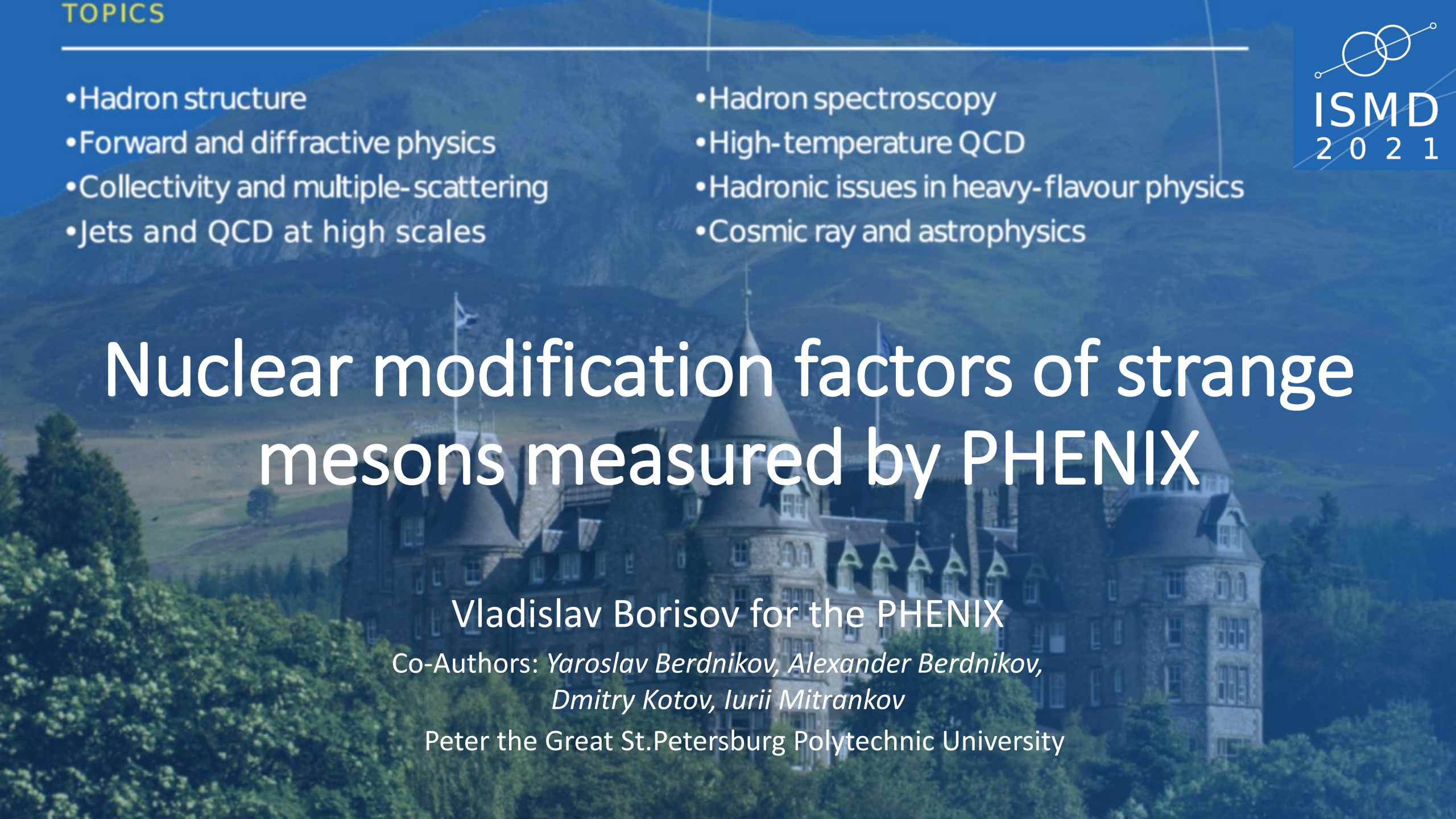


Nuclear modification factors of strange mesons measured by PHENIX

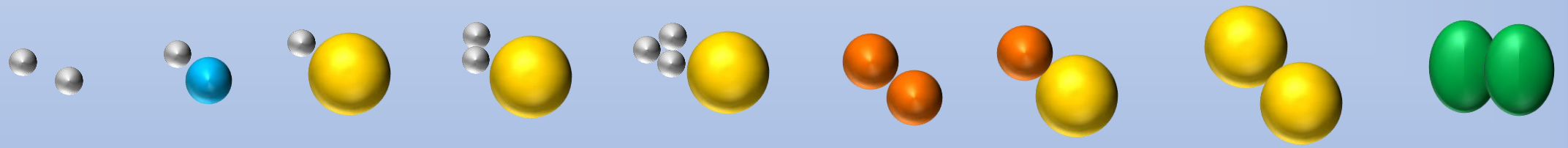
Vladislav Borisov for the PHENIX

Co-Authors: *Yaroslav Berdnikov, Alexander Berdnikov, Dmitry Kotov, Iurii Mitrankov*

Peter the Great St.Petersburg Polytechnic University

Motivation

- Strangeness content vs. first generation quarks in hadron production:
  - ✓ Strangeness enhancement, recombination and radial flow at moderate p_T
  - ✓ Energy loss flavor dependence at high p_T
- Pythia 8 and AMPT predictions:
  - ✓ Study from different perspectives (soft QCD, Lund Model, coalescence from QGP)
- PHENIX study different observables in a large variety of SYSTEMs
  - ✓ Minimal conditions to form a QGP and its properties



Hadrons in this talk

(hidden) strange

h	Quark content	Decay modes	BR, %	Mass, MeV
K^+/K^-	$u\bar{s}\ /\ s\bar{u}$			~495
K_S^0	$\frac{d\bar{s}-s\bar{d}}{\sqrt{2}}$	$\pi^0\pi^0$	~30	~498
$K^{0*}/\overline{K^{0*}}$	$d\bar{s}\ /\ s\bar{d}$	$\pi^{\mp}K^{\pm}$	~67	~896
φ	$\sim 0.9999 \cdot s\bar{s}$	K^+K^-	~49	~1019

light flavored

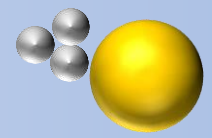
h	Quark content	Decay modes	BR, %	Mass, MeV
π^0	$\frac{u\bar{u}-d\bar{d}}{\sqrt{2}}$	$\gamma\gamma$	~99	~135
π^+/π^-	$u\bar{d}\ /\ d\bar{u}$			~140
ω	$\sim\frac{1}{\sqrt{2}}(u\bar{u}+d\bar{d})$	$\pi^0\gamma$	~8.4	~783
$p/\bar{p}$	$uud\ /\ \bar{u}\bar{u}\bar{d}$			~938

