Latest d+Au results from PHENIX

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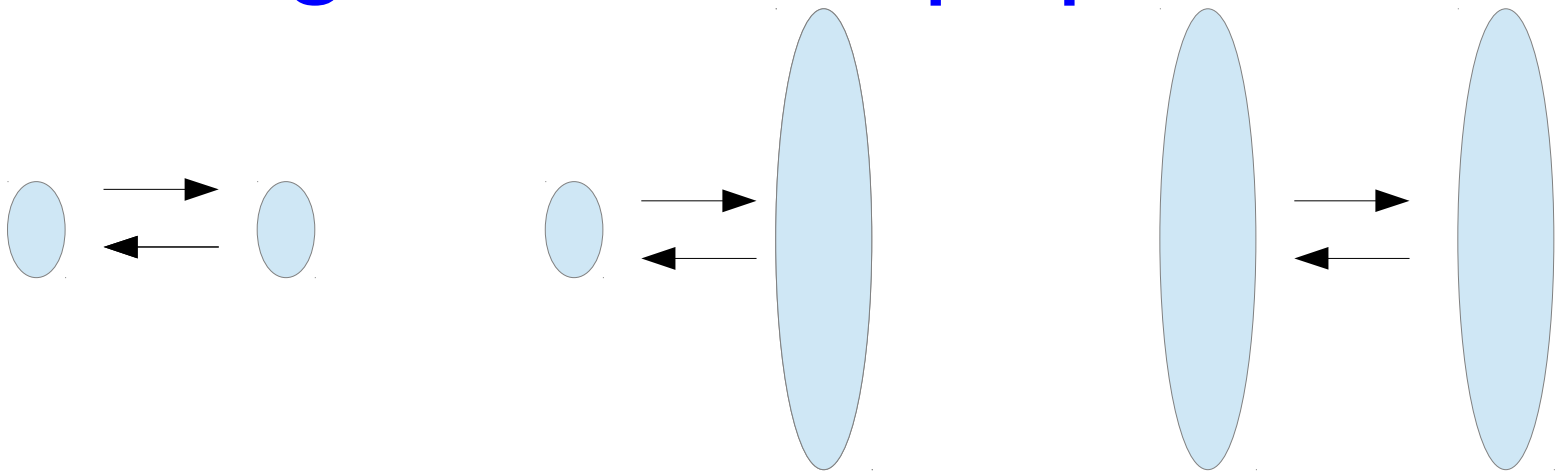
d+Au: bridge between p+p and Au+Au



p+p d(p)+Au Au+Au

- p+p: baseline reference
- d+Au: baseline reference, cold nuclear effect
- Au+Au: hot nuclear effect

- Is d+Au really just a reference?
- Do we create something hot in this tiny system?

System size dependence

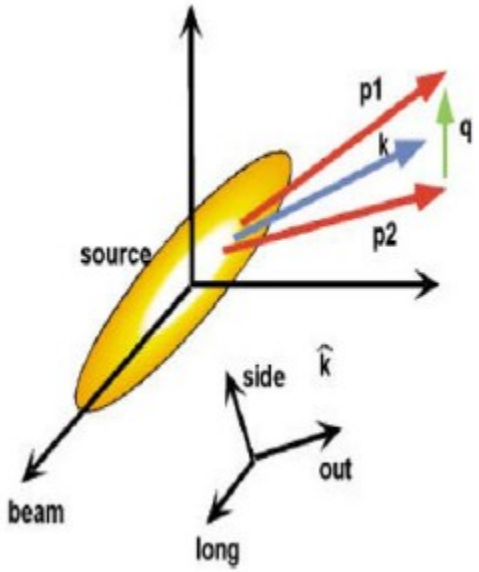
- Central d+Au and peripheral Au+Au

System	<Ncoll>	<Npart>
Au+Au 60-92%	14.8 ± 3.0	14.7 ± 2.9
d+Au 0-20%	15.1 ± 1.0	15.3 ± 0.8

- Similar number of collisions, and number of participants
- Any difference between the two?

The size of the fireball

- To measure the size of the fireball, we use the HBT (Hanbury-Brown and Twiss) correlation to measure the size of the fireball at freeze-out



$$C(q_{side}, q_{out}, q_{long}) = (1-\lambda) + \lambda(1+\mathrm{G})\mathrm{F}c\,,$$

