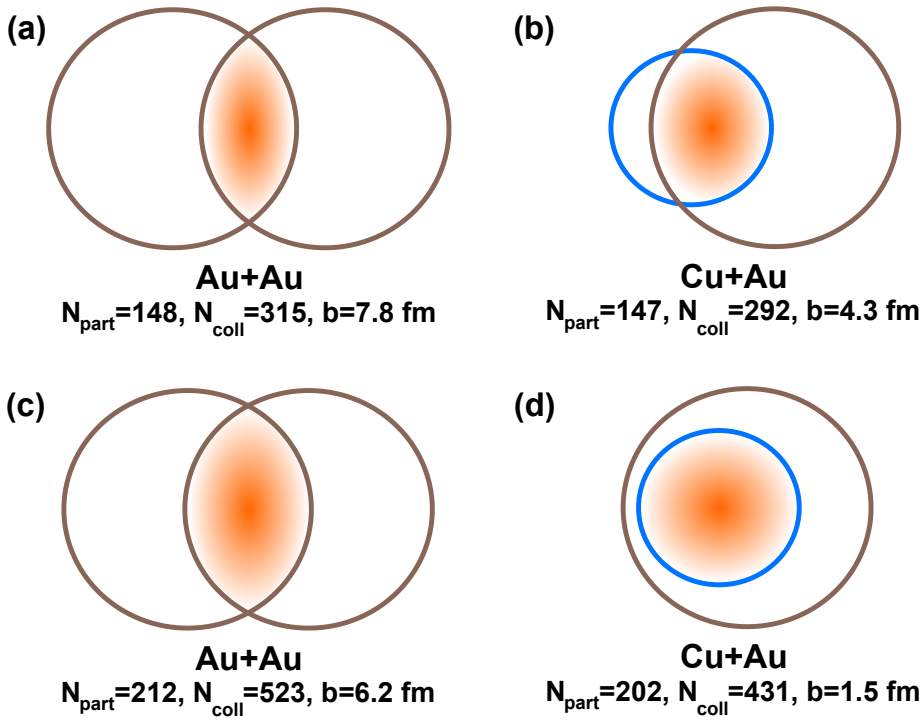
1. PHENIX
   - Detector
   - Collisions
   - Hadron identification
2. High $\mathrm{p_T}$ hadrons in large system
   - Mesons
   - Baryons
3. High $\mathrm{p_T}$ hadrons in small system
   - π^0, Φ p+Au, d+Au, He+Au
   - R_{dAu} of mesons + baryons

Detector



PHENIX, beam view

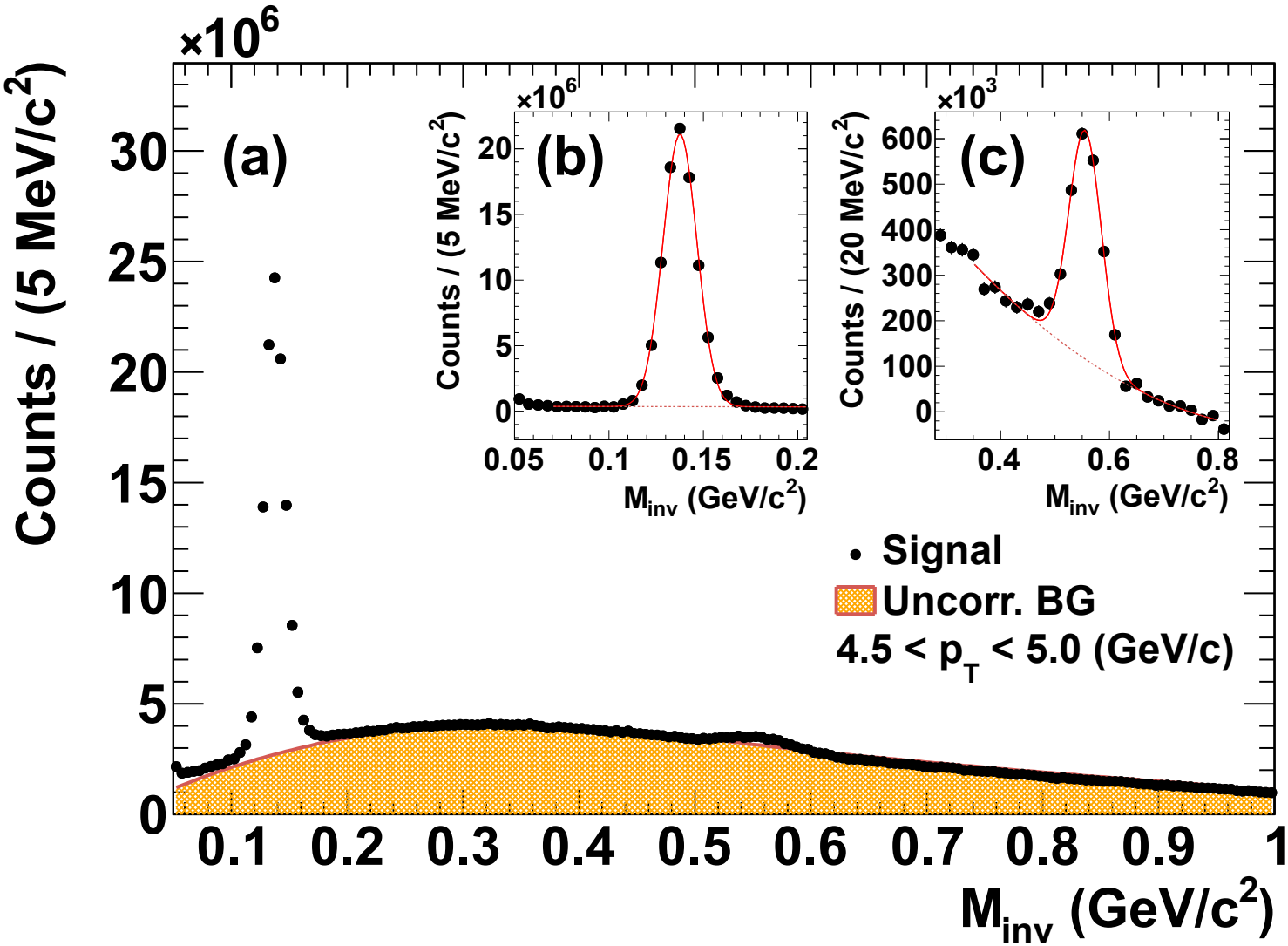
Collisions



Au+Au and Cu+Au collisions with comparable N_{part}

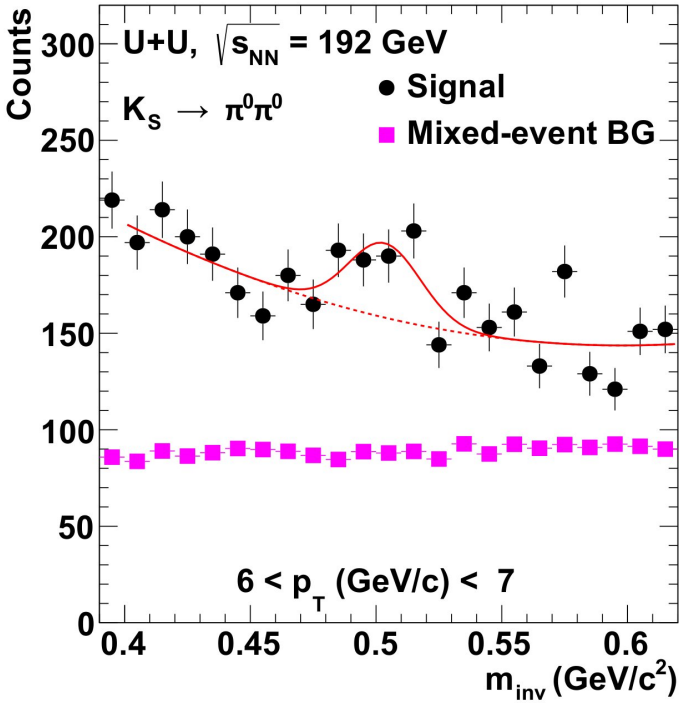
Beam-beam counters are used to determine the event centrality. The mean number of participating nucleons (N_{part}) and the binary collisions (N_{coll}) in various centrality intervals are estimated with a Glauber model Monte-Carlo simulation folded with the BBC response.

Hadron identification π^0 and η

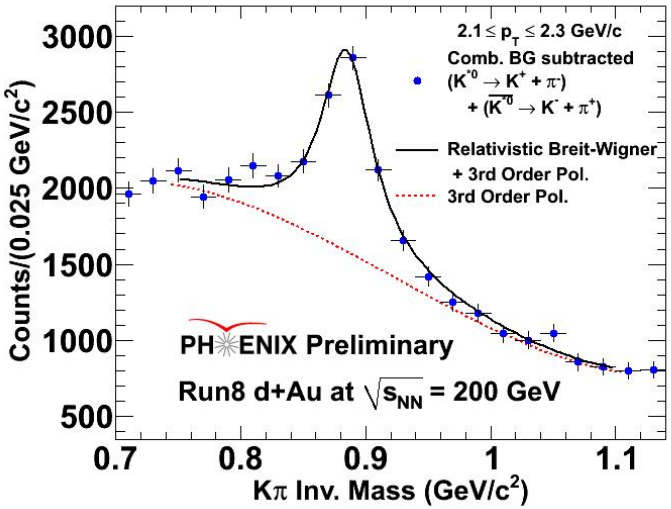


Invariant mass distribution for gamma-gamma pair

Hadron identification K^0_S and K^*

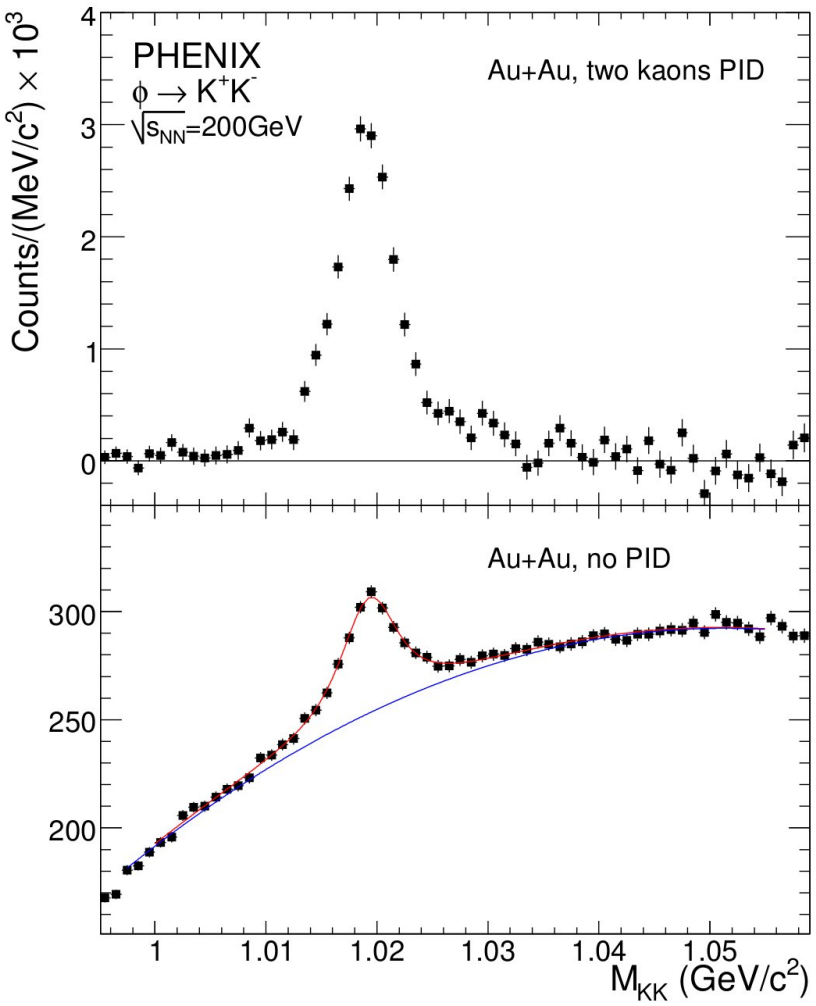


The K^0_S mesons are reconstructed by combining the π^0 candidates in pairs within the same event.