η	$0.57 \cdot (u\bar{u}+d\bar{d}) + 0.60 \cdot s\bar{s}$	$\gamma\gamma$	~39	~548

Small Systems

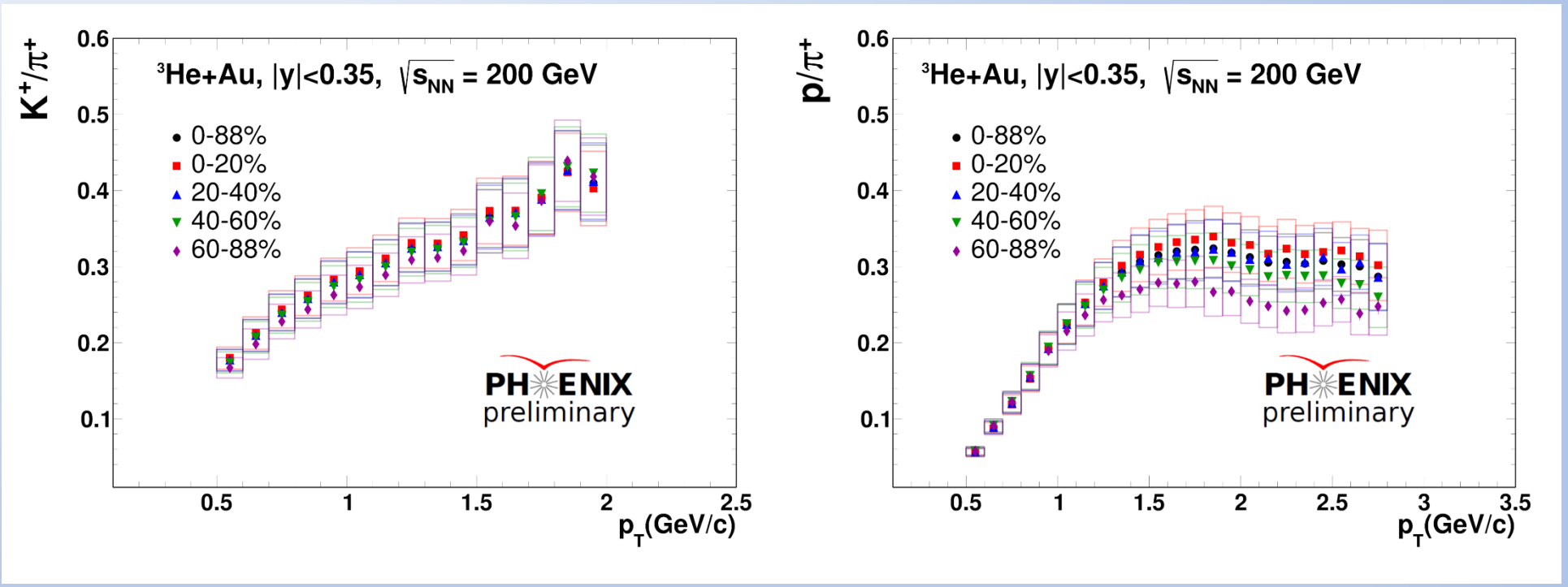
Vladislav Borisov for PHENIX collaboration

Ratios in small systems



^{3}He+Au

PHENIX



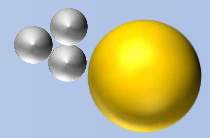
ISMD 2021

No strangeness enhancement

A hint of proton enhancement

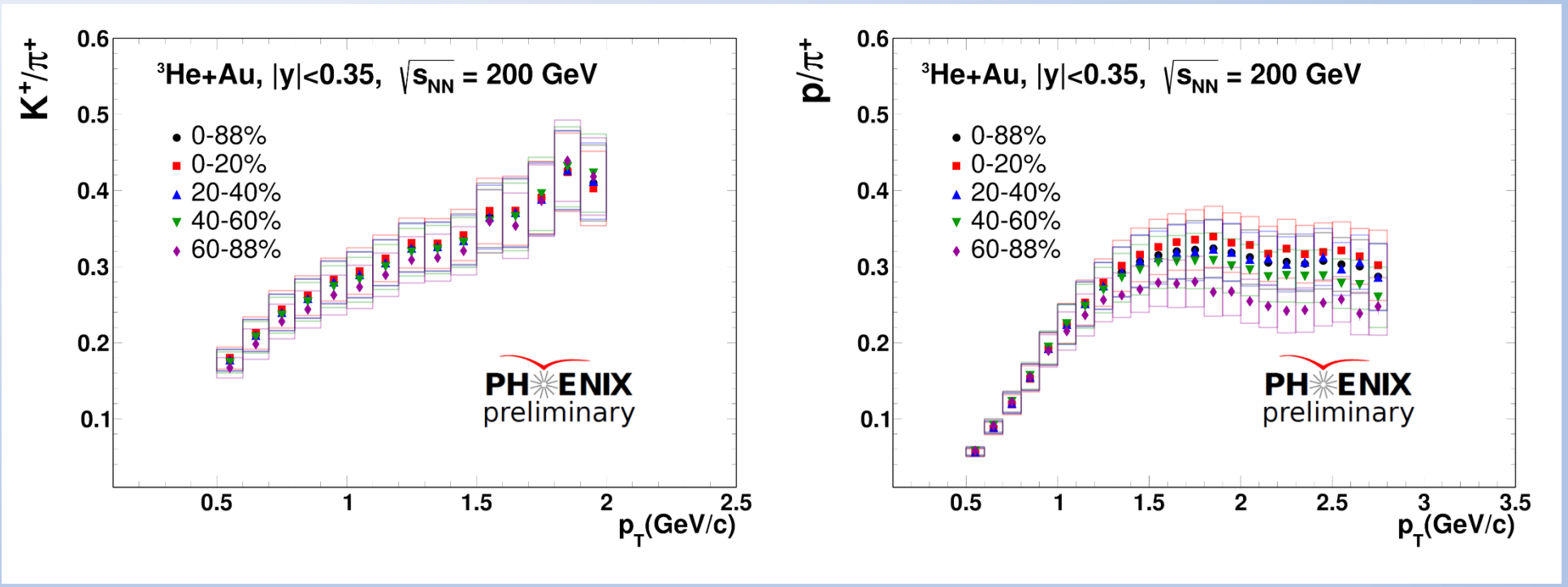
POLYTECH
Peter the Great St.Petersburg Polytechnic University