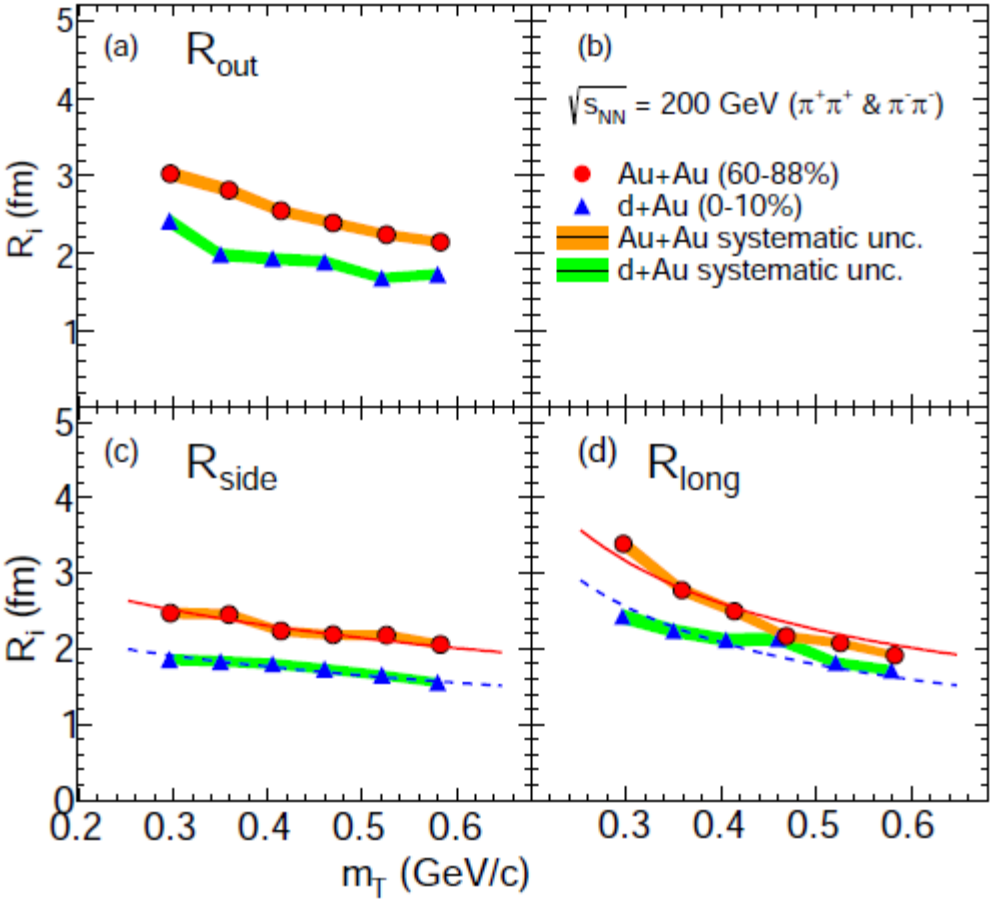
Fc=Coulomb Correction

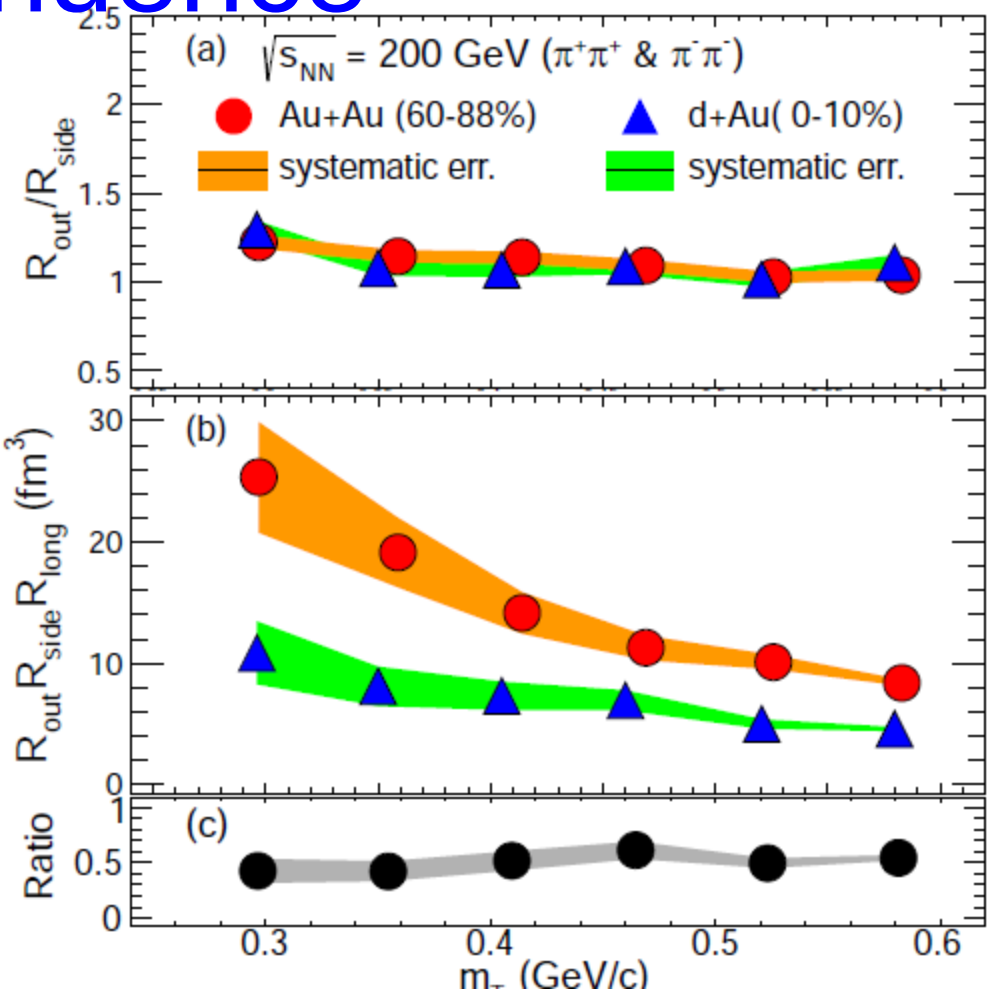
$$G=\exp\left(-R_{side}^2 q_{side}^2 - R_{out}^2 q_{out}^2 - R_{long}^2 q_{long}^2\right)$$

- out: direction of mean transverse momentum of the pair
- Side: orthogonal to out
- long: beam direction

