POLYTECH
Peter the Great St.Petersburg Polytechnic University

A Virtual Tribute to Quark Confinement and the Hadron Spectrum 2021

PHENIX

Modeling φ-meson production in small collision systems observed by PHENIX

Mariia Mitrankova for the PHENIX

Co Authors: Yaroslav Berdnikov, Alexander Berdnikov,

Dmitry Kotov, Iurii Mitrankov, Dariia Larionova

Peter the Great St.Petersburg Polytechnic University

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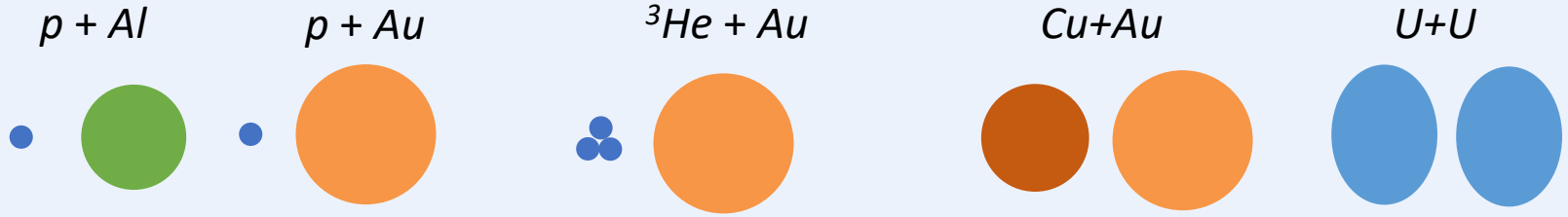
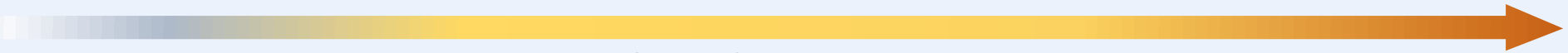
Motivation

200 GeV



pQCD

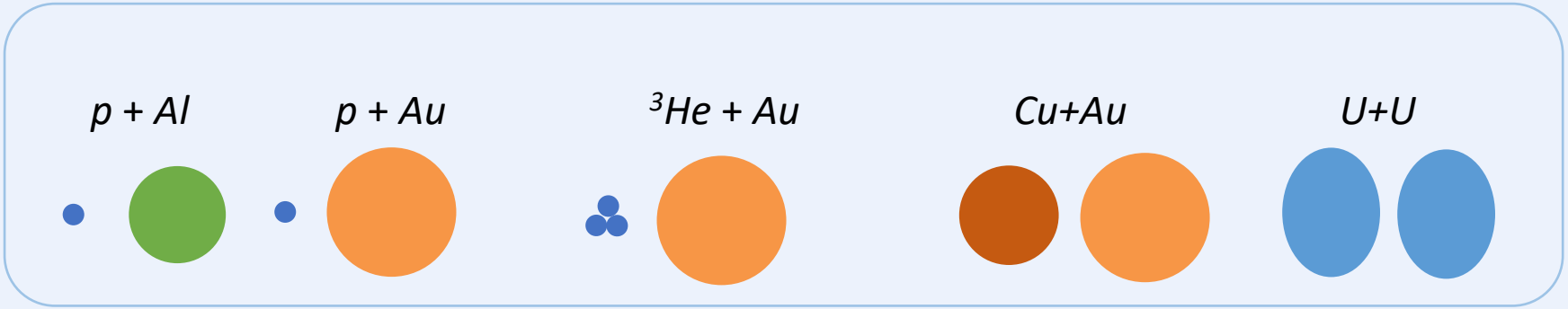
Signatures for QGP formation



System size

Motivation

200 GeV



PHENIX study different observables in a large set of small collision systems

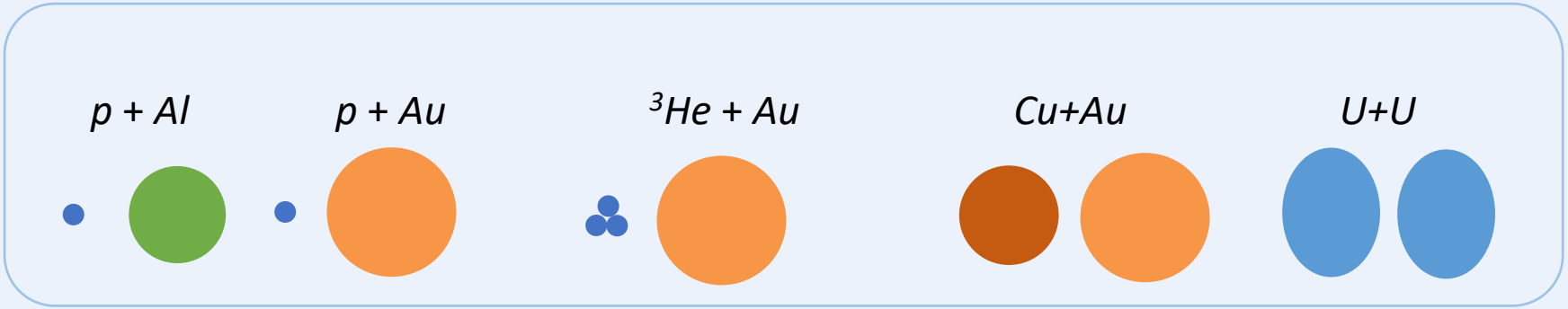
- Minimal conditions to form a QGP

Asymmetric large collision systems

- Strangeness enhancement, recombination and radial flow at moderate p_T
- Energy loss flavor dependence at high p_T