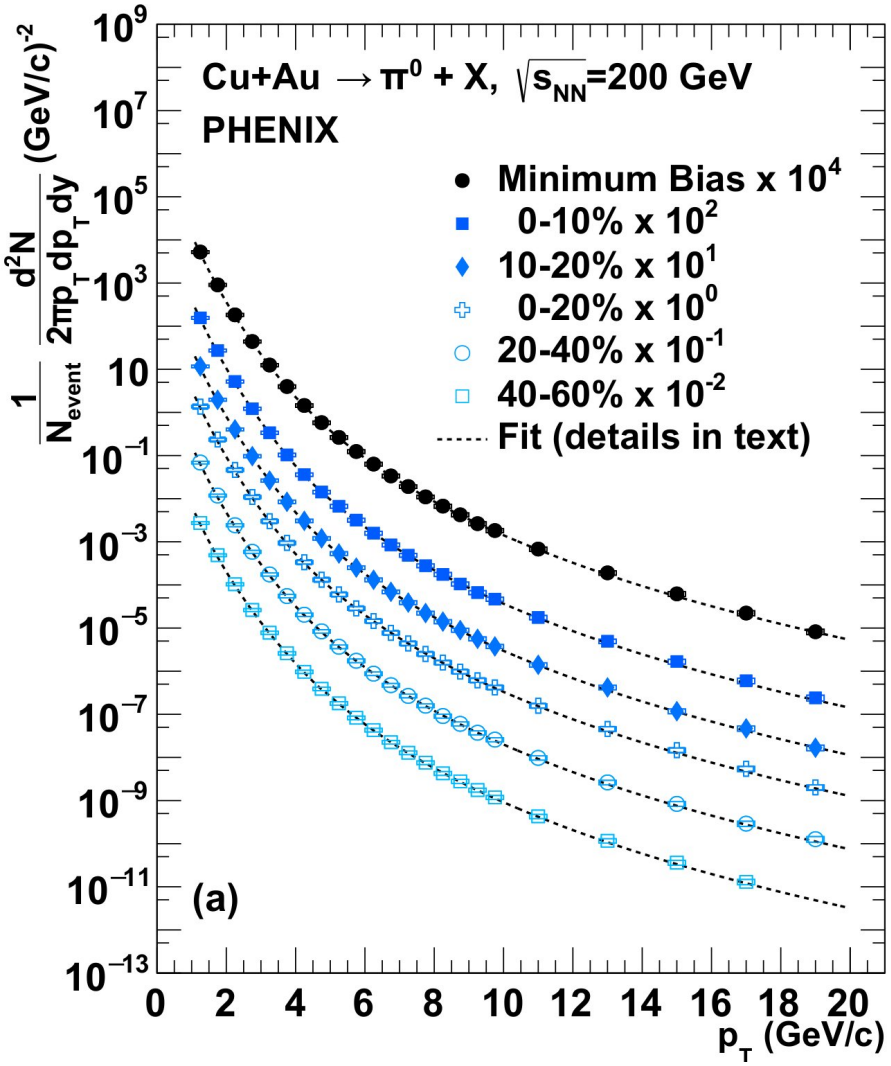
The K^{*0} and $\overline{K^{*0}}$ mesons are reconstructed via the $K^+\pi^-$ and $K^-\pi^+$

Hadron identification ϕ

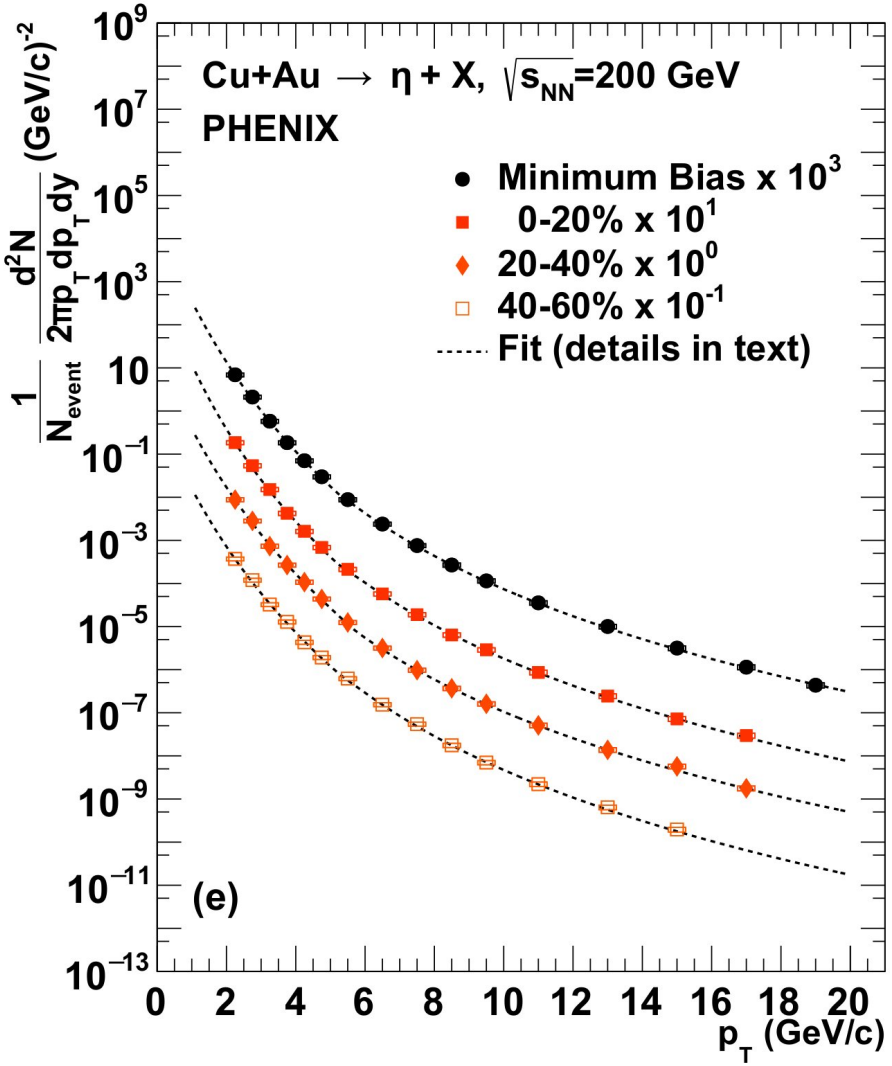


Invariant mass distributions obtained with the "two kaons PID" and "no PID" methods after subtraction of the combinatorial background estimated using the event-mixing technique. Plot on the top corresponds to integrated p_T range whereas plot on the bottom is for the range $2 < p_T$ (GeV/c)< 3. The "no PID" spectrum is fit to the sum of a Breit-Wigner fuction convolved with a Gaussian function to account for the Φ signal, and a polynomial function to account for the residual background.