m_T dependence

arxiv 1404.5291

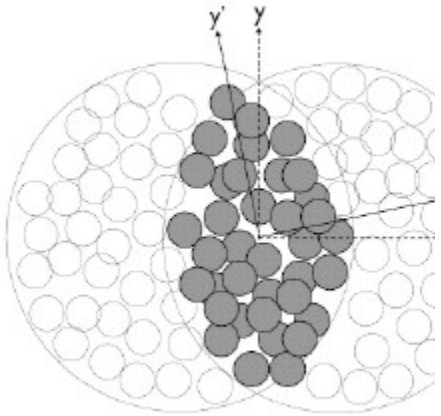




- Similar m_T dependence between dAu and AuAu

- V(dAu) < V(AuAu)
- m_T dependence of volume is similar

Dependence in R



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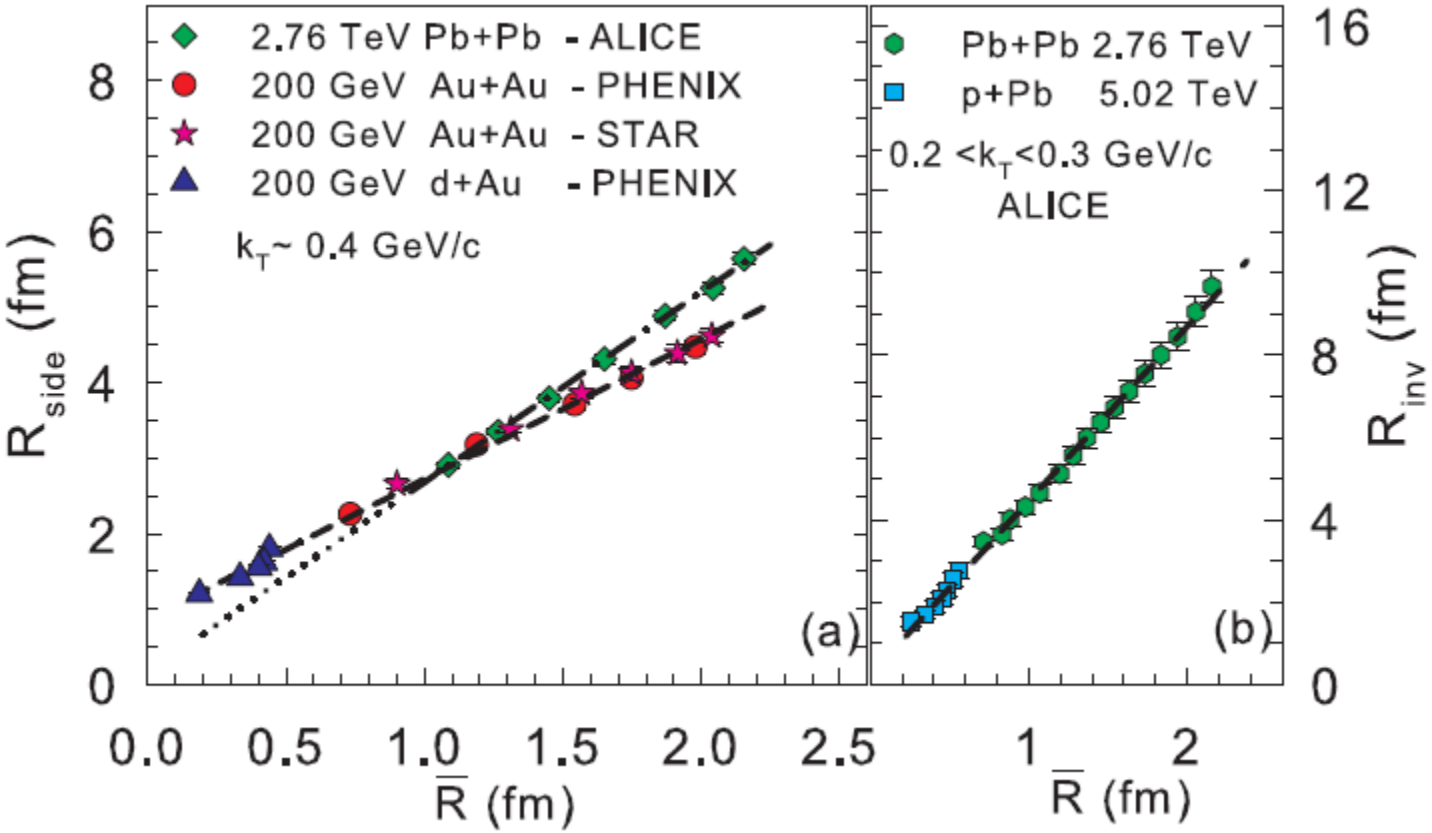
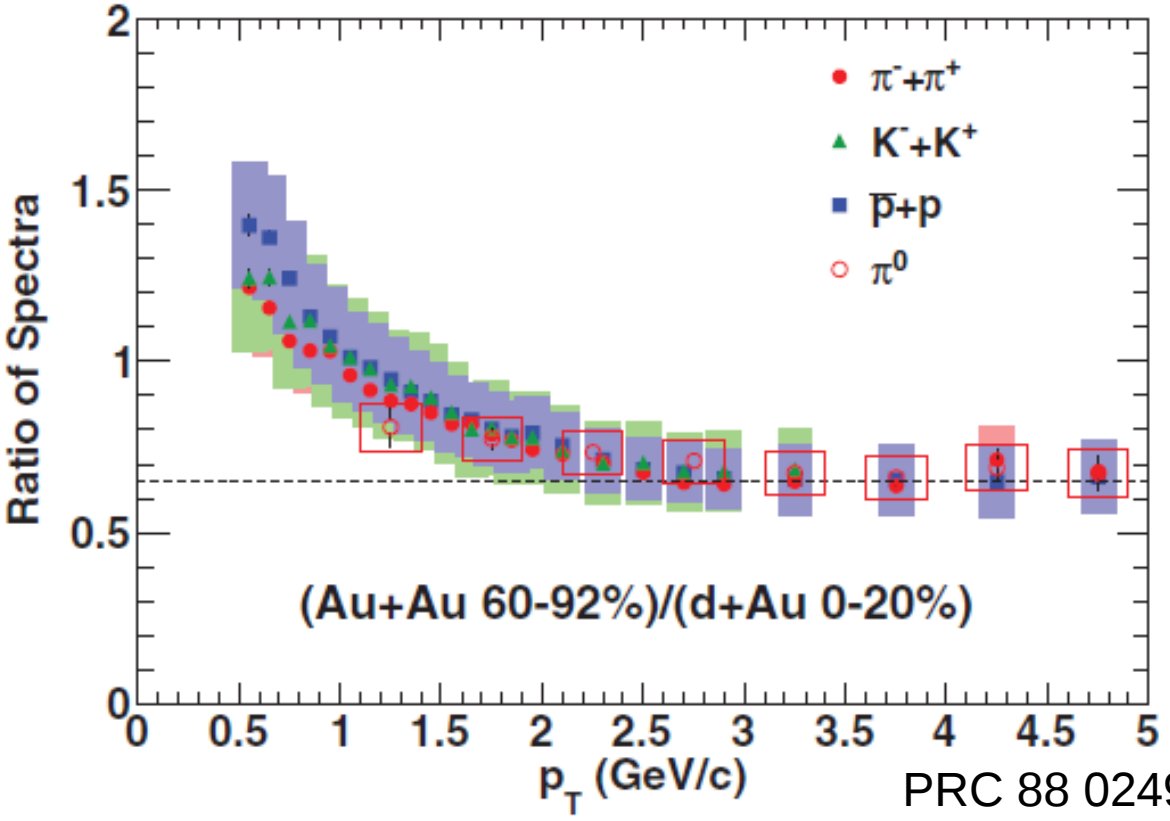


- $1/R = \mathrm{sqrt}(1/\sigma_x^2 + 1/1/\sigma_y^2)$
- Linear dependence and nice scaling between Au+Au and d+Au
- Different slope between Pb+Pb (2.76 TeV) and Au+Au (0.2 TeV)

