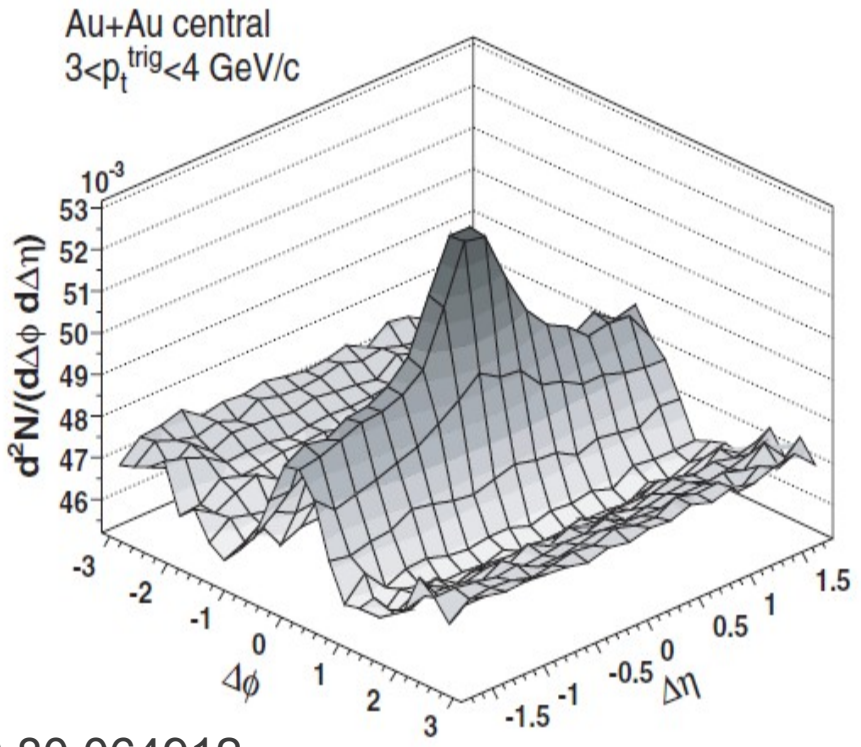
Studying the medium behavior of the dilute system in d+Au collisions in PHENIX

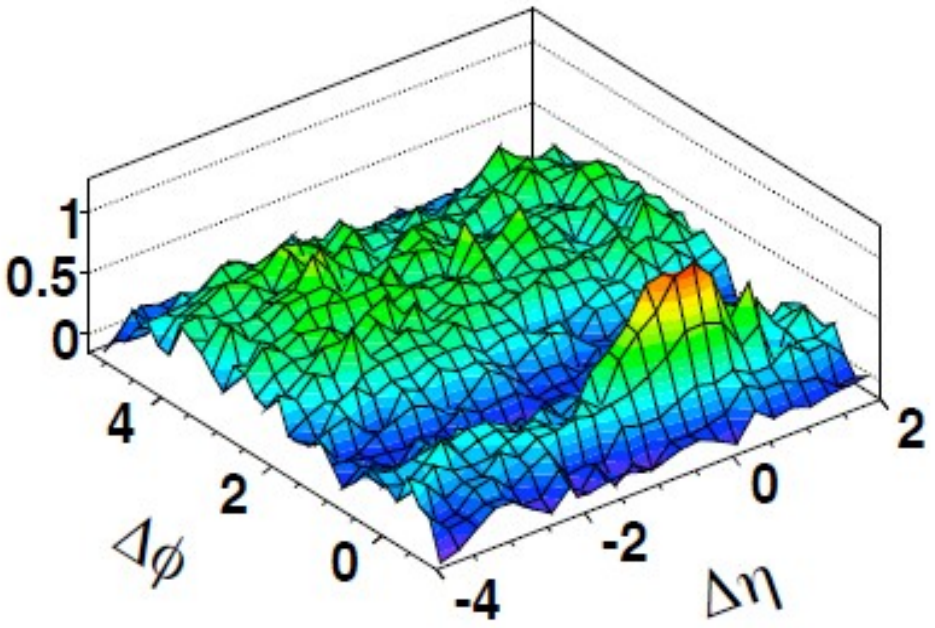
John Chin-Hao Chen
RIKEN BNL Research Center