Mesons



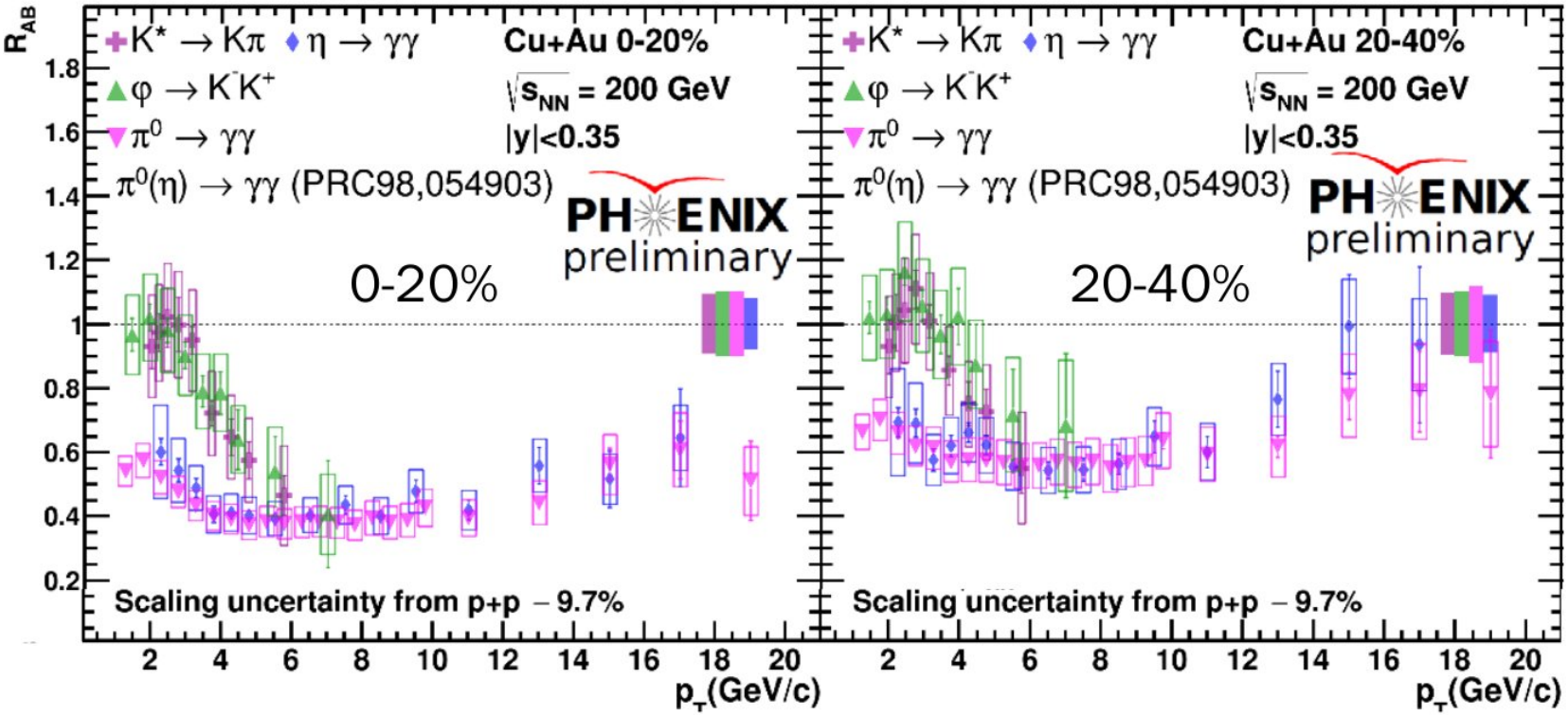
π^0 invariant yield



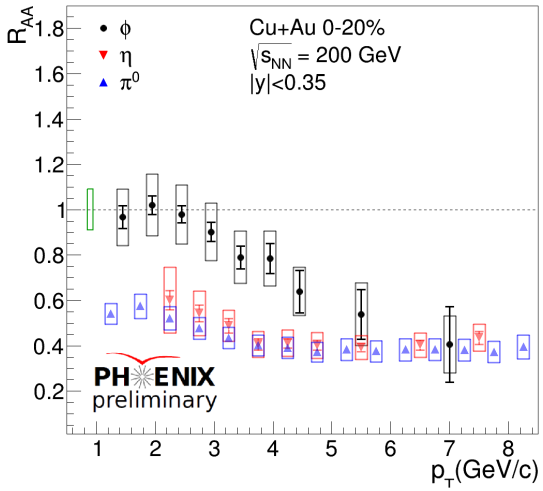
η invariant yield

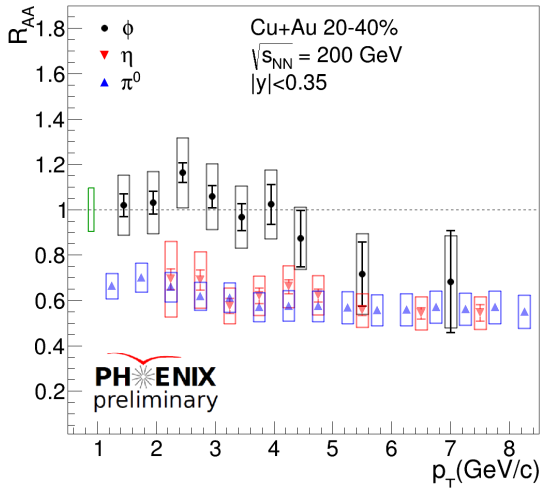
Mesons

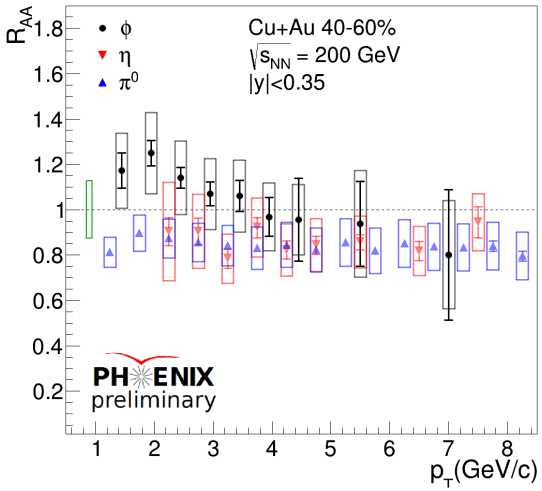
Meson R_{AA} Cu+Au

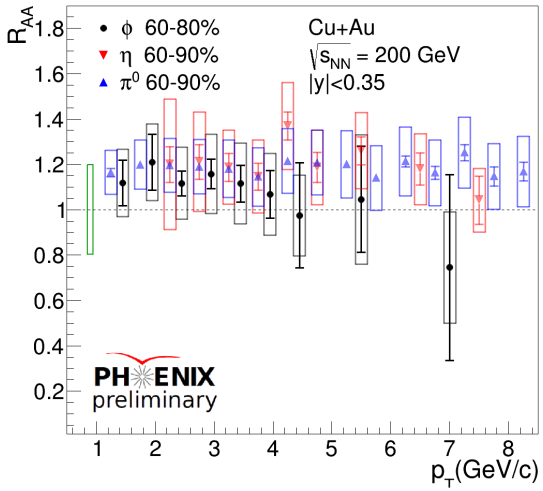


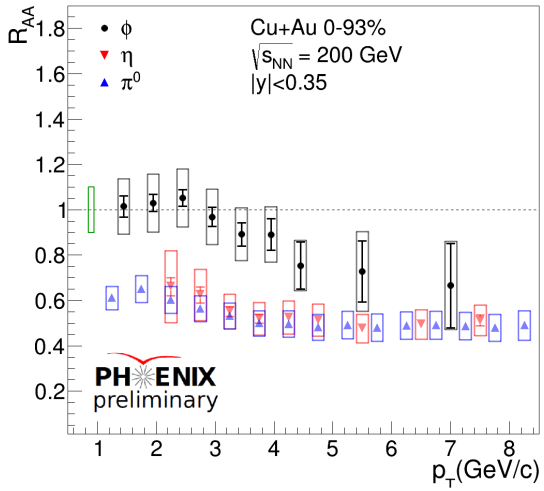
R_{AB} for K^* and Φ meson $>$ R_{AB} for π^0 and η at low p_T in central events
Difference disappears at high p_T