Motivation

200 GeV



PHENIX study different observables in a large set of small collision systems

- Minimal conditions to form a QGP

PYTHIA 8, AMPT def, AMPT sm

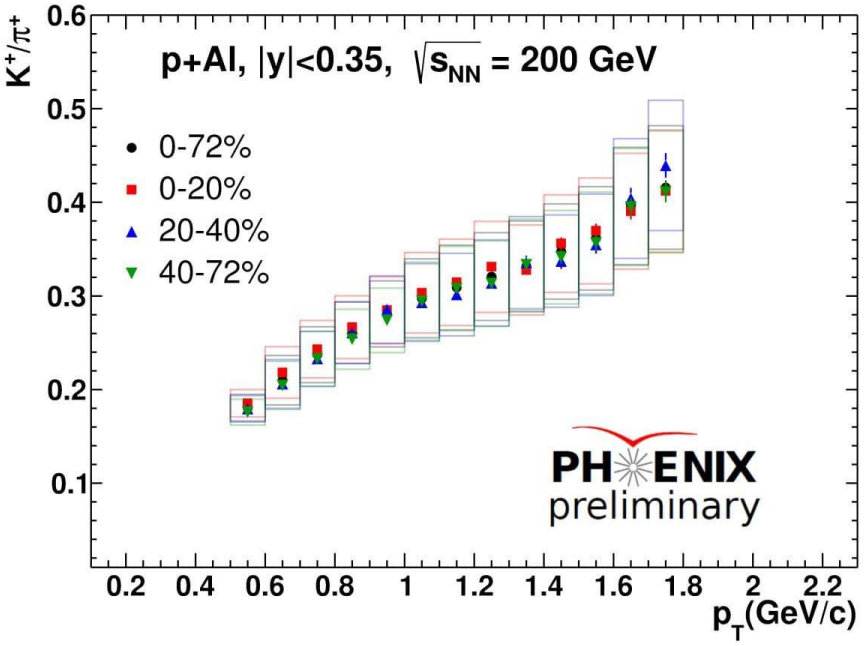
Asymmetric large collision systems

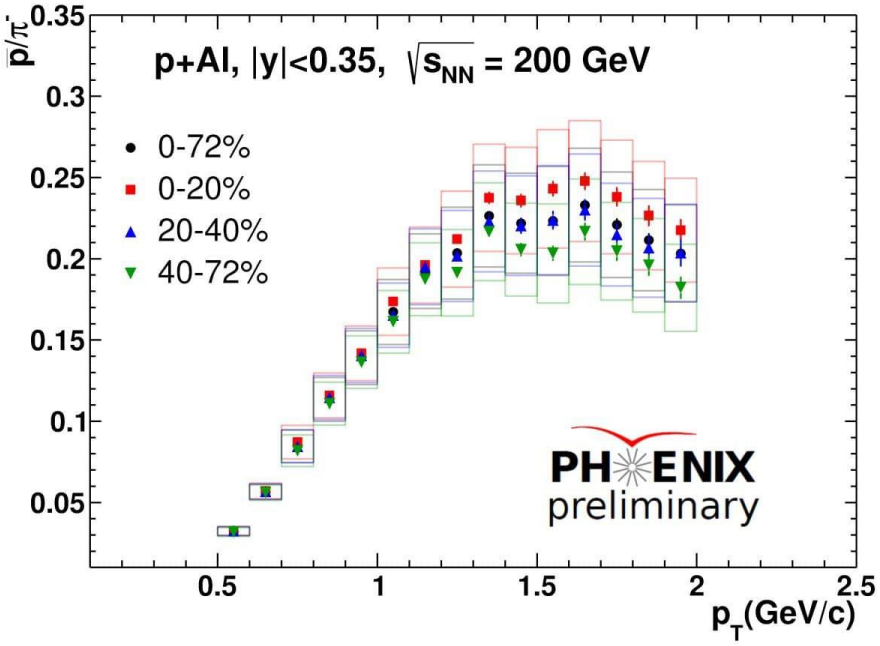
- Strangeness enhancement, recombination and radial flow at moderate p_T
- Energy loss flavor dependence at high p_T

Small Systems

Ratio in small systems

- $p + Al$



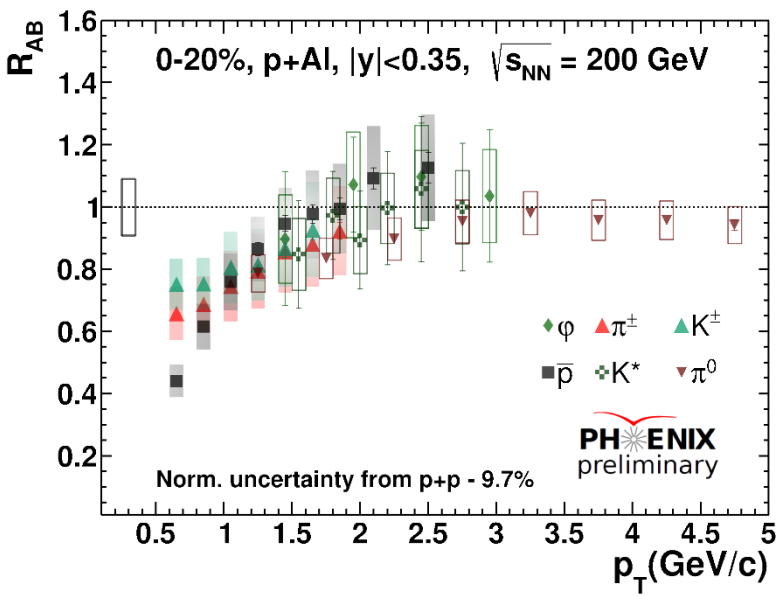


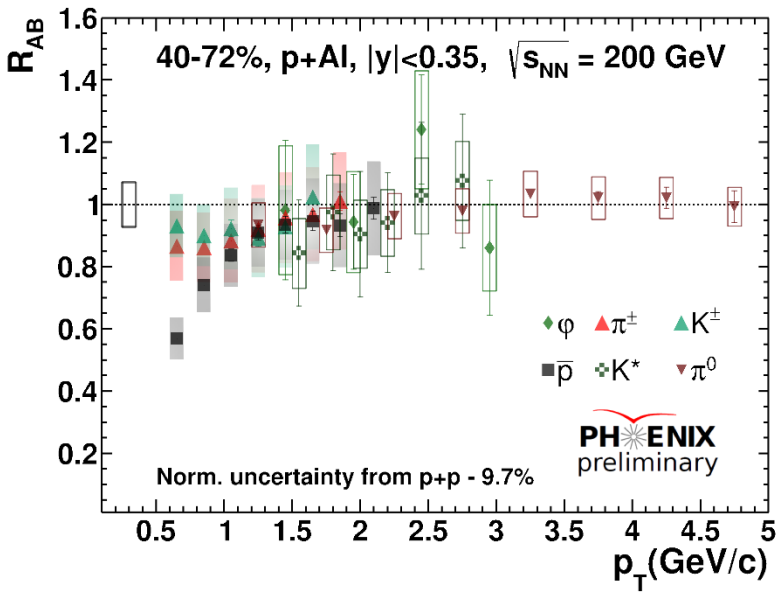
No strangeness enhancement

No proton enhancement?