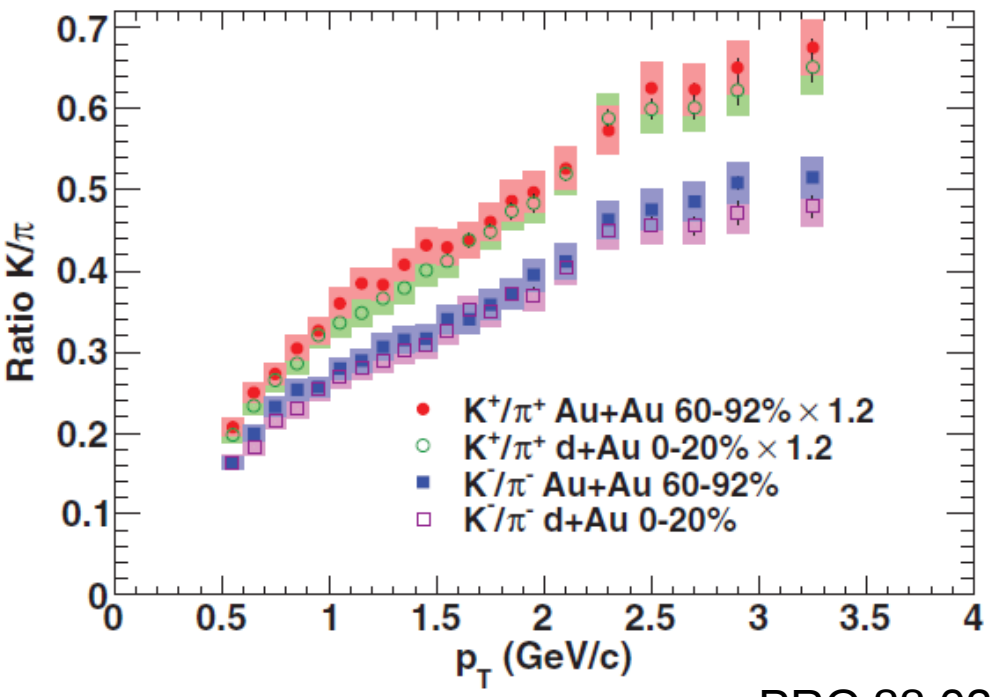
Particle yields in d+Au and Au+Au

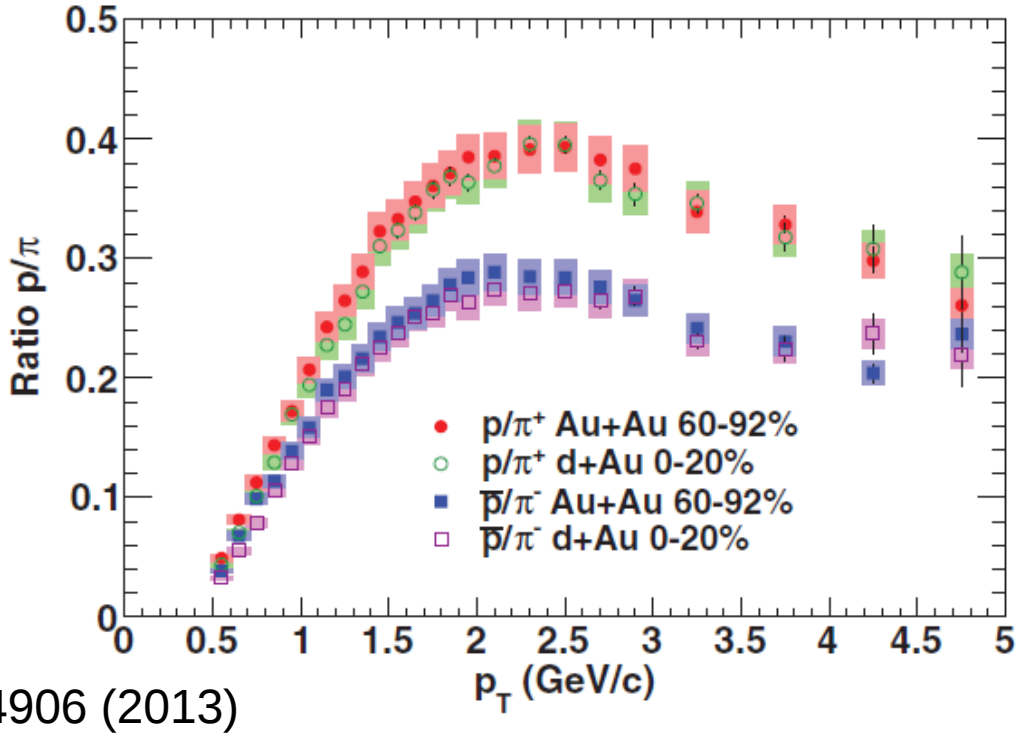


PRC 88 024906 (2013)

- More soft particles in peripheral Au+Au than central d+Au!

K/π and p/π ratio in d+Au and Au+Au



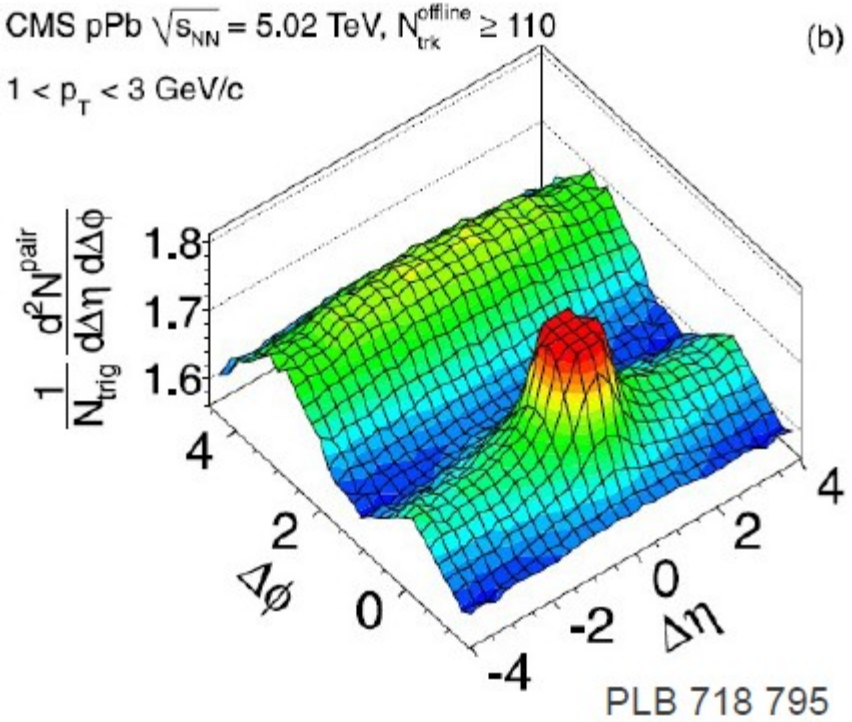


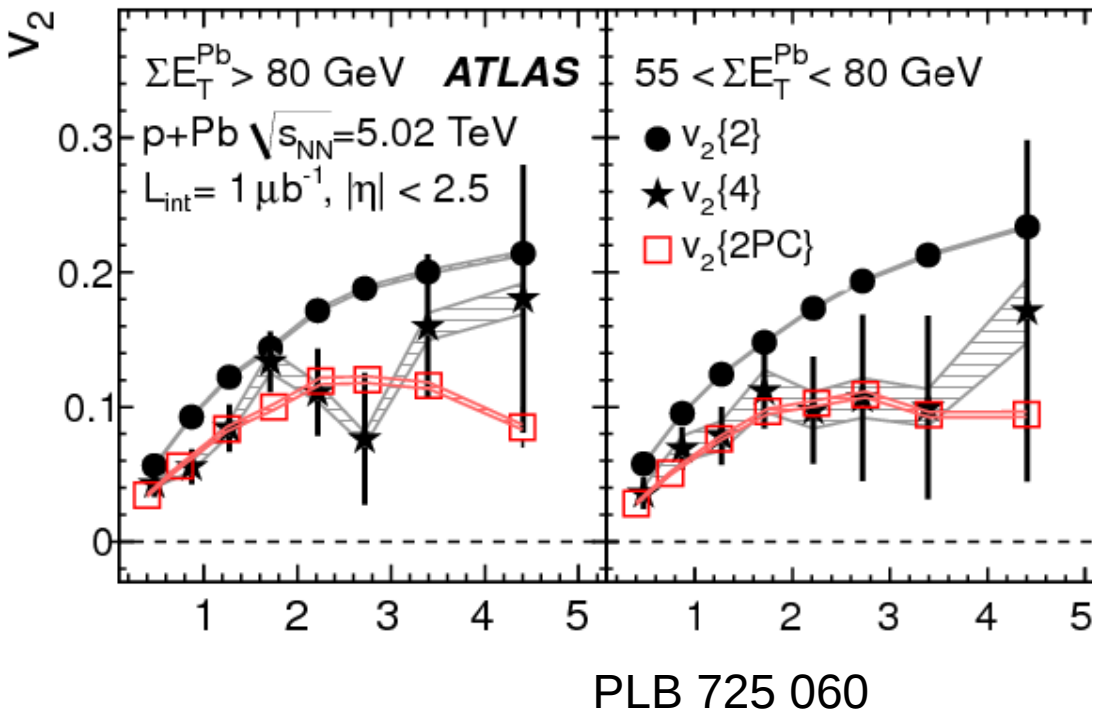
PRC 88 024906 (2013)

- The K/π and p/π ratios in peripheral Au+Au and central d+Au are the same
- Similar chemical compositions in both systems

Small fireball in d+Au?

- In p+Pb collisions in LHC, some collective flow like structure are shown, how about RHIC?



