Recent Flow Results in d+Au Collisions from Beam Energy Scan at RHIC-PHENIX

experimental introduction
pA, dA and ^{3}HeA at 200GeV
dA at 20 − 200GeV
summary

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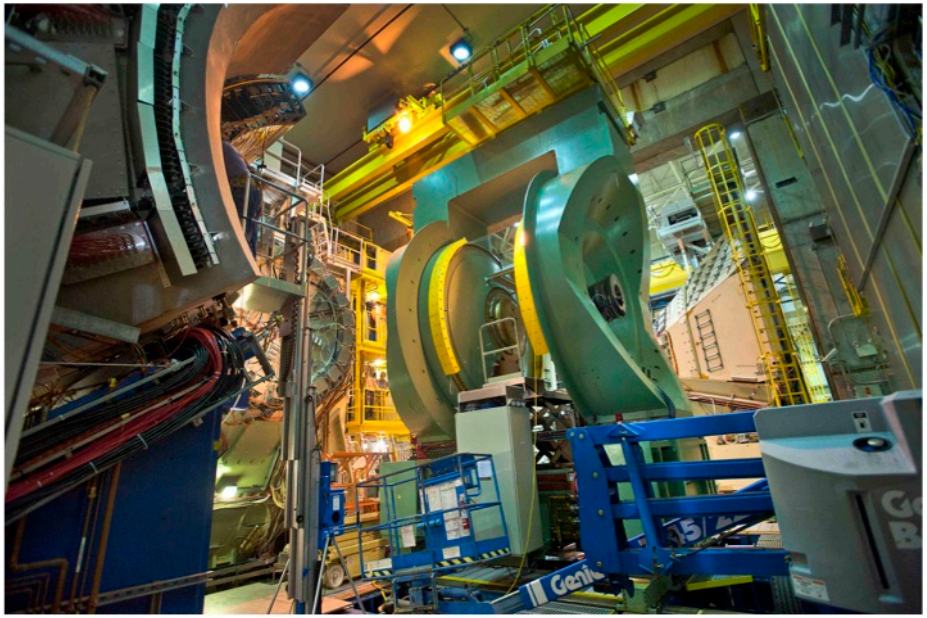
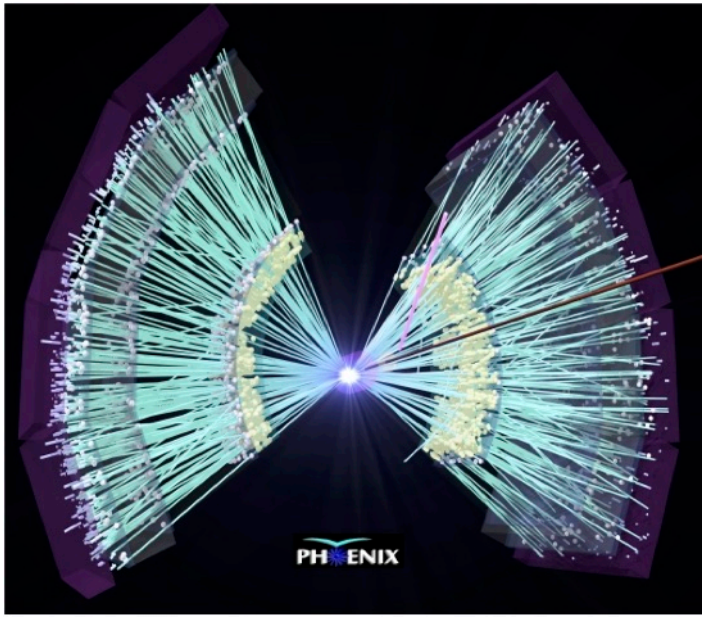
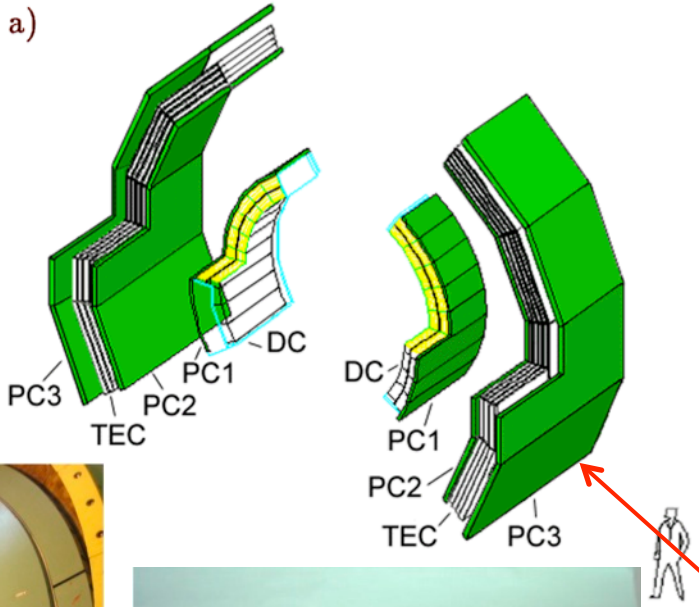
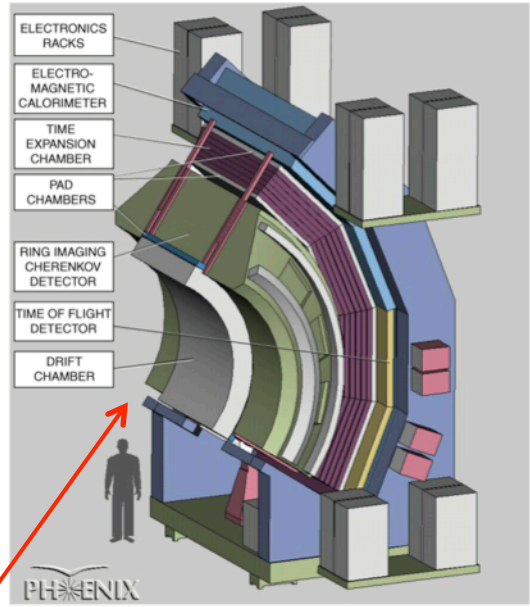
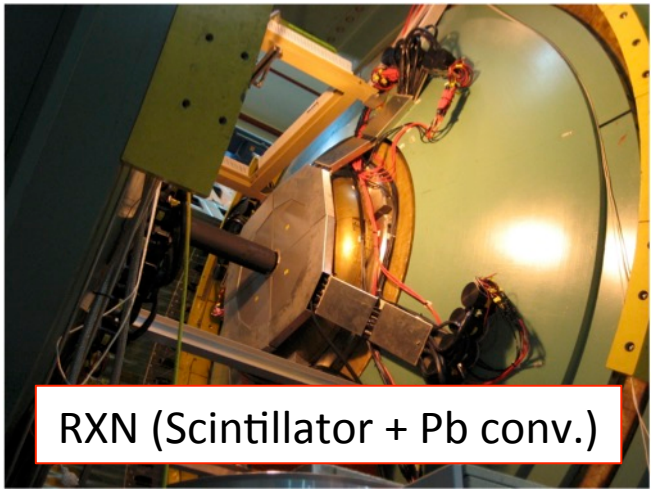




PHENIX detectors



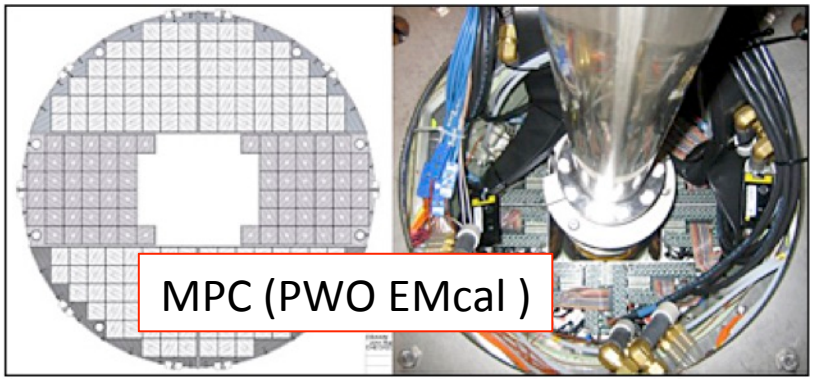




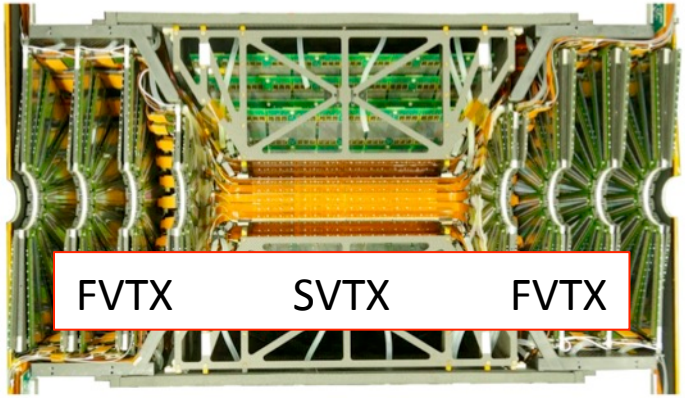
RXN (Scintillator + Pb conv.)