Ratios in small systems



^{3}He+Au

PHENIX

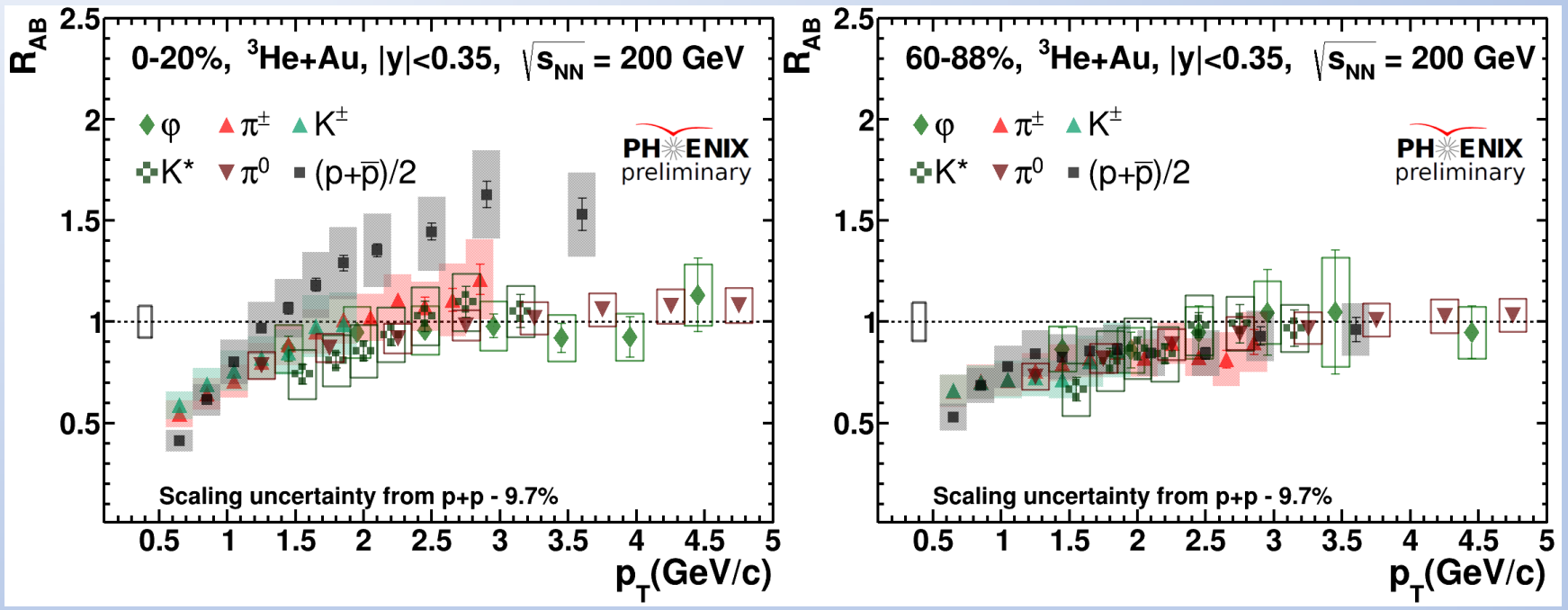


ISMD 2021

Radial flow or recombination

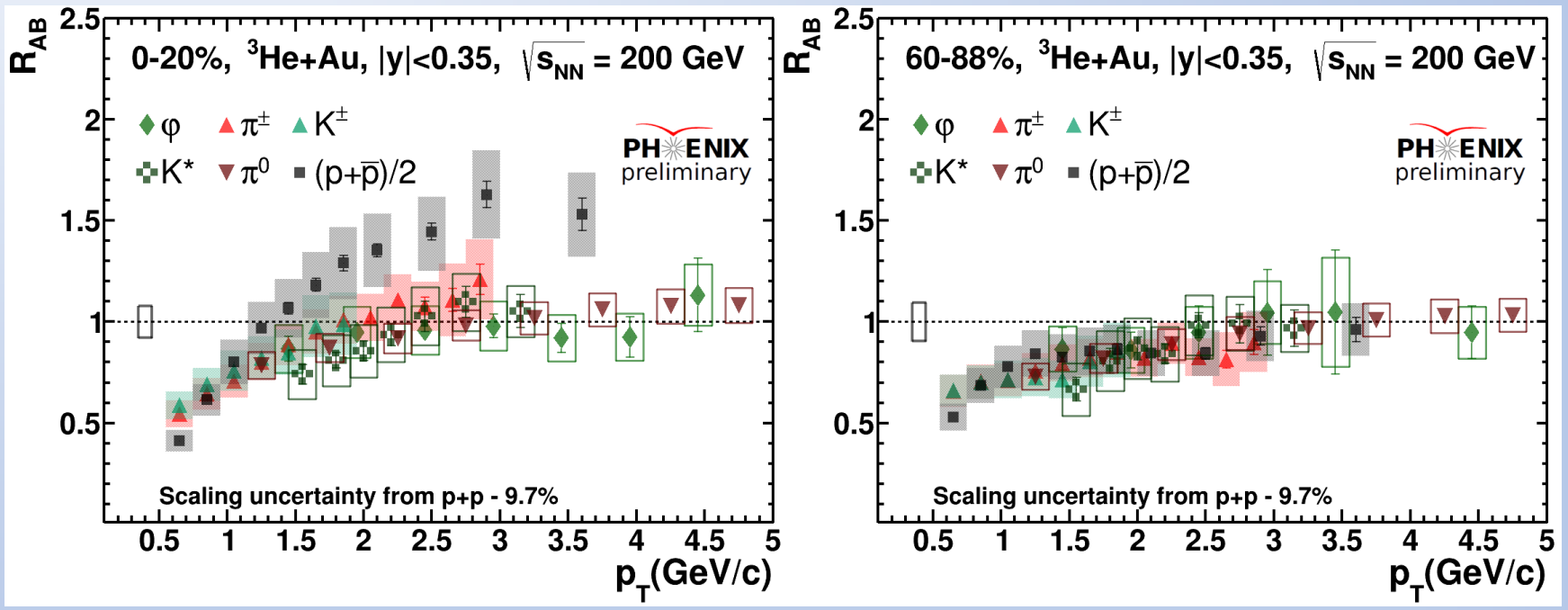
POLYTECH
Peter the Great St.Petersburg Polytechnic University