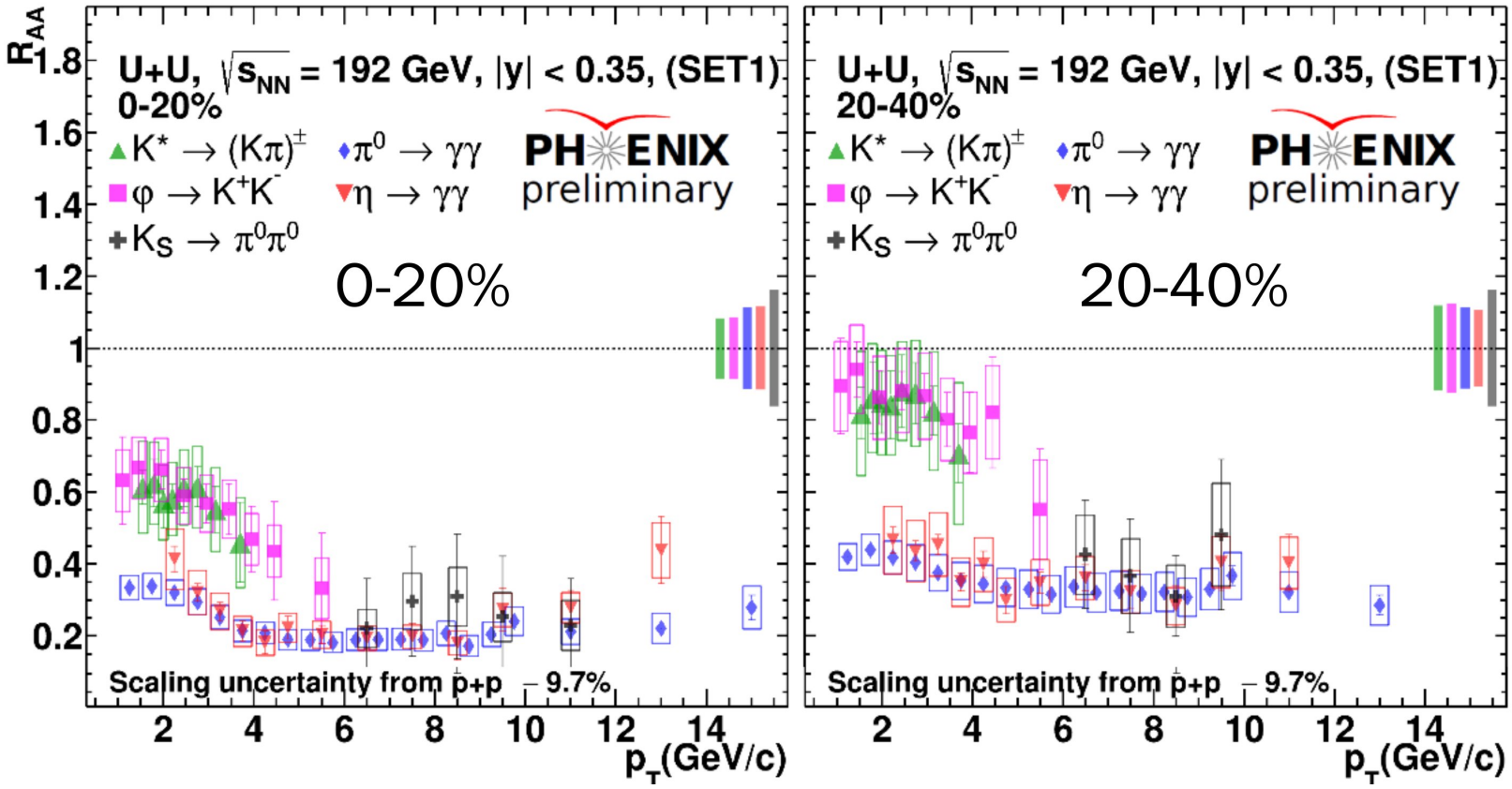




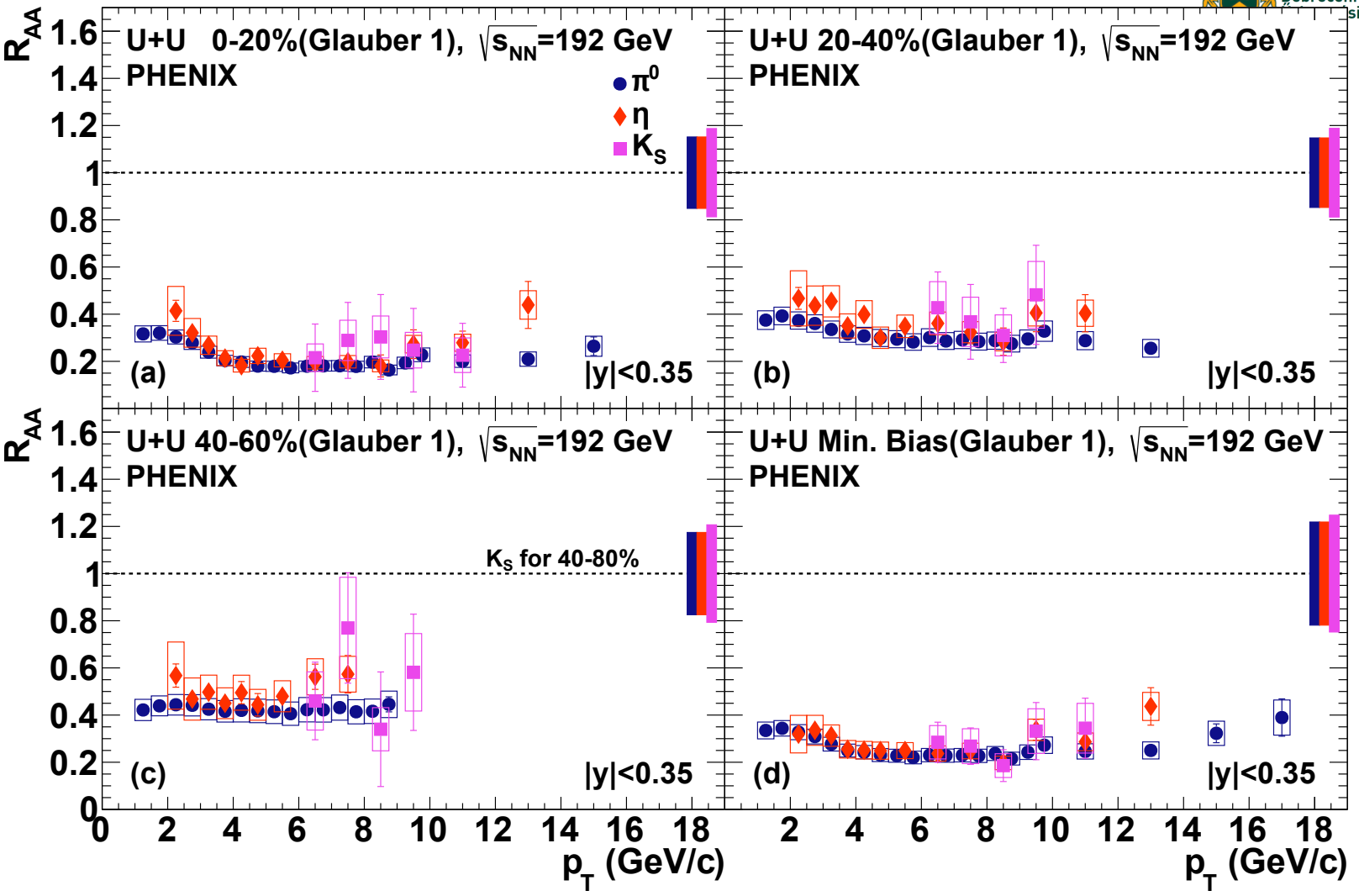


R_{AA} for Φ, η and π^0 in Cu+Au in different centrality bins

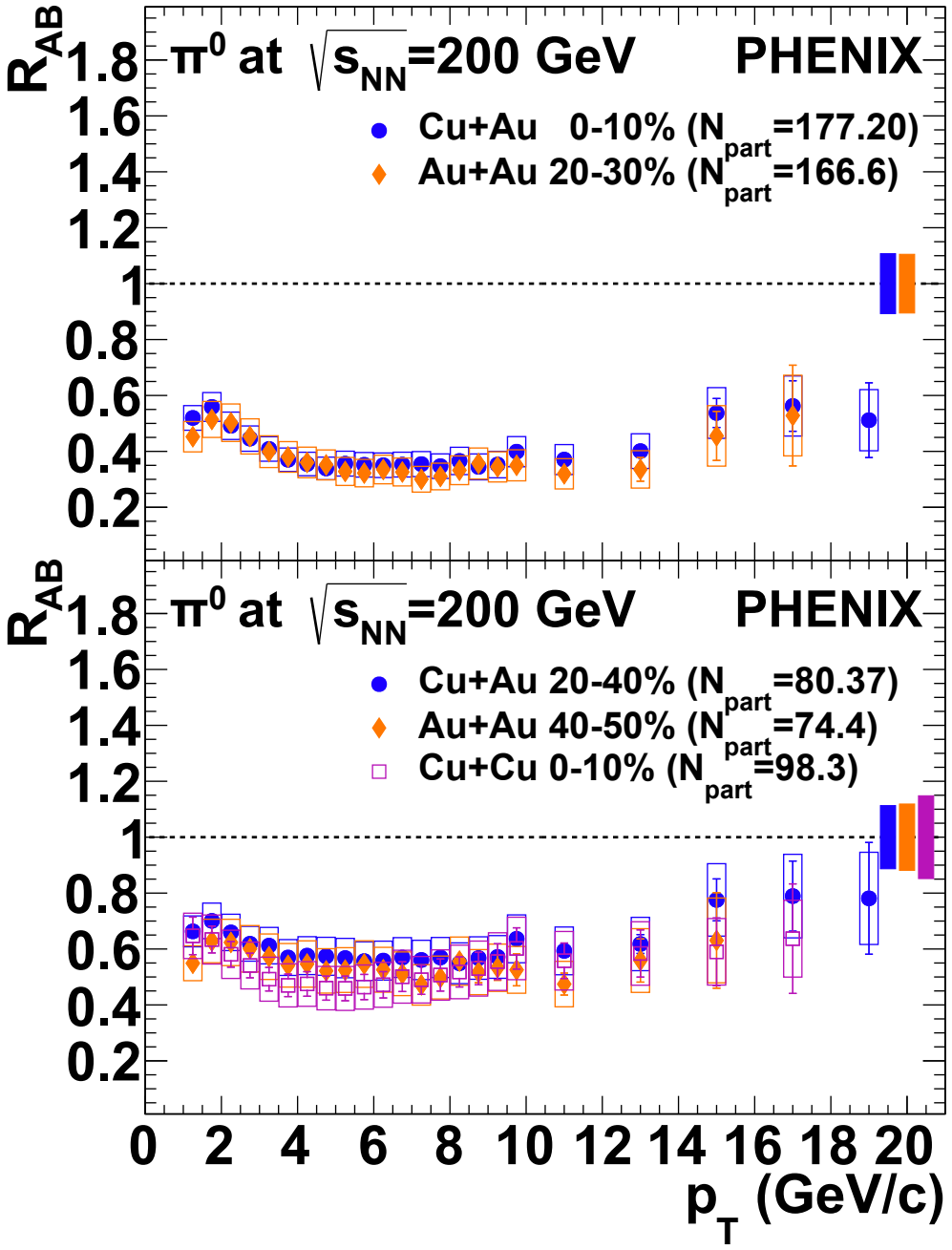
Meson R_{AA} in U+U



Strange quark dependence also present in U+U collisions at low p_T

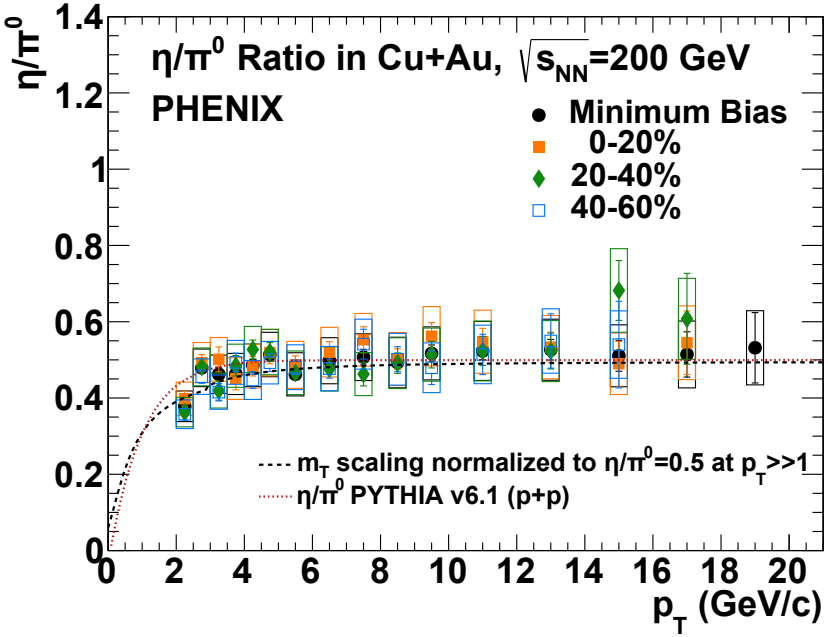


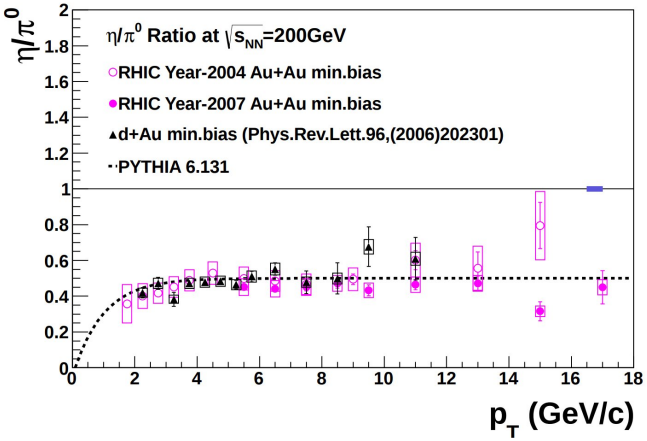
Nuclear modification factors of π^0 , η and K_S mesons as functions of p_T for different U+U centrality intervals.

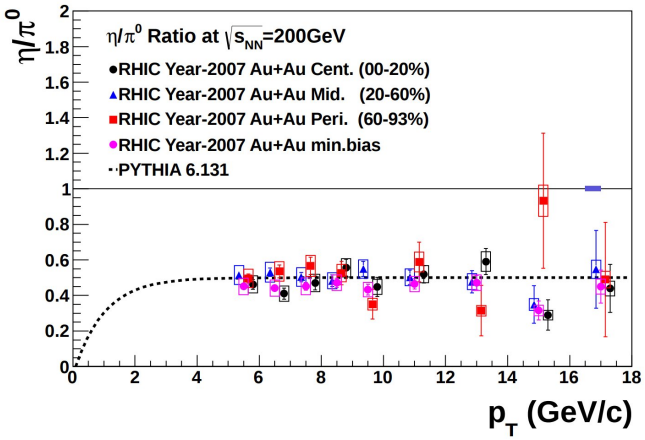


Comparison of π^0 R_{AB} measured in Cu+Au, Au+Au and Cu+Cu collisions. It suggests that π^0 suppression mostly depends on the energy density and size of the produced medium. Corona-effect?

η/π^0



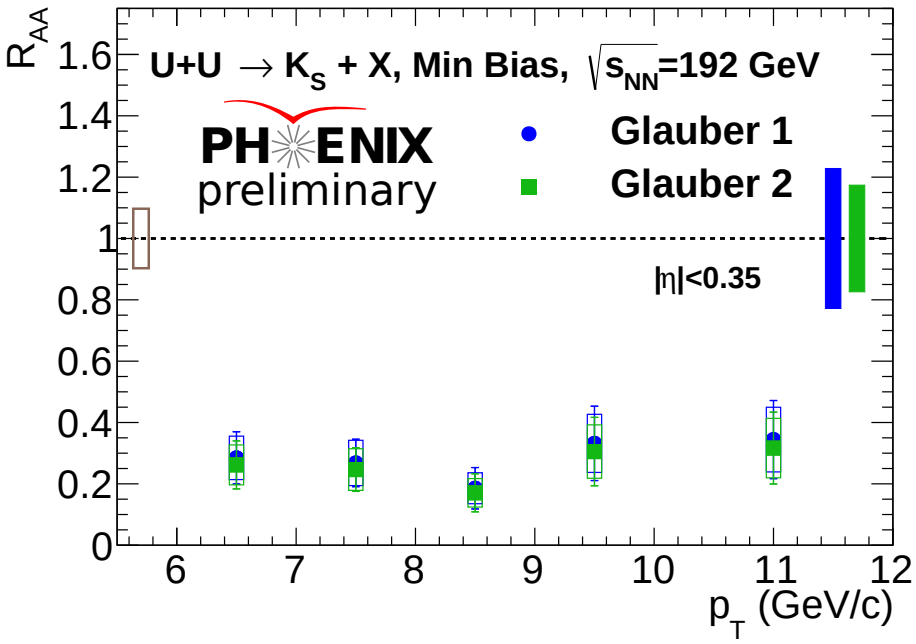


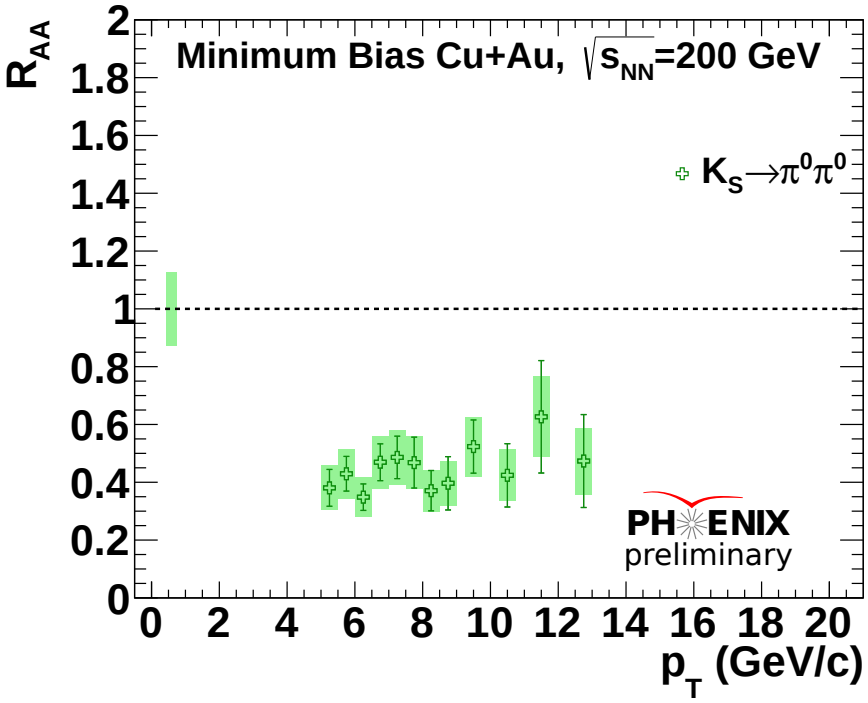


Ratios of η and π^0 yields measured as a function of p_T in different centrality intervals.
The QGP does not affect the jet fragmentation into these light mesons.

Similar results in Au+Au.