IS2013
2013/09/12

Ridge at RHIC



PRC 80 064912

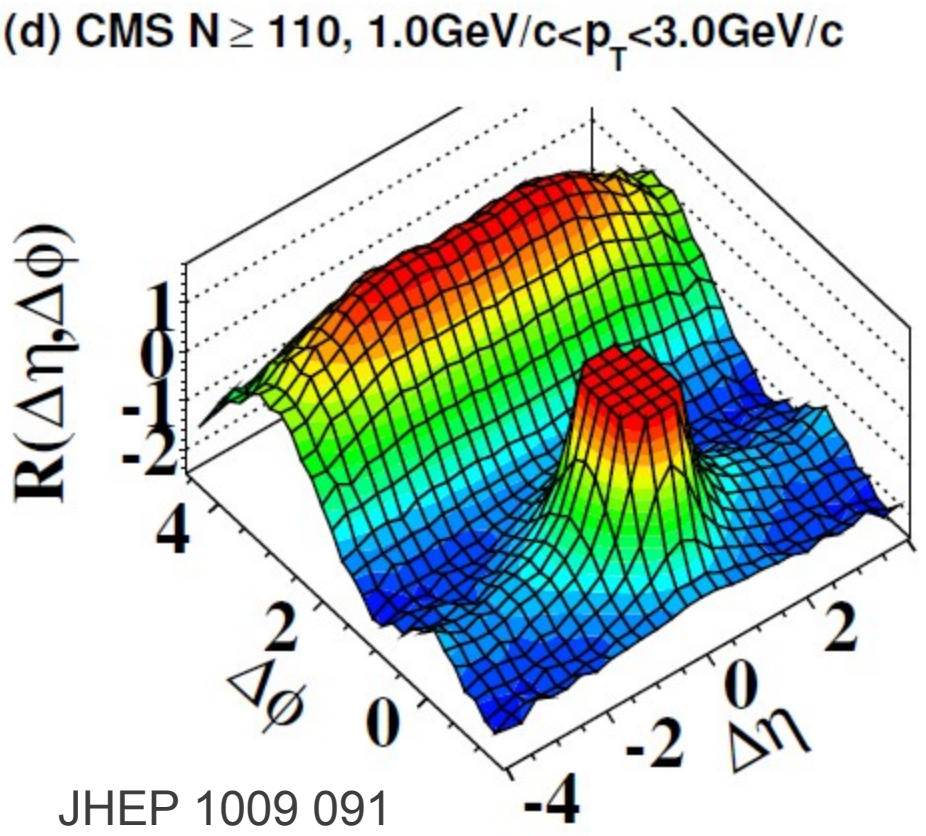


(b) Au+Au 0-30% (PHOBOS)