R_{AB} in small systems



- φ & K^{0*} R_{AB} follows other light mesons R_{AB}
- Protons yields are enhanced in 0-20% ^{3}He+Au

R_{AB} in small systems



³He+Au

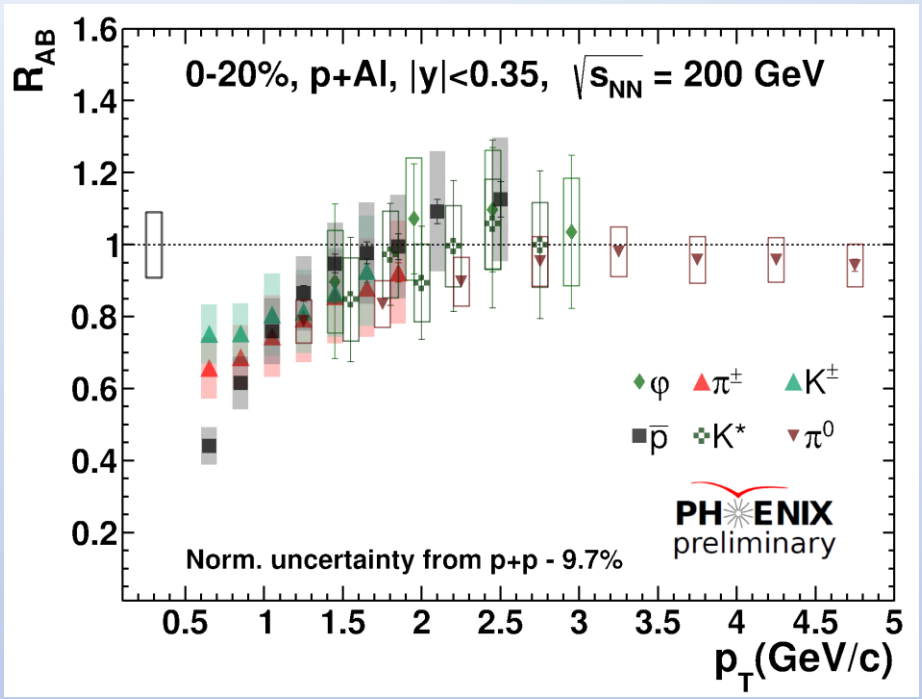
PHENIX

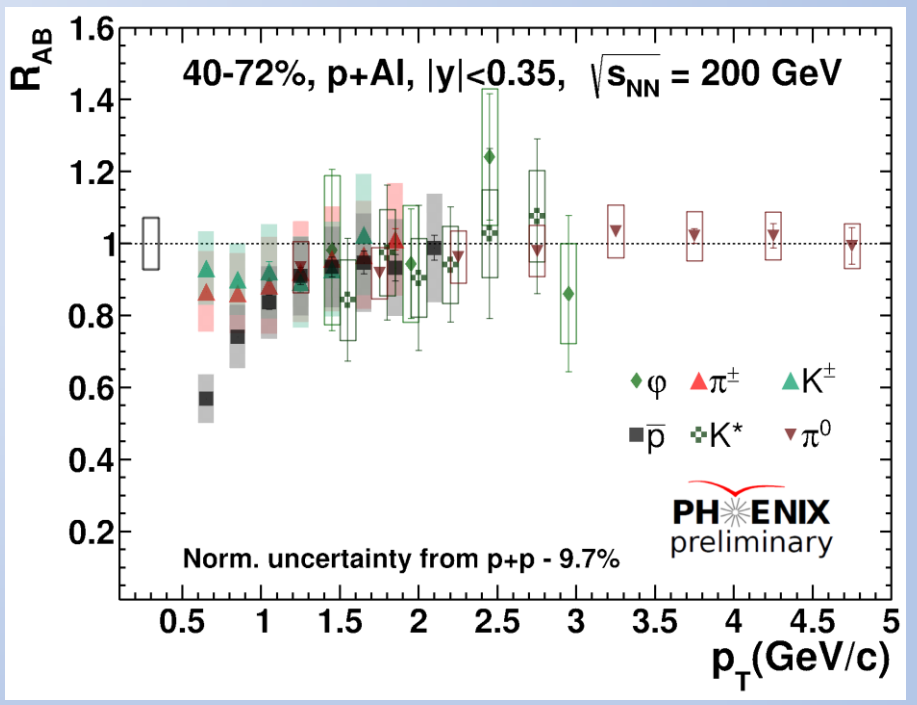
ISMD 2021

- ✓ Recombination can explain protons $R_{AB} > \varphi\ R_{AB}$
- X ~~Radial flow~~