BBC (Quartz Cherenkov)

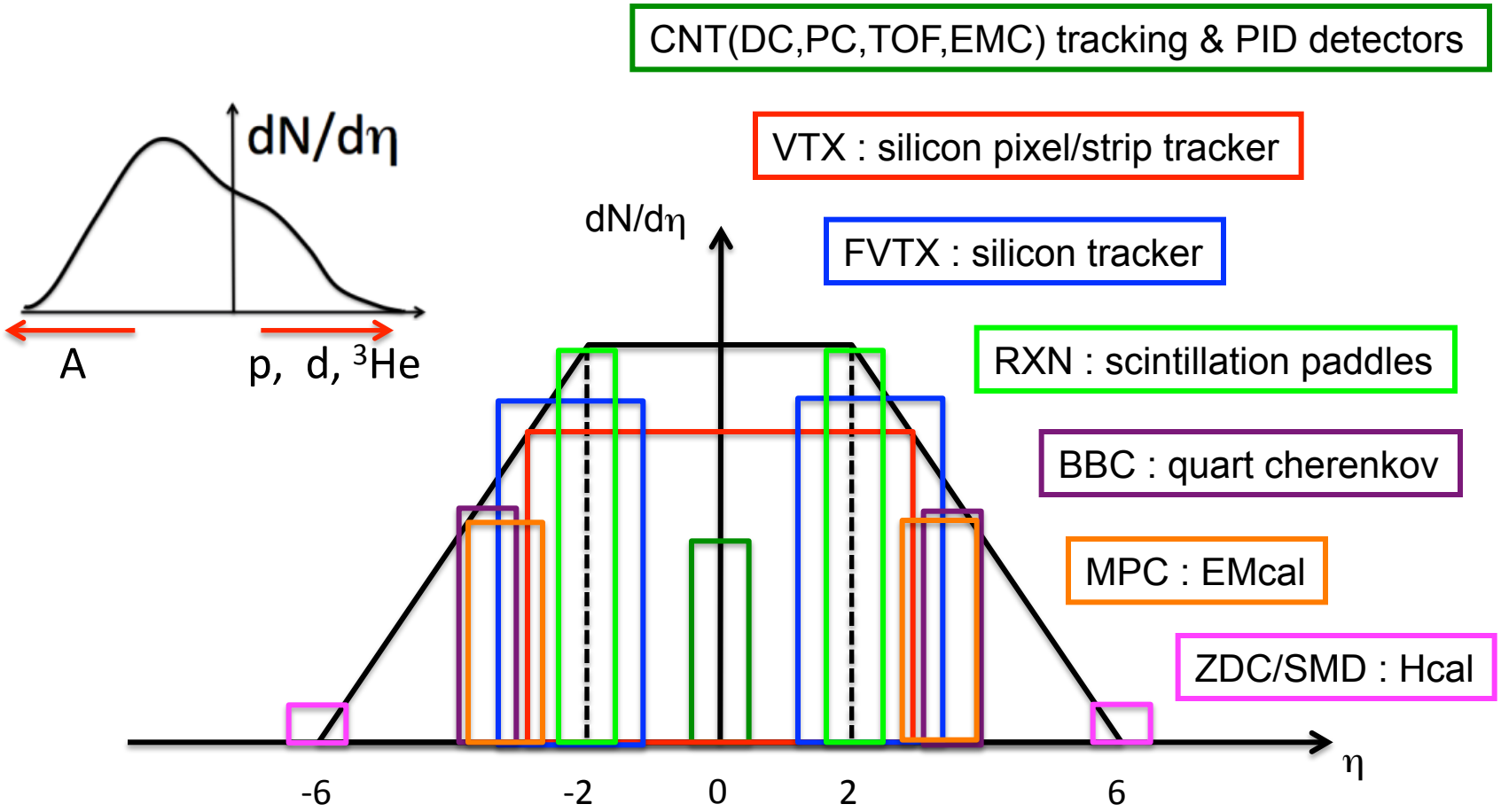
Central Arm Spectrometer (DC, PCs, TEC, RHIC, ACC, TOF, EMCAL)



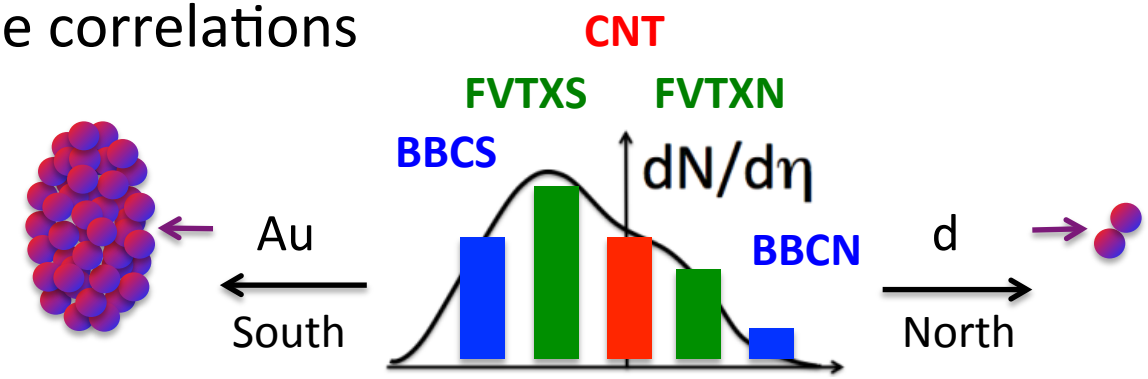
MPC (PWO EMcal)

