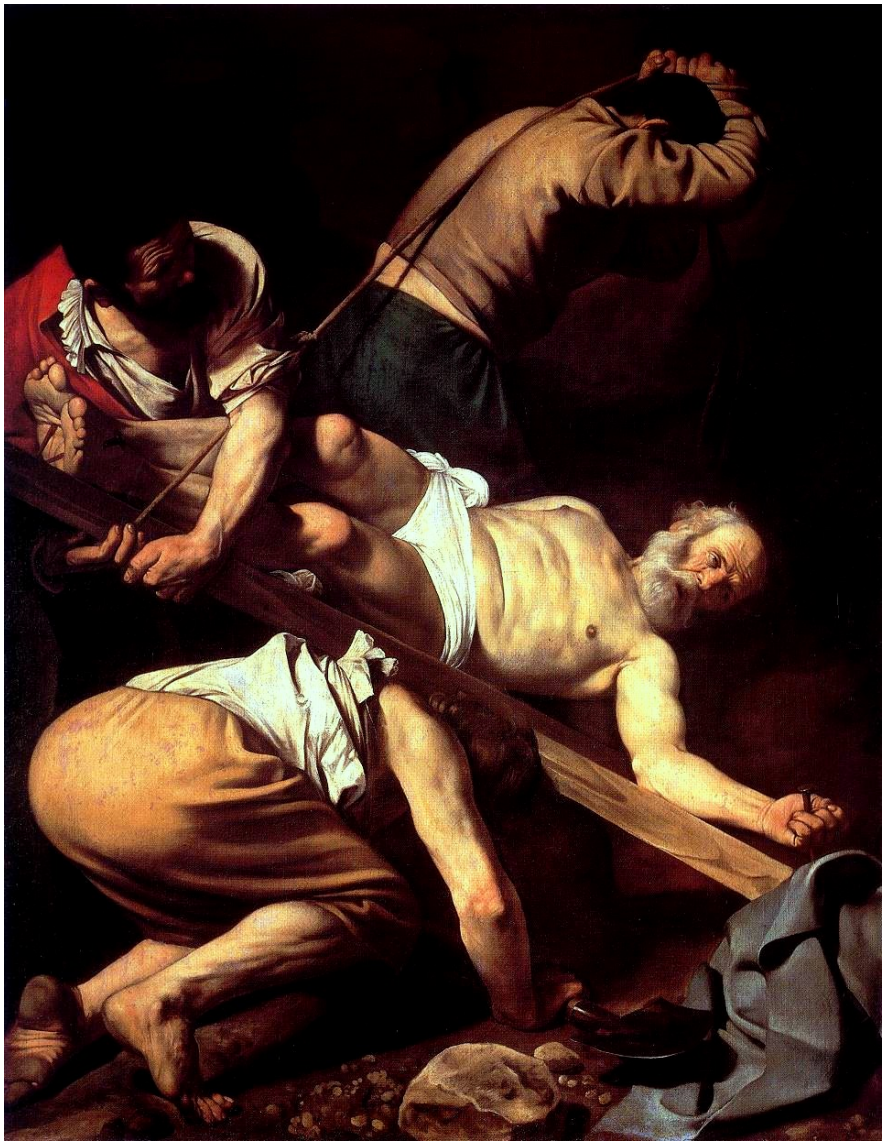


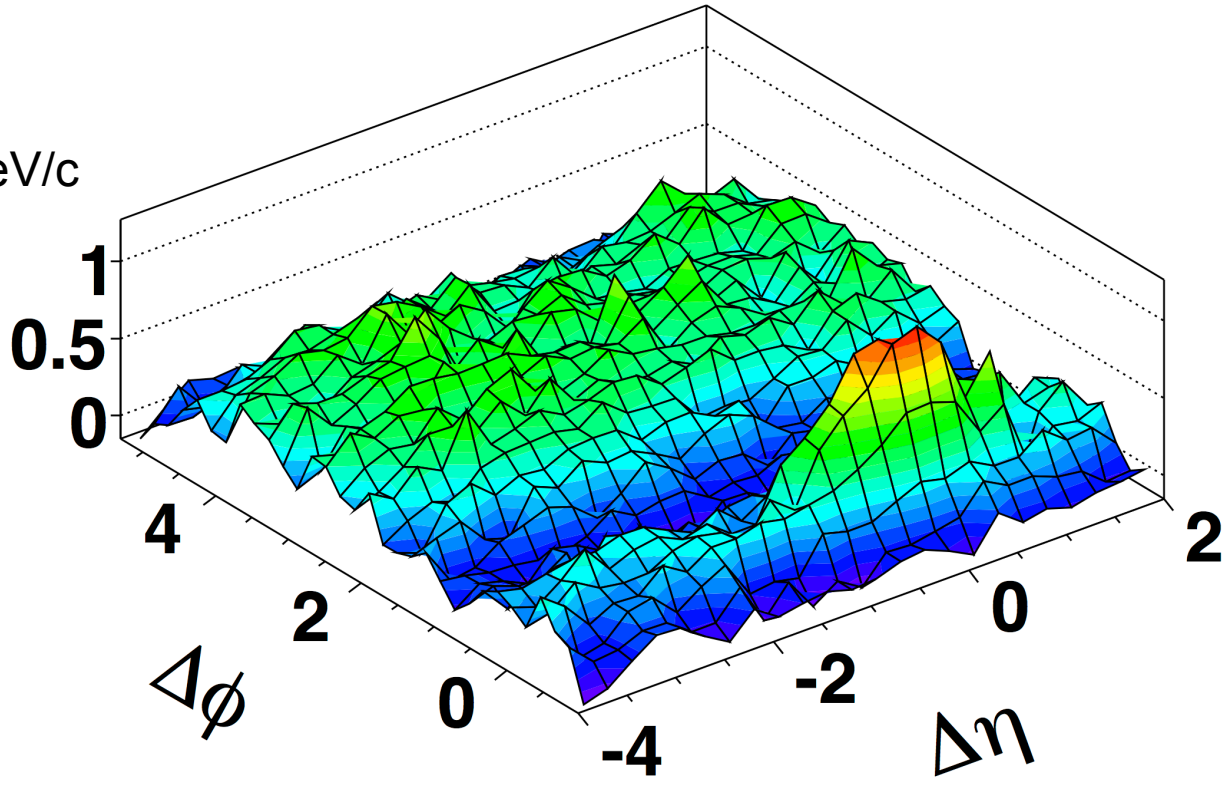
Dihadron Correlations, flow, and jets: Quo Vadis?

