

# Medium formation in small systems?

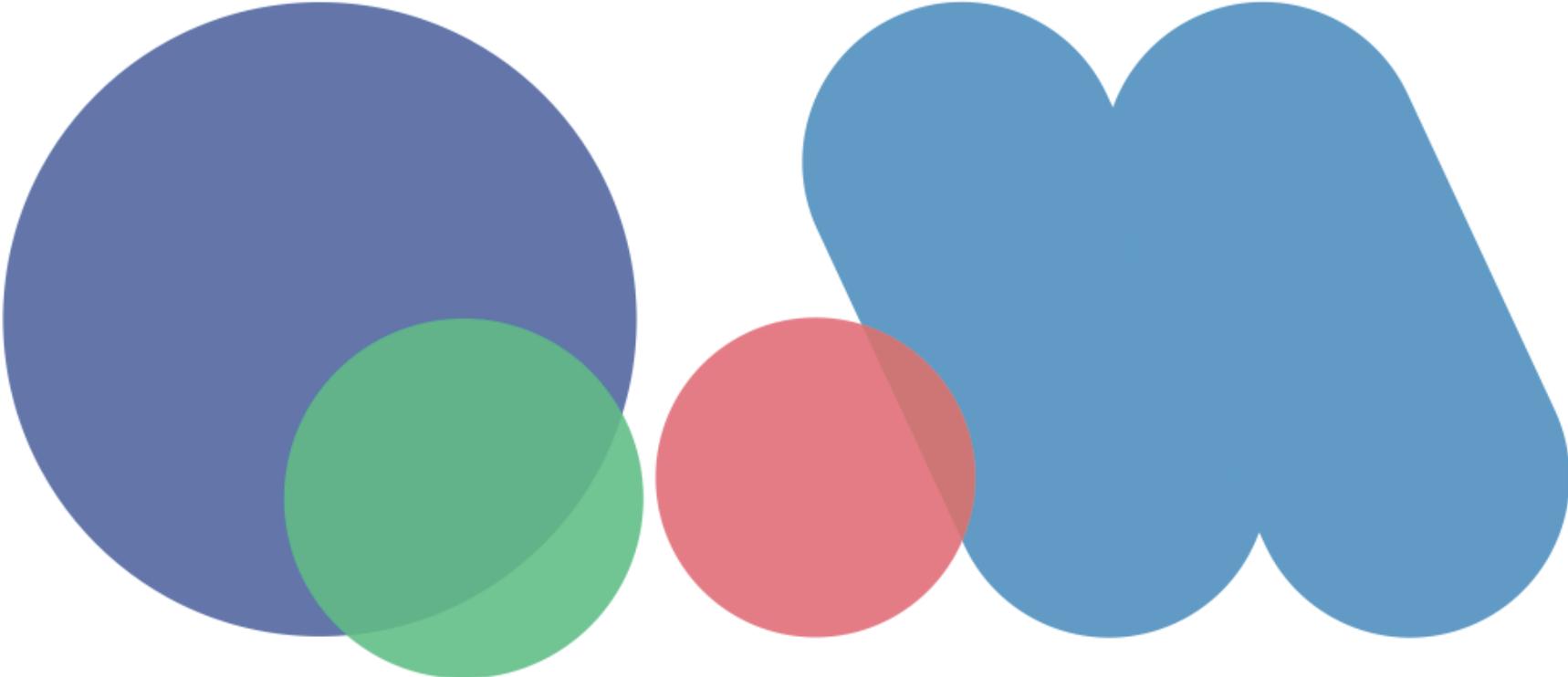
Experimental results from RHIC

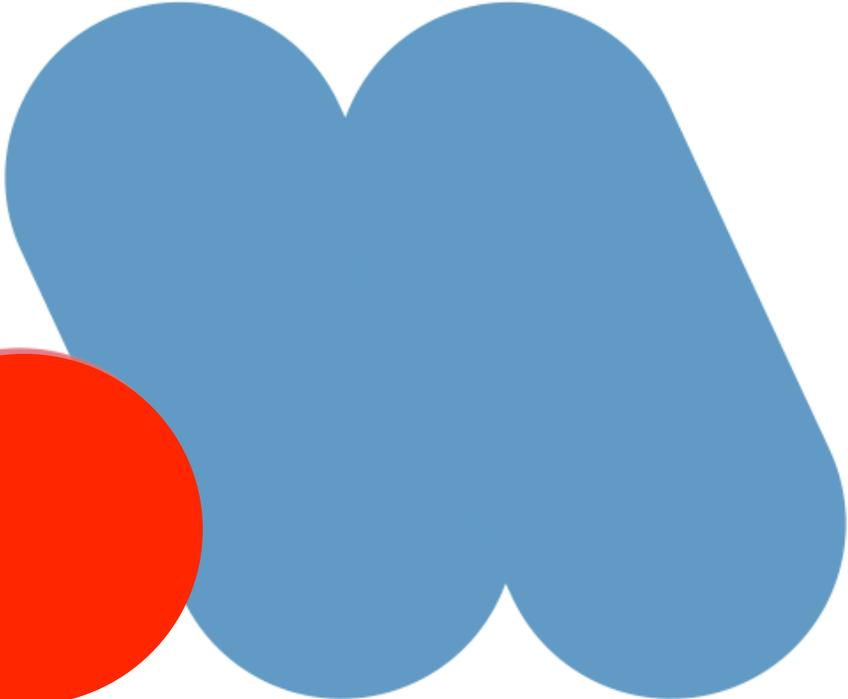
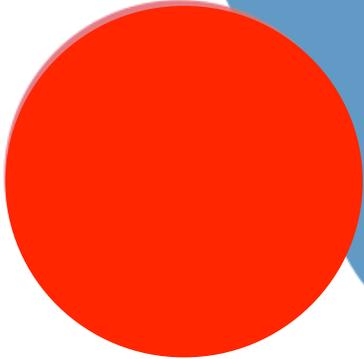
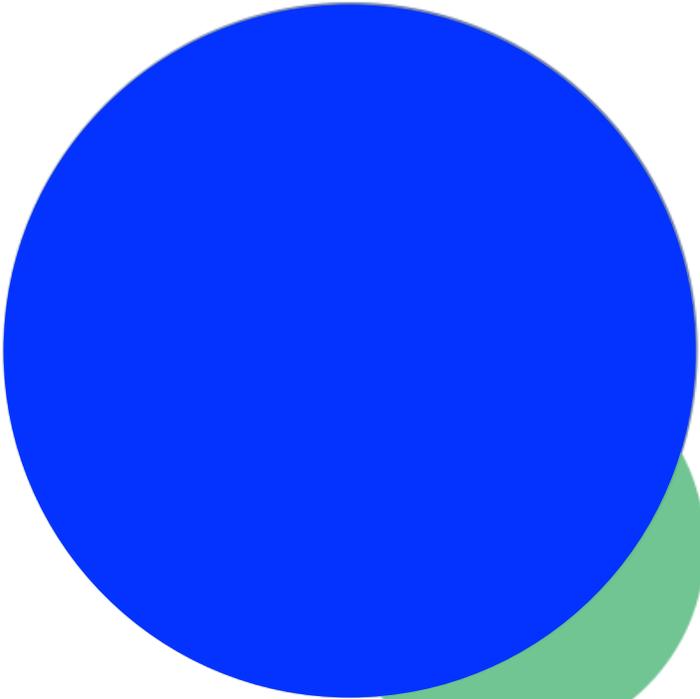
Paul Stankus