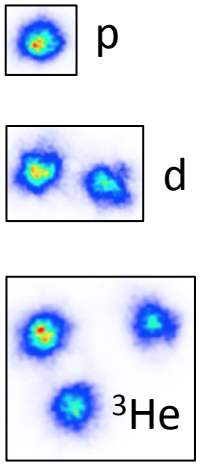


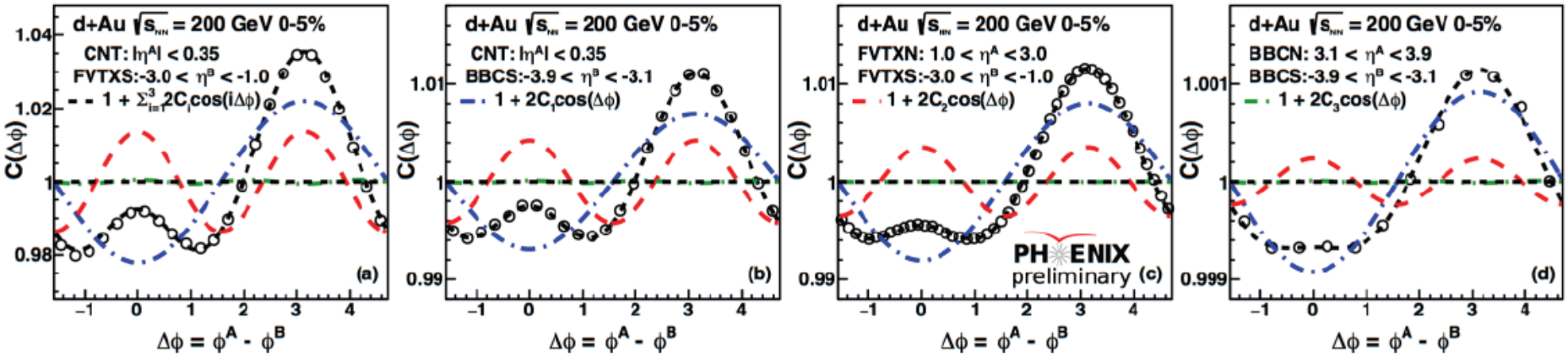
PHENIX detector acceptance



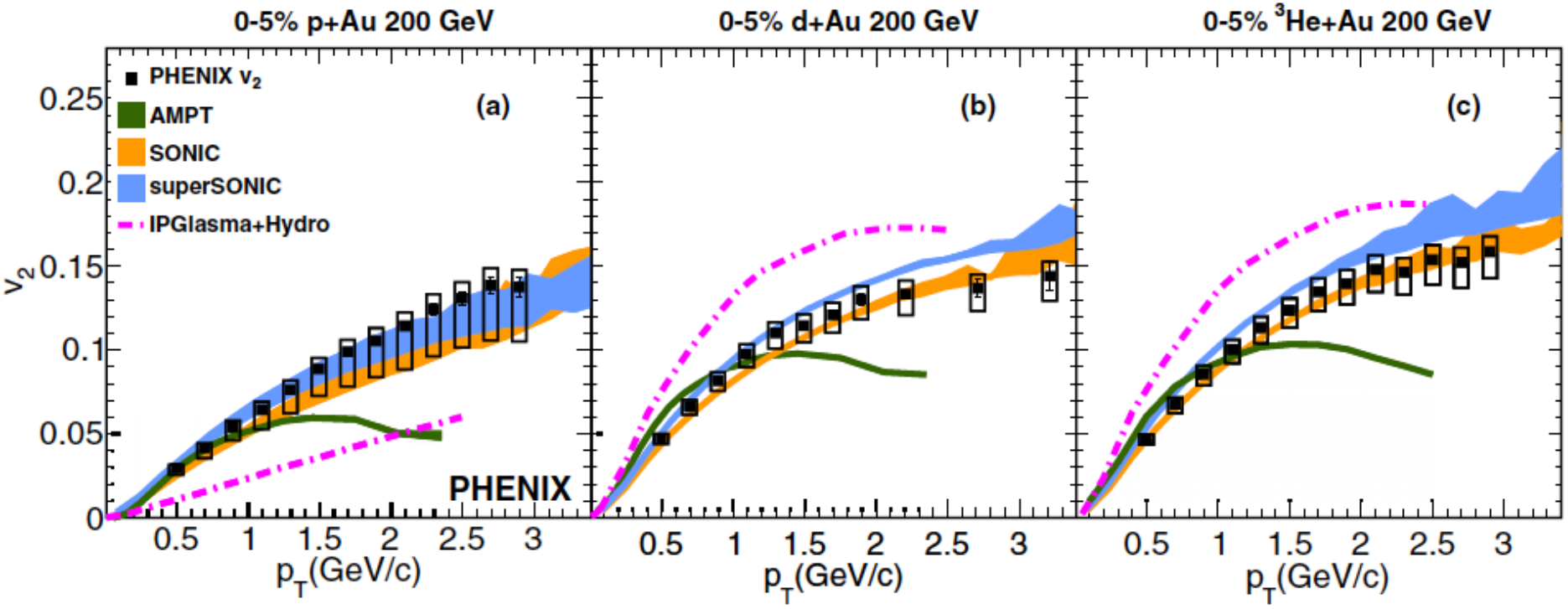
2-particle correlations







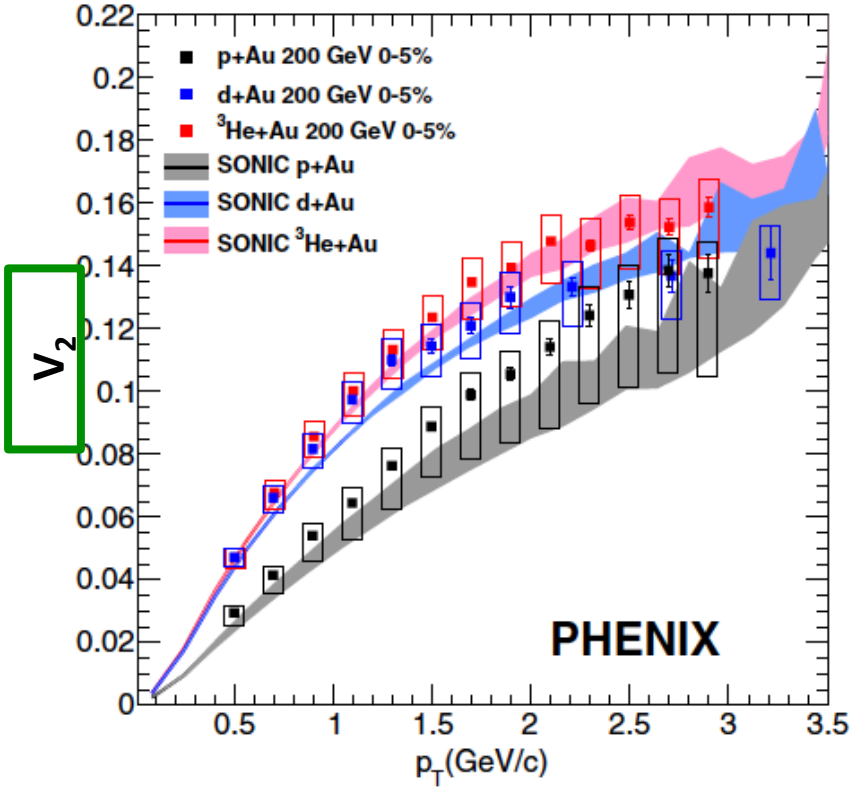
$v_2(p_T)$ ($|\eta|<0.35$) in pAu, dAu and ^{3}HeAu collisions central (0-5%) at 200GeV

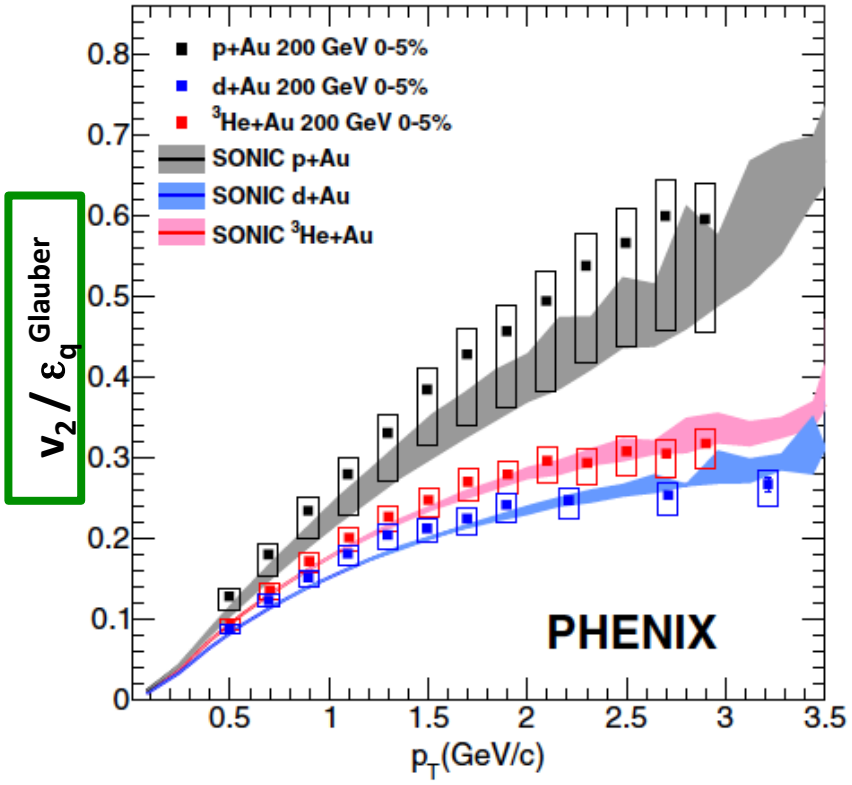


Phys. Rev. C95 (2017) 034910
Phys. Rev. Lett. 114 (2015) 192301
Phys. Rev. Lett. 115 (2015) 142301

Hydro-models and parton−cascade can generally describe the measurements.

Comparison among pAu, dAu and ^{3}HeAu collisions with and without $\varepsilon_2^{\text{Glauber}}$ scaling