James Dunlop

Acceptance, acceptance

PHOBOS, Phys. Rev. Lett. 104, 062301 (2010)

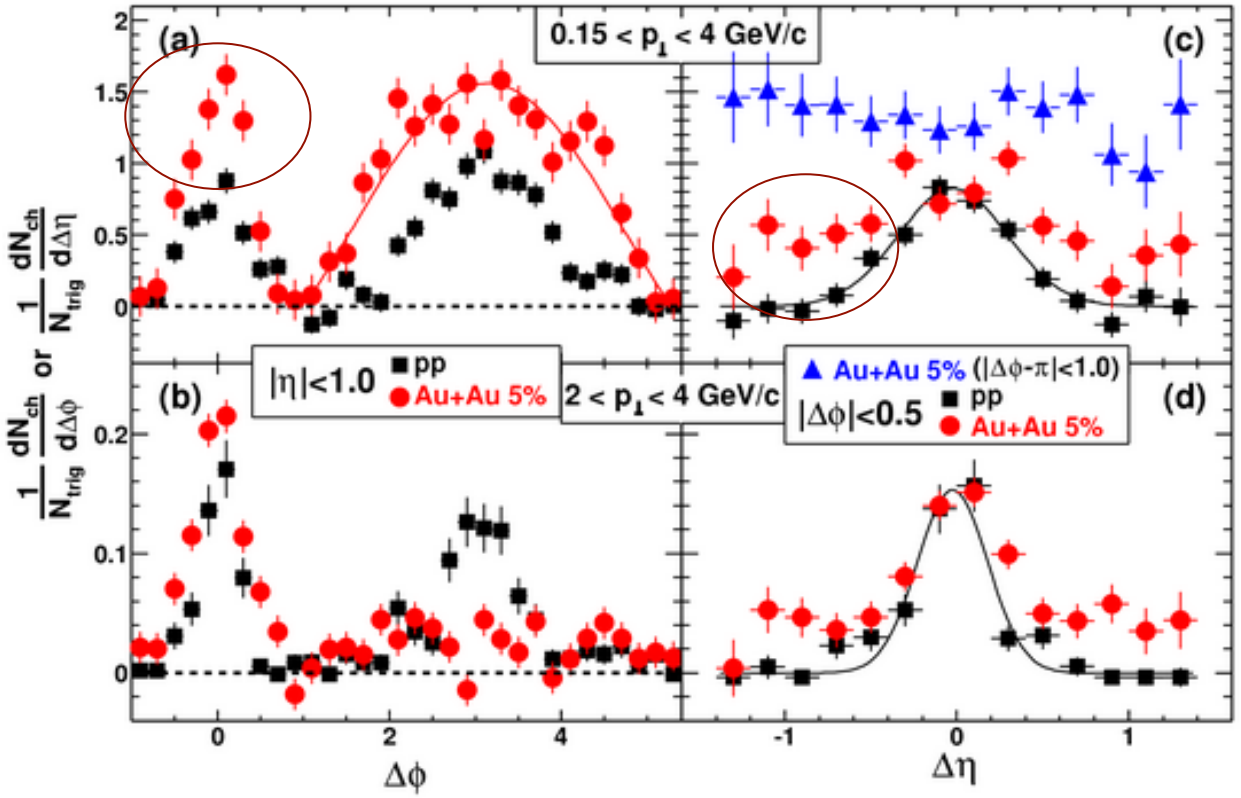
p_T^{trig} > 2.5 GeVc
p_T^{assoc} > 7-35 MeV/c



- Cleanest measurement at RHIC: PHOBOS
- Why? Acceptance allows for long-range vs. short-range