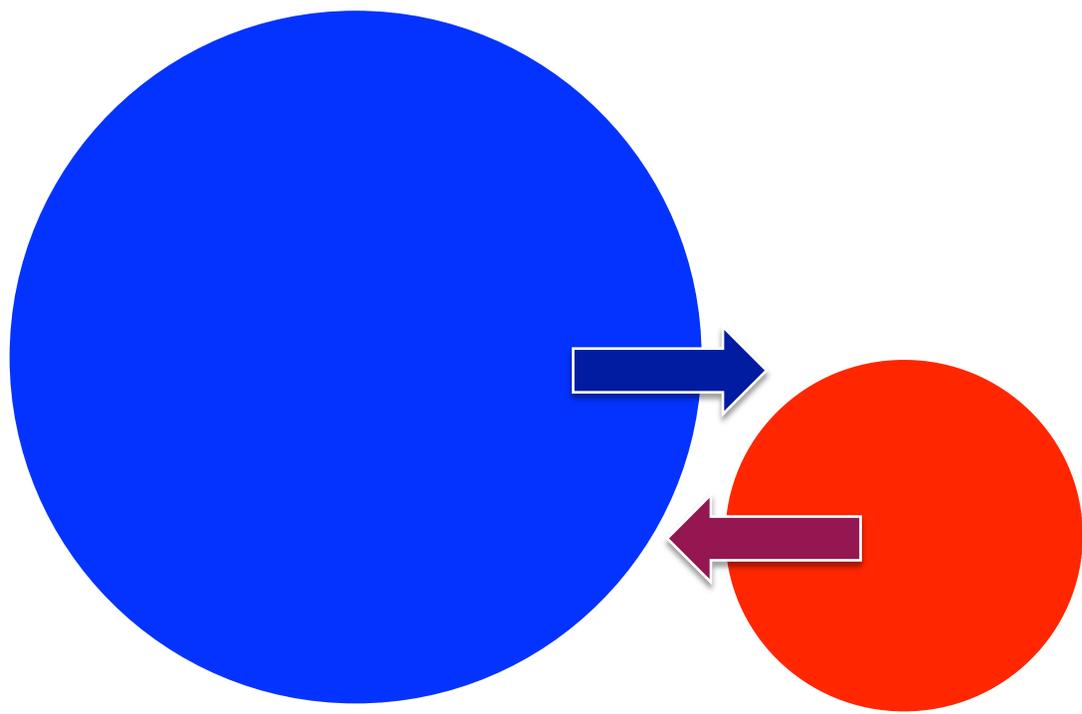
Oak Ridge National Lab

Quark Matter 2015, Kobe, Japan



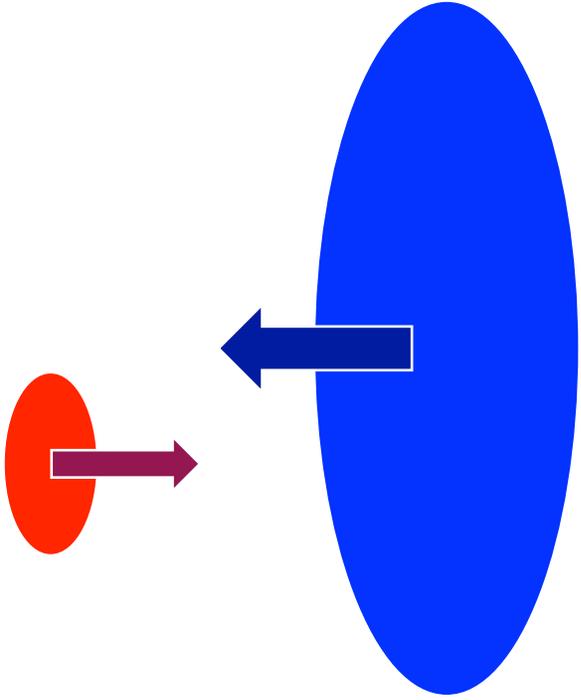


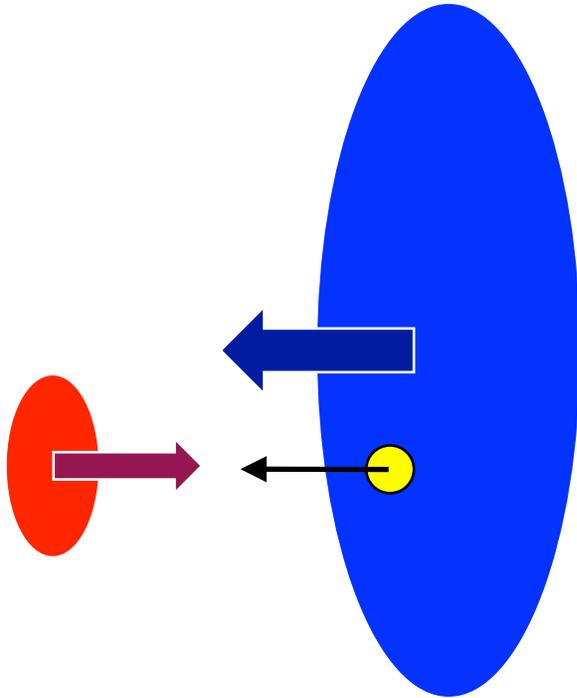




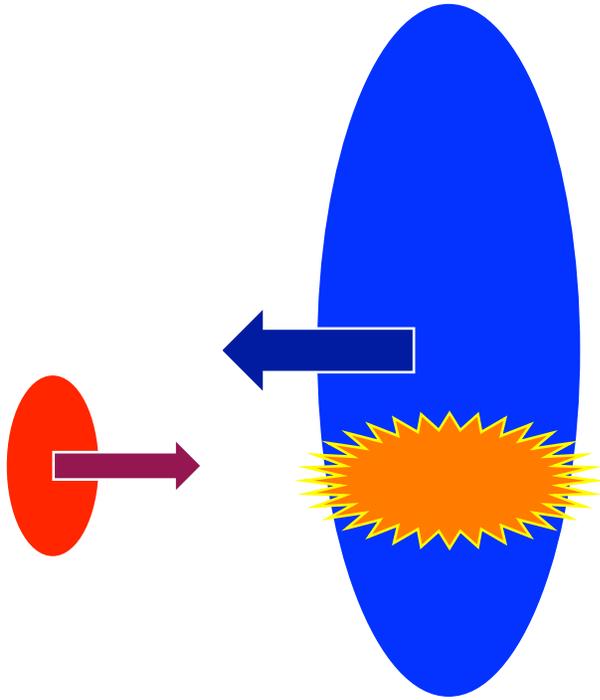
**Au**

**d**

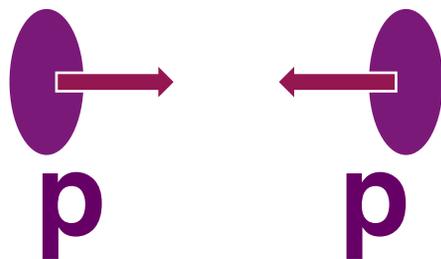
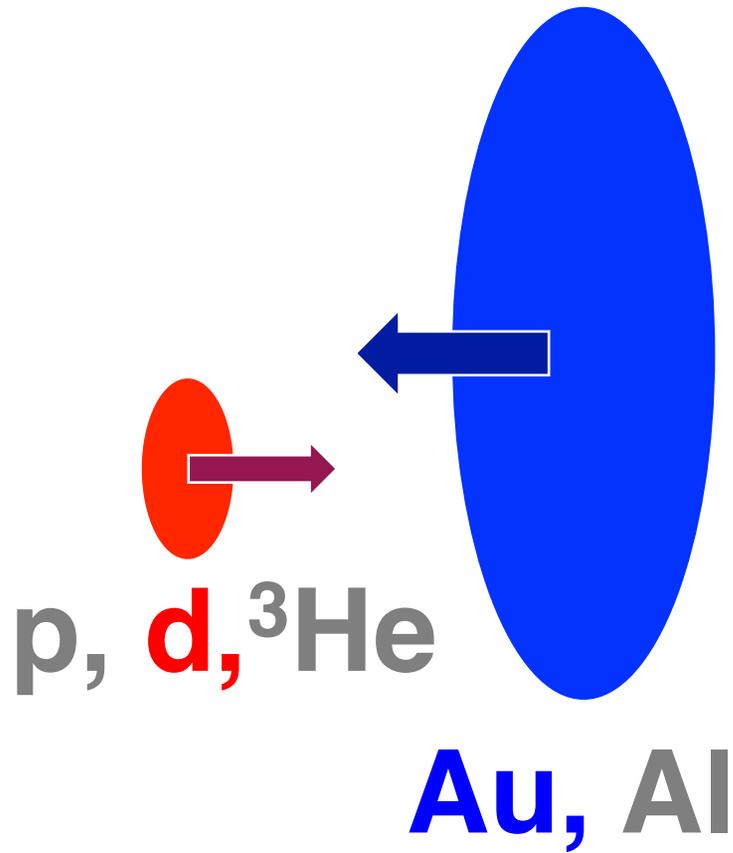