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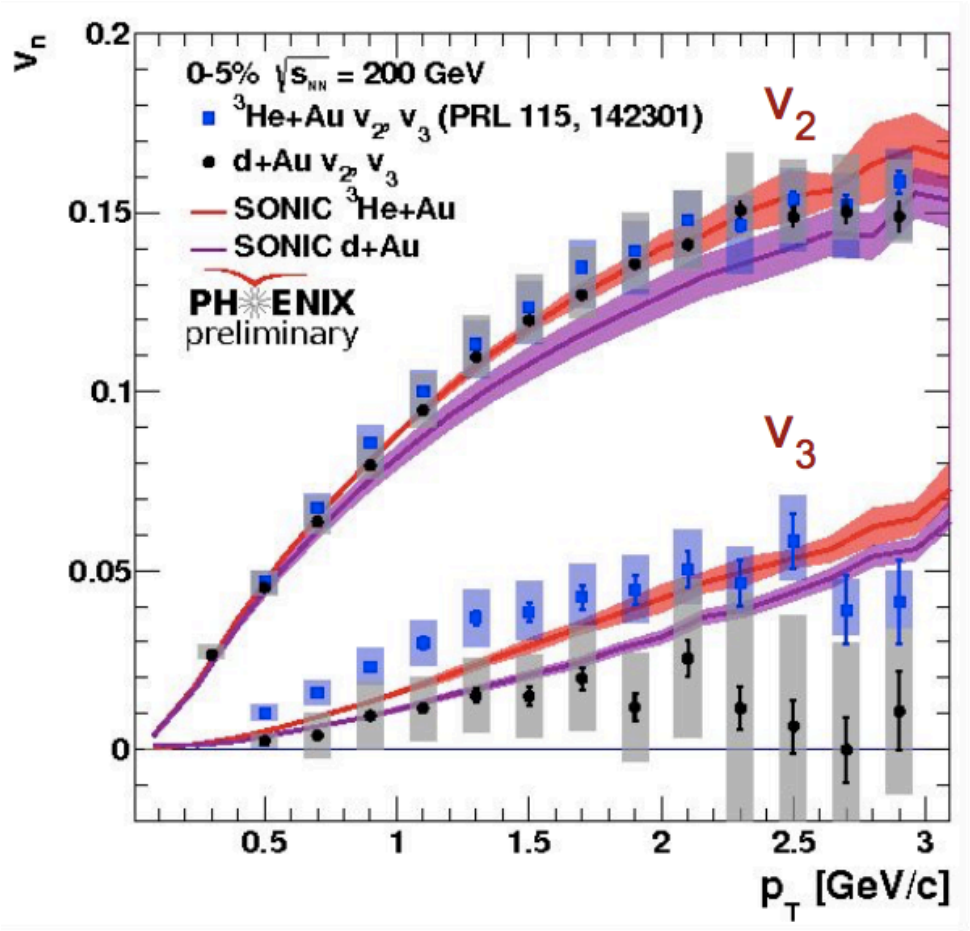
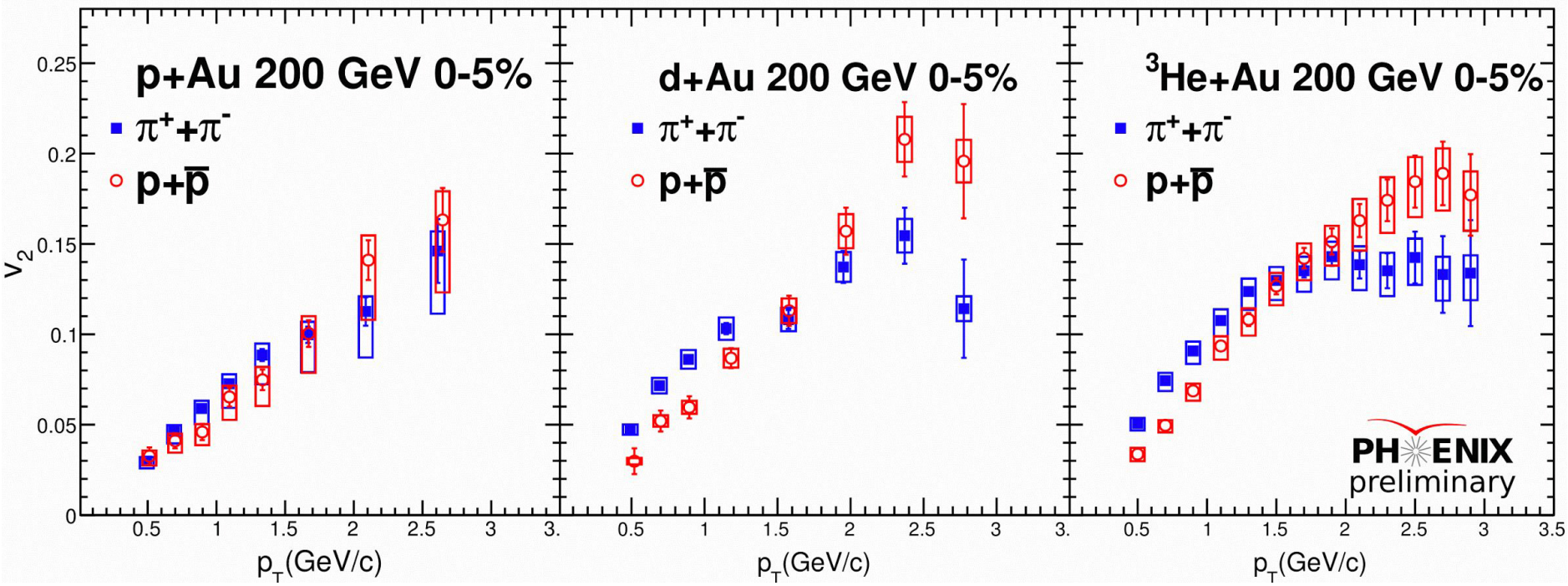
Higher initial density in pAu?