Ridge-ology

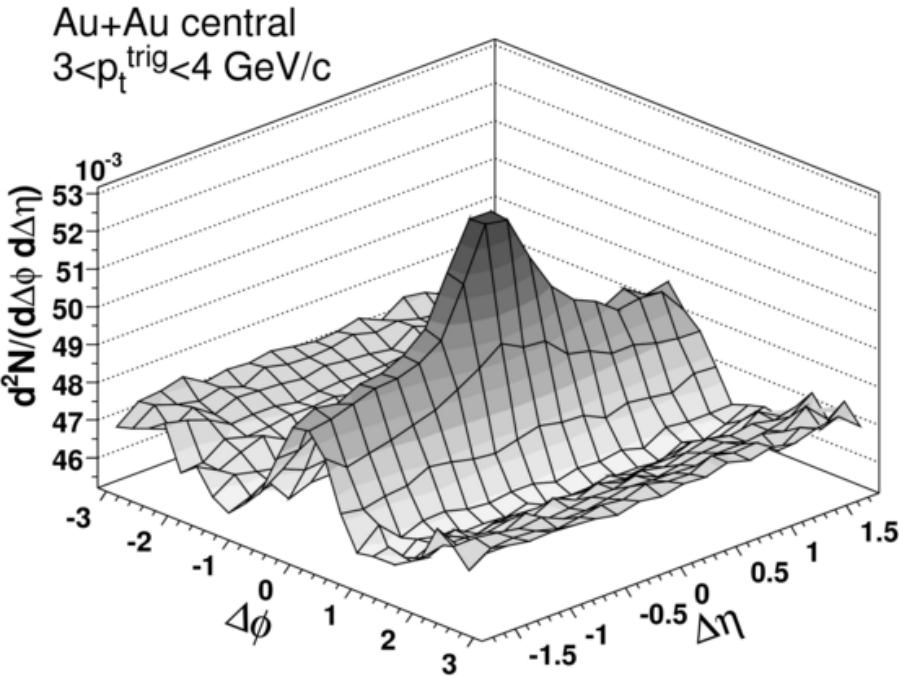
STAR, Phys. Rev. Lett. 95 (2005) 152301

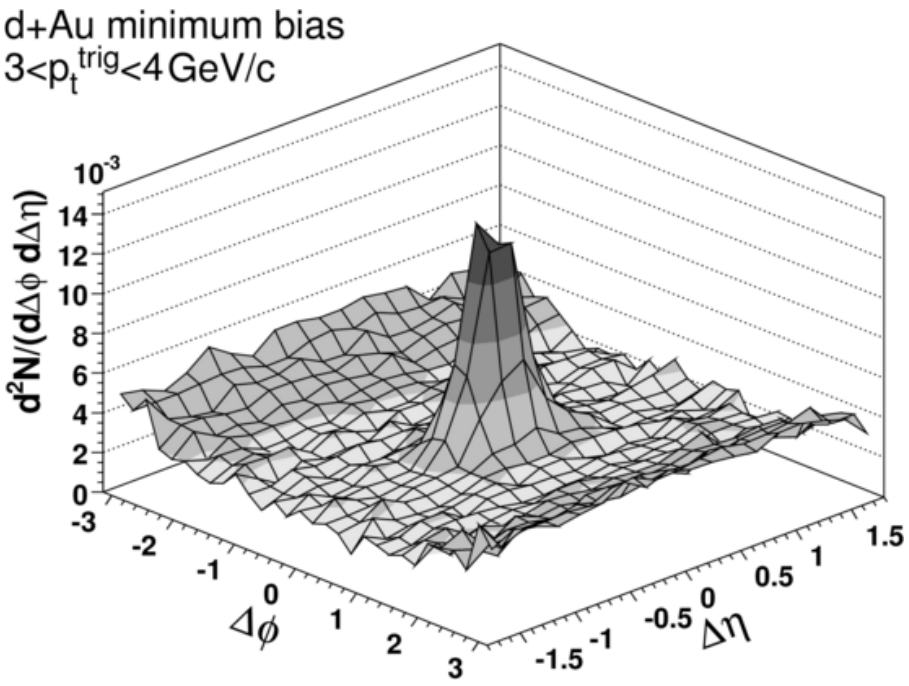


- First found as a “discrepancy” between analyses
  - Earlier measurements did not attempt to correct Δη triangular acceptance imposed by η cuts: deemphasized high-η correlation structure

“Hard” Ridge

STAR, Phys. Rev. C **80** (2009) 64912 $2<p_T^{assoc}<p_T^{trig}$

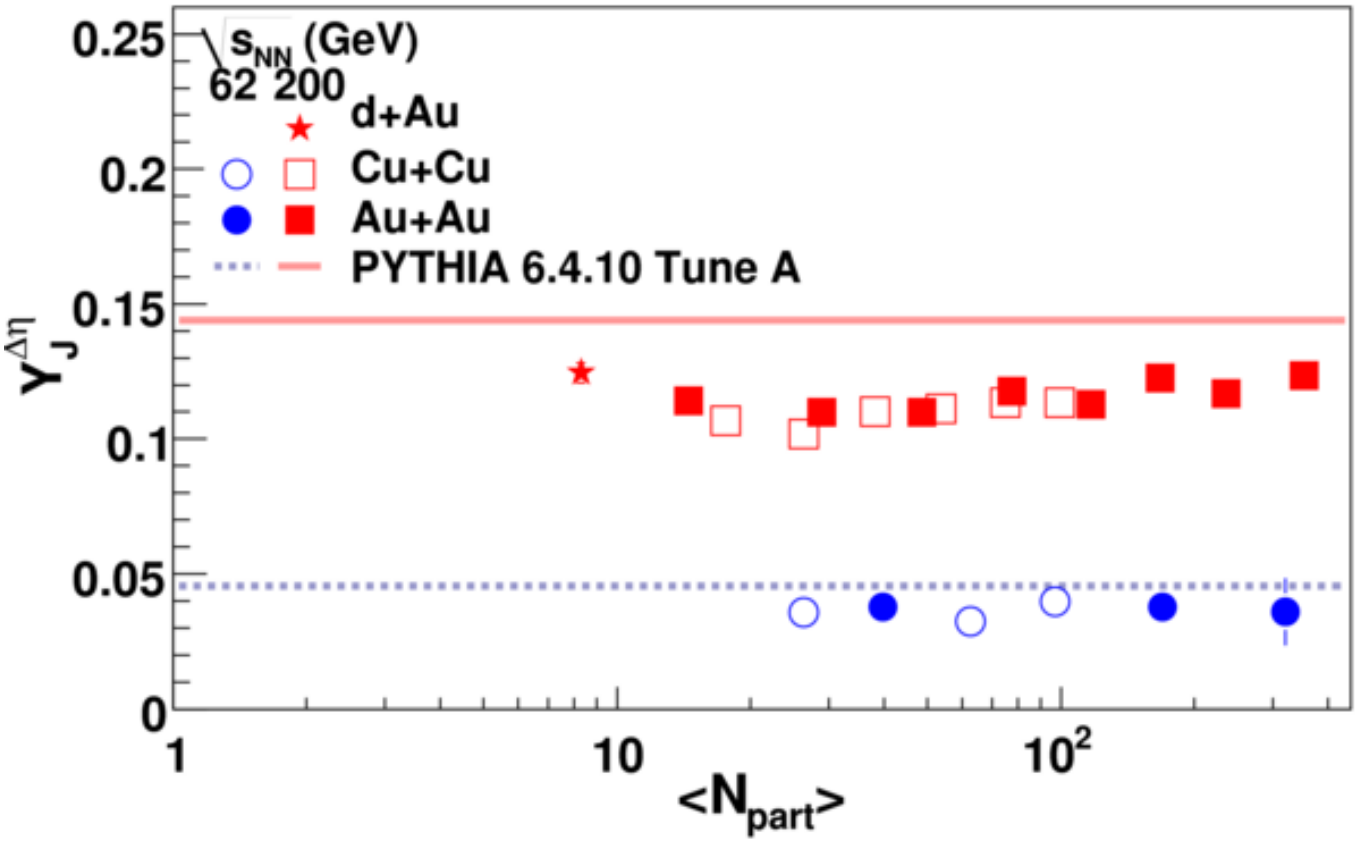




- d+Au used as reference, no sign of long-range structure
  - Attempted factorization into broadened dAu-like peak (“jet”) and long-range structure (“ridge”), after subtracting v_2.
  - Works to some level for harder triggers; factorization not so clear once triggers become softer, and “jet-like” peak widens further

“Jet-like” yield

STAR, Phys. Rev. C 85, 014903 (2012)