Old Idea  
d+Au reveals  
“initial-state” CNM  
effects



New Idea  
Significant “final  
state effects”,  
medium creation in  
small system



## Broad checklist

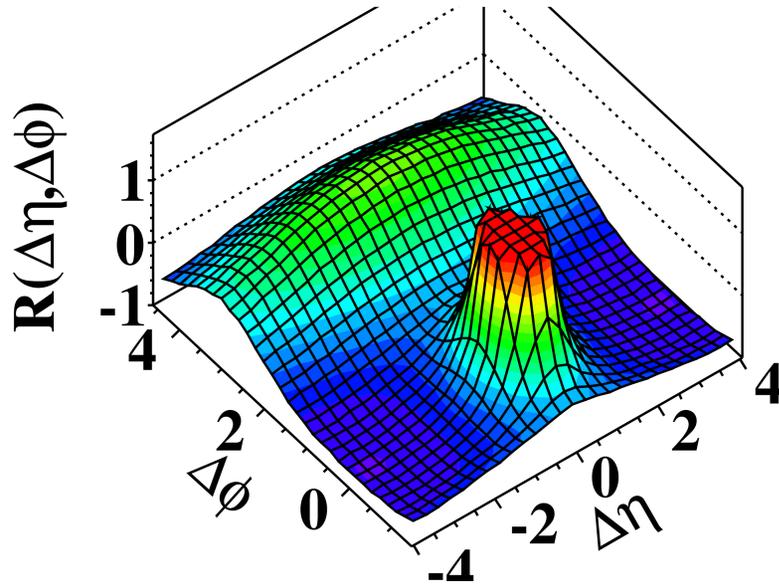
- Flow-like correlations
- Heavy flavor production
- High- $p_T$  hadrons (jet quenching)



# Flow-like correlations

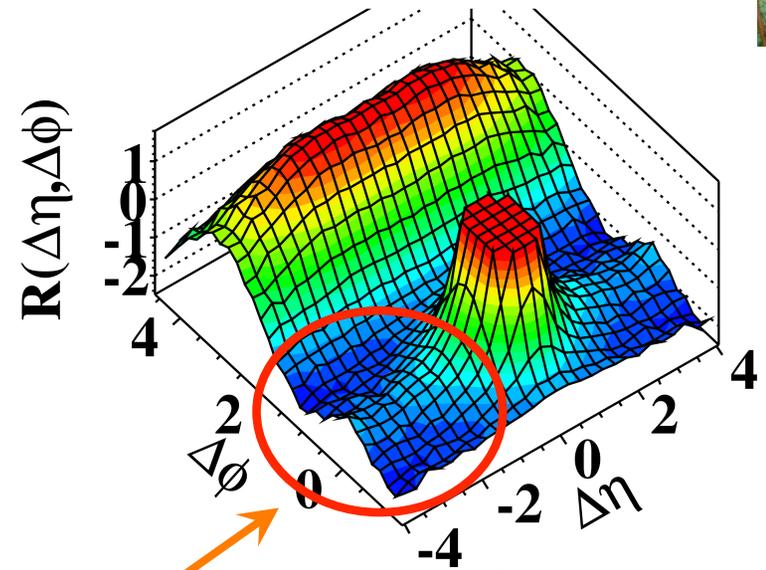


(b) CMS MinBias,  $1.0\text{GeV}/c < p_T < 3.0\text{GeV}/c$



CMS p+p, JHEP 09 (2010) 091

(d) CMS  $N \geq 110$ ,  $1.0\text{GeV}/c < p_T < 3.0\text{GeV}/c$



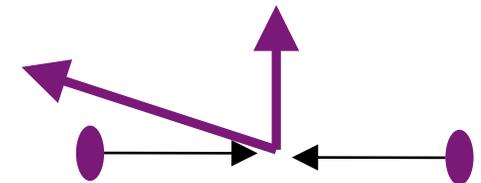
Near Side

Long Range

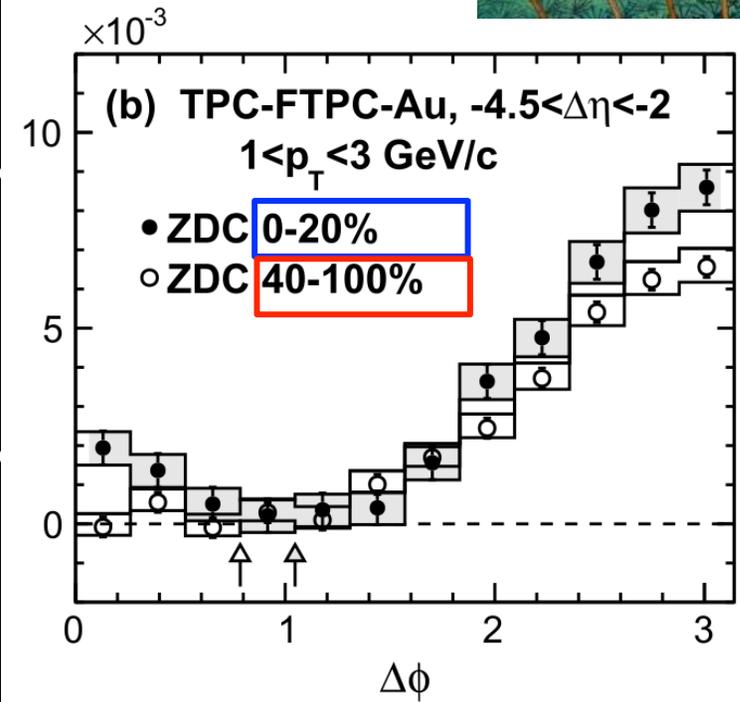
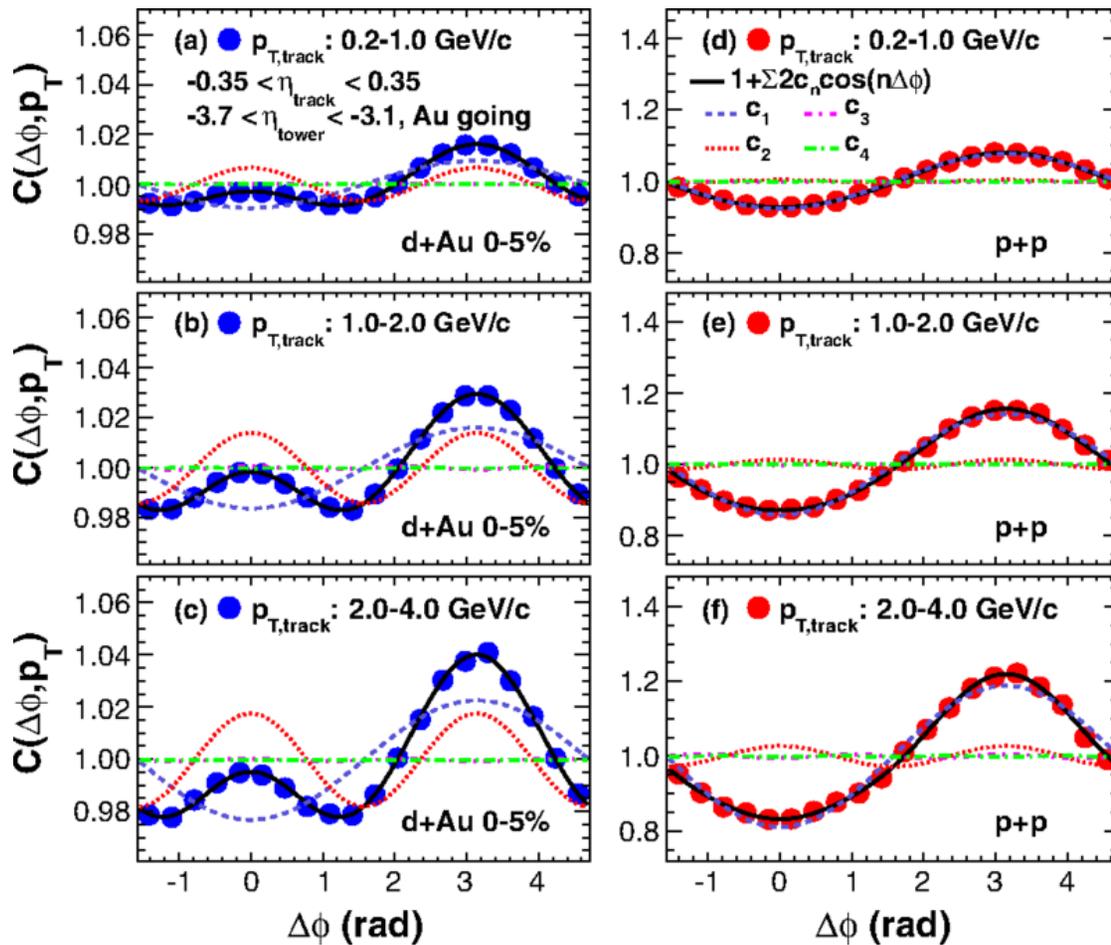