v_2 and v_3 in dAu and ^{3}HeAu collisions



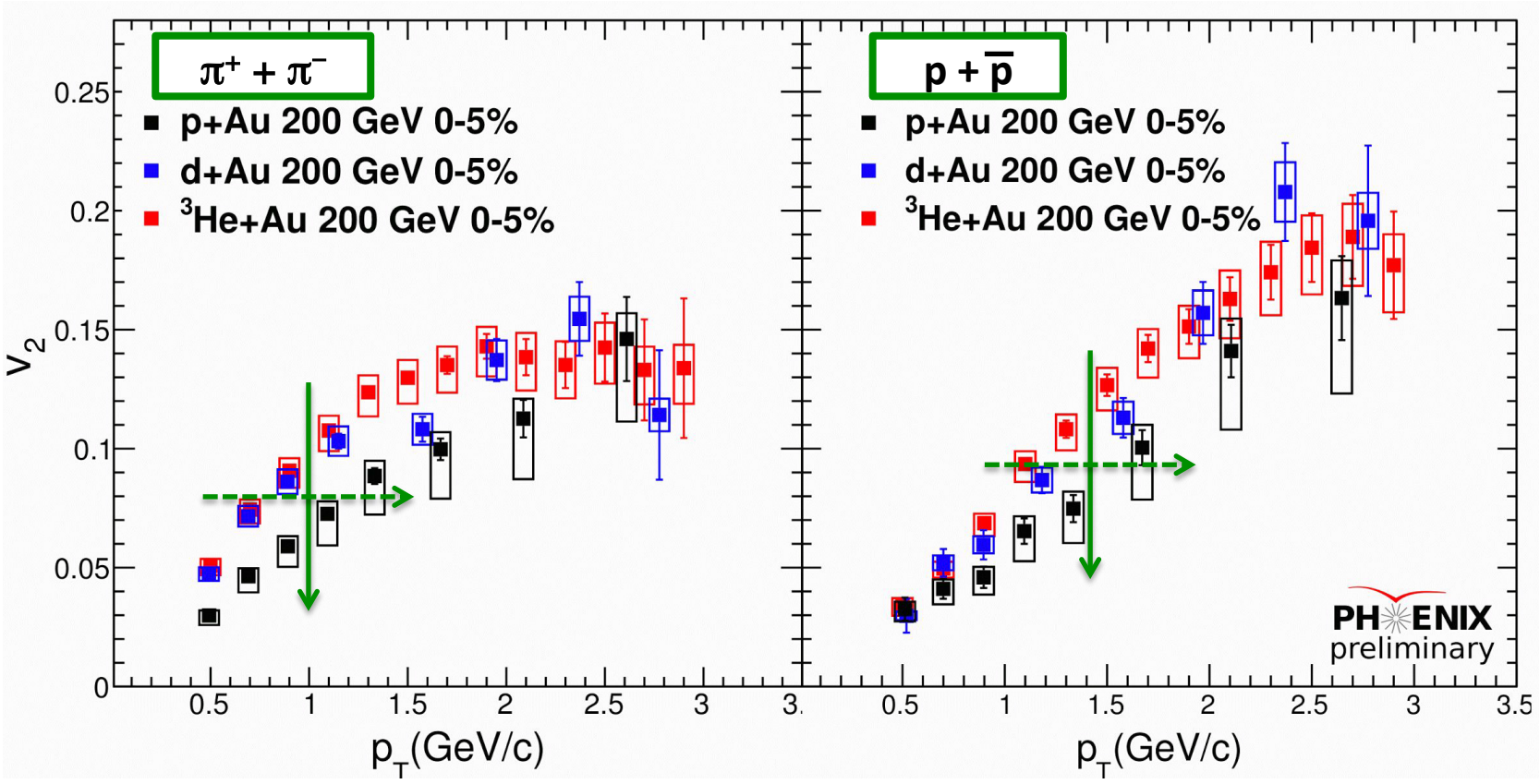
sizable v_3 seen in ^{3}HeAu

v_2 with PID in pAu, dAu and ^{3}HeAu collisions



mass splitting + Baryon/Meson difference are seen

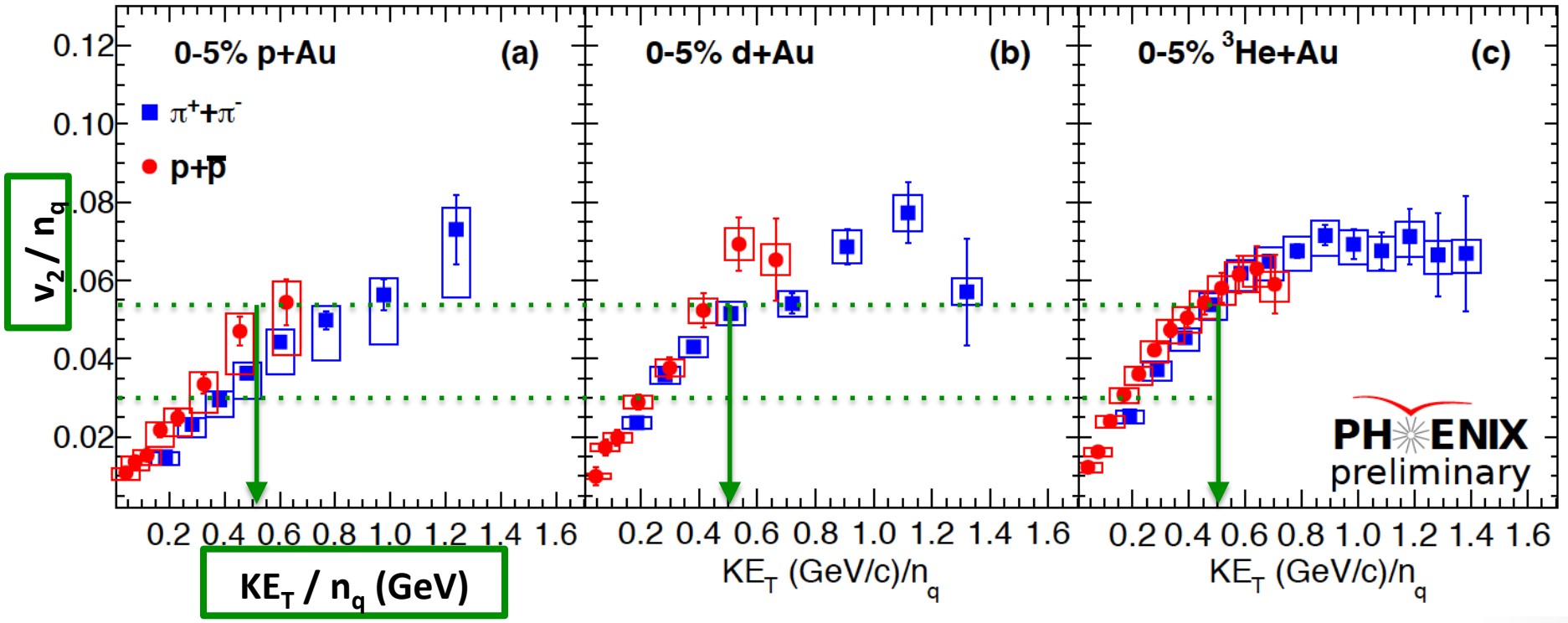
Comparison among pAu, dAu and ^{3}HeAu collisions



mostly reduction of v_2 or increasing p_T (v_2/ε was larger in pA)

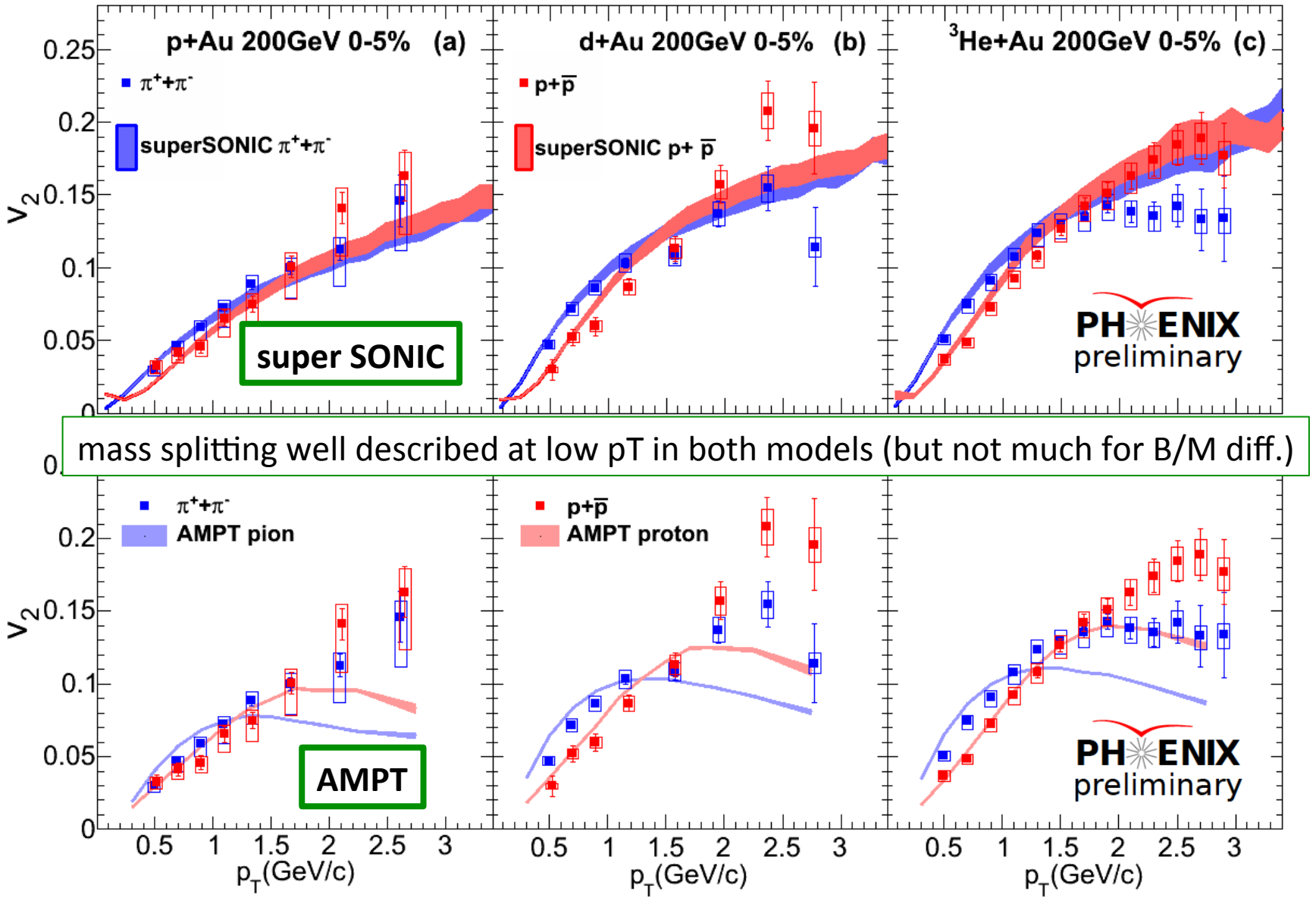
- simultaneous comparison of p_T distribution
- comparison of v_2/ε ($/n_{CQ}$) at a fixed multiplicity

N-quark scaling between π and (anti-)protons



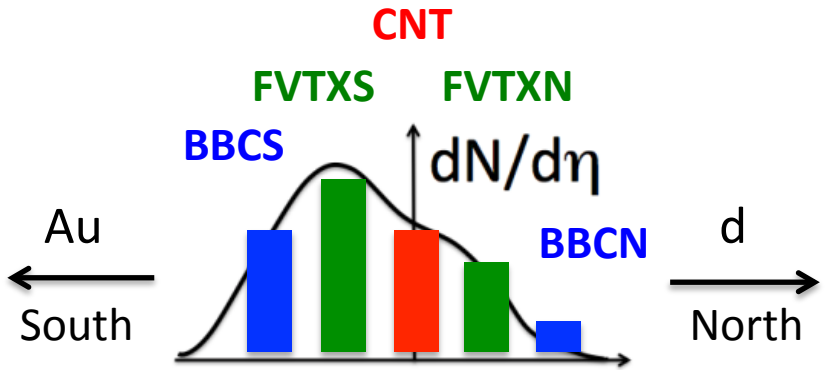
mostly scaled with n_{CQ} for all systems
some scaling breaks more in smaller system towards pp?