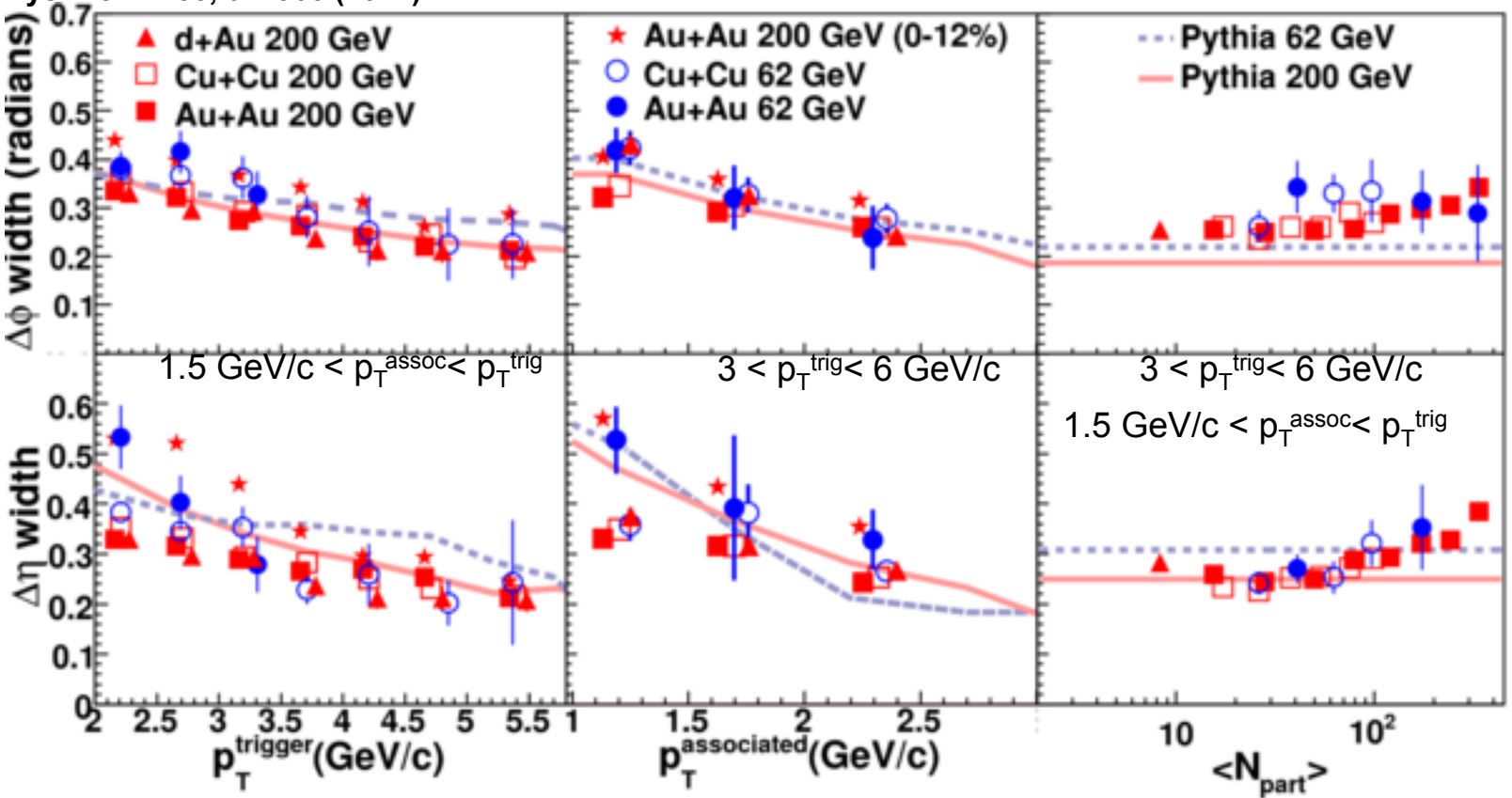


3 <p_T^{trig}<6 GeV/c
1.5 < p_T^{assoc}<p_T^{trig}

- “Jet-like” yield invariant over systems
  - Determined 2 ways:
    - Δφ peak, by subtracting 1.78 <|Δη|<0.78 from |Δη|<0.78
    - Δη peak, subtracting flat background 1.78 <|Δη|<0.78 from |Δη|<0.78

A note on “jet-like” peak widths

STAR, Phys. Rev. C 85, 014903 (2012)

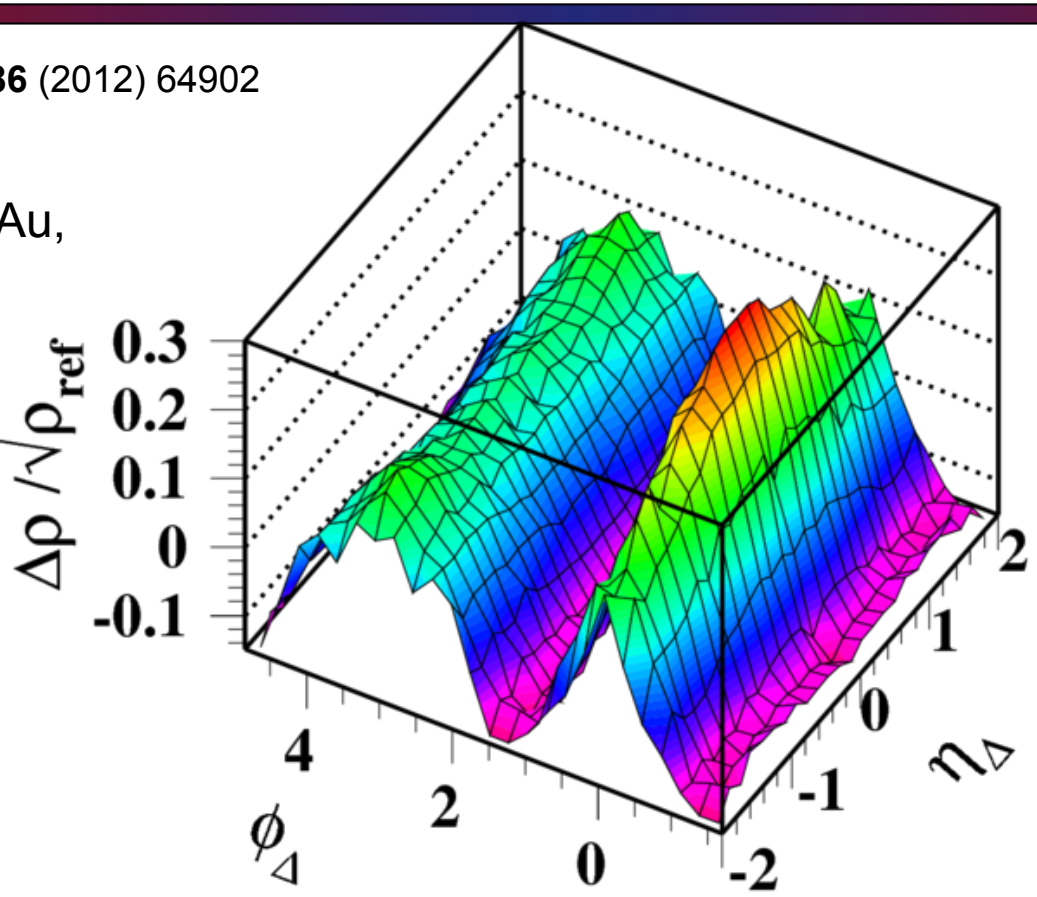


- Widths of peaks are sizeable, and p_T and N_{part} dependent
- Separation of “jet-like” from longer range problematic in STAR at low p_T: only a few sigma range, even pushing to limits of acceptance