## Flow checklist:

- Centrality
- Geometry
- $p_T$  dependence



# Long-range correlations in d+Au

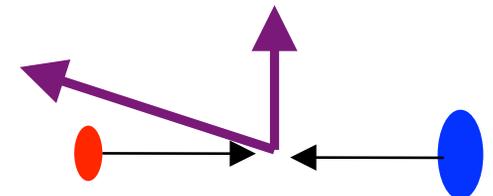


STAR, PLB 747, (2015) 265-271

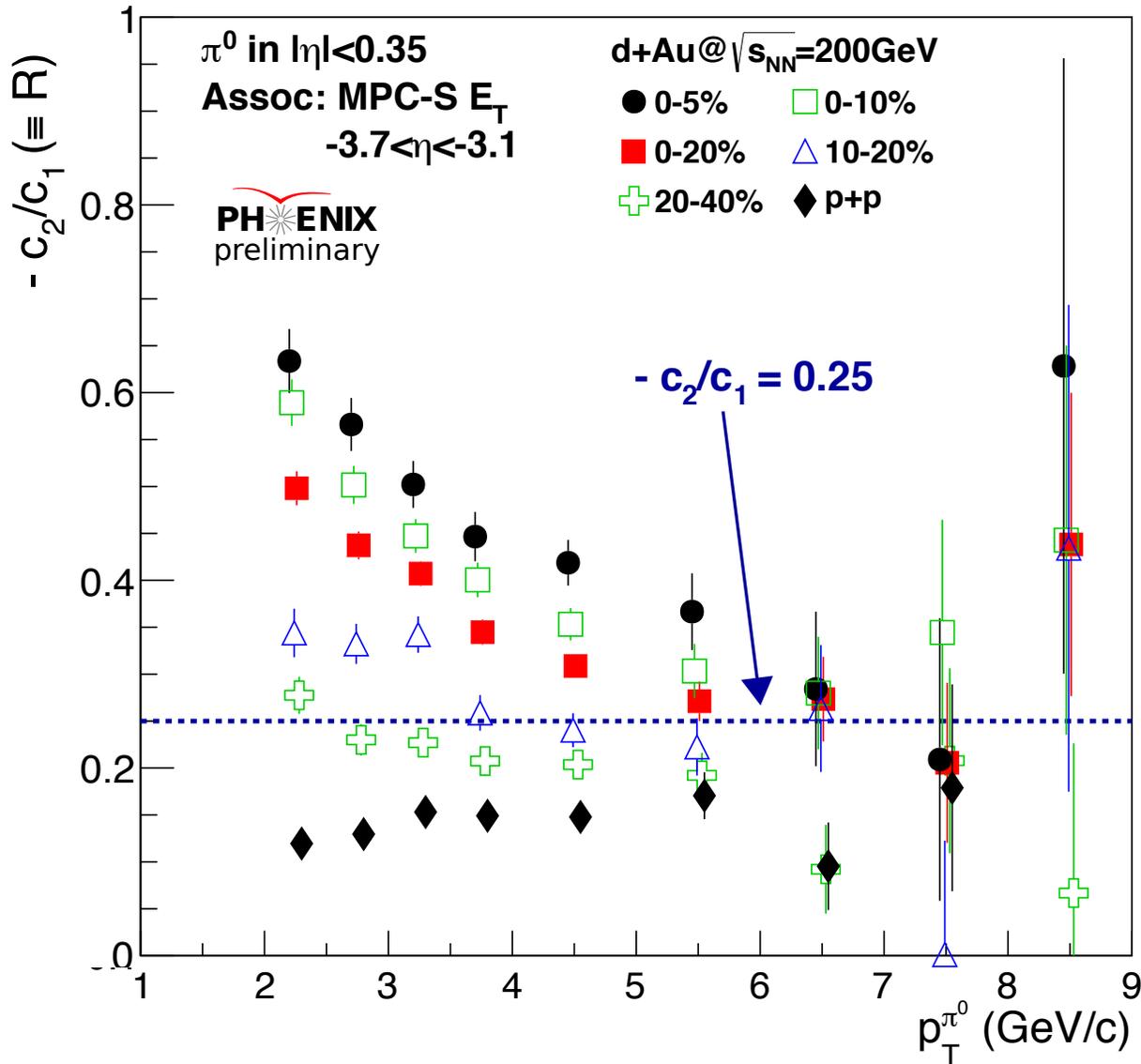
d+Au 0-5%

p+p min-bias

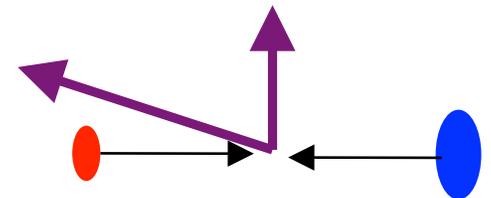
PHENIX, PRL 114, 192301 (2015)