R_{AB} in small systems

- $p + Al$

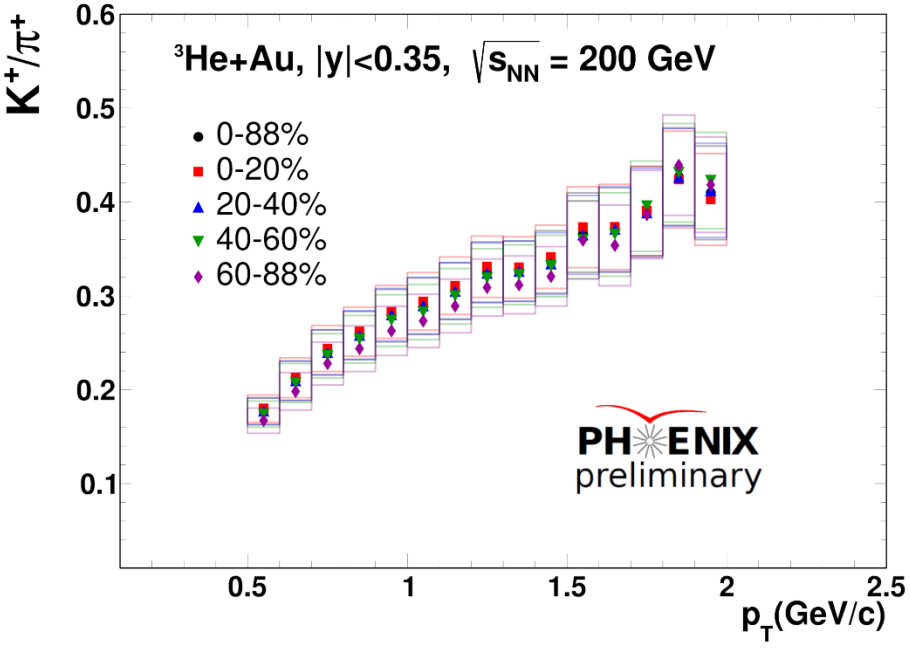


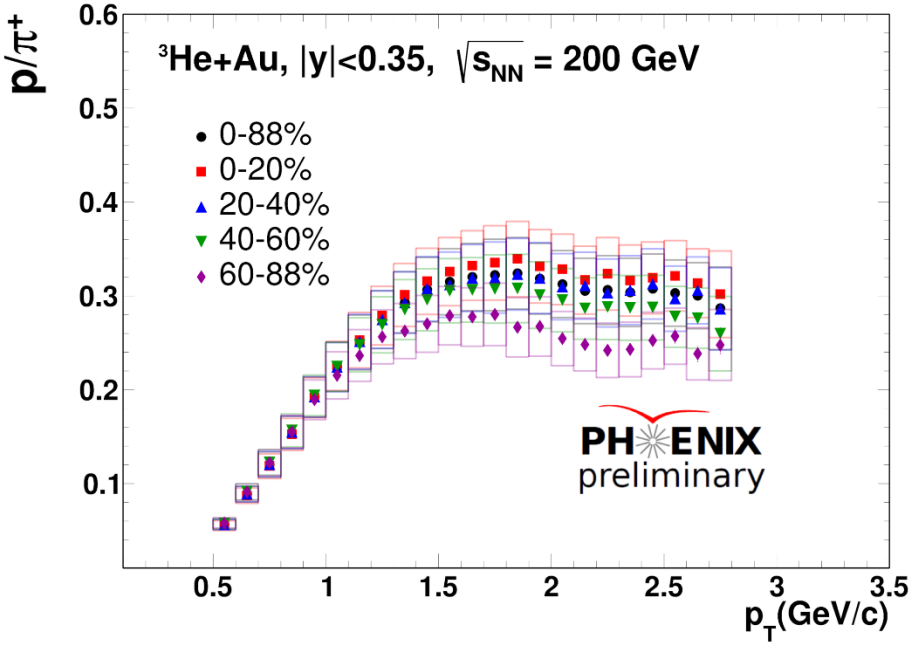


- All light hadrons R_{AB} follow the same curve

Ratio in small systems

$^3He + Au$



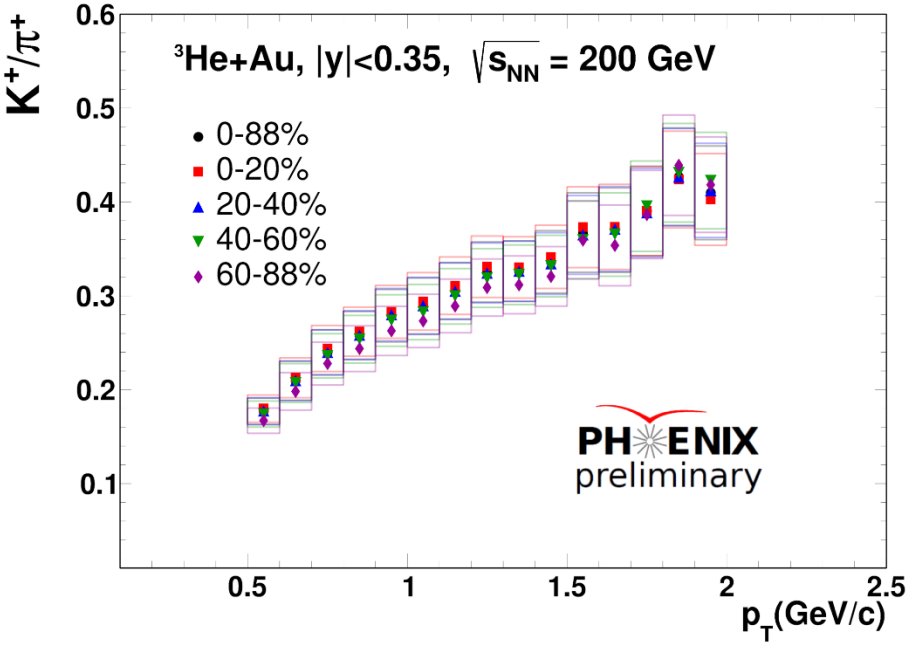


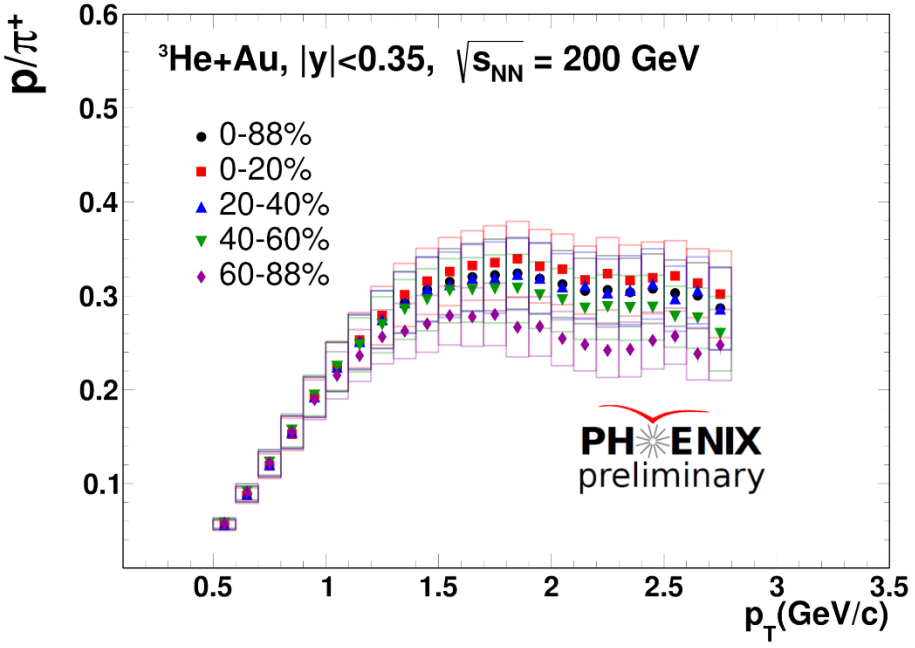