Low p_T

STAR, Phys. Rev. C **86** (2012) 64902

200 GeV Au+Au,
0-5% Central

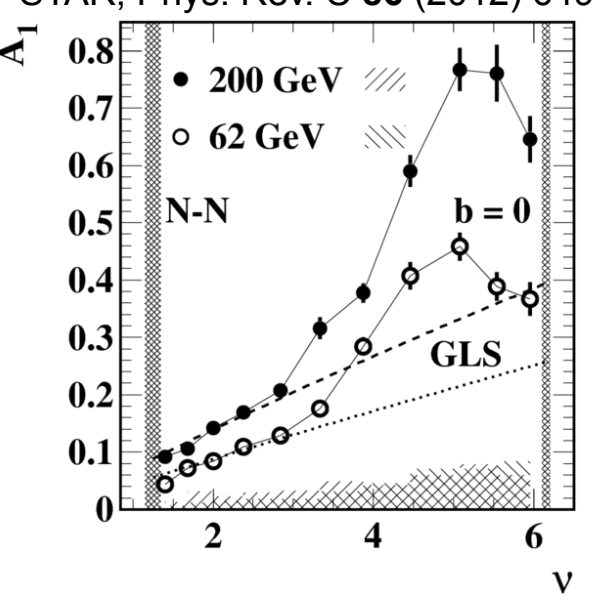


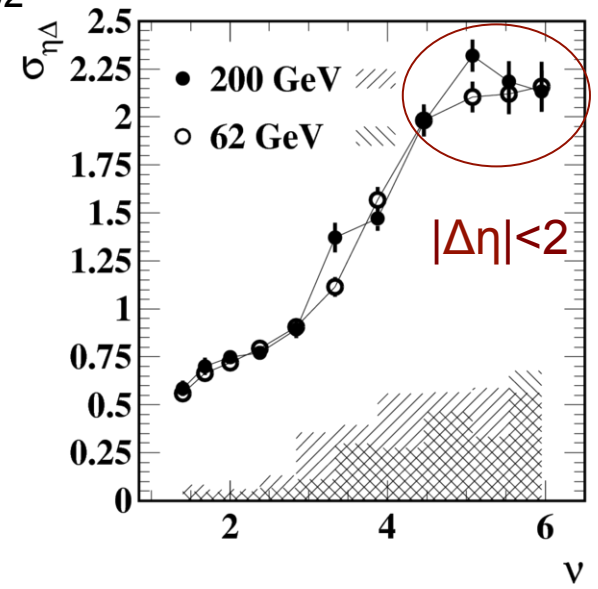
Symmetrized per-trigger normalized correlation function, p_T>0.15 GeV/c

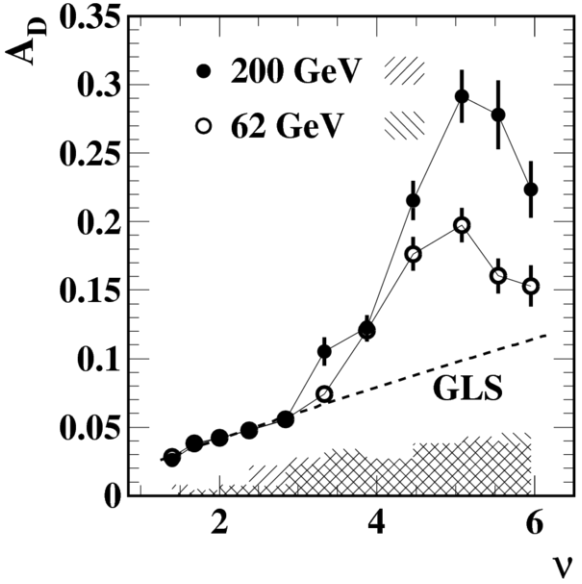
- No clear separation of long-range and short-range
- Multi-parameter fit to Δη-independent v_1 and v_2, 2-d Gaussian + offsets, narrow exponentials, a Δφ independent Gaussian, and away-side modulation in Δη