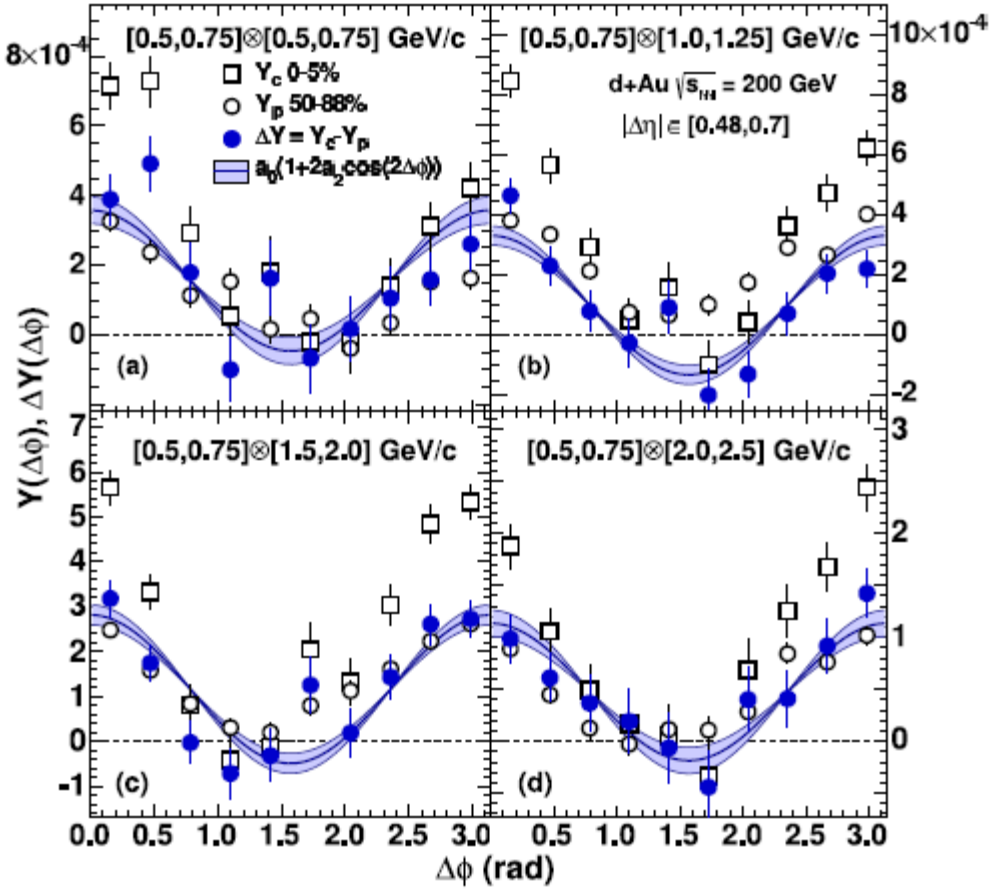


d+Au at RHIC vs p+Pb at LHC

- Smaller energy (0.2 TeV vs 5.02 TeV)
- Slightly different initial state geometry (d vs p)

- Can we see “ridge” (η–separated long range correlation) in d+Au collisions?
- Can we see v_2 in central d+Au collisions?

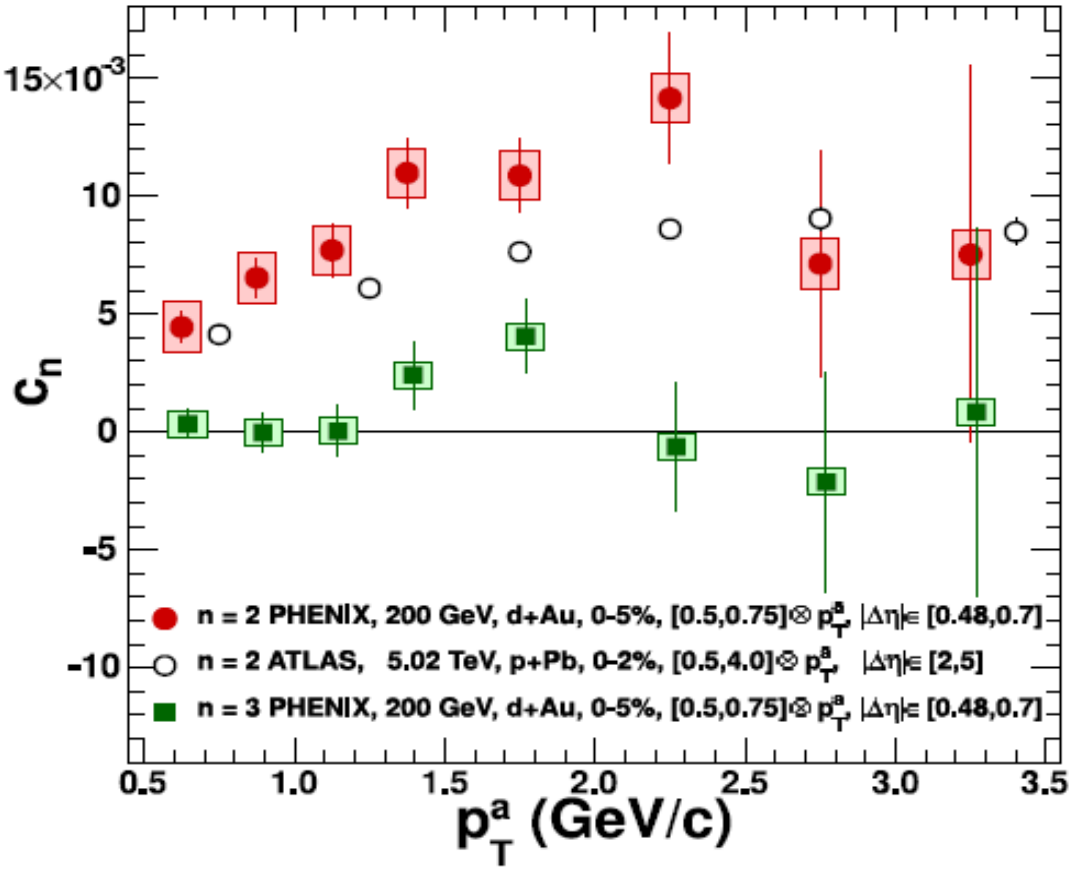
CF in central d+Au collisions



PRL 111 212301 (2013)

- $0.48<|\Delta\eta|<0.7$
- Use ZYAM to subtract the underlying background
- The per trigger yield correlation in 0-5% d+Au collisions is larger than d+Au 50-88%
- After subtracting 50-88%, the remaining correlation function has a v_2-like ($\cos 2\Delta\phi$) shape