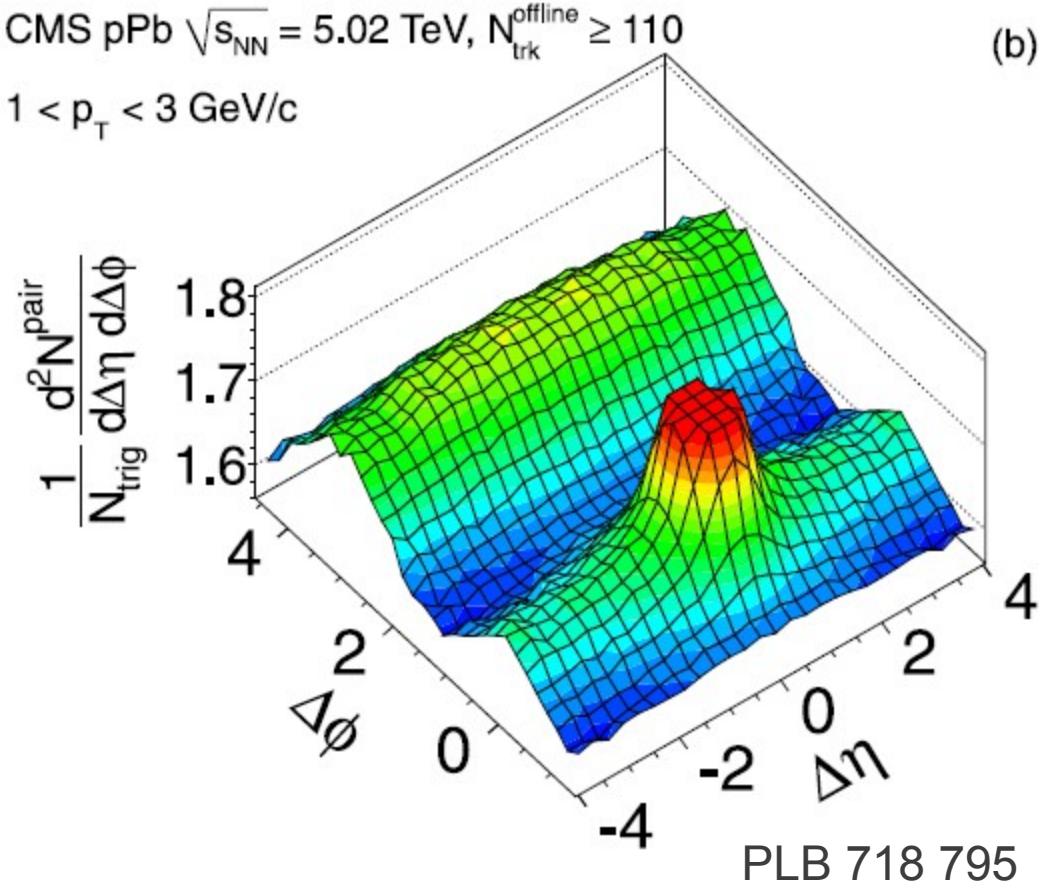
PRL 104 062301

Ridge appears in central Au+Au collisions, and extend to $|\Delta\eta| \sim 4$

Ridge at LHC



JHEP 1009 091



PLB 718 795

- Ridge appears at high multiplicity pp/pPb collisions
- The ridge looks like a v2 structure

What about d+Au at RHIC?

- A relatively simple system than Au+Au
- A slightly more complicated system than pPb
- A much lower energy than LHC (0.2 TeV vs 5.02 TeV)
-
- Can we see v2 in dAu?
- Can we see ridge in dAu?

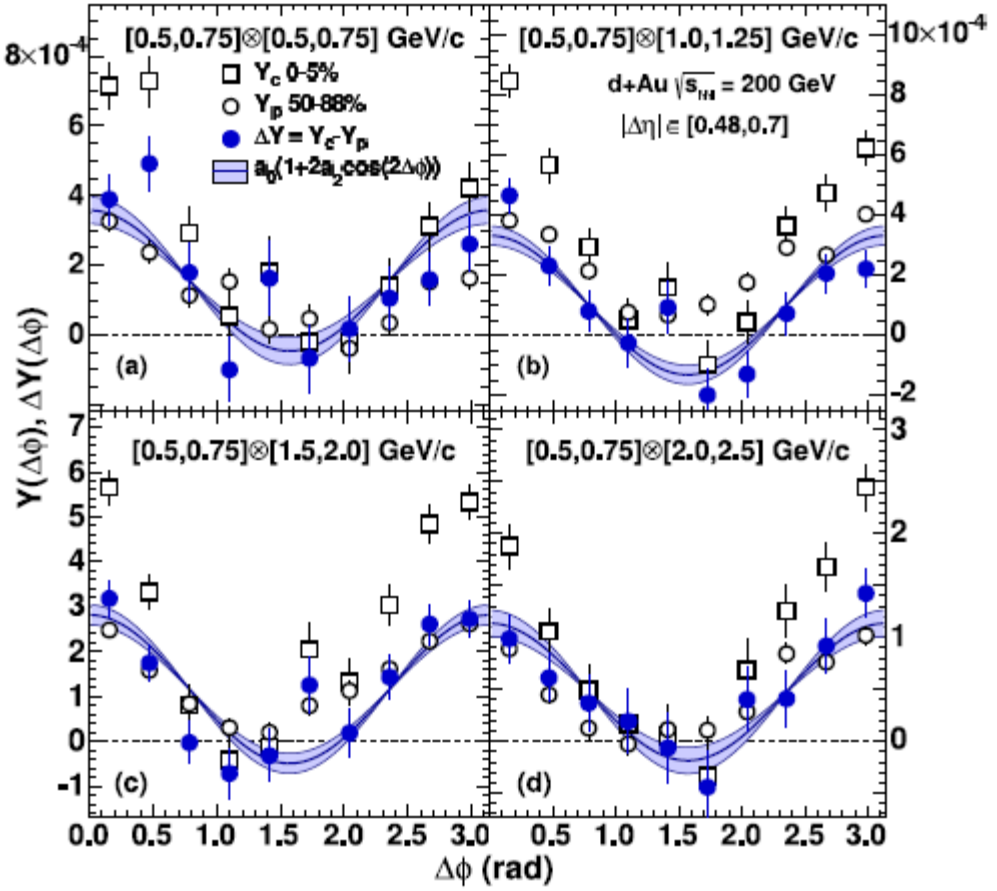
Lessons from previous experience

- From the experience of LHC:
  - We need to select high multiplicity events
- From measuring v_2 in Au+Au collisions:
  - The medium in d+Au is thin, the non-flow contribution is strong
  - Need to remove the non-flow contribution as cleanly as possible

Measuring dAu v_2/ridge in PHENIX

- Use two-particle correlation method
  - Both particles fall in central arm acceptance
  - $0.48<|\Delta\eta|<0.7$
- Select most central d+Au collisions (0-5%)
- Use peripheral d+Au collisions (50-88%) as a proxy for non-flow contributions
- After subtracting the non-flow contribution, extract the Fourier coefficients