Alternative picture from fit model

STAR, Phys. Rev. C **86** (2012) 64902



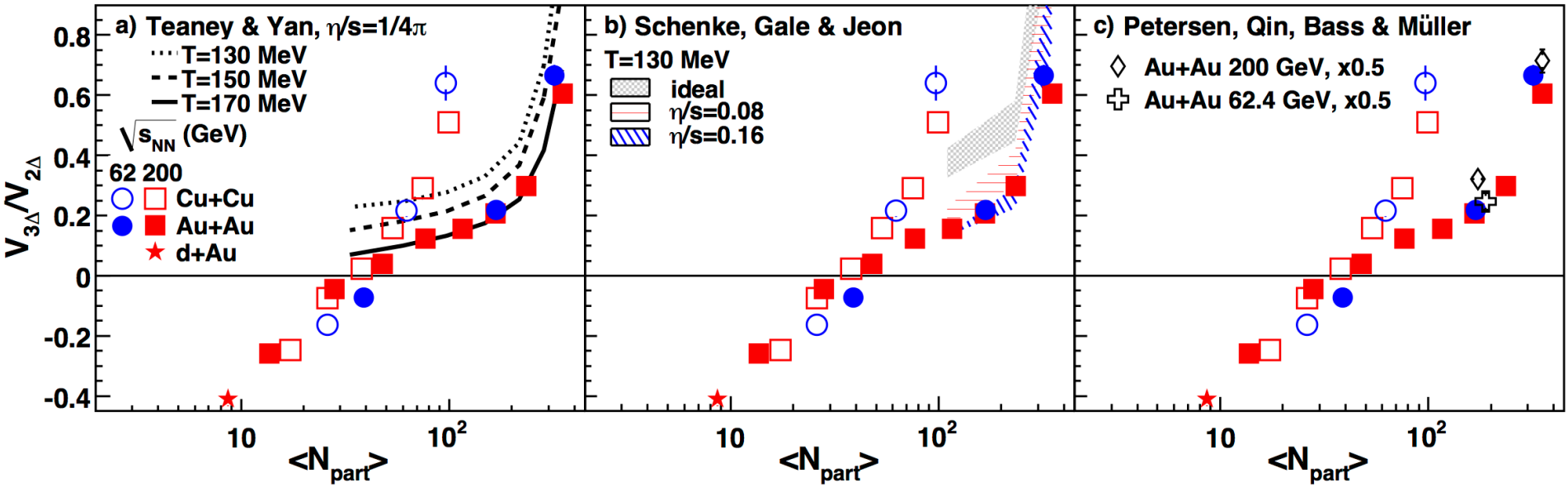




- Dramatic widening and amplitude increase of same-side 2-d Gaussian, accompanied by increase in v_1
  - Also: no sign of v_2 in most central collisions
- One fit model. Introduction of v_n into model picks up strength from Gaussian, esp. in v_3, and readjusts v_1 and v_2
- Can larger η acceptance distinguish?
  - iTPC upgrade will push to Δη ~3. Also can use FTPC's at η~2.5-4.

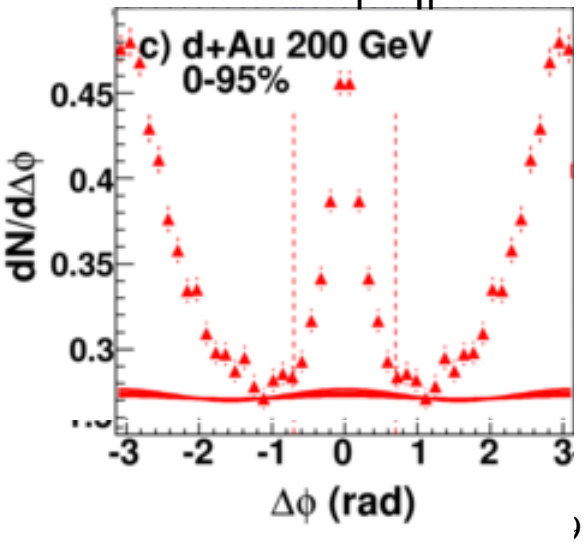
Back to triggered data: V_n

STAR, Phys. Rev. C 85, 014903 (2012) 2< p_T^{trig}< 6 GeV/c 1.5 GeV/c < p_T^{assoc}< p_T^{trig}



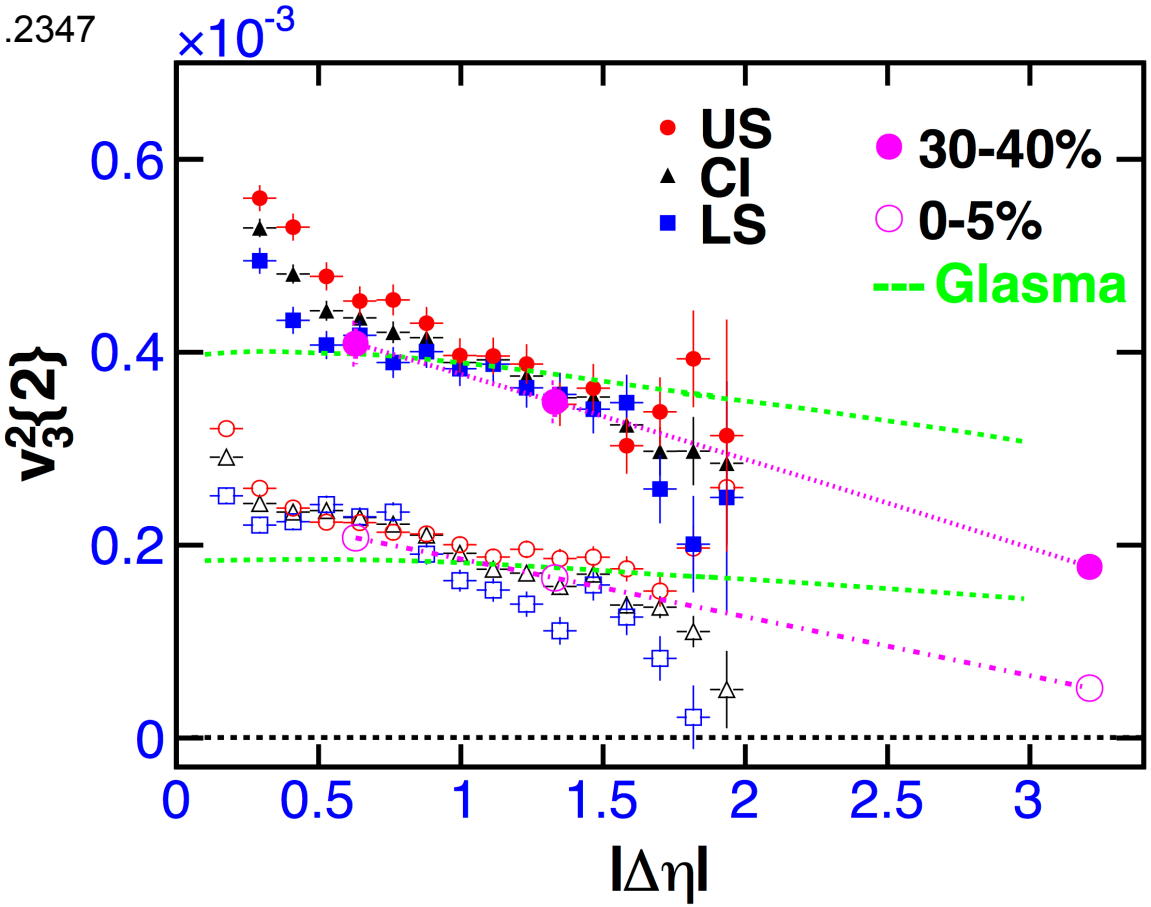
- Data fit to 2-d Gaussian in φ,η + η-independent harmonics up to 4th order
- N.B.: Negative $V_{3\Delta}$ in d+Au collisions
  - Picks up away-side jet-like correlation
- Disadvantage: pushing hydro to limits of applicability by requiring large p_T