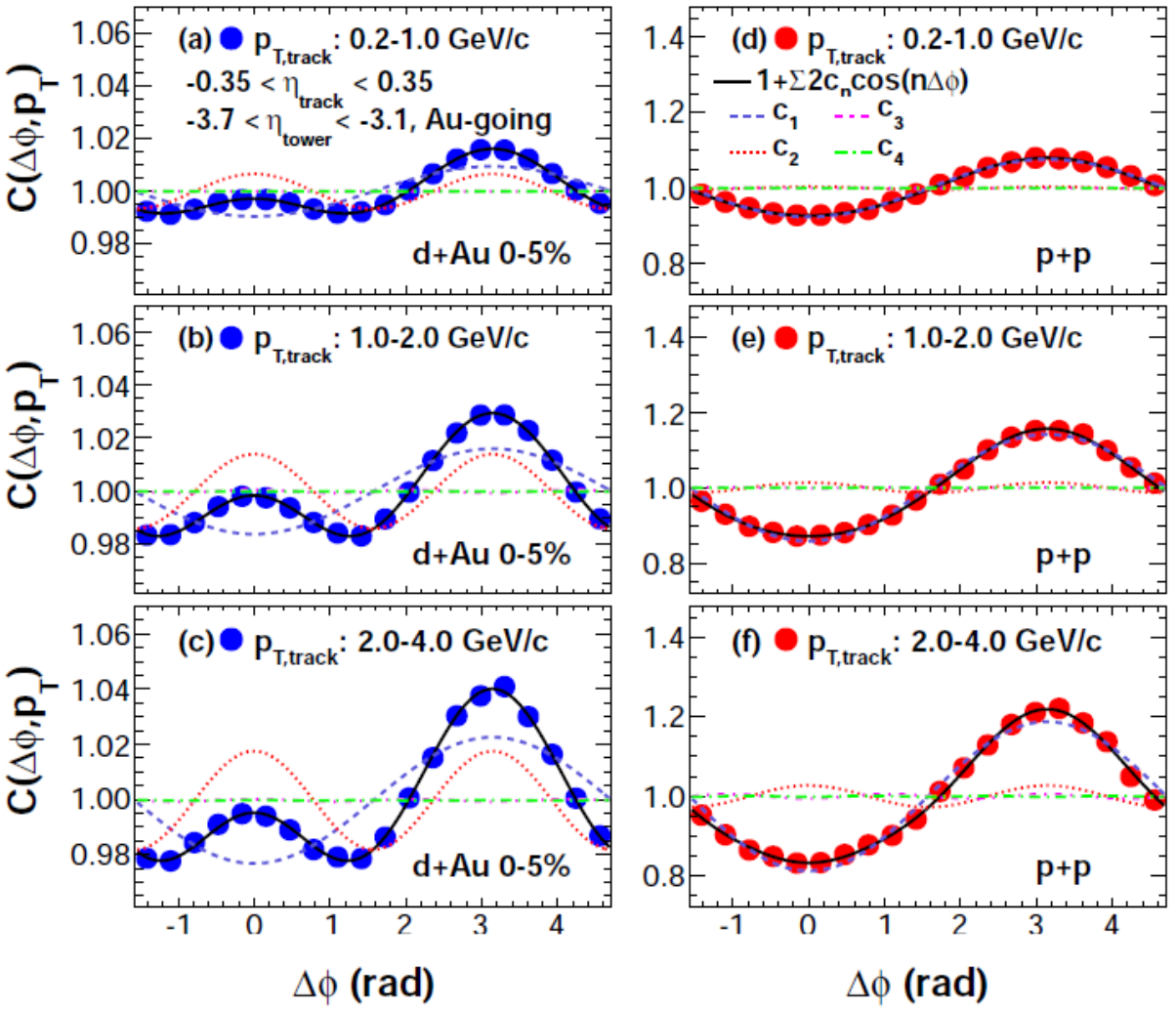
c_2 (c_3) vs p_T



PRL 111 212301 (2013)

- $c_n = v_n^A * v_n^B$
- Significant c_2, and c_2 increases with p_T
- c_3 is consistent with 0, basically no c_3 (or v_3) contribution in d+Au!