No strangeness enhancement

A hint of proton enhancement

Ratio in small systems

$^3He + Au$

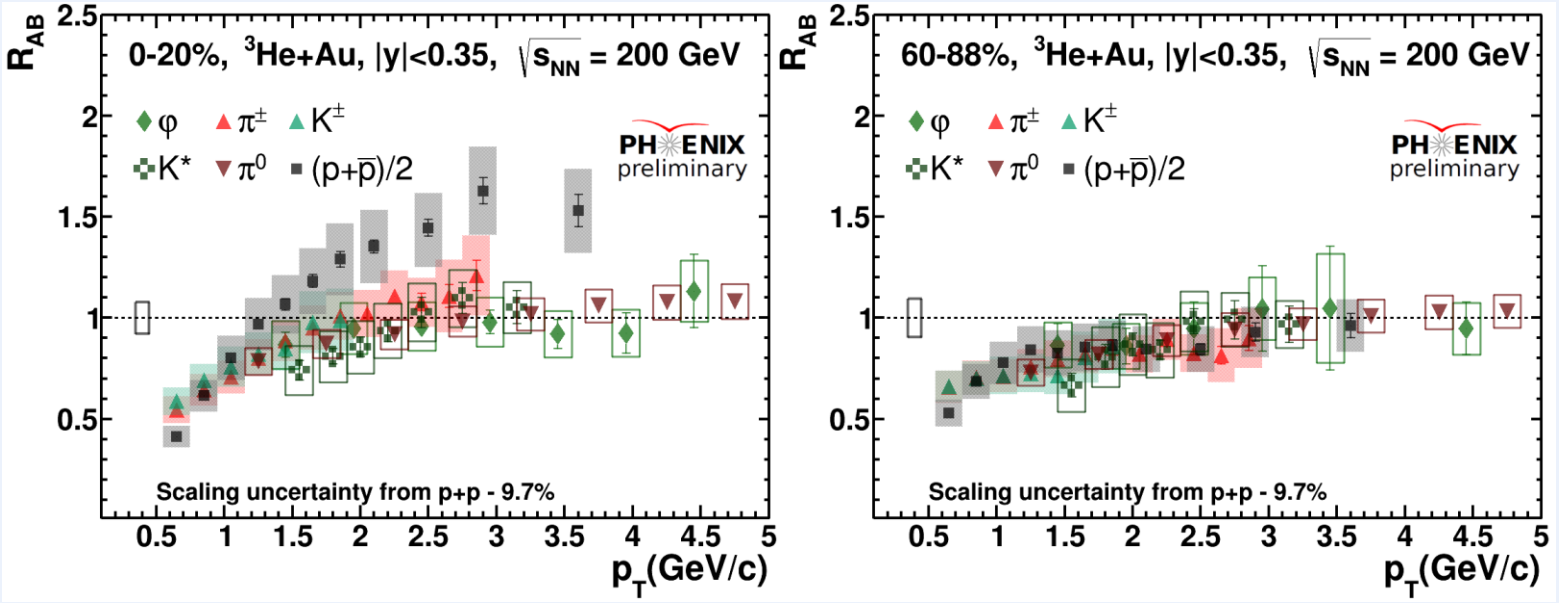




Radial flow or recombination

R_{AB} in small systems

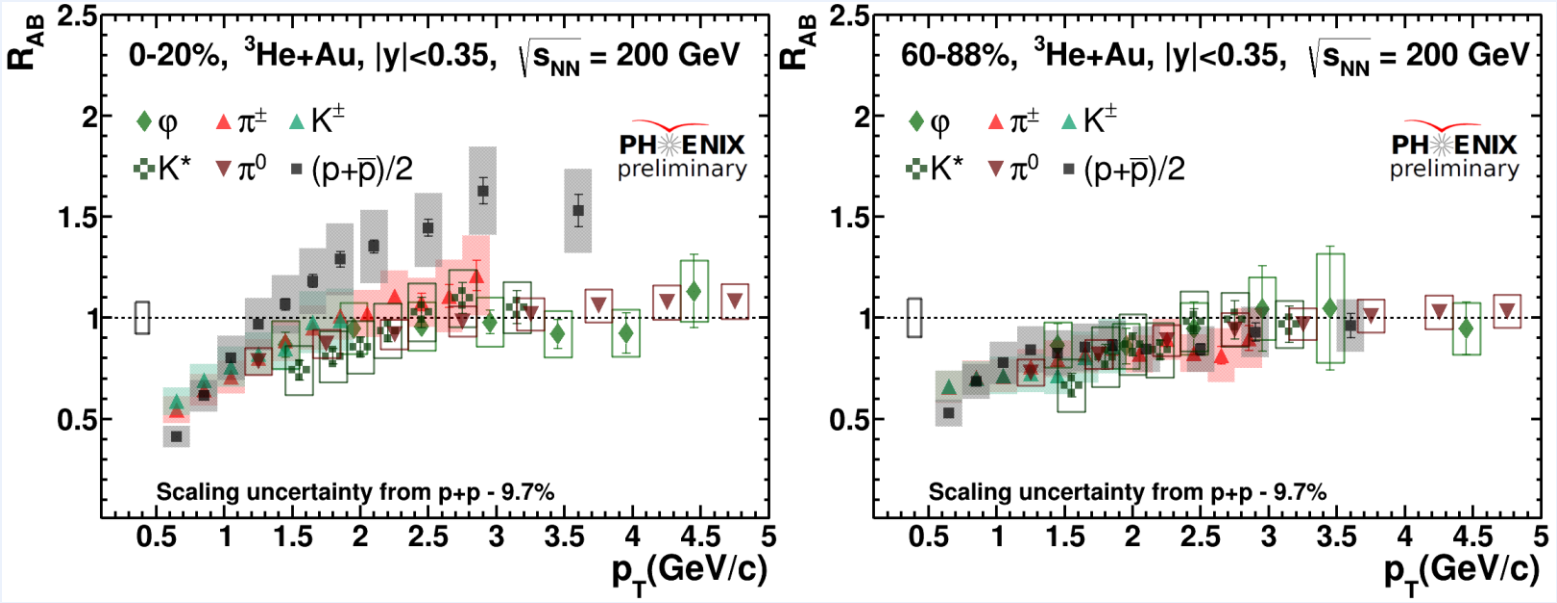
$^3He + Au$



- All light mesons R_{AB} follow the same curve