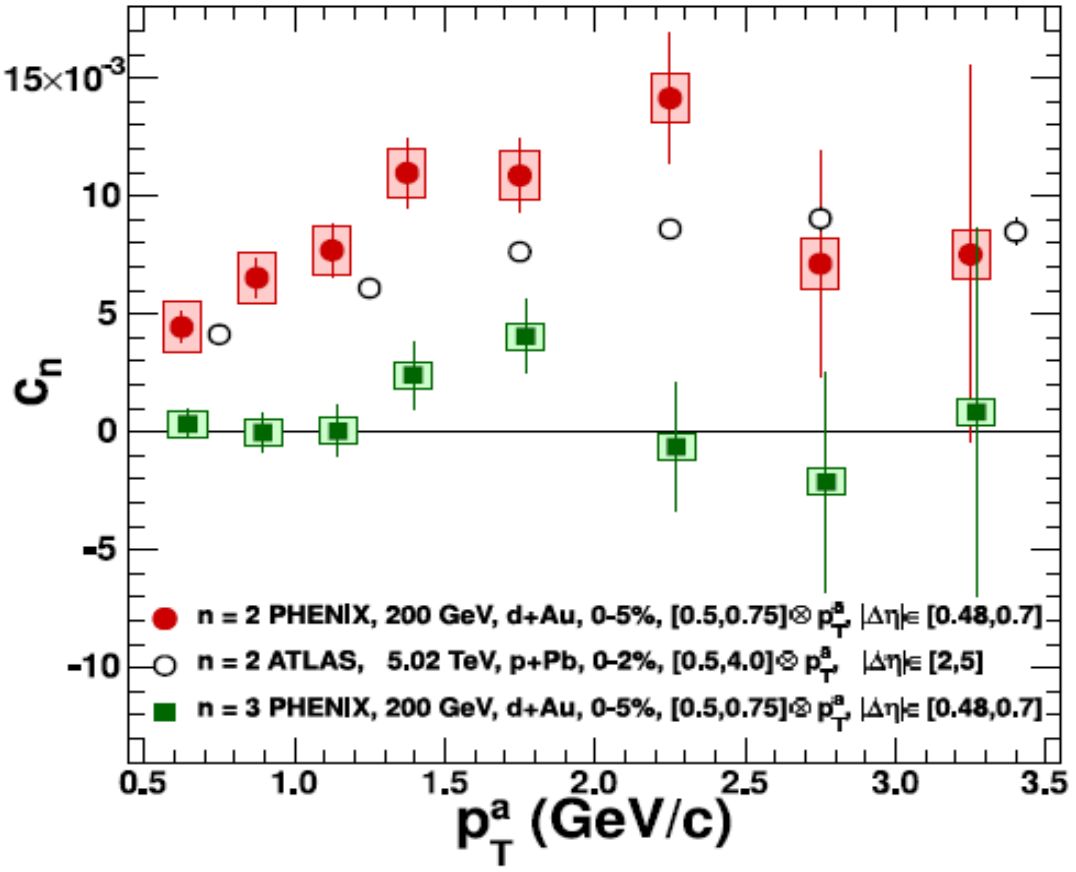
Correlation functions in d+Au



arXiv:1303.1794

- $0.48<|\Delta\eta|<0.7$
- 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 shape