Comparison with (hydro- or cascade-) models

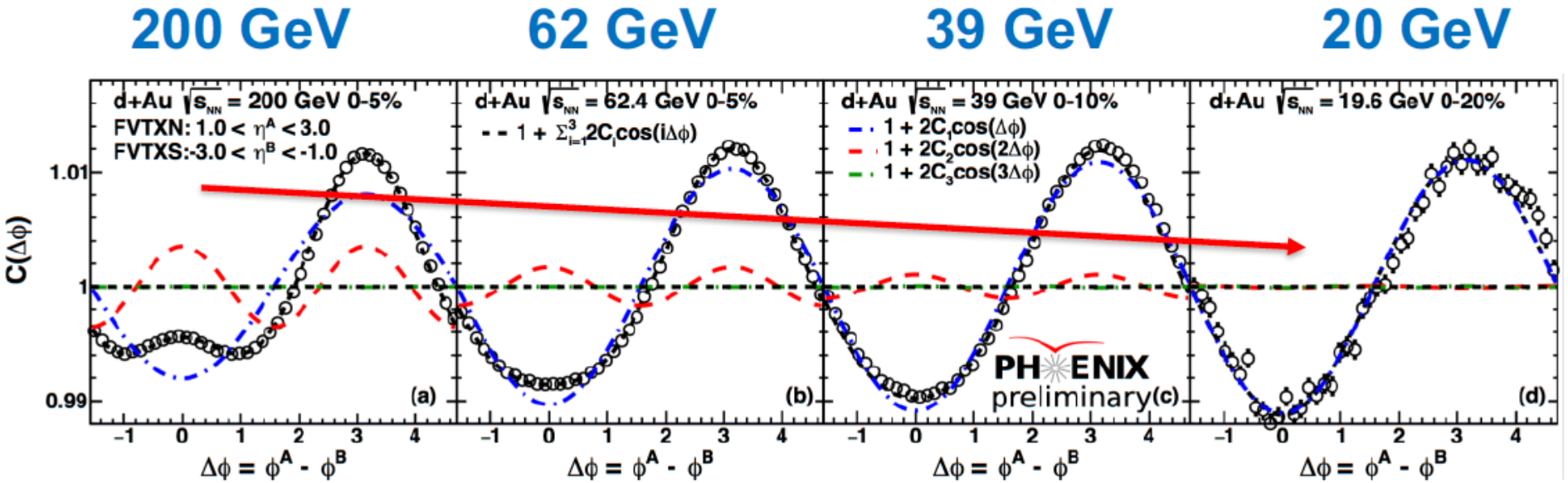


mass splitting well described at low pT in both models (but not much for B/M diff.)