- Protons yields are enhanced in 0-20% ^{3}He+Au, as in *p/d*+Au

R_{AB} in small systems

$^3He + Au$

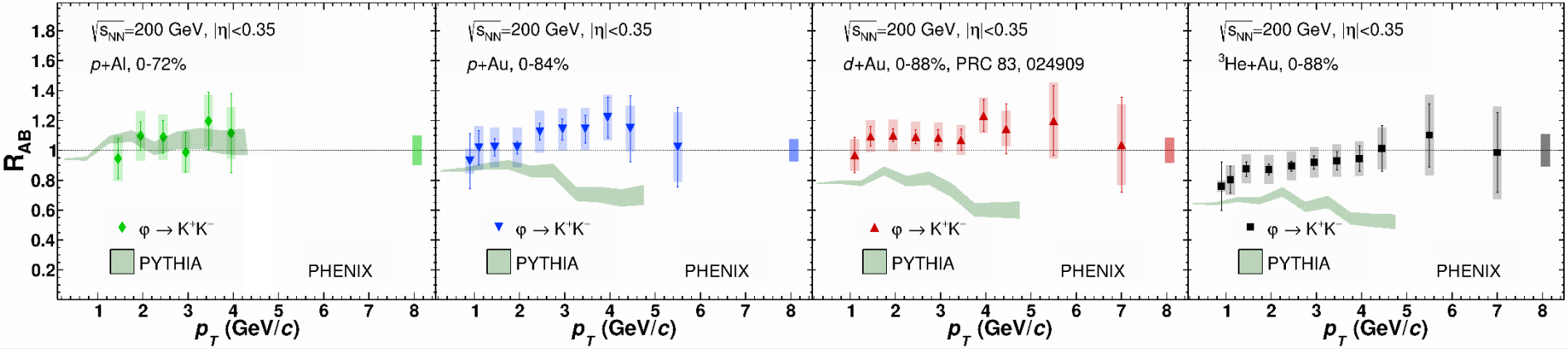


✓ Recombination can explain protons $R_{AB} > \varphi\ R_{AB}$

X ~~Radial flow~~

PYTHIA 8

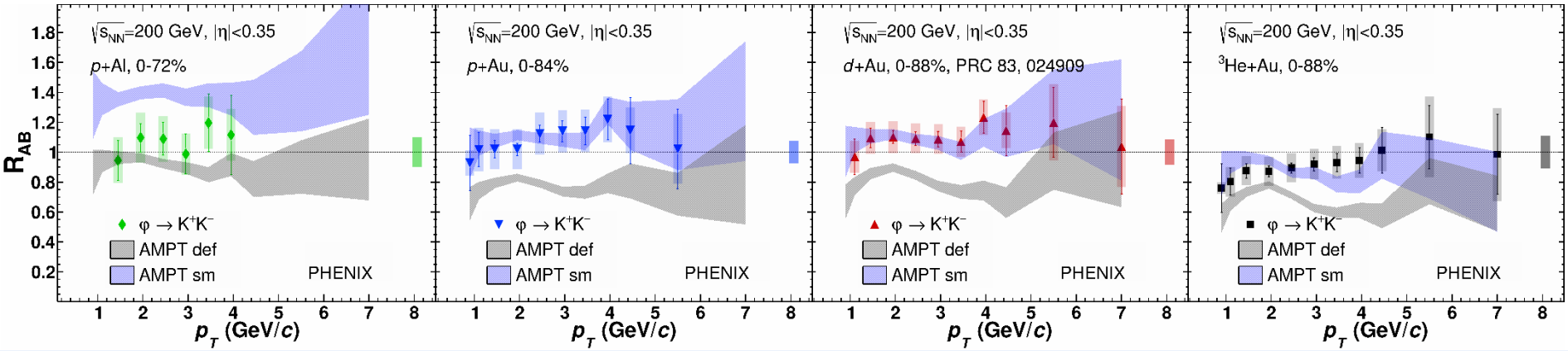
- $p + Al$
- $p + Au$
- $d + Au$
- $^3He + Au$