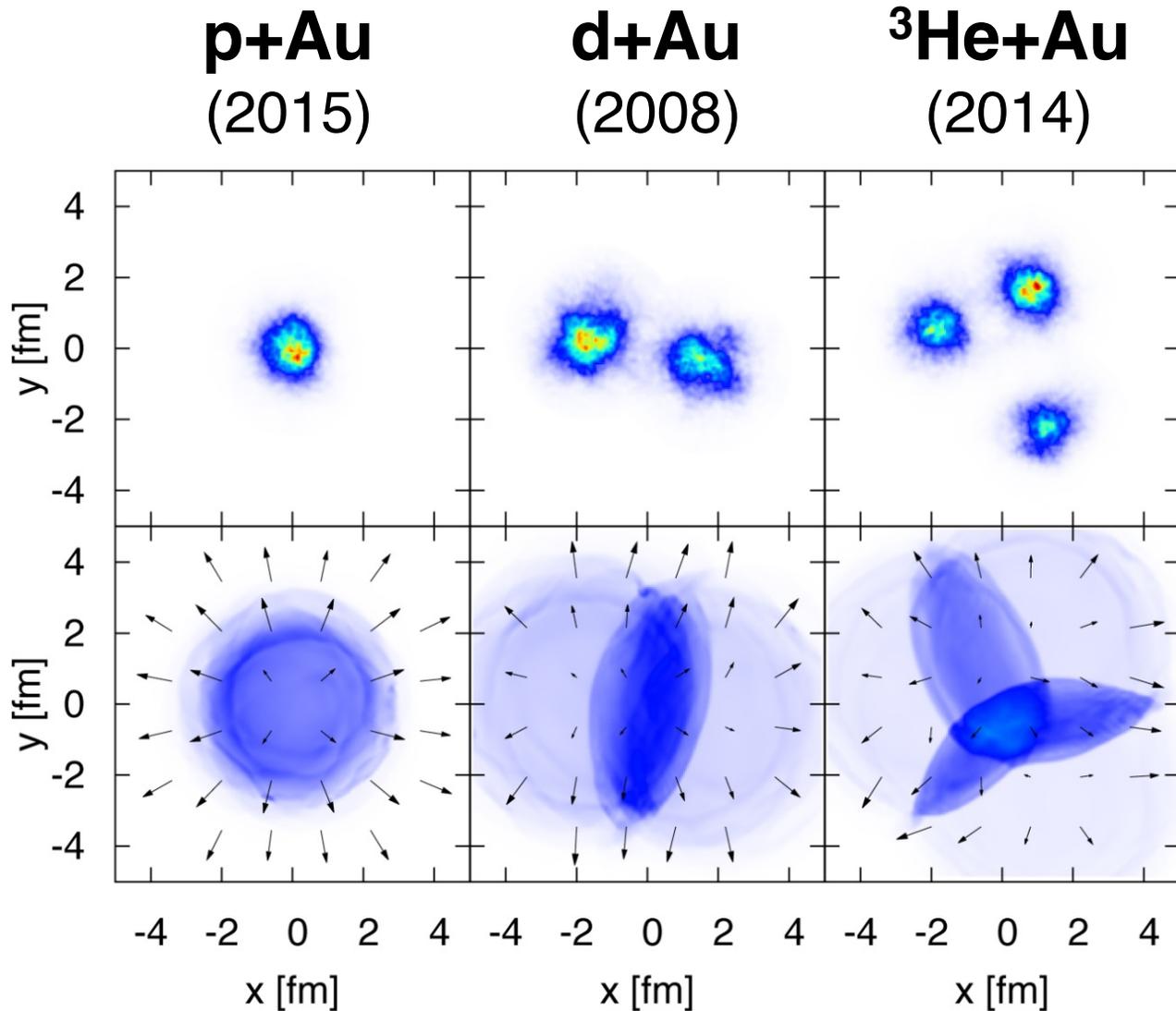
# Shape: $-c_2/c_1 \sim \text{Near/Away}$