Beam energy dependence of 2-particle correlations in dAu collisions

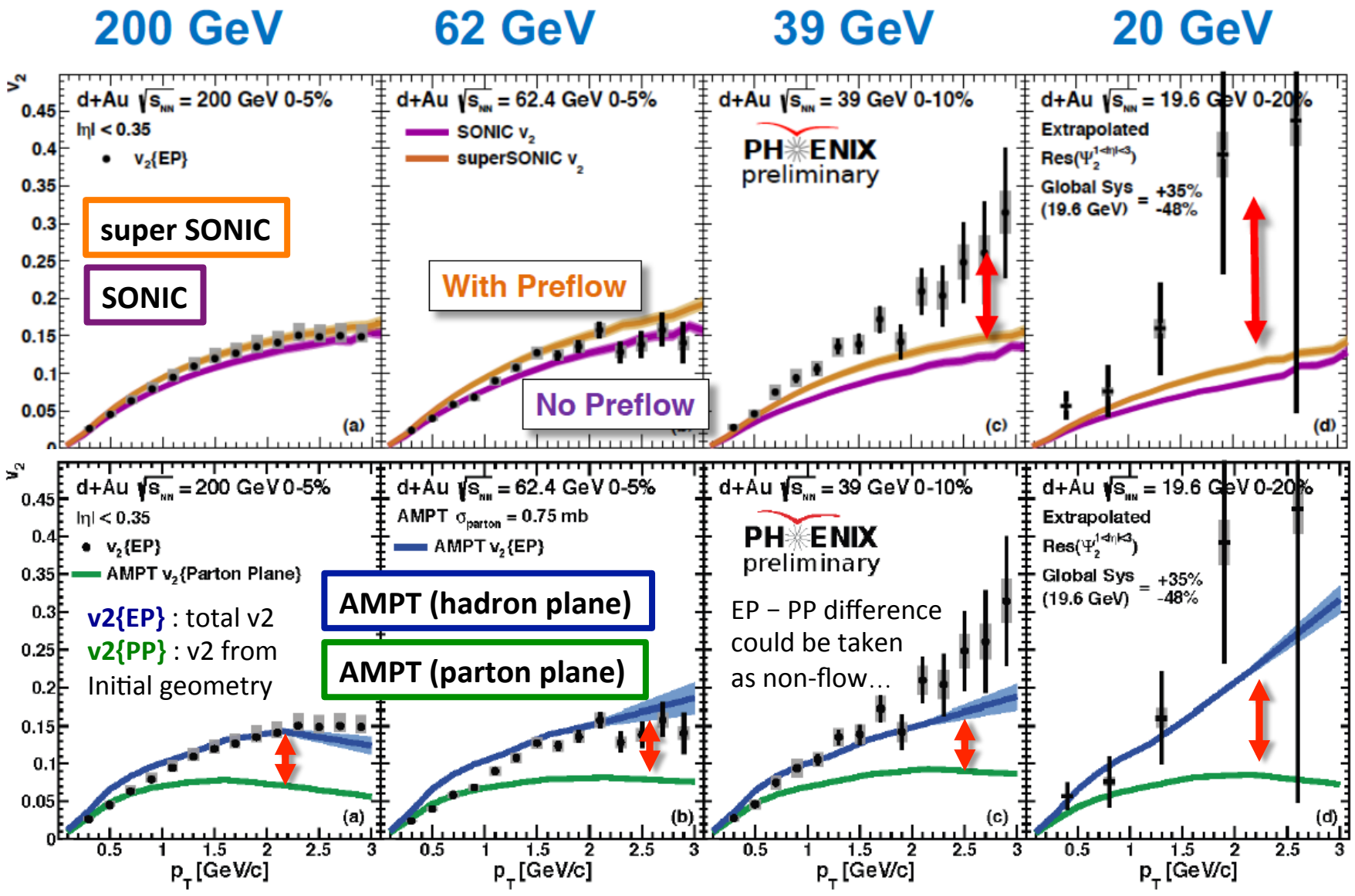


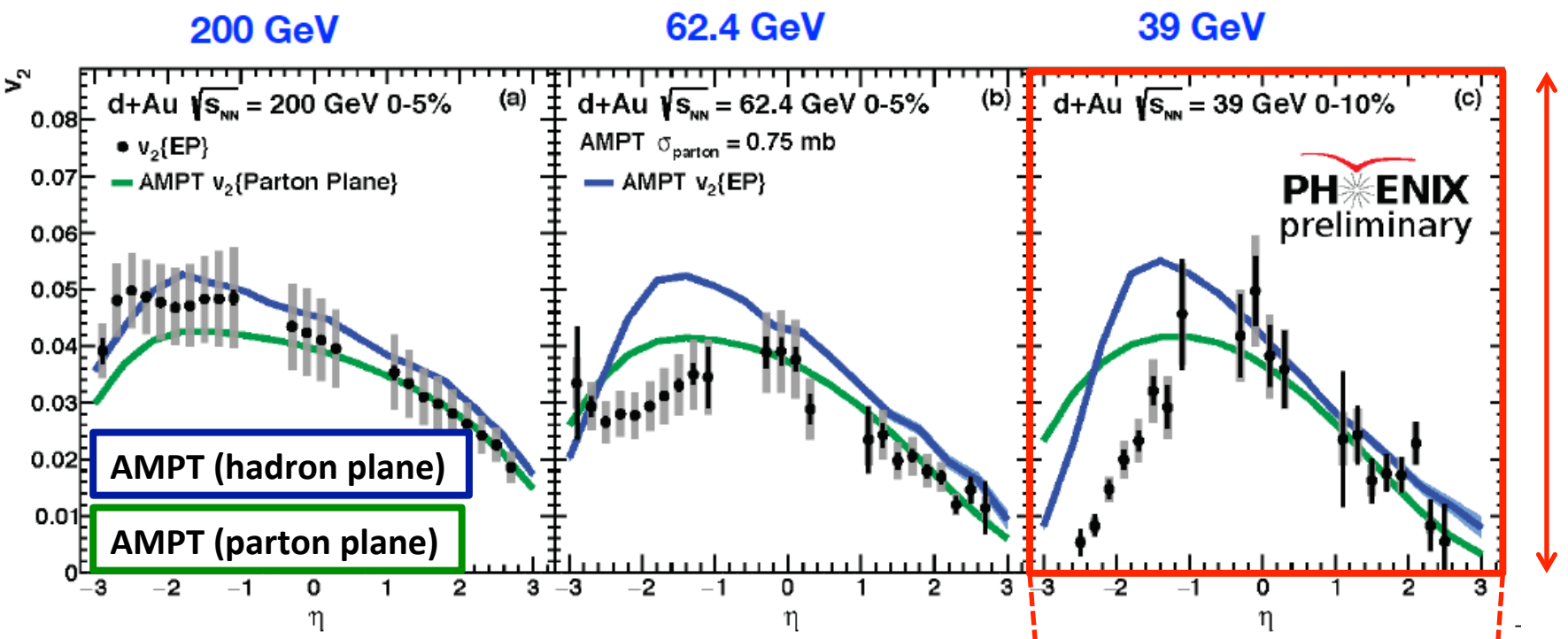
2-particle correlations FVTXS-FVTXN



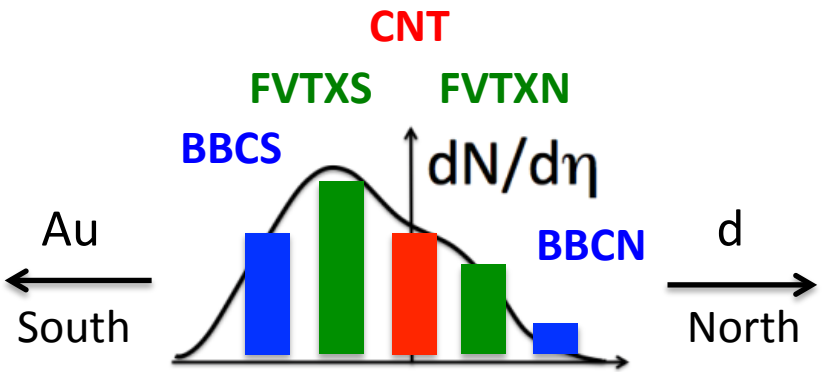
Beam energy dependence of $v_2(p_T)$ ($|\eta|<0.35$)

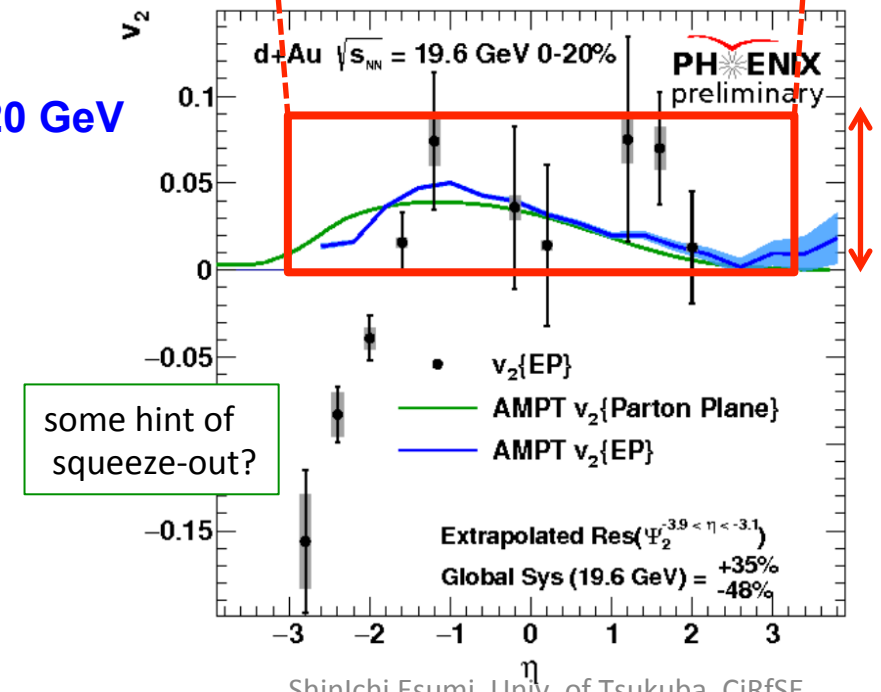
in central (0-5, -10, -20%) collisions



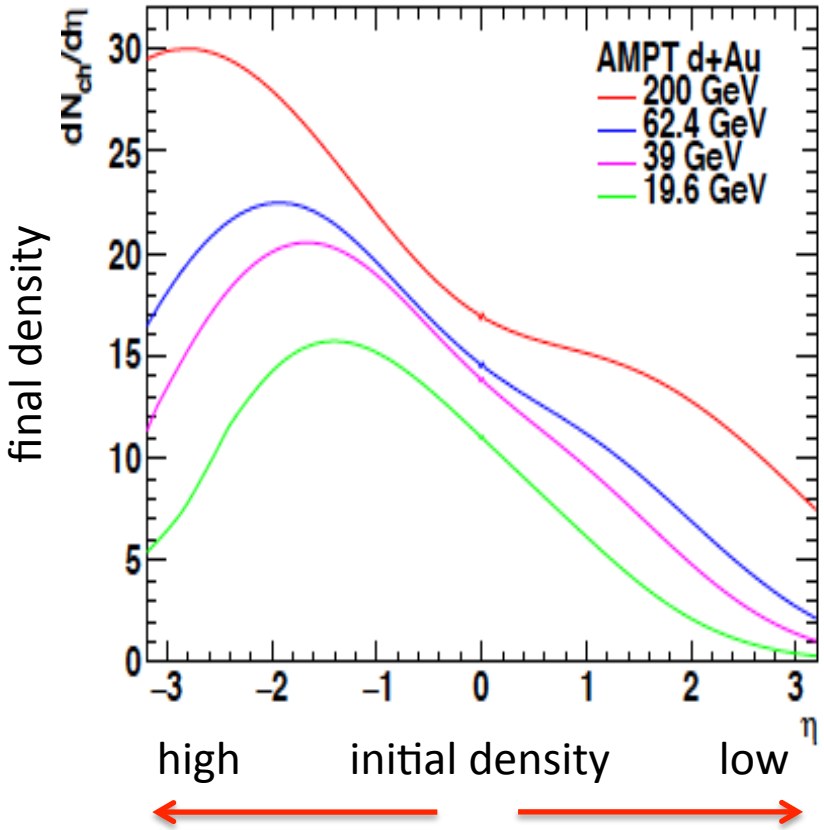


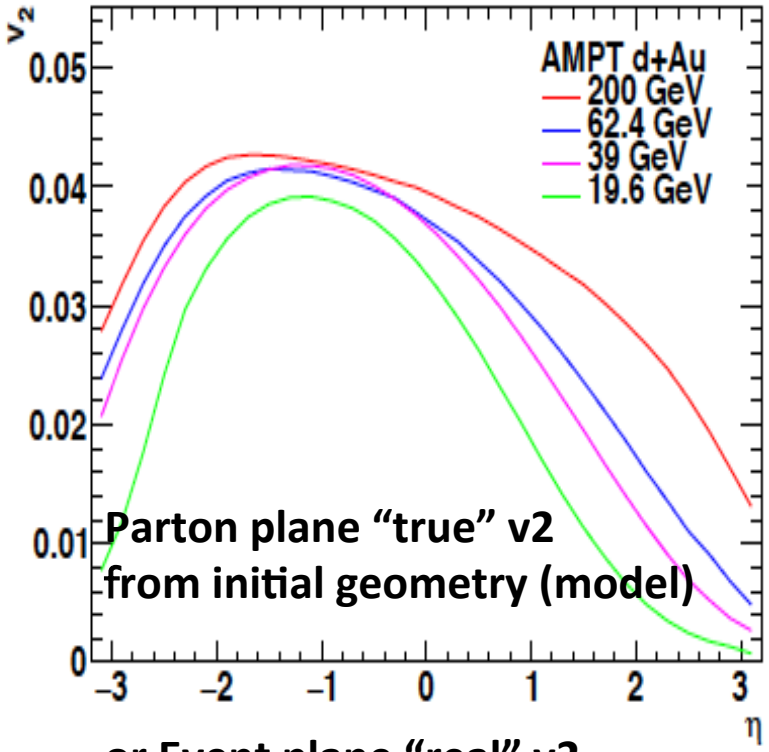
Eta dependence of v2 at 20, 39, 62 and 200GeV dAu





AMPT simulation : $dN_{ch}/d\eta$ and $v_2(\eta)$ at 20, 39, 62 and 200GeV dAu collisions