K_S

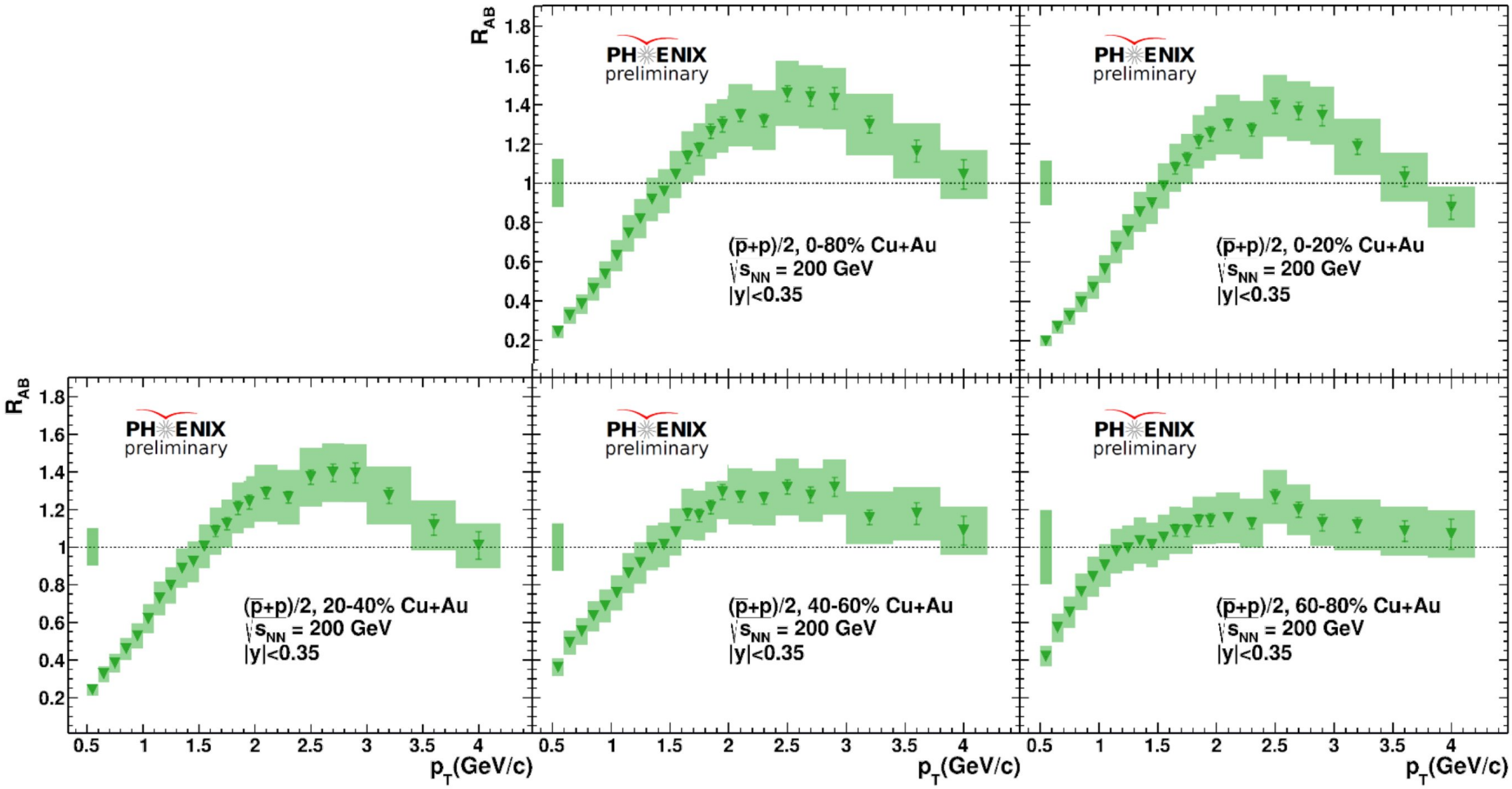




R_{AA} of K_S in different collision systems.

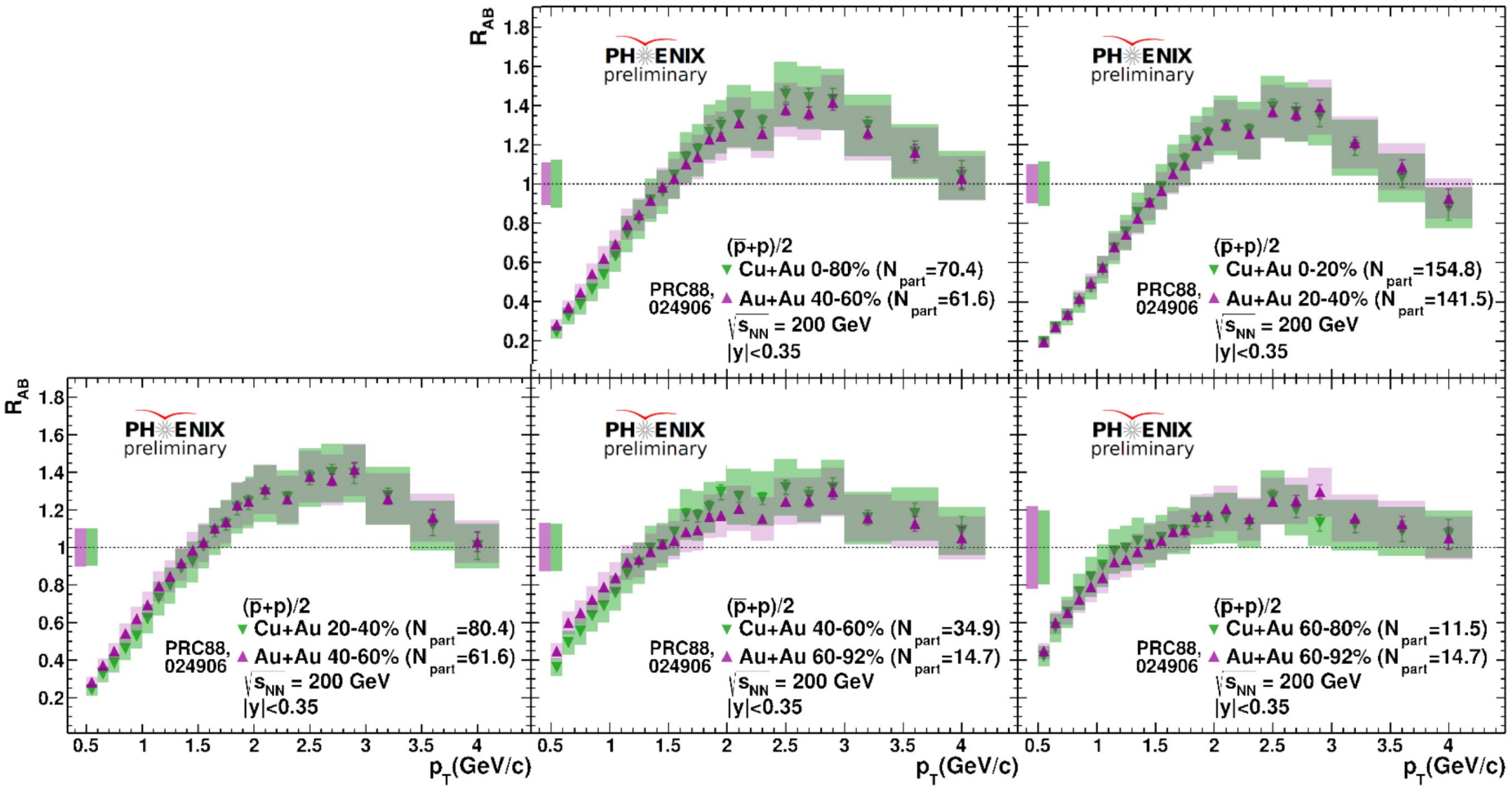
Parameter	"Glauber 1"	"Glauber 2"
R (fm)	6.81	6.86
a (fm)	0.60	0.42
β_2	0.280	0.265
β_4	0.093	0

Baryons



Enhancement of $(p + \bar{p})/2$ yield at moderate p_T

Baryons

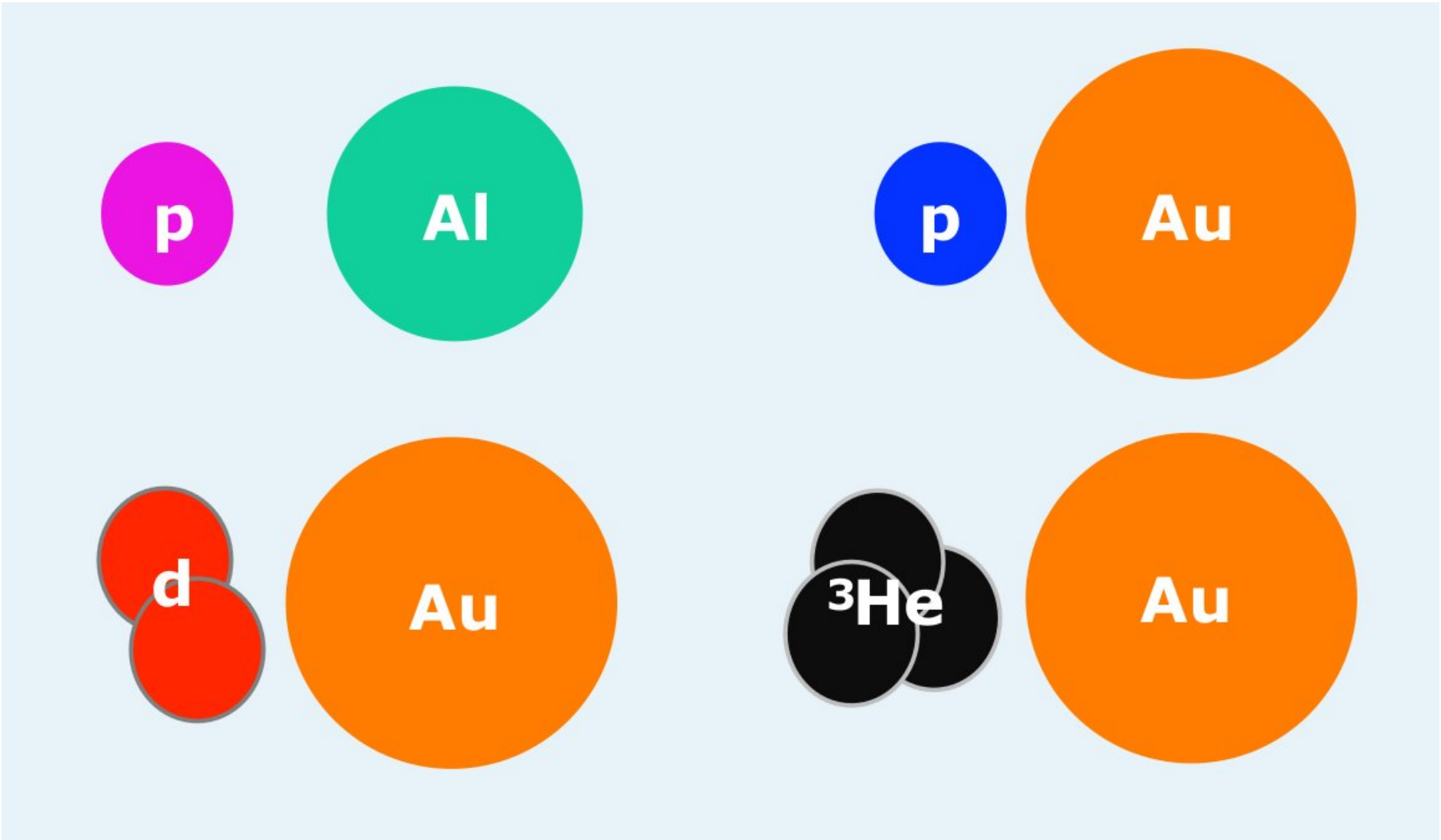


R_{AA} of $(p + \bar{p})/2$ consistent across Cu+Au and Au+Au at similar N_{part}