↑ Near-side peak visible



# Geometry control at RHIC



Initial State

Final State

Phys. Rev. Lett. 113,  
112301 (2014), figure  
courtesy of B. Schenke

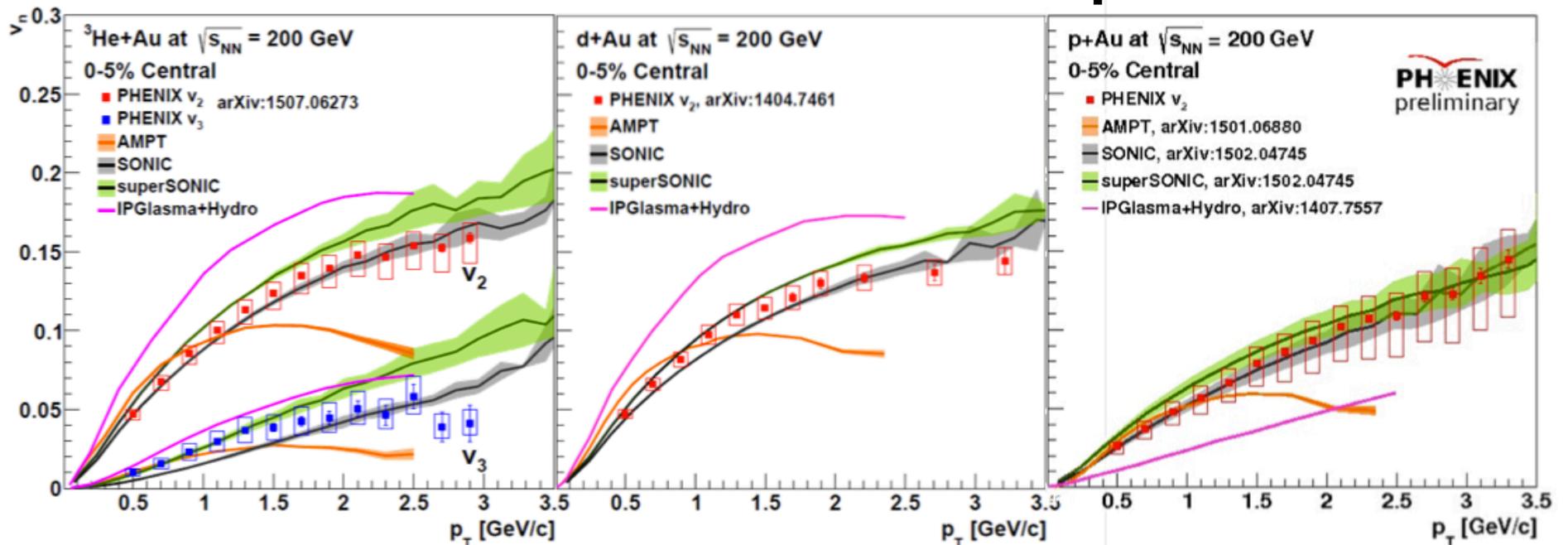
# Full palette of $v_2, v_3$



## $^3\text{He}+\text{Au}$

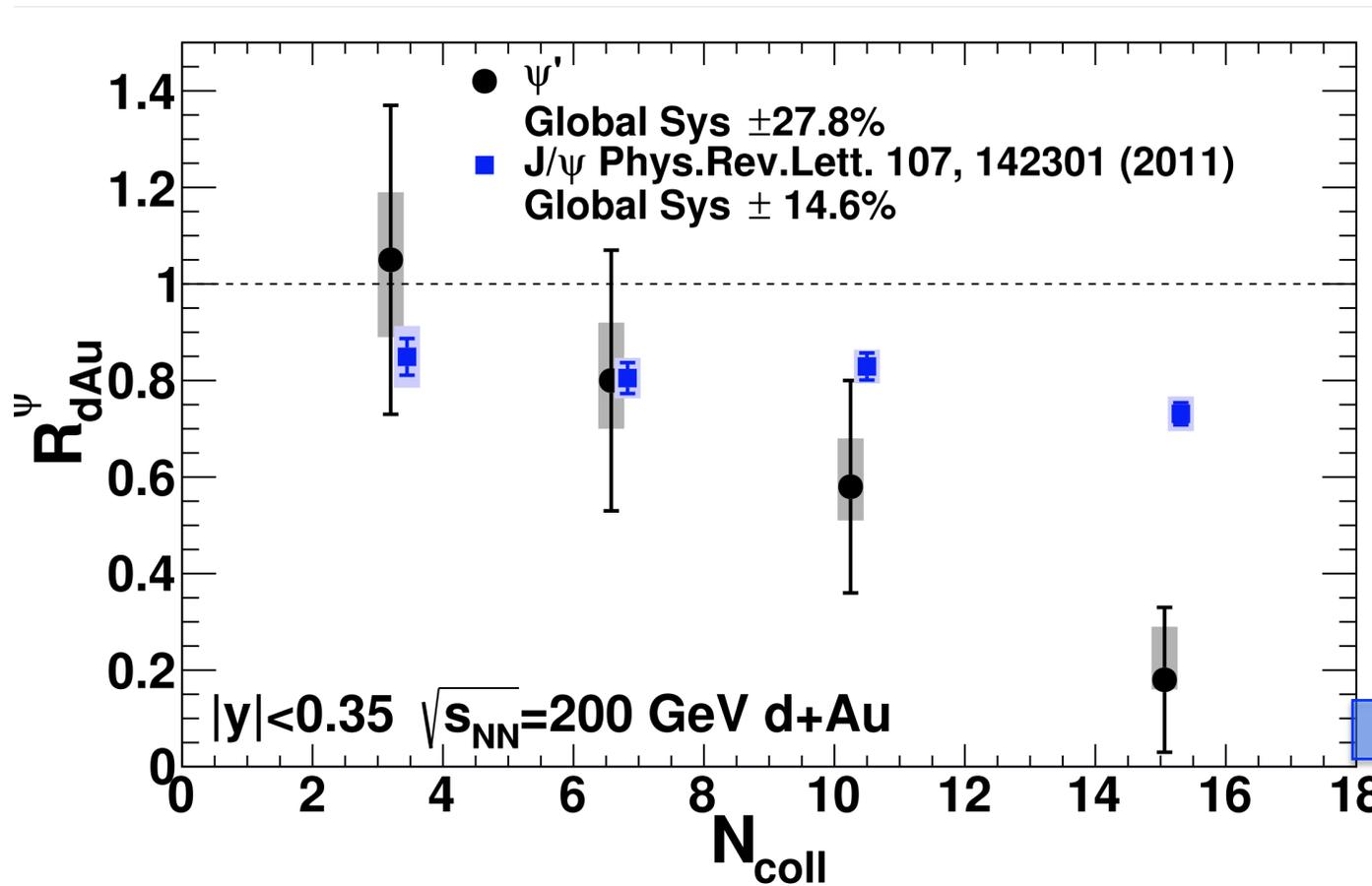
## $\text{d}+\text{Au}$

## $\text{p}+\text{Au}$

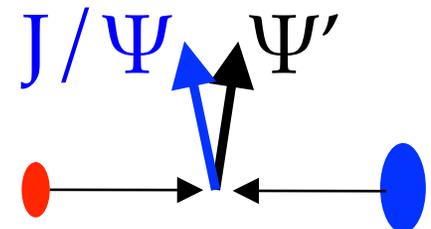


AMPT: arXiv:1501.06880  
SONIC: arXiv:1502.04745  
IP+Hydro: arXiv:1407.7557

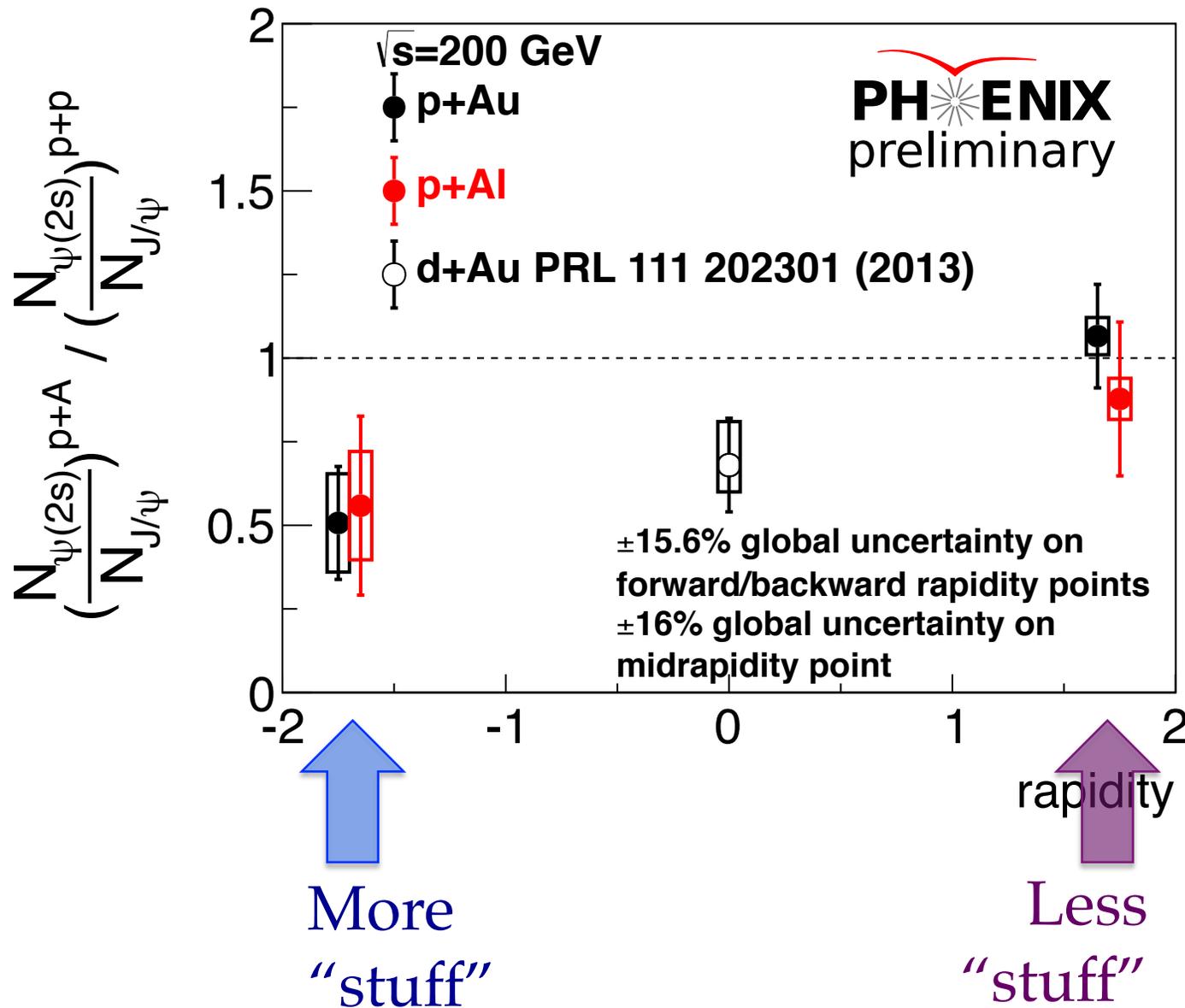
# $\Psi(2s)$ relative suppression



PHENIX, PRL 111, 202301 (2013)