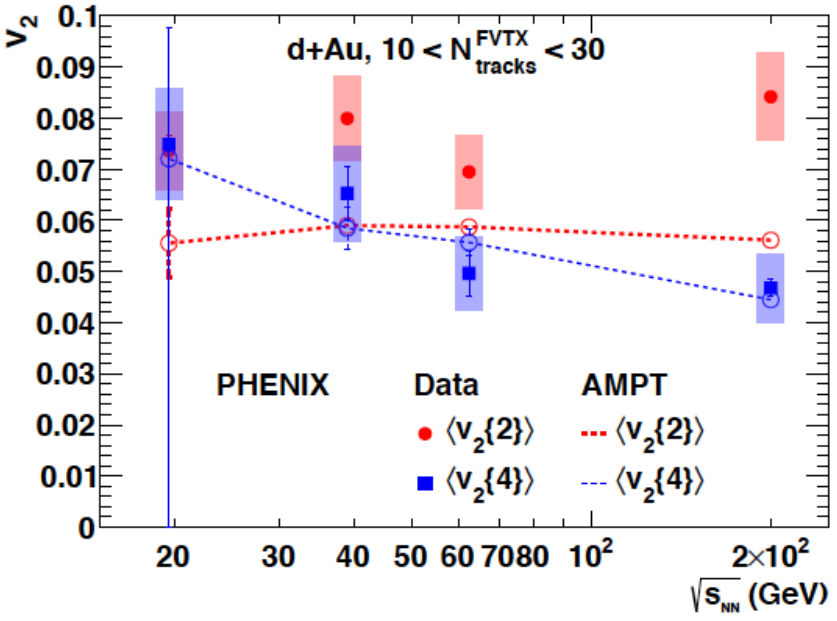
or Event plane "real" v2
from final hadrons (experiment)

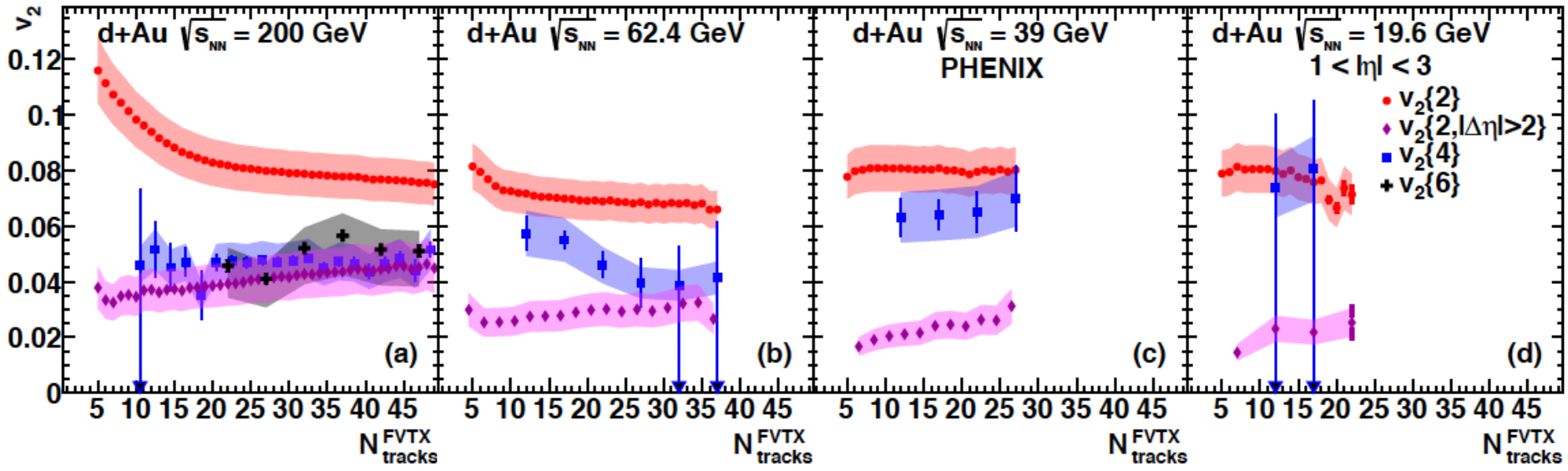
$\varepsilon_{STD} \longleftrightarrow \varepsilon_{Part}$

v_2 with multi-particle correlations among 200, 62, 39, 20GeV dAu collisions at similar multiplicity

- real values of $v_2\{4\}$ in dAu (as pPb at LHC)
- complex values $v_2\{4\}$ in pAu
  $v_2\{4\} = (- c_2\{4\})^{1/4}$, where $c_2\{4\}>0$

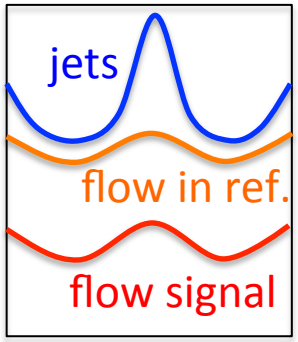
arXiv:1707.06108 ($v_2\{6\}$: new)





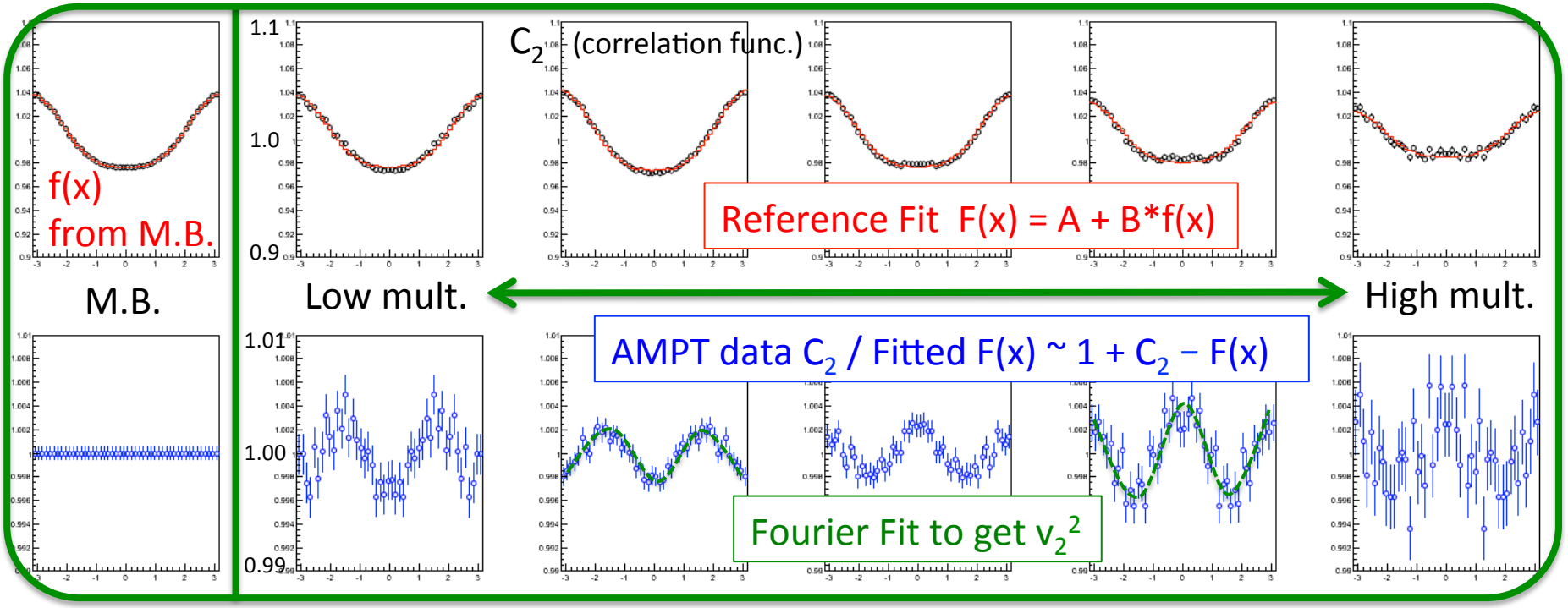
AMPT simulation with pp at 500GeV --- test of reference fitting ---

ATLAS, CMS v2 extraction in pp contradicts with each other, just because of the different definition of v2, both with un-modified jet assumption.



- RHIC beam energy at 200, 500 GeV
- string melting on with σ = 0 , 3 mb
- mult. class mul1:($|\eta|<3$) , mul2:($3<|\eta|<4$)
- particles pairs in $|\eta|<3$, $|\eta|<1$ & $3<|\eta|<4$
- η-gap cut : $2.5<|\Delta\eta|<5.0$
- single pT cut : $p_T > 0.2$ GeV/c

correlation shape changes with mult. (by jet-modification or flow-evolution)



Summary

- Charged particle and identified particle v_2 (and v_3) are measured in central pA, dA and ^{3}HeA at 200GeV
- Beam energy (p_T , η) dependence of v_2 is measure in dA collisions at 20 − 200GeV
- Sizable flow in small systems at RHIC, which is driven by initial density with its geometry
- Centrality (multiplicity) and η dependence to come
- Simulation studies --- how we see flow in small system