c_2 (c_3) vs p_T

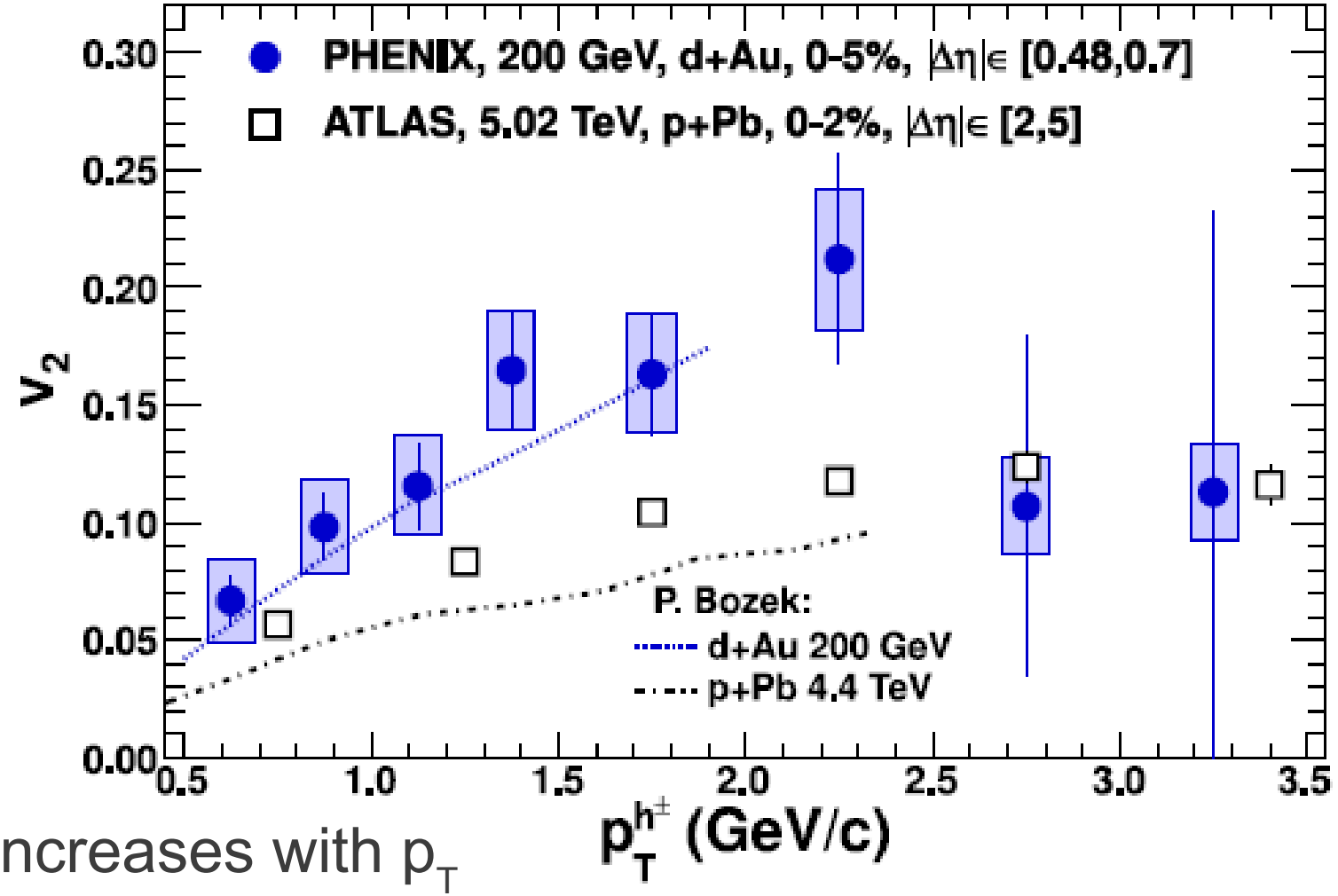


arXiv:1303.1794

- $c_n = v_n^A * v_n^B$
- 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 dAu!