POLYTECH
Peter the Great St.Petersburg Polytechnic University

R_{AB} in small systems

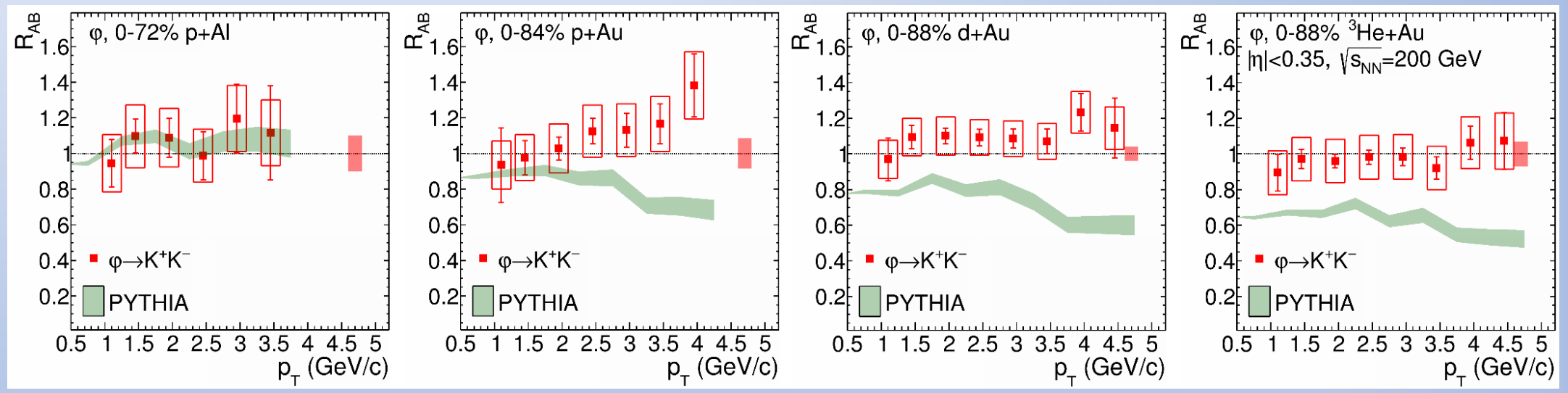




p+Al

- No baryon and strangeness enhancement

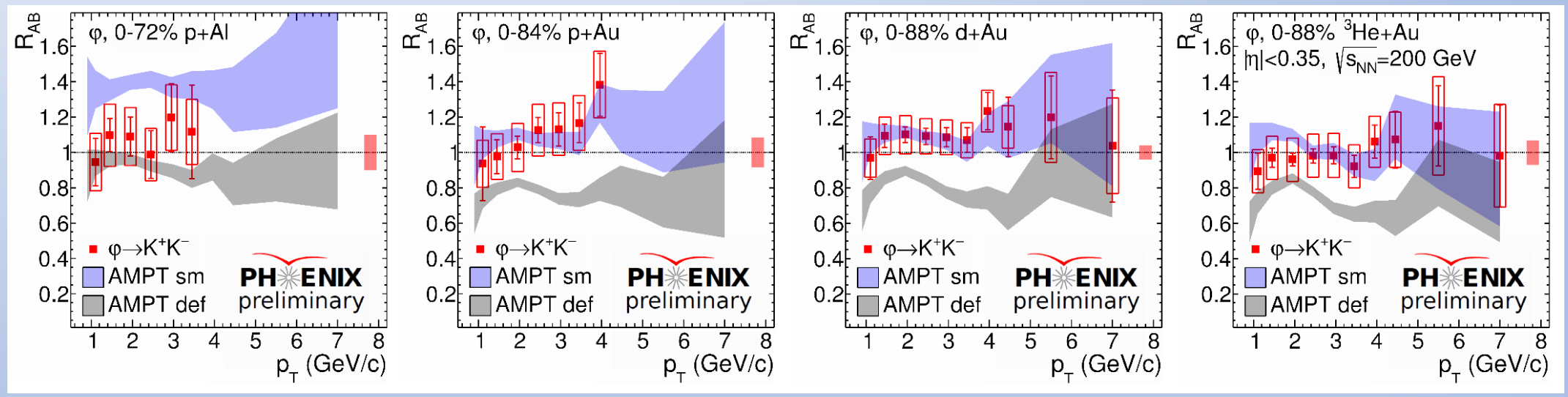
R_{AB} in small systems



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

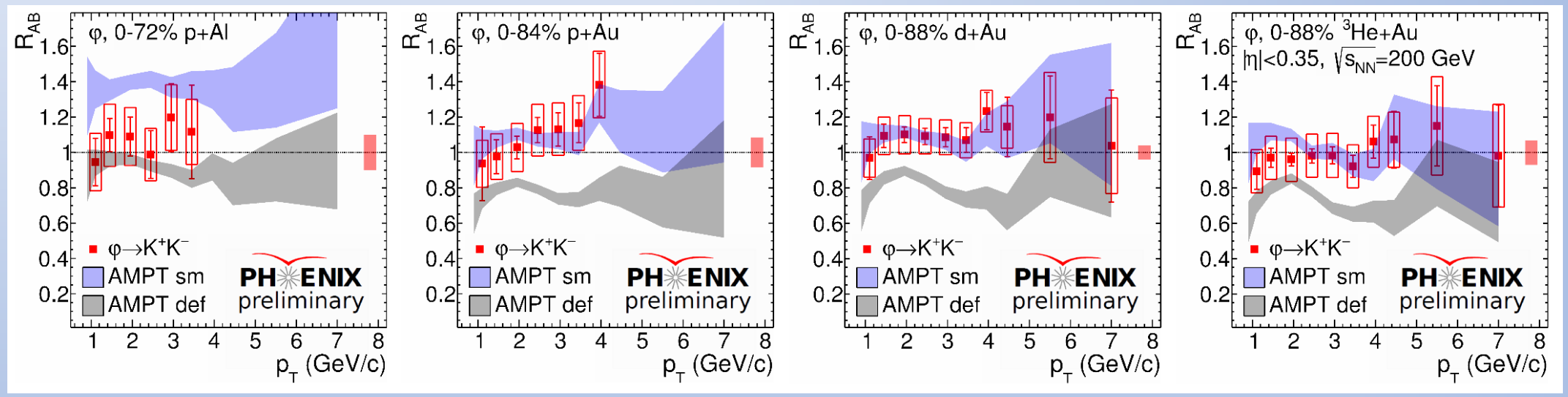
X Pythia 8 underestimates φ R_{AB} in p/d/³He+Au