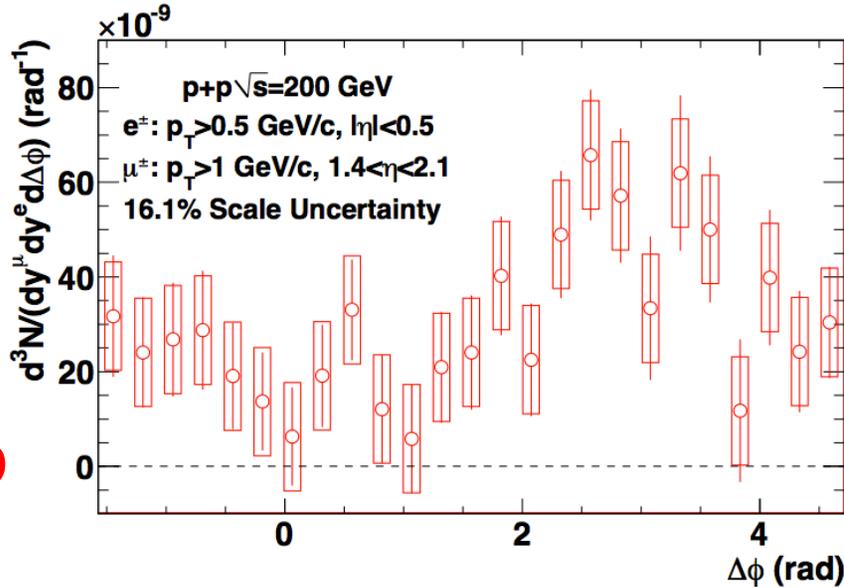
# $\Psi(2s)$ relative suppression



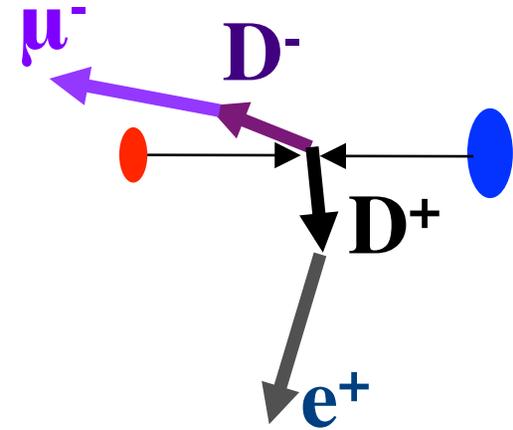
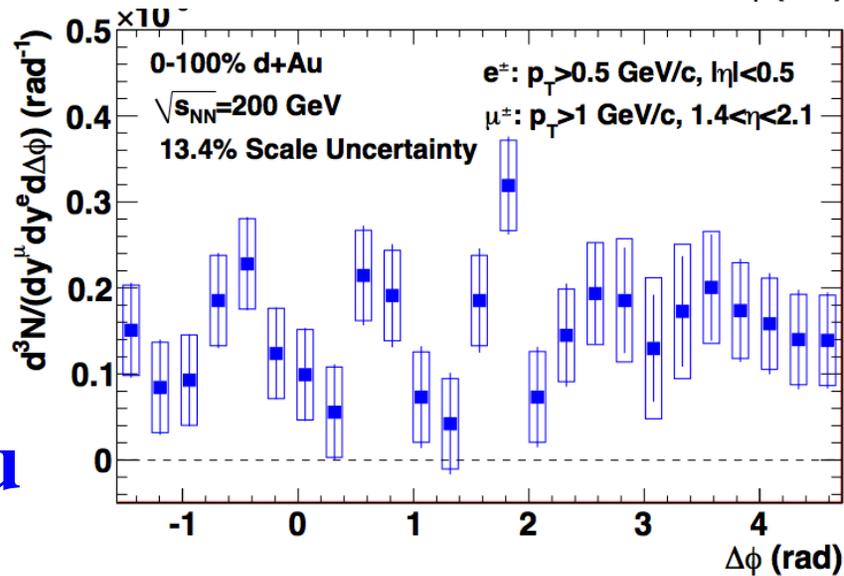
# Open charm de-correlation



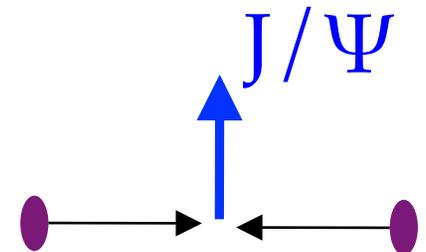
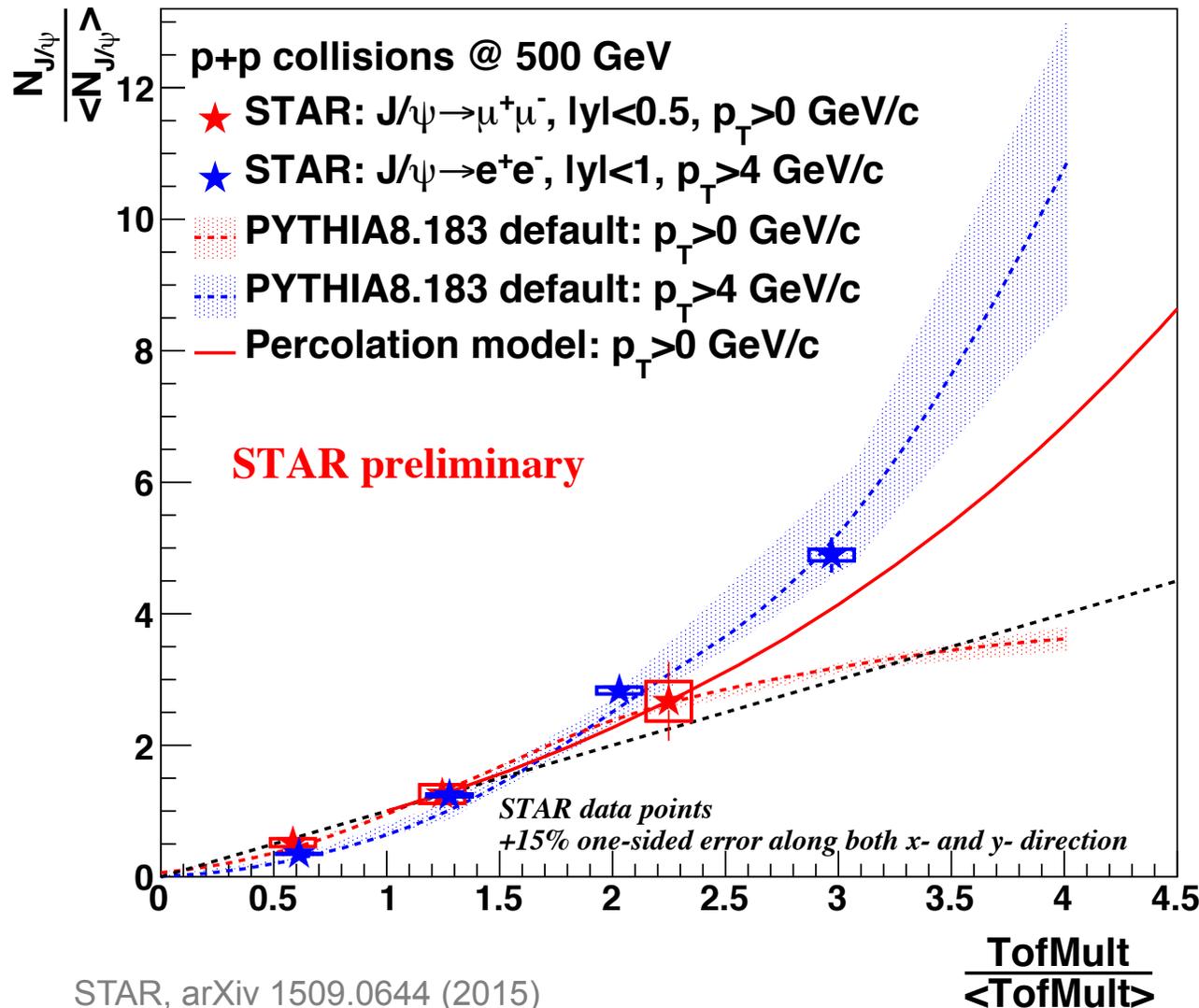
**p+p**