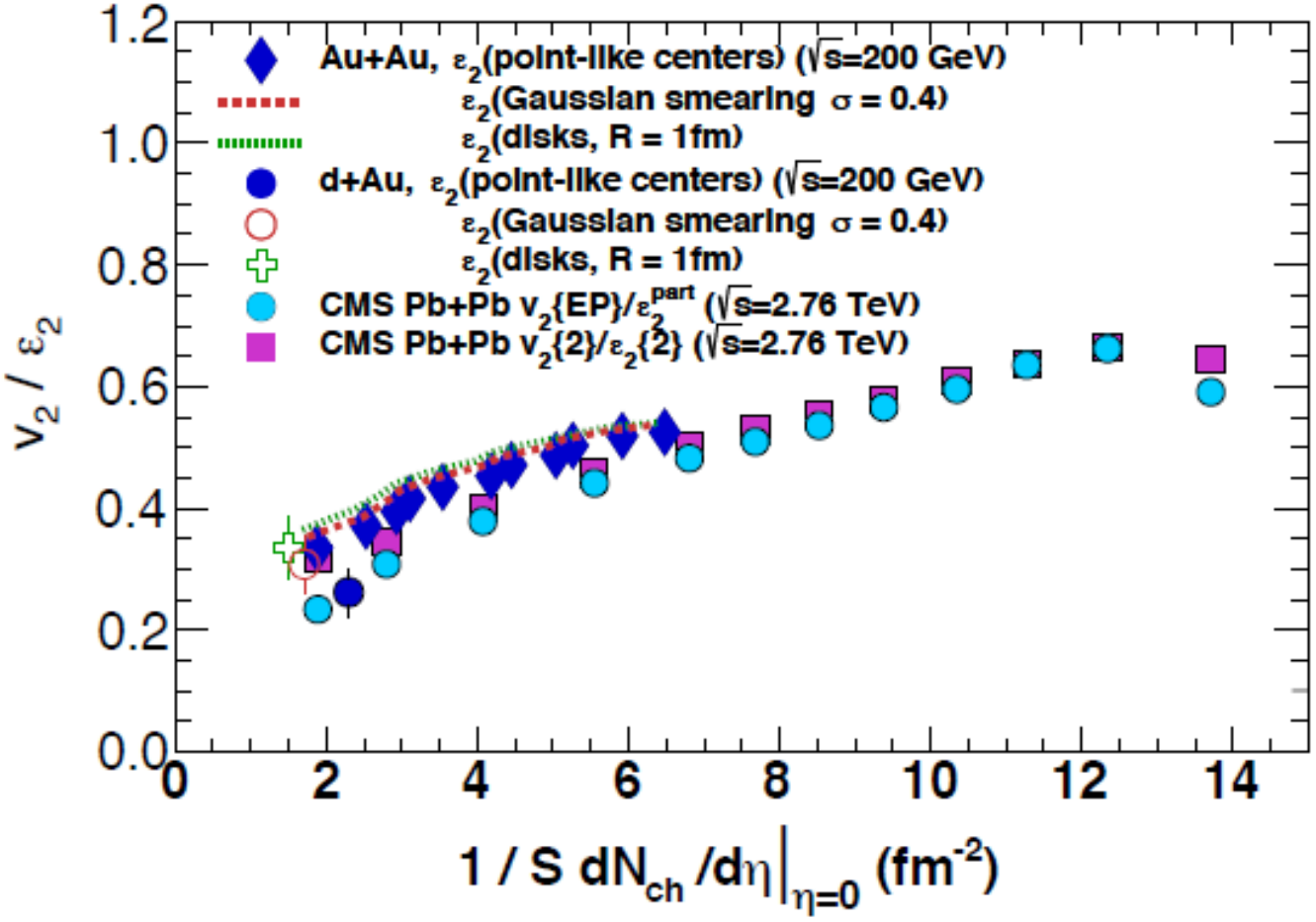
v_2 vs p_T

arXiv:1303.1794



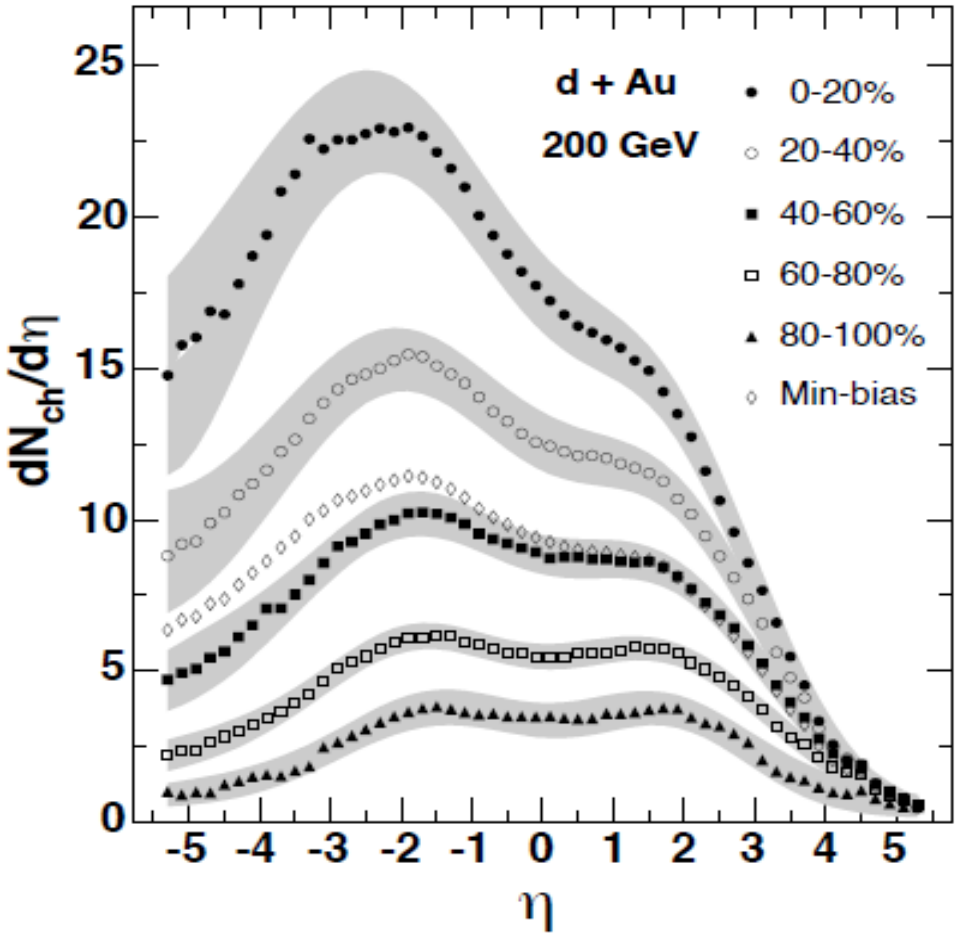
- v_2 increases with p_T
- v_2 in d+Au agrees well with hydro calculations up to 2 GeV
- v_2 in d+Au (@200 GeV) > v_2 in p+Pb (@ 5.02 TeV)

v_2/ε_2 vs 1/S dN/dη



- v_2/ε_2 in Au+Au (@200GeV) roughly follows the Pb+Pb trend (@ 5.02 TeV) in 1/S dN/dη
- d+Au roughly follows the trend