R_{AB} in small systems



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

R_{AB} in small systems

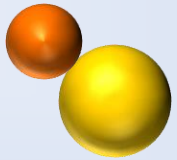


- Minimal conditions to from QGP may lie in between
  - p+Al and p+Au

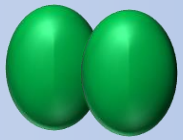
Large Systems

Vladislav Borisov for PHENIX collaboration

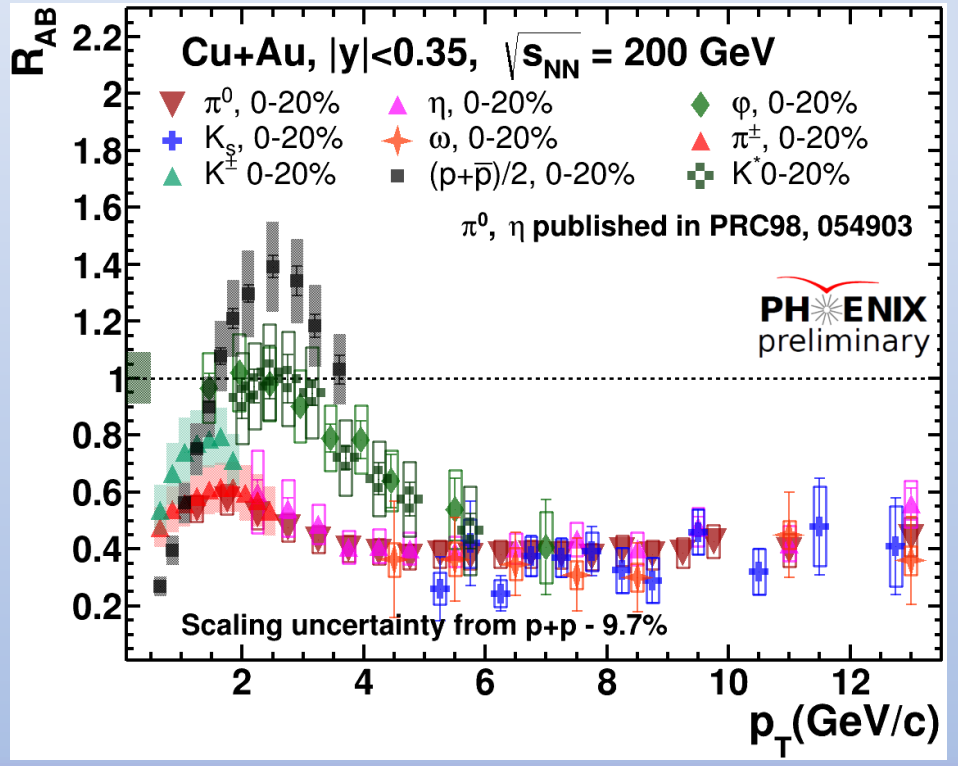
New addition from Cu+Au & U+U collisions