|Δη|<1.78



An attempt to measure v_3 at low p_T

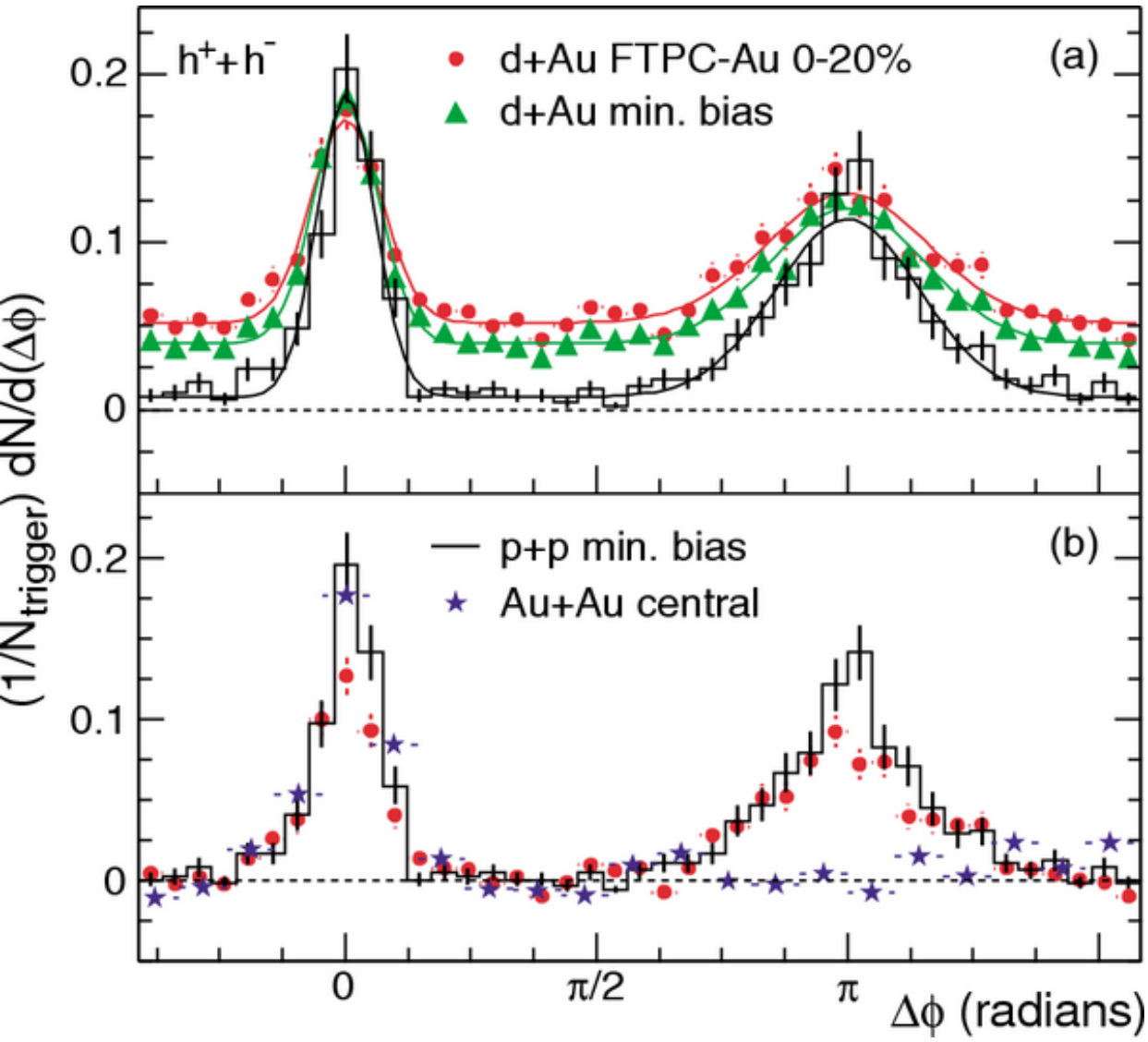
STAR, arXiv:1301.2347



- Assume: no jet-like peak at all at low p_T, just fit to harmonics
- Strong dependence on |Δη|
  - N.B. 3 large points from 3 different analysis techniques, including event planes of FTPC, TPC, and 2-particle correlations with large |Δη| imposed

Back to d+Au

Actual published figure from STAR, Phys. Rev. Lett. **91** (2003) 072304



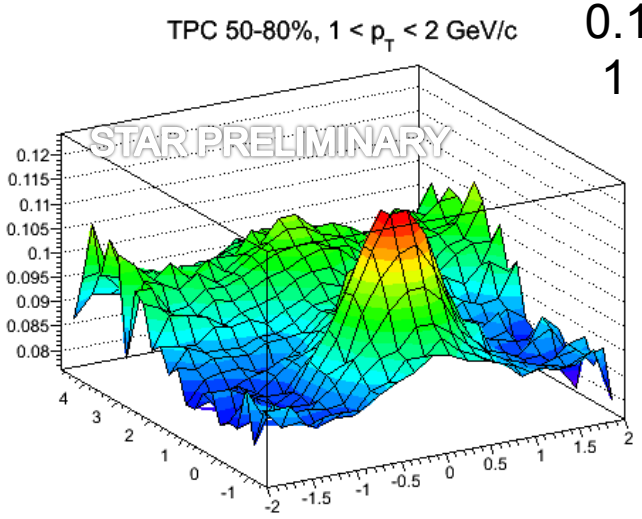
- 2003: d+Au just like p+p at mid-rapidity
- N.B.
  - $|\eta| < 0.7$
  - $|\Delta\eta| < 1.4$
  - No correction for triangular acceptance
  - Au+Au corrected for v_2 in bottom panel
  - d+Au corrected for (flat) underlying event