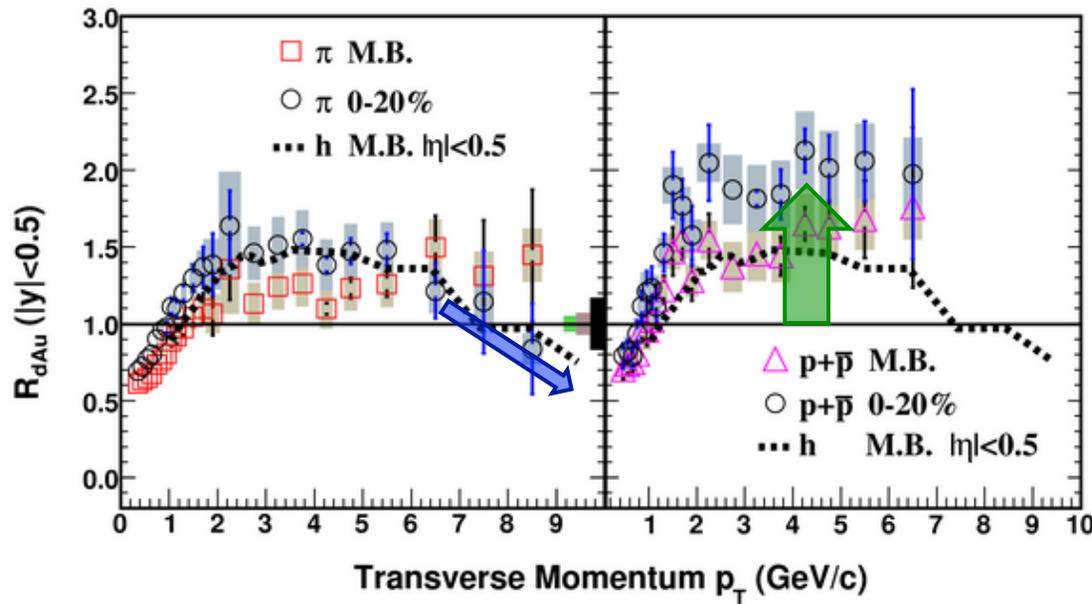
**d+Au**



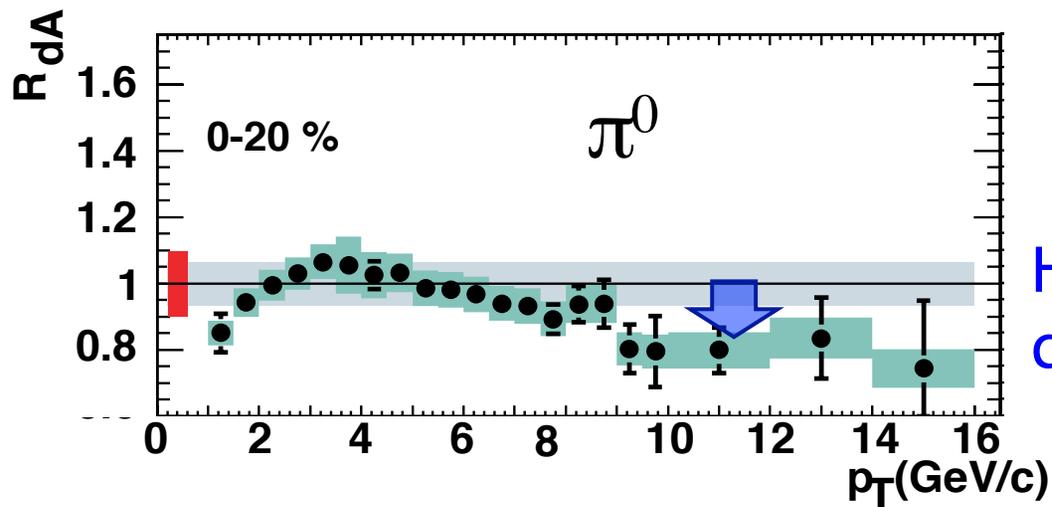
# J/Ψ vs p+p multiplicity



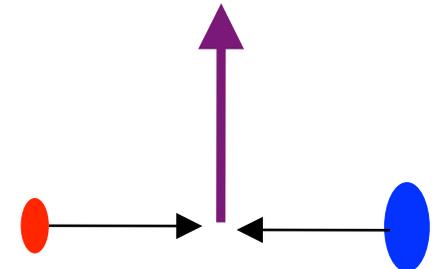
# Hadron $R_{dAu}$



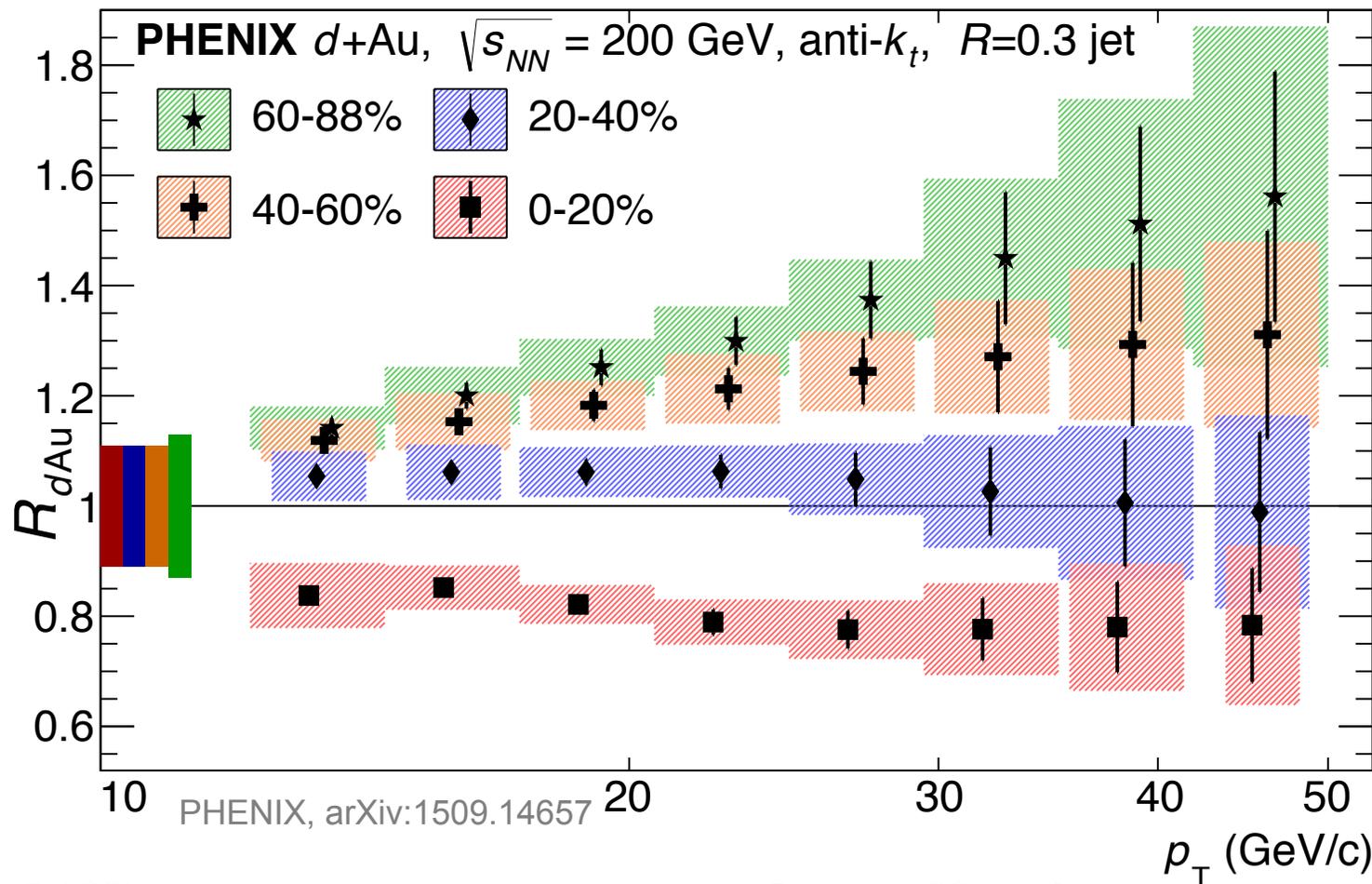
Cronin;  
Radial flow?



Hint of jet  
quenching?



# Jets in d+Au



Difficult to understand as a CNM effect!

Strong hard/soft correlation - proton configurations?

# Checklist/Summary

Extra material

# $\Psi(2s)$ relative suppression