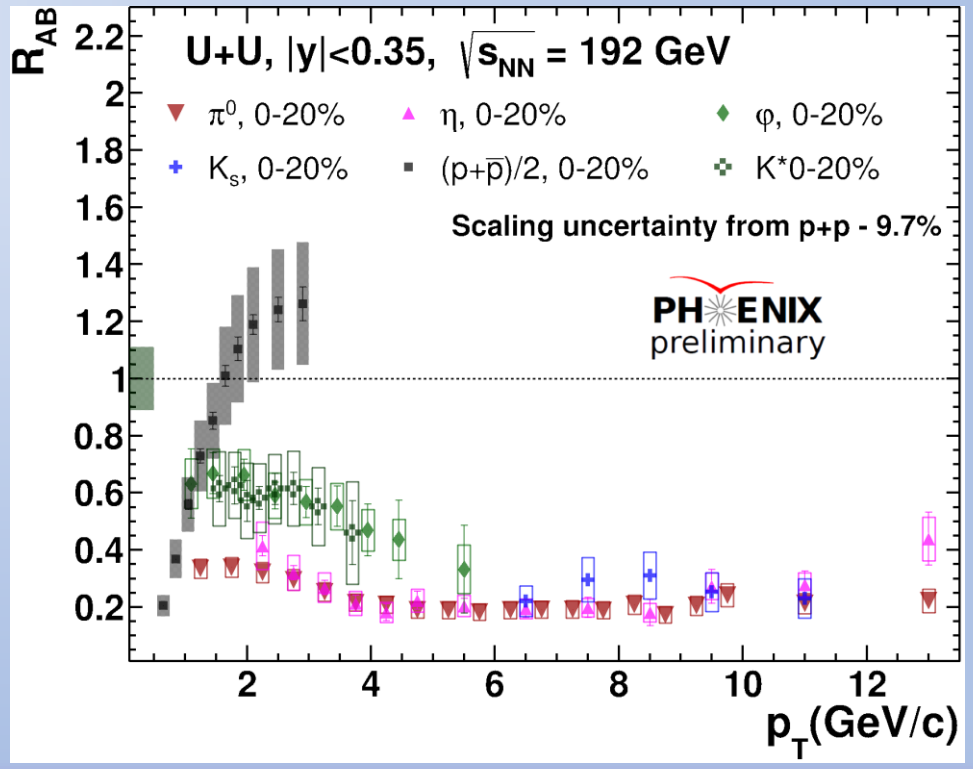


Cu+Au

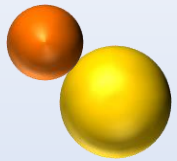


U+U

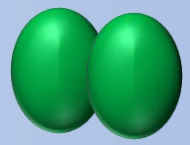


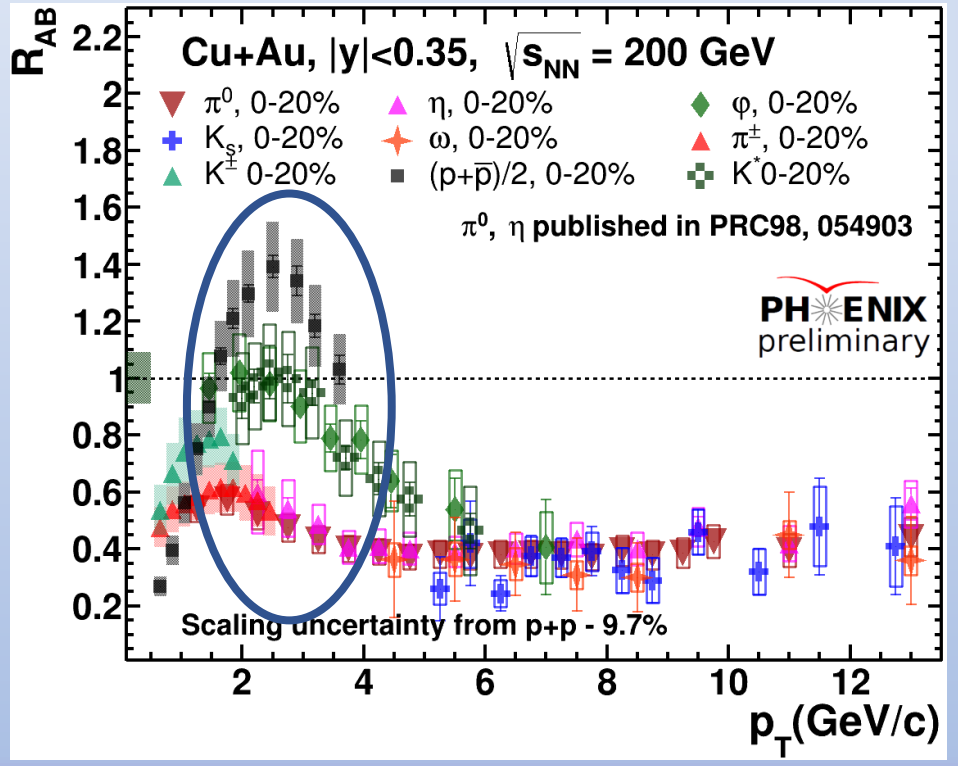


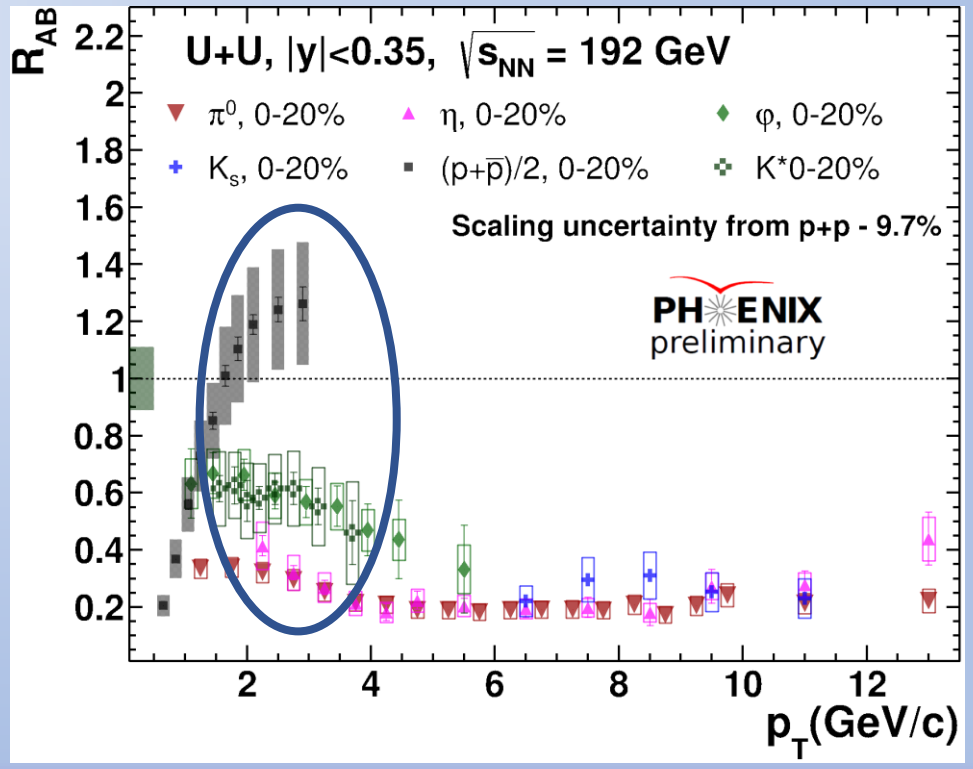
New addition from Cu+Au & U+U collisions



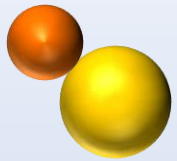
At intermediate p_T: $(p+\bar{p})/2\ R_{AB} \geq \varphi, K^{*0}\ R_{AB} \geq \pi^0, \eta\ R_{AB}$