✓ Pythia 8 is in well agreement with R_{pAl} for φ

X Pythia 8 underestimates φ R_{AB} in p/d/^{3}He+Au

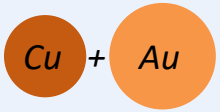
AMPT def/sm

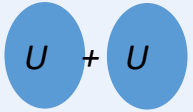


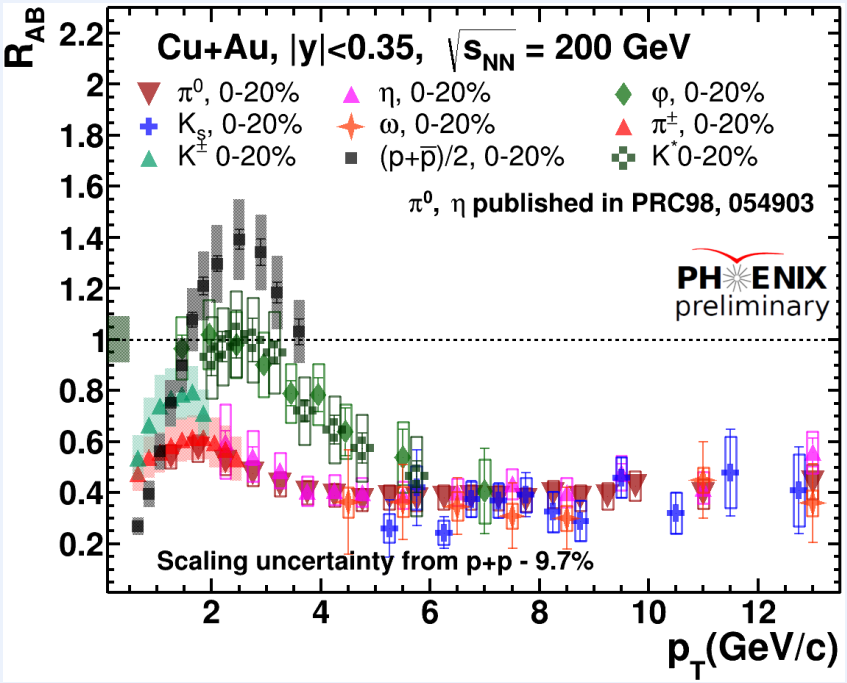
- φ R_{pAl} is well estimated by default AMPT calculations
- String melting AMPT well predicts φ yields in p/d/^{3}He+Au

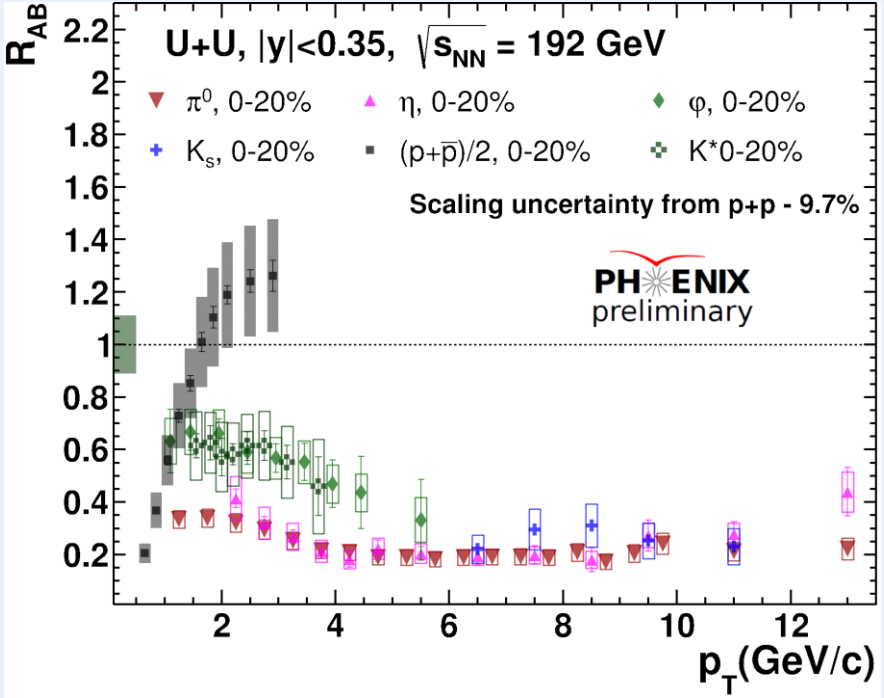
Large Systems

New addition from Cu+Au & U+U collisions



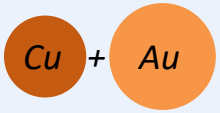


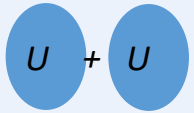


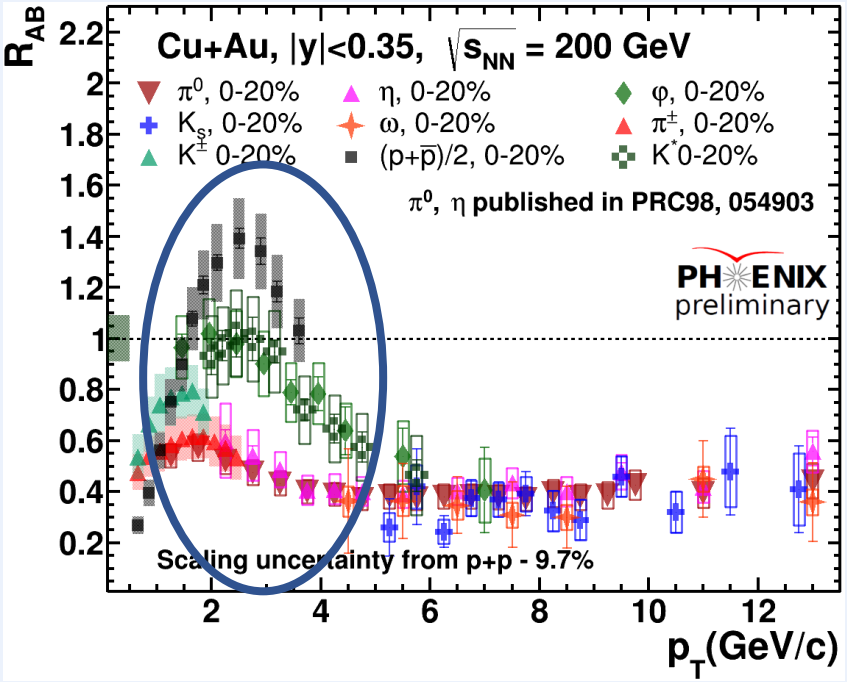


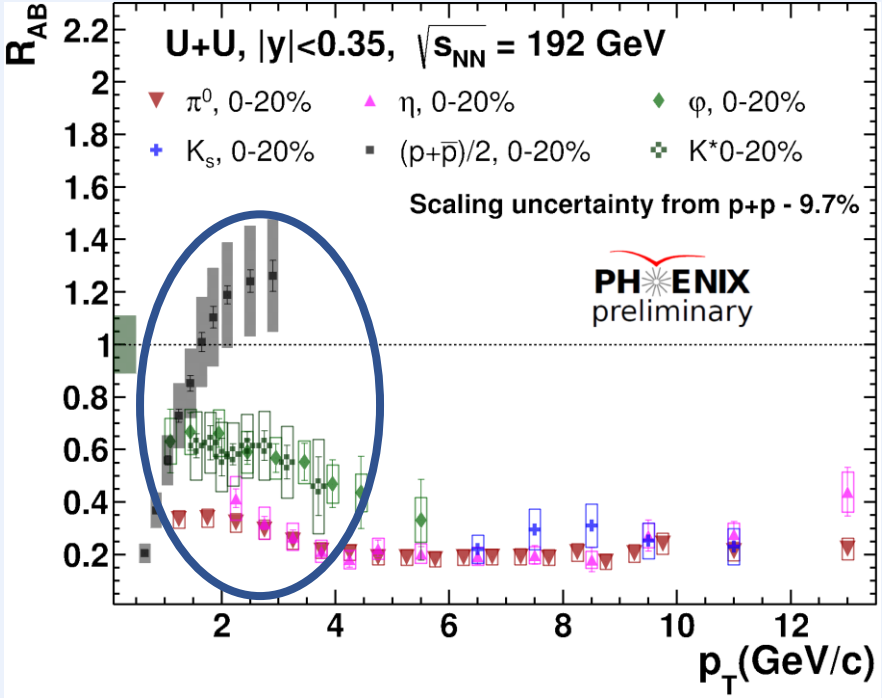
New addition from Cu+Au & U+U collisions