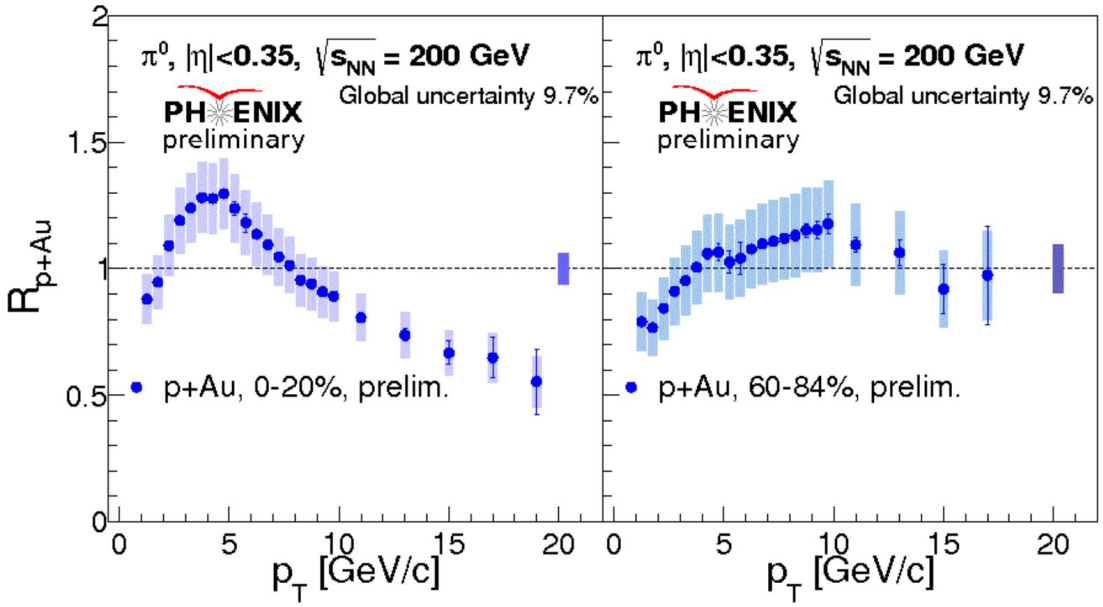
Summary large systems

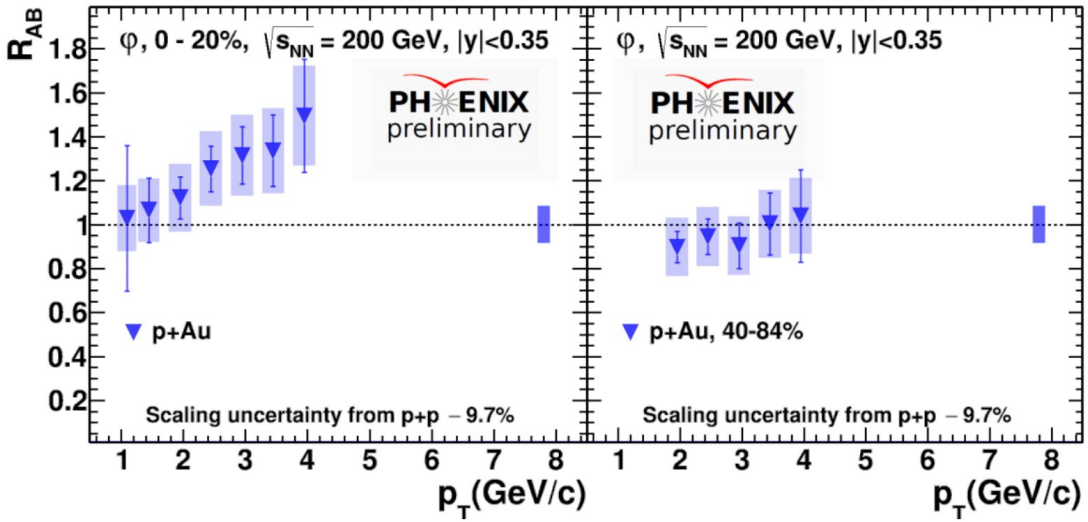
1. Strangeness dependence in R_{AA} at low p_T in central events
2. R_{AA} for all meson species converges at high p_T
3. Ratios of η and π^0 is similar to other large systems
4. Corona-effect is either non-existent or very small
5. Same baryon enhancement seen in Cu+Au and Au+Au

Small System

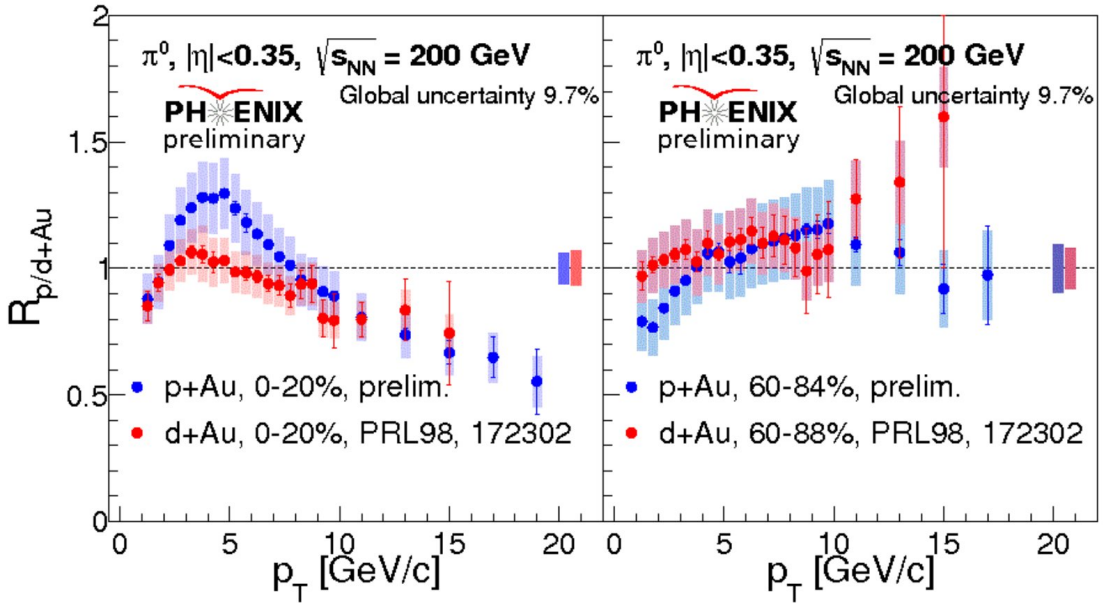


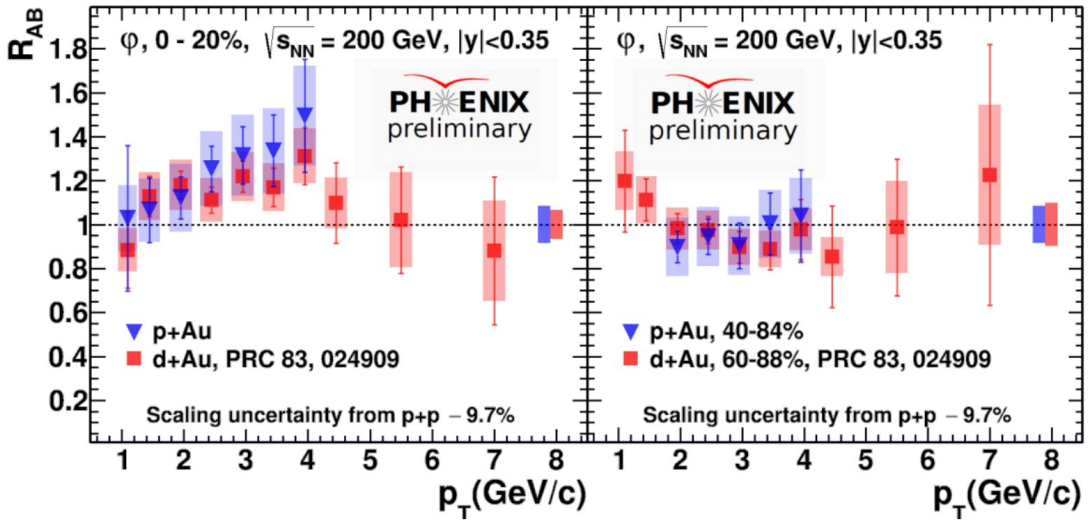
π^0, Φ p+Au note the different p_T scale!