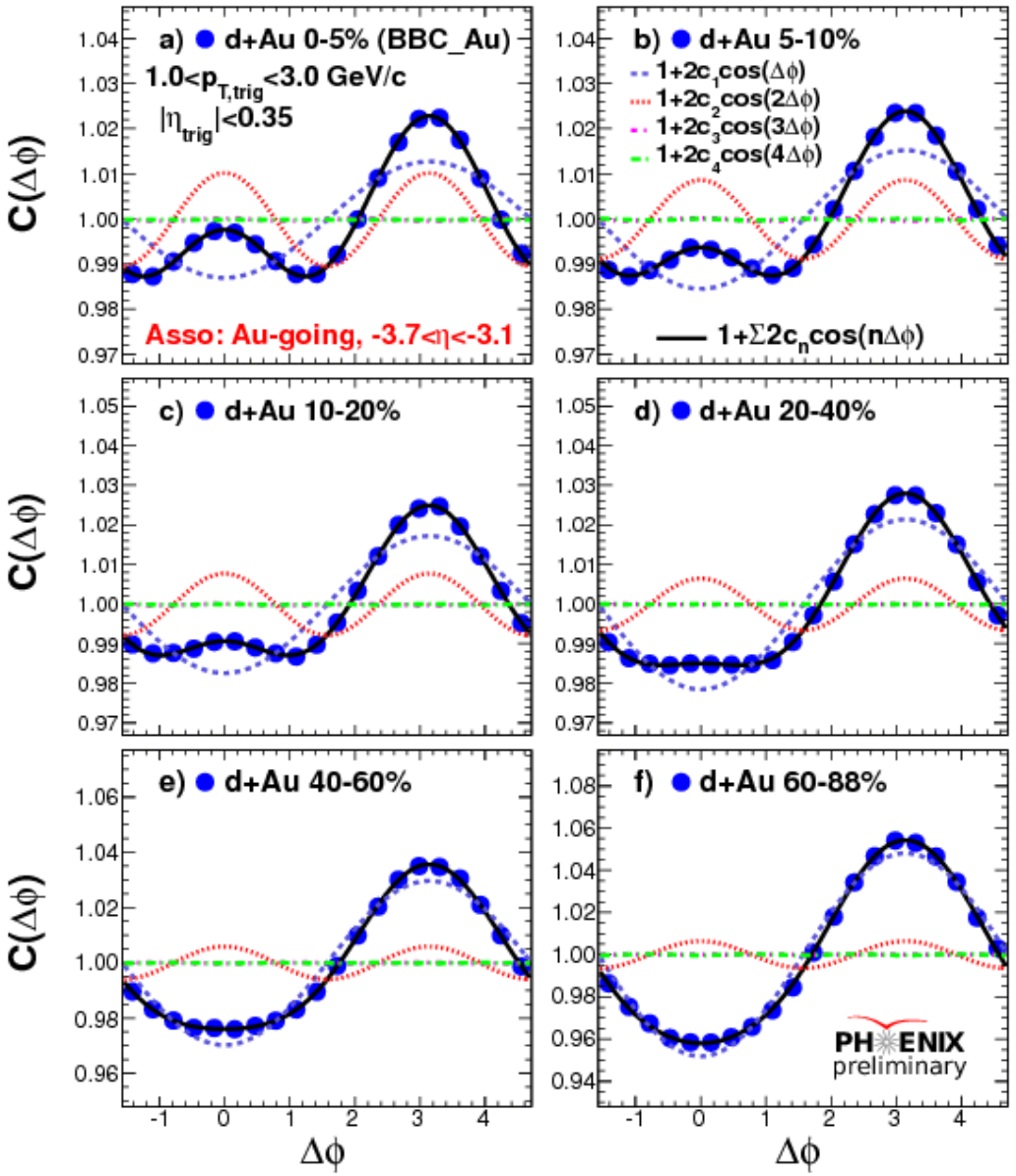
η separated long range correlations



arxiv 1404.7461

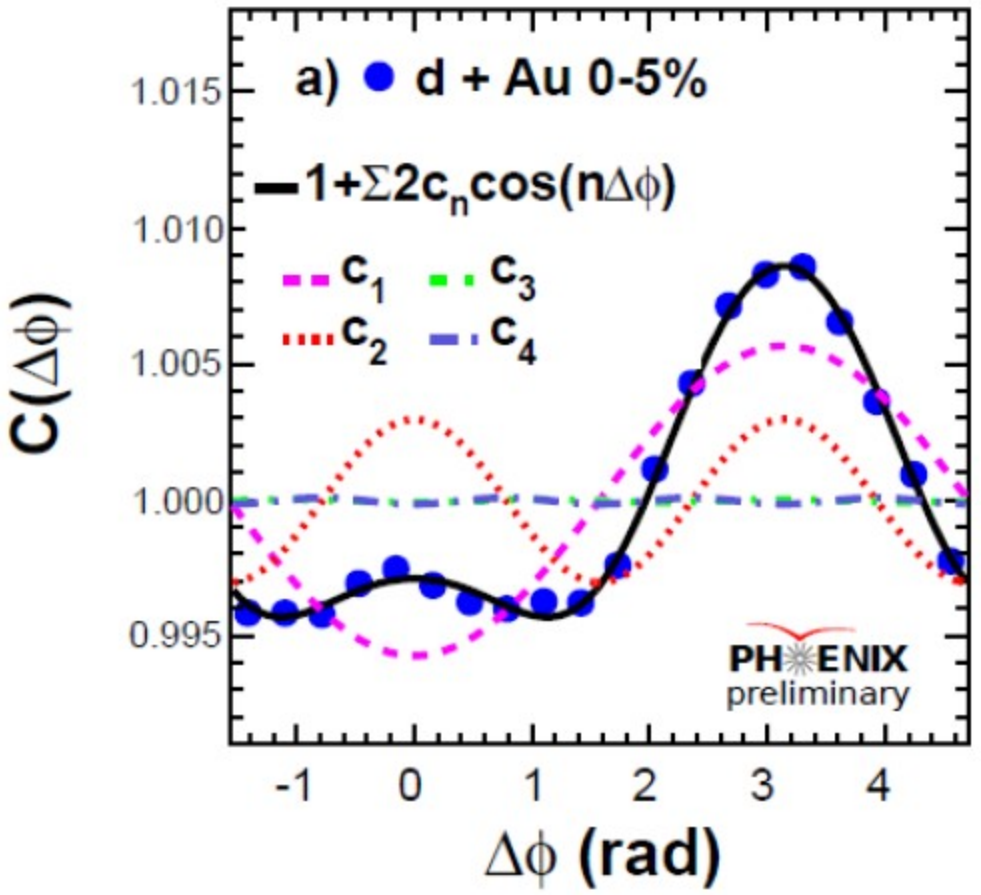
- p+p: dominate by c_1 or $\cos\Delta\phi$ correlations (conservation of momentum)
- d+Au: enhancement at $\Delta\phi \sim 0$, which is the “ridge”

Centrality dependence



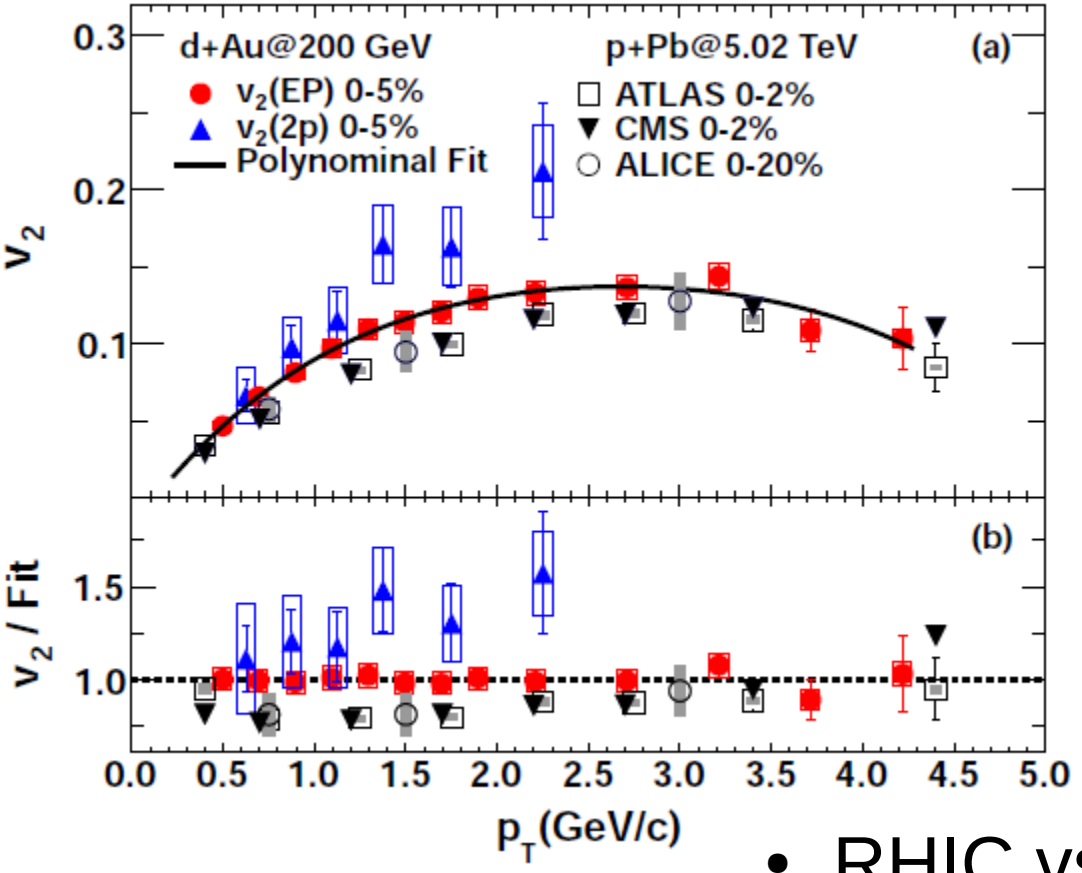
- When mid-rapidity particles are correlated with Au-going side, there is significant correlations at $\Delta\phi \sim 0$
- The nearside correlation decreases when moving to peripheral d+Au collisions
- c_1 and c_2 are comparable in central d+Au collisions

Ridge in d+Au at $|\Delta\eta| > 6$



By correlating clusters in both muon piston calorimeter (MPC), $3.1<|\eta|<3.9$, the long range correlation at $\Delta\phi \sim 0$ is still preserved