At moderate p_T: $(p+\bar{p})/2\ R_{AB} \geq \varphi, K^*\ R_{AB} \geq \pi^0, \eta\ R_{AB}$





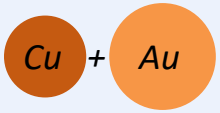


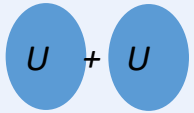


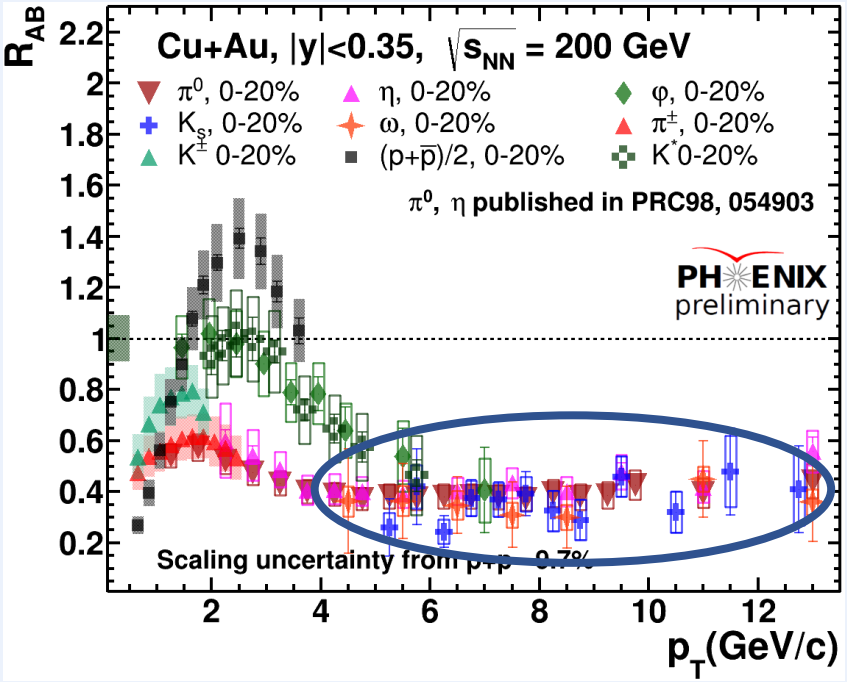
New addition from Cu+Au & U+U collisions

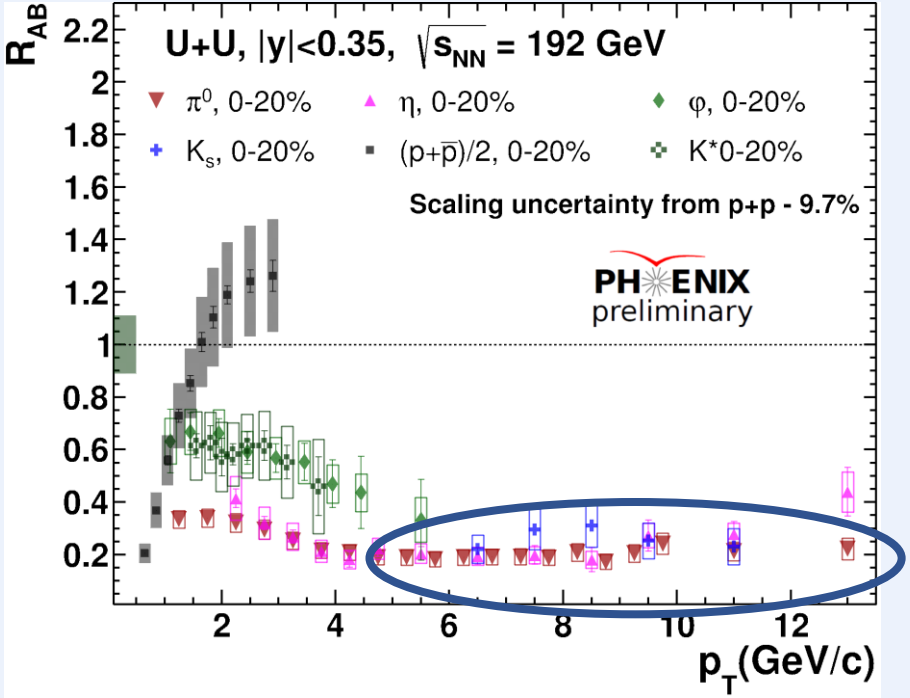
At moderate p_T: $(p+\bar{p})/2\ R_{AB} \geq \varphi, K^*\ R_{AB} \geq \pi^0, \eta\ R_{AB}$