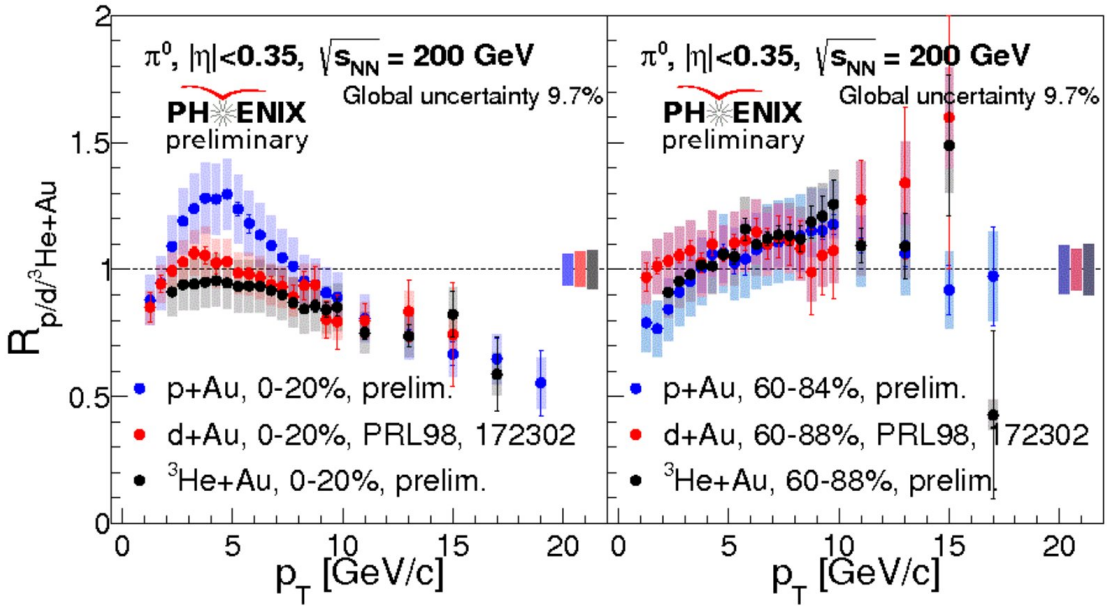


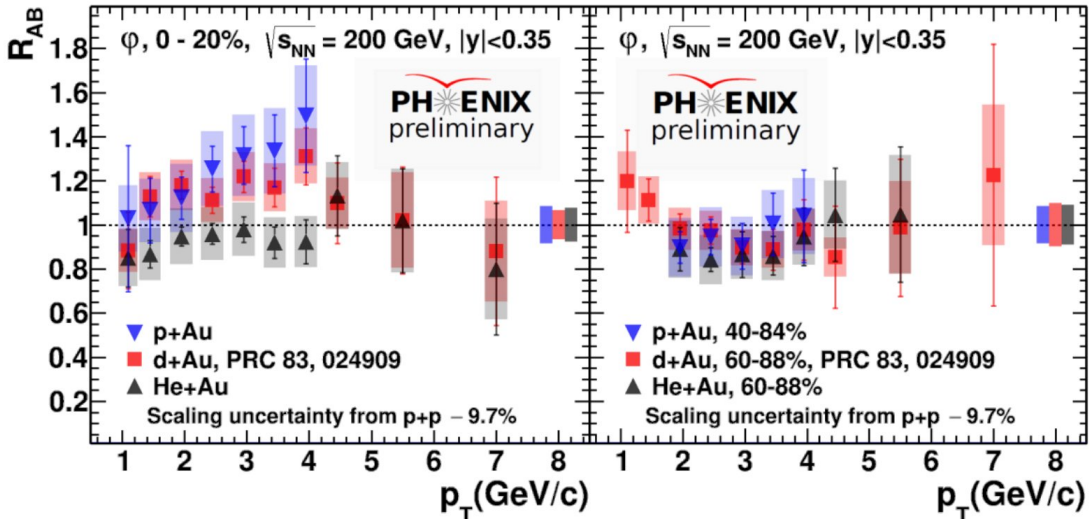
π^0, Φ p+Au, d+Au

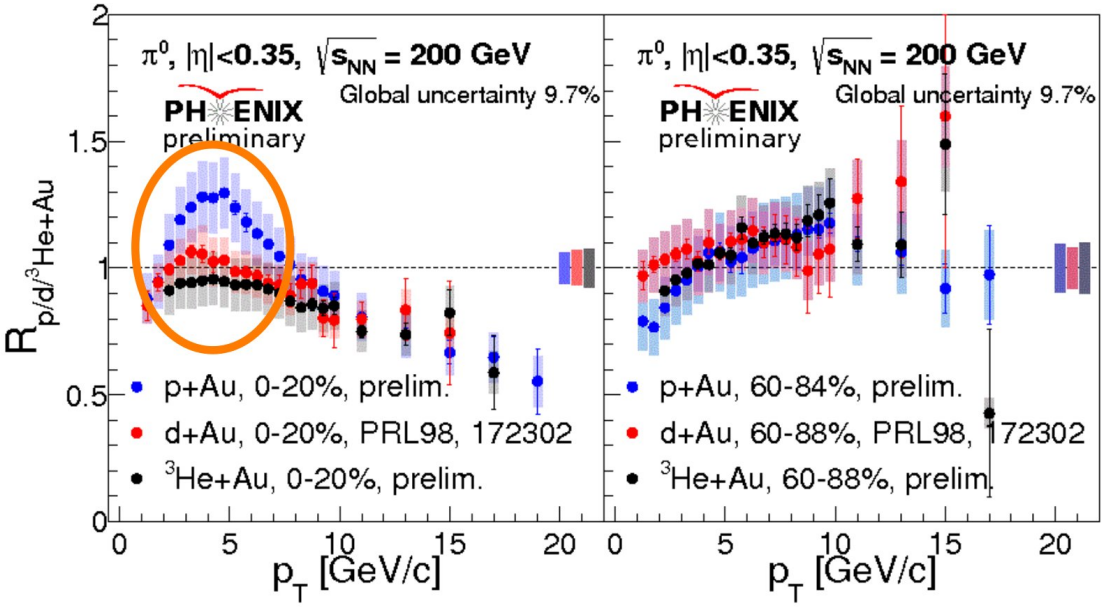


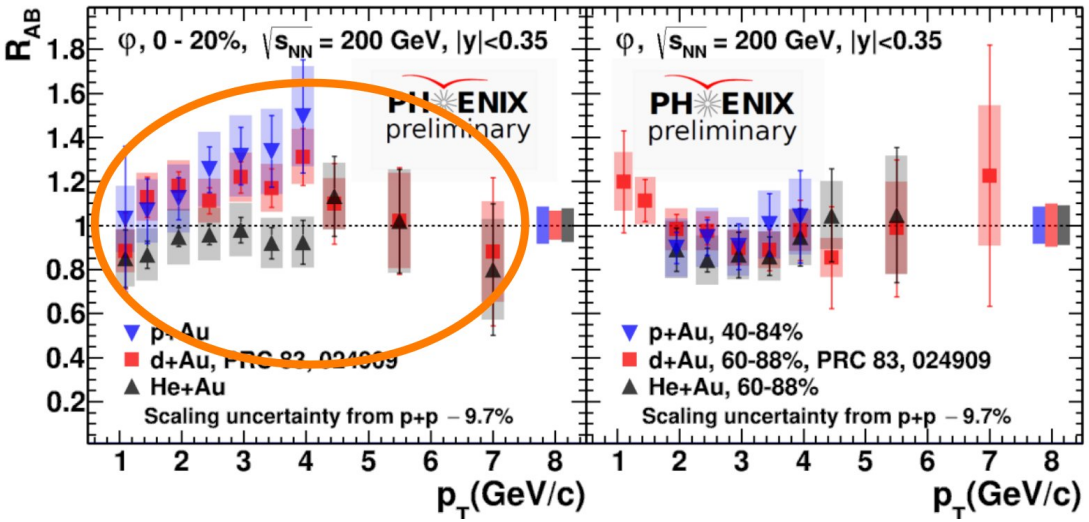


π^0, Φ p+Au, d+Au, He+Au

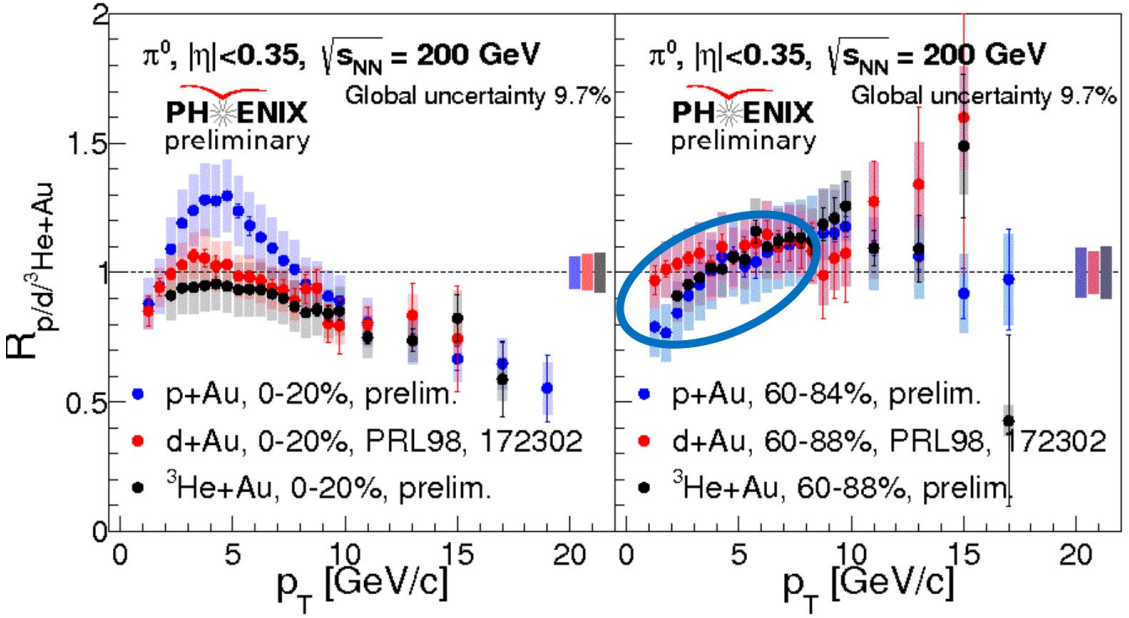


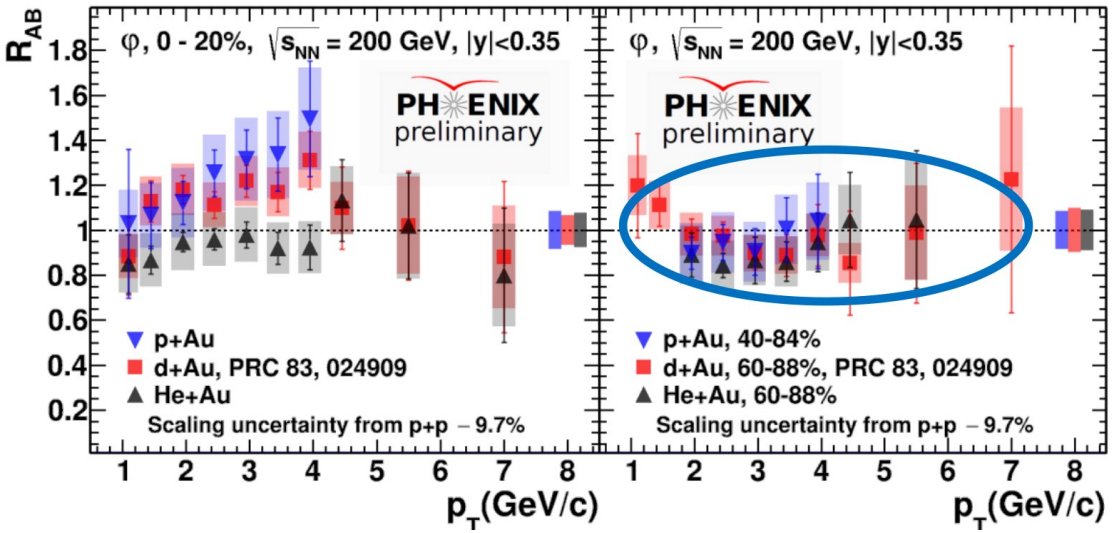






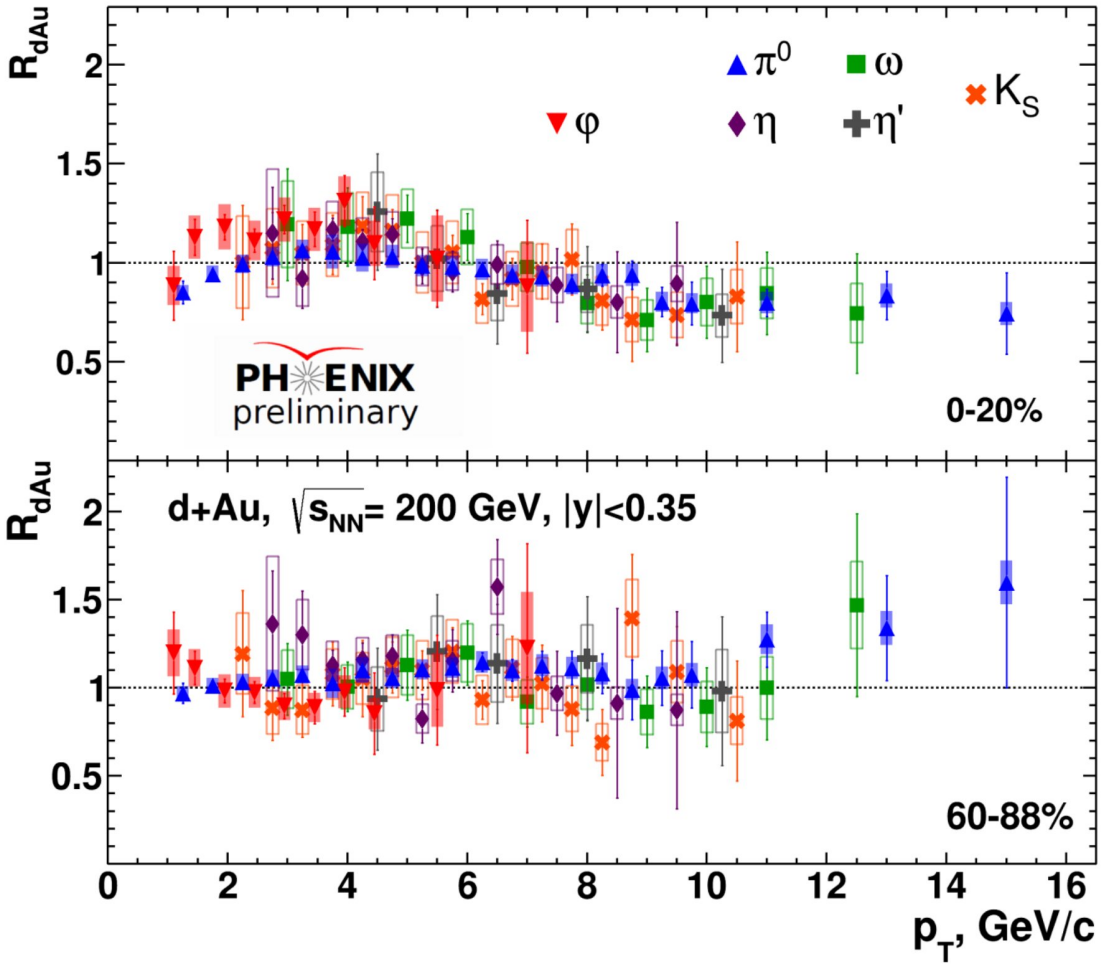
Ordering:
$R_{pAu} > R_{dAu} > R_{HeAu}$
in 0-20% at intermediate p_T range.
Hint of π^0 suppression in central collisions.