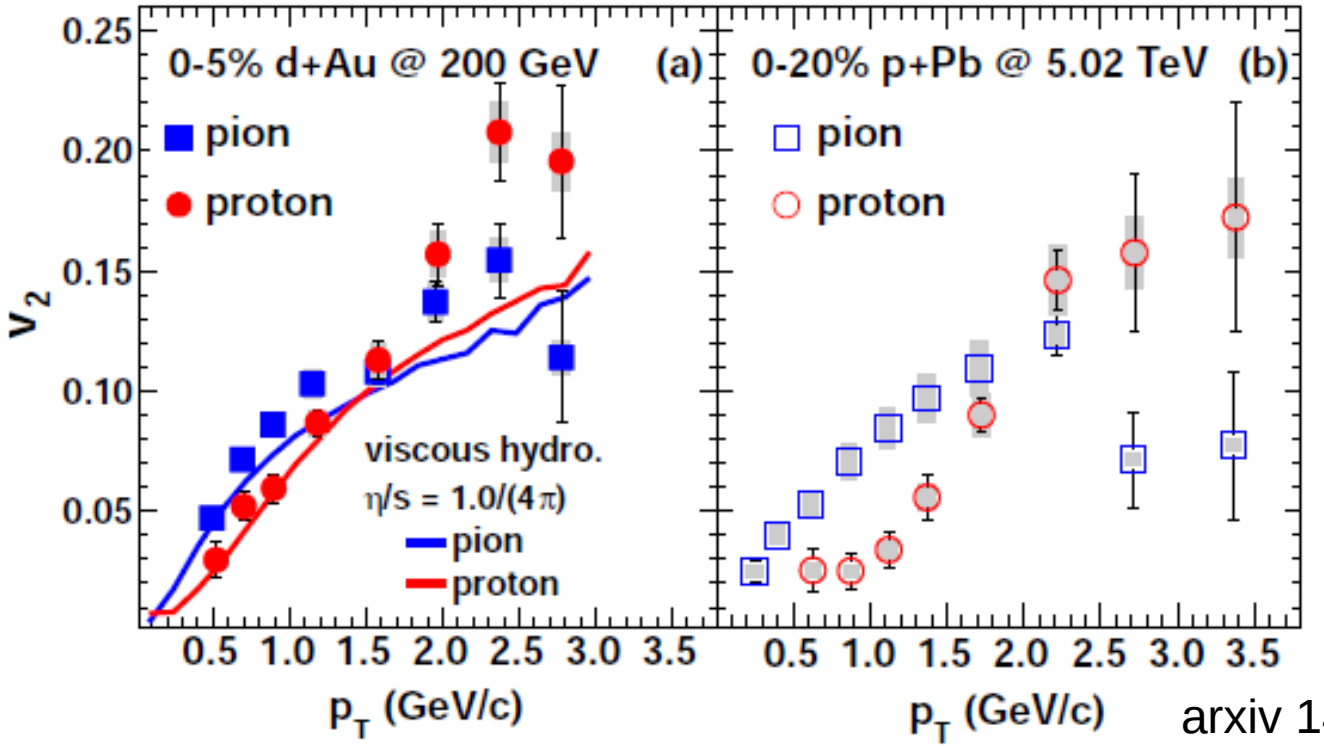
Charged hadron v_2 in d+Au



arxiv 1404.7461

- For dAu
  - v_2(EP) < v_2(2p)
  - less non-flow in Event-plane method
- RHIC vs LHC
  - RHIC has slightly higher v_2 than LHC

Pid v2



arxiv 1404.7461

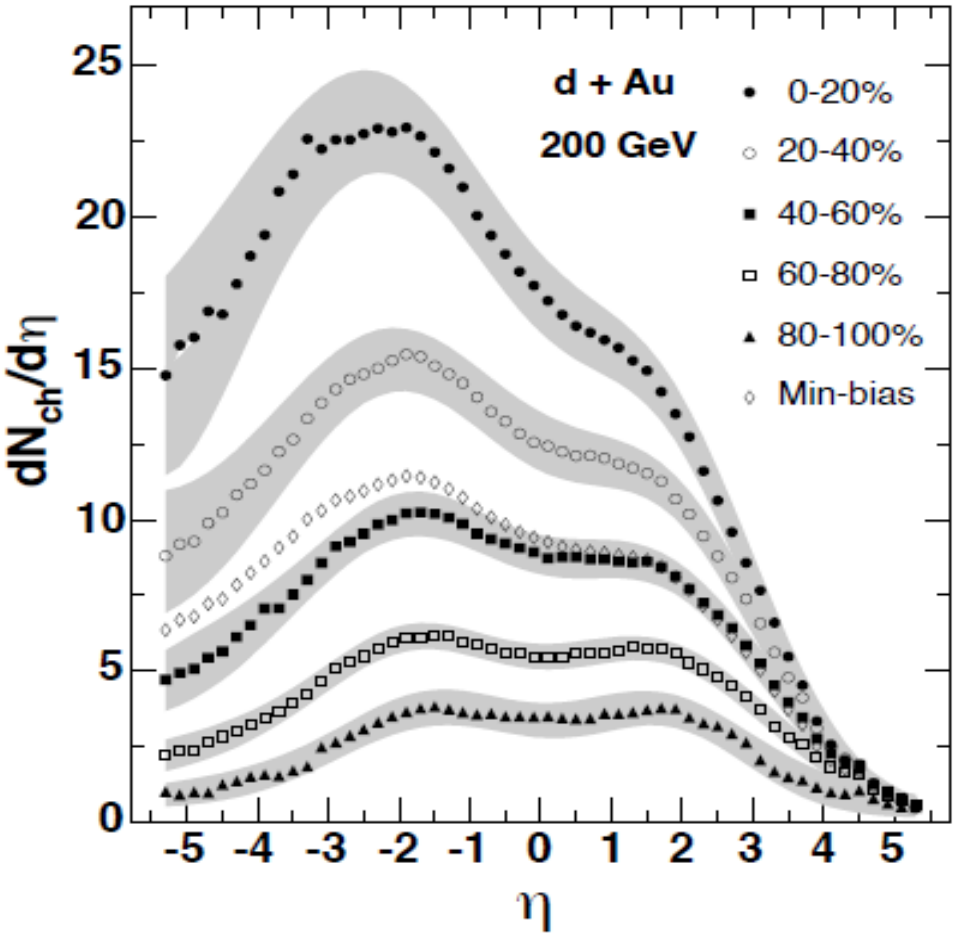
- Mass ordering of v_2 is seen in d+Au
- Stronger mass ordering at LHC

summary

- Size of the fireball
  - have similar m_T dependence in d+Au and Au+Au
  - scales with R across systems
- Particle productions
  - Peripheral Au+Au has more soft particles than central d+Au
  - Similar p/π and K/π ratio between central d+Au and peripheral Au+Au
- v_2 in d+Au
  - is compatible with v_2 in p+Pb
  - shows mass ordering

Backup slides

Central-forward (backward) correlation



PRC 72 031901

- The multiplicity distributions in d+Au collisions are asymmetric
- Measure the two-particle correlations of one particle at mid-rapidity (with central arm spectrometer, $|\eta|<0.35$) and another particle at forward calorimeter (with Muon Piston Calorimeter, $3.1<|\eta|<3.9$)