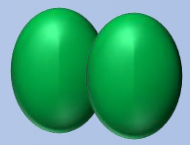


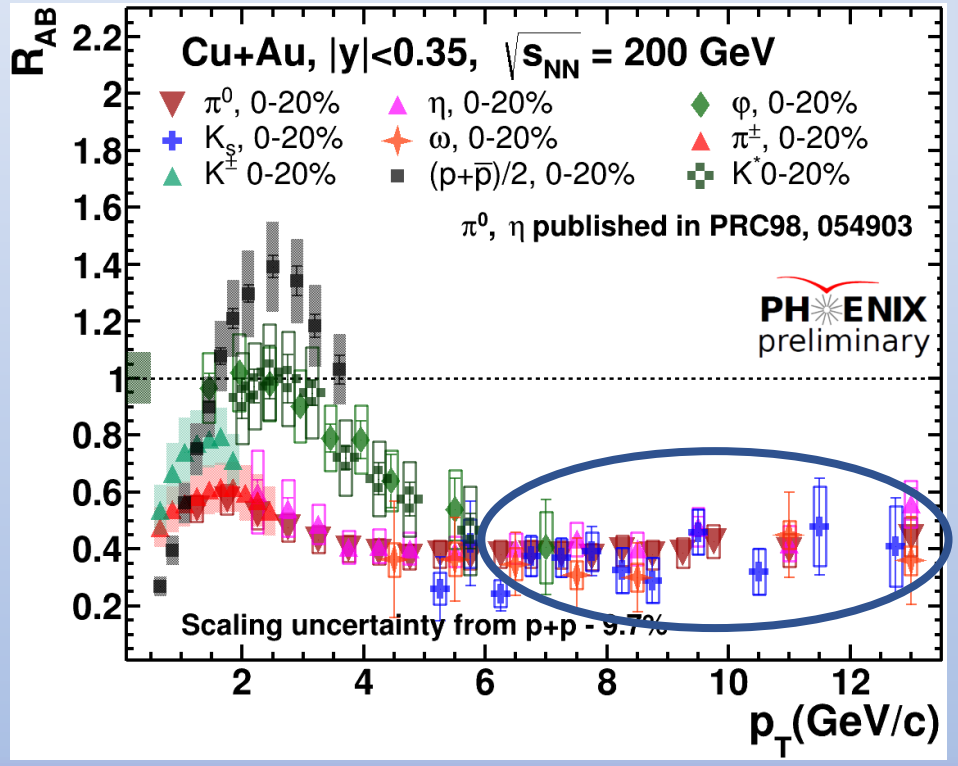


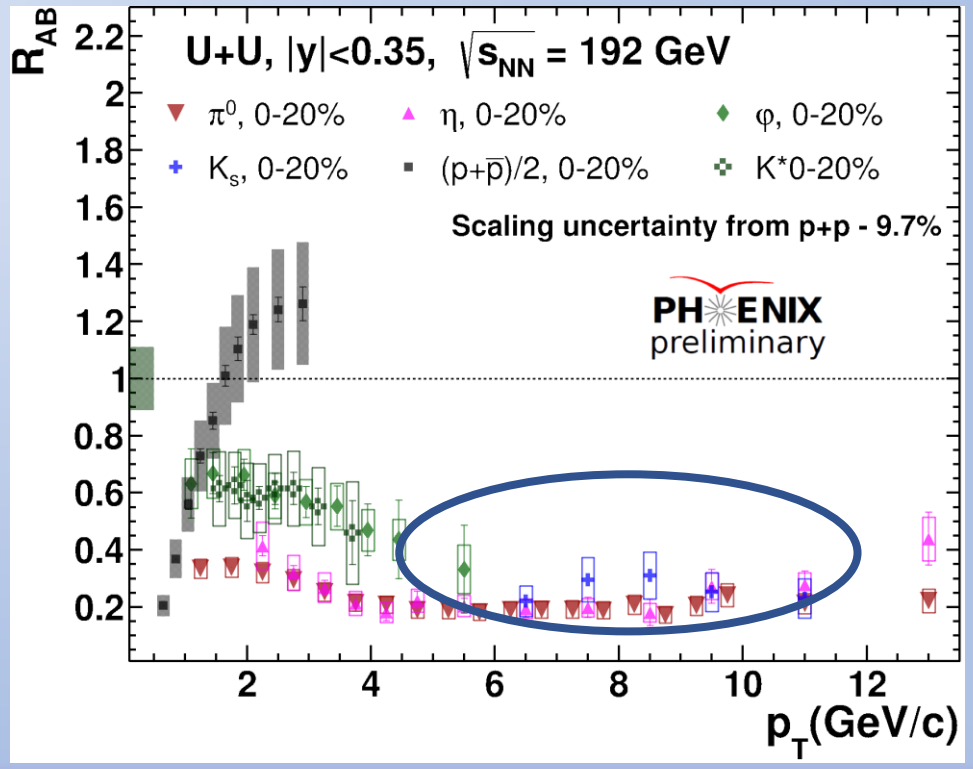
New addition from Cu+Au & U+U collisions



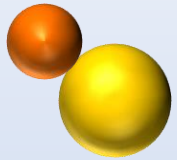
At intermediate p_T: Interplay of radial flow, strangeness + recombination
Flavor independent suppression at high-p_T

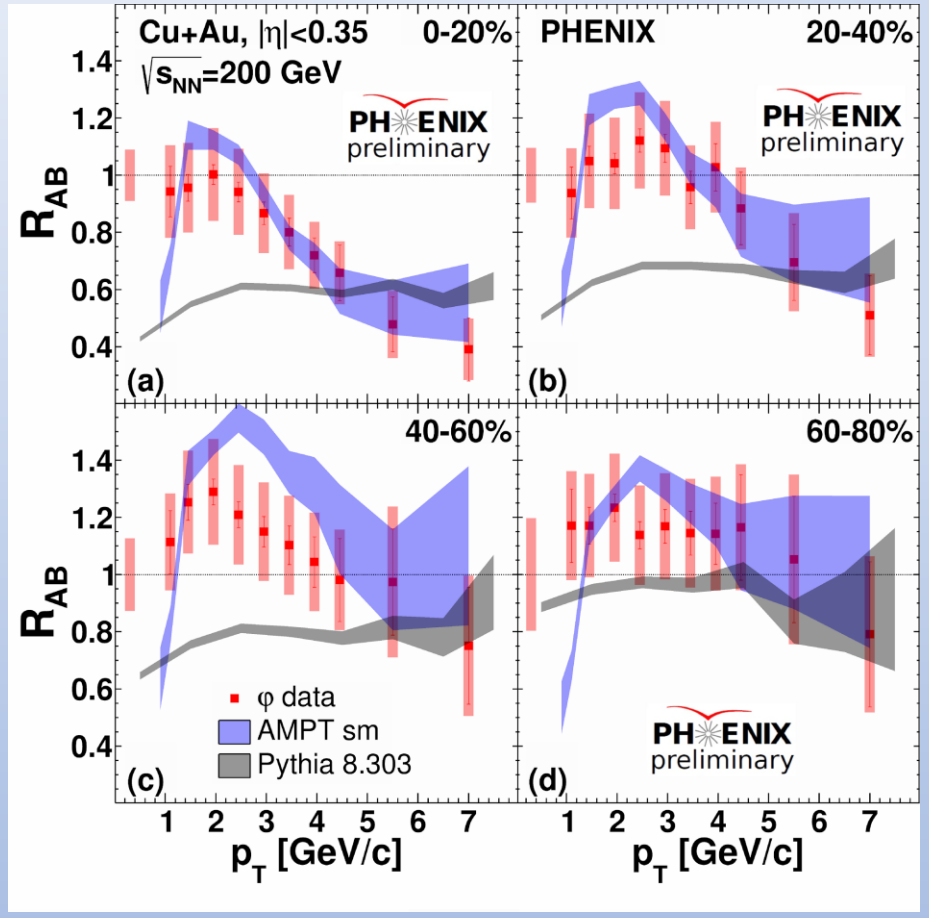


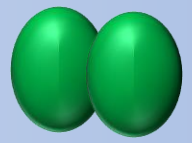




New addition from Cu+Au & U+U collisions

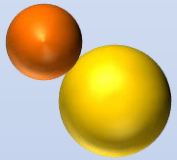


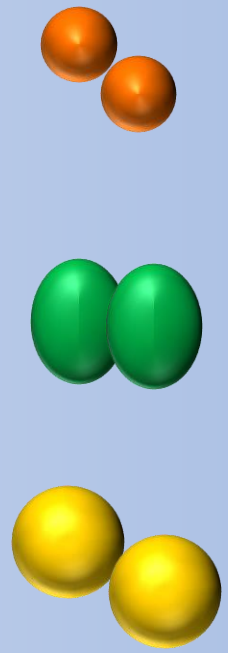




- ✓ String melting AMPT well predicts φ R_{CuAu}
- ✓ Coalescence can explain φ yields enhancement
- X Pythia failed at central Cu+Au

New addition from Cu+Au & U+U collisions





$\langle R_{AB} \rangle$ of φ meson scales with collision system size

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 at high-p_T in heavy-ion collisions

Coalescence might be an answer for strangeness enhancement:

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

Strange meson production scales with collision system size