Flavor independent suppression at high-p_T

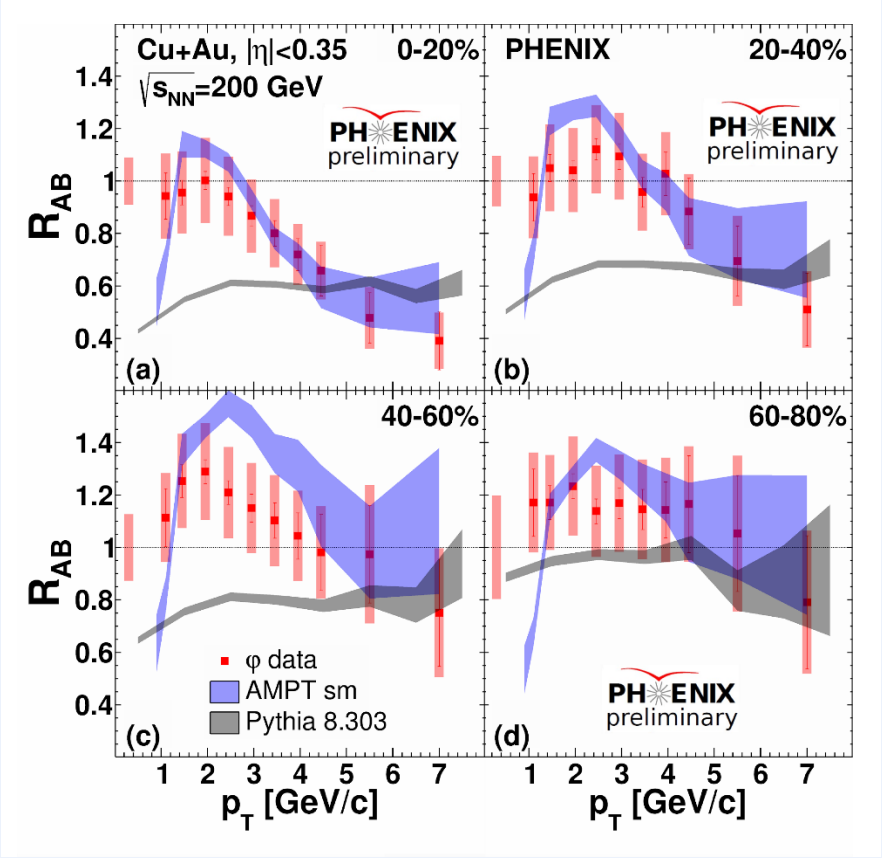






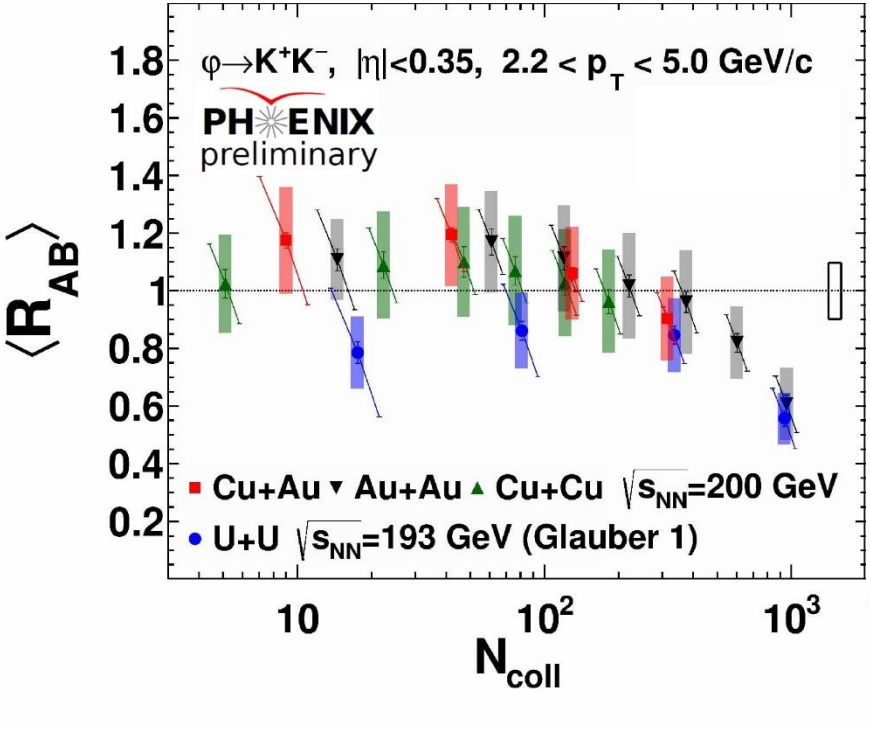


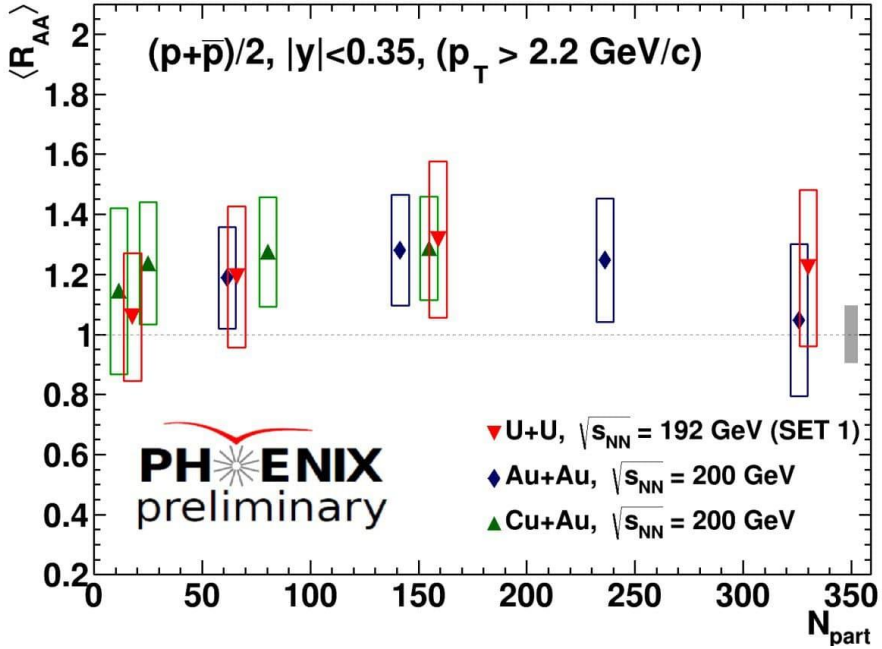
φ R_{CuAu}: PYTHIA vs AMPT sm



- ✓ String melting AMPT well predicts φ R_{CuAu}
- ✓ Coalescence can explain φ yields enhancement
- X Pythia failed at central Cu+Au

Integrated R_{AB} in large systems





Summary

Summary

Small systems:

Minimal conditions to from QGP may lie in between p+Al and p+Au:

- ✓ A hint of proton enhancement in p/d/^{3}He+Au
- ✓ String melting AMPT φ $R_{p/d/^3He+Au}$ & Pythia and def AMPT for φ R_{pAl}
- X But NO strangeness enhancement in small systems

Large systems:

No flavor dependence suppression at high-p_T in heavy-ion collisions

Coalescence might be an answer for strangeness enhancement:

- ✓ String melting AMPT well predicts φ R_{CuAu}

Light hadron production scales with collision system size

Thank you for your attention!