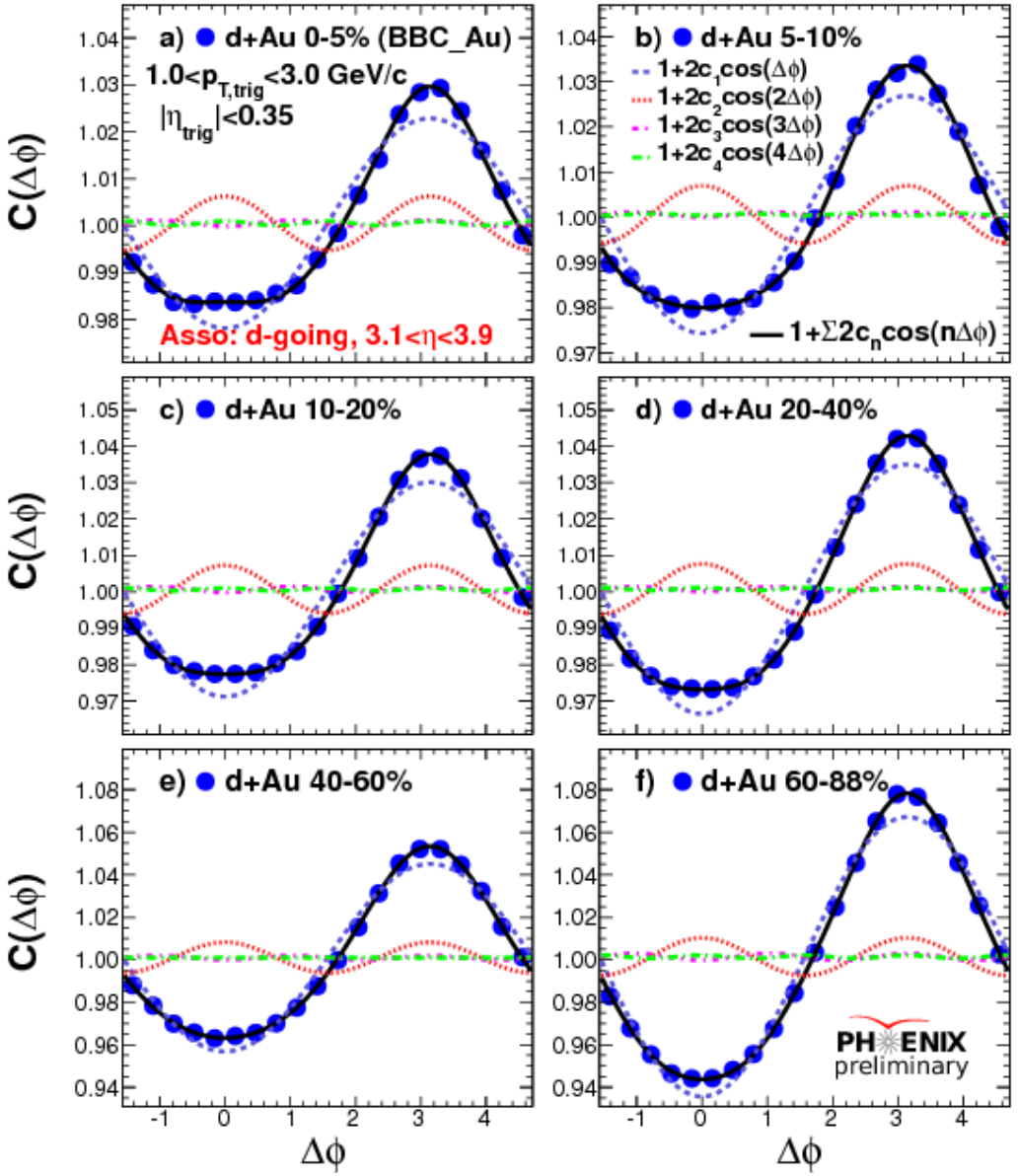
Central-forward (backward) correlation



PRC 72 031901

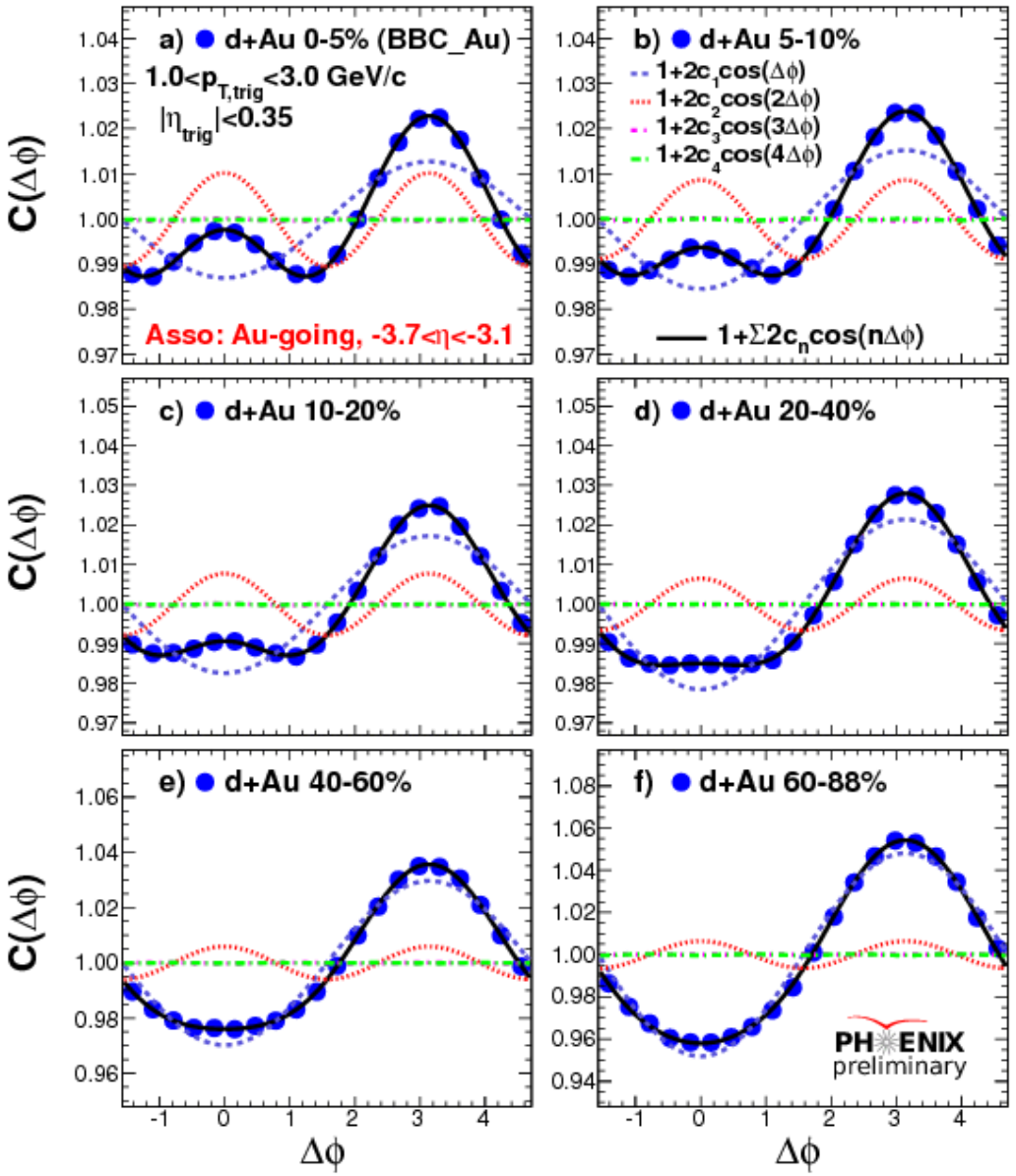
- The multiplicity distribution in d+Au collisions are asymmetric
- Measure the two-particle correlations of one particle at mid-rapidity (with central arm spectrometer, |eta|<0.35) and another particle at forward calorimeter (with Muon Piston Calorimeter, 3.1<|η|<3.9)

Central-forward (d-going side)



- When correlated with d-going side, there is no local maximum in correlations at $\Delta\phi$ ~0
- The correlation is dominate by c_1 contribution

Central-backward (Au-going side)



- When 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

Summary

- d+Au v_2 is measured via two particle correlation method in PHENIX
- The v_2 value is consistent with hydro calculations
- v_3 is consistent with 0
- When particles at mid-rapidity are correlated with particles at forward rapidity on Au-going side, a near-side correlation has been observed, where no correlation is seen in d-going side