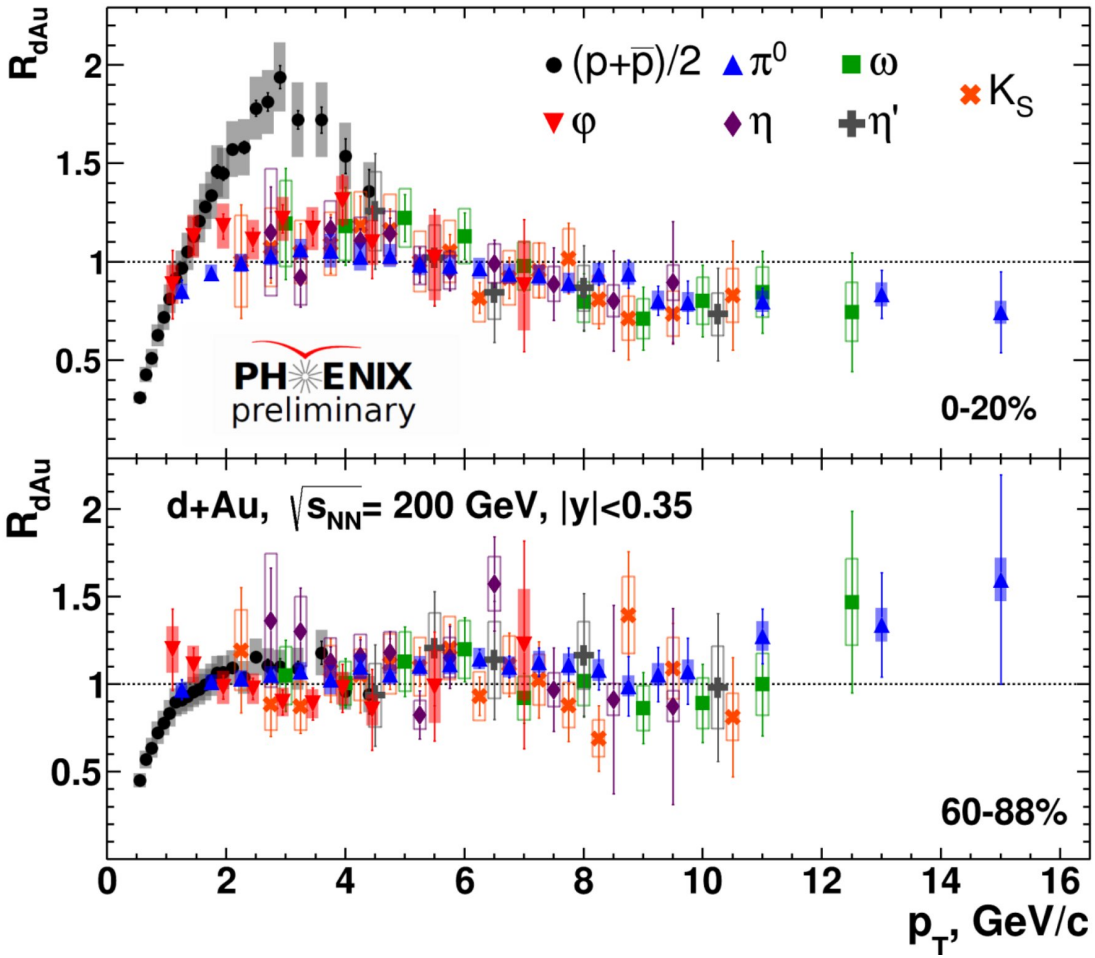
$R_{pAu} \approx R_{dAu} \approx R_{HeAu}$
Hint of π^0 enhancement in peripheral collisions at high p_T.

R_{dAu} of mesons



Light mesons R_{dAu} exhibit similar shape in the whole low p_T range, in contrast to large system at low p_T

R_{dAu} of mesons + baryons



Protons R_{dAu} shows enhancement at moderate p_T as in heavy-ion

Summary small systems

1. π^0, Φ $R_{pAu} > R_{dAu} > R_{HeAu}$ in 0-20% at intermediate p_T range
2. π^0, Φ $R_{pAu} \approx R_{dAu} \approx R_{HeAu}$ in peripheral collisions
3. Light mesons R_{dAu} exhibit similar shape in contrast to heavy-ion
4. Protons R_{dAu} shows enhancement at moderate p_T as in heavy-ion

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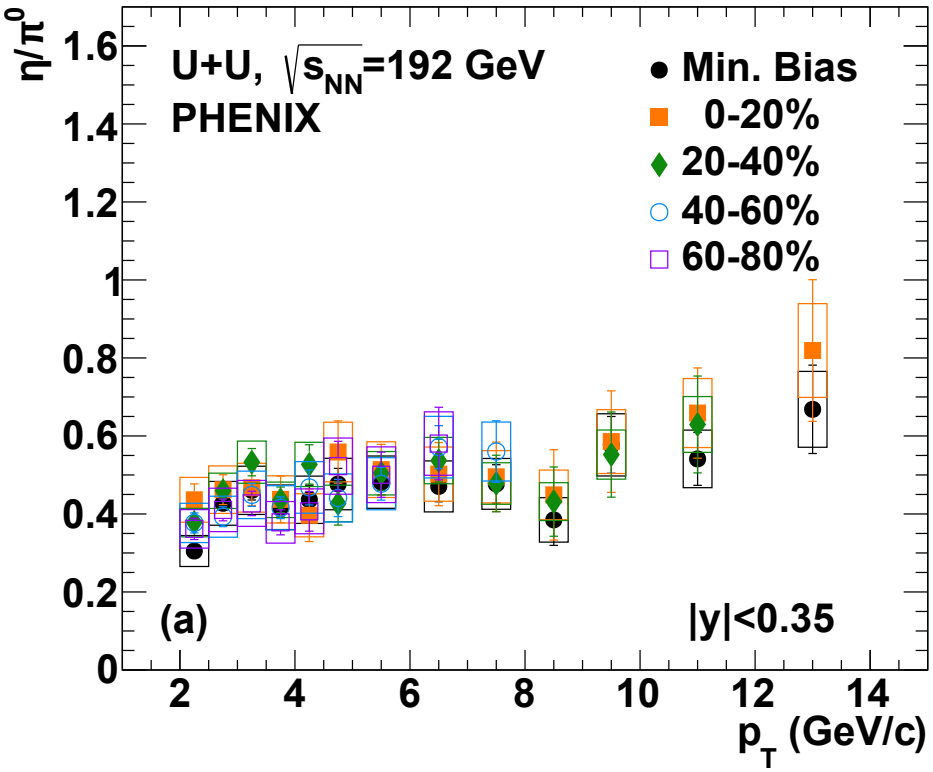
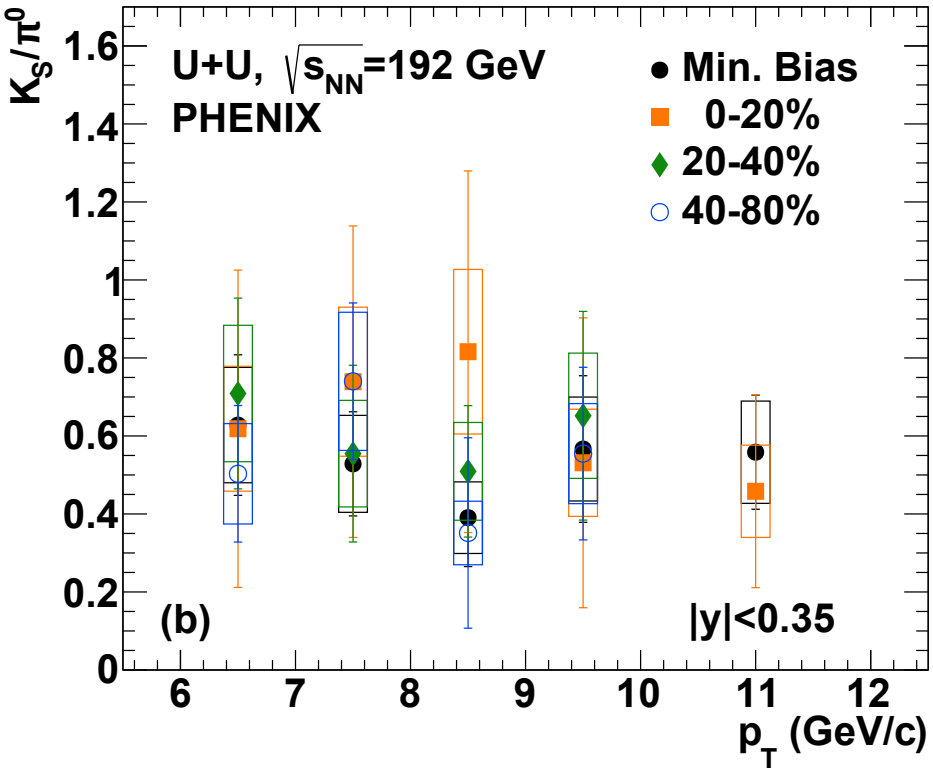
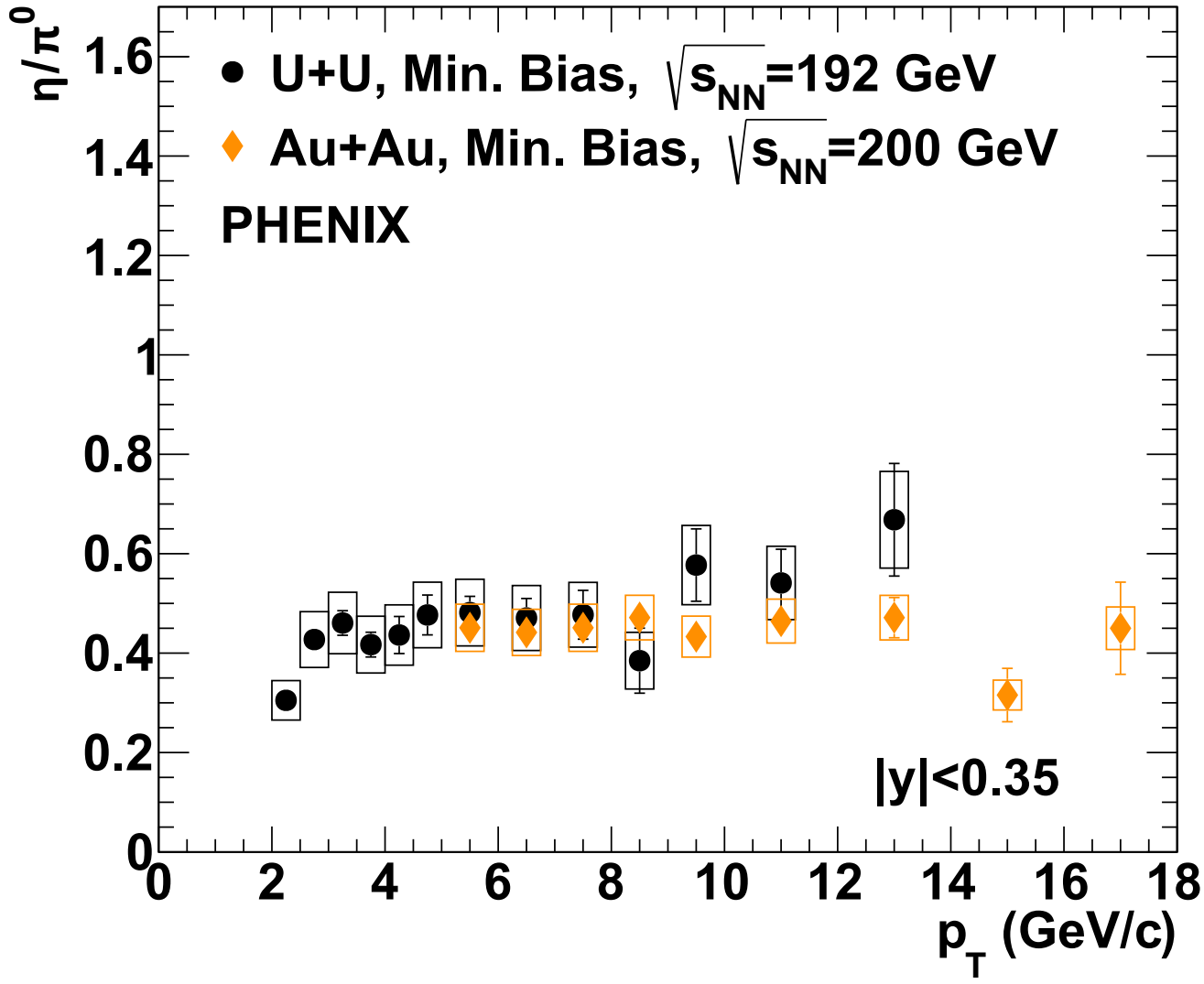
NKFIH, OTKA-131991

Backup





The η/π^0 and K_S/π^0 as a function of p_T for different U+U centrality intervals



The comparison of η/π^0 ratios obtained in U+U and Au+Au.