Full 2-d correlations in d+Au

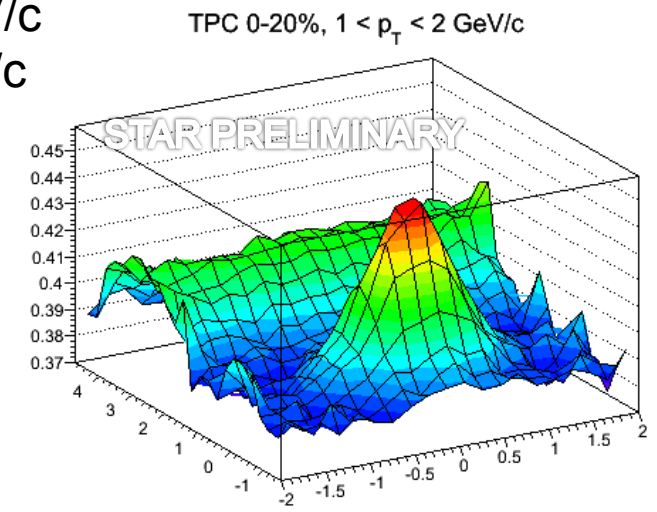
F. Wang, RBRC workshop Apr. 2013

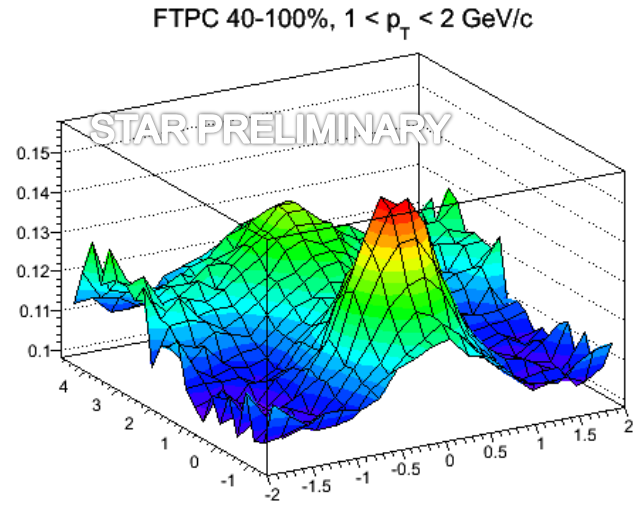
$0.15 < p_T^{trig} < 3$ GeV/c

$1 < p_T^{assoc} < 2$ GeV/c

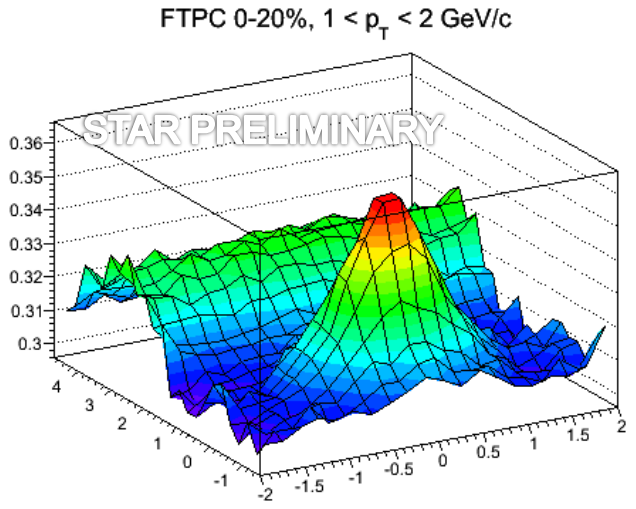


TPC mult.
$|\eta|<1$
as centrality





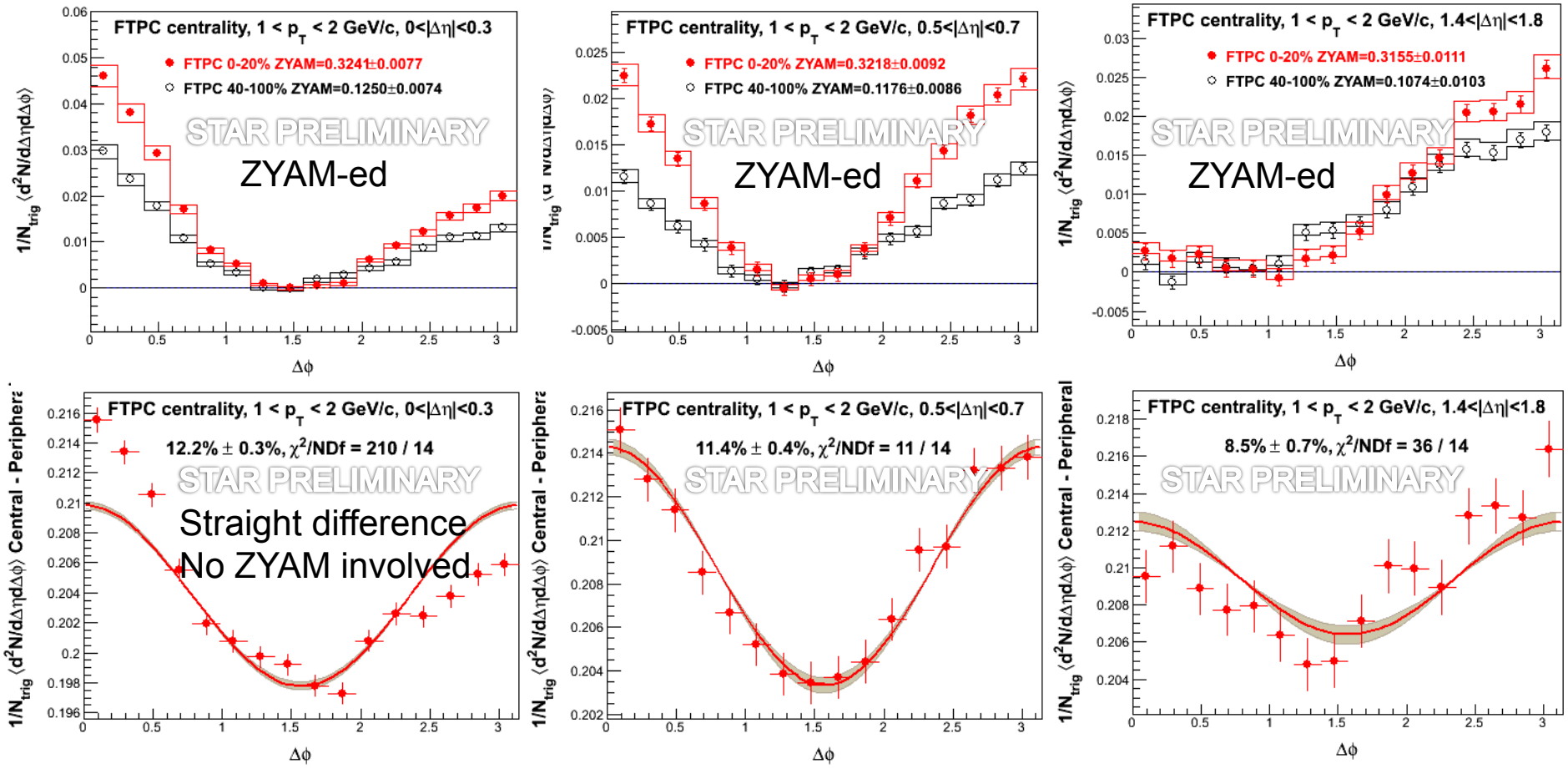
FTPC mult.
$-3.8<\eta<-2.8$
as centrality



Δφ projections in different Δη (FTPC mult. -3.8<η<-2.8 as centrality)

F. Wang, RBRC workshop Apr. 2013

$0.15 < p_T^{trig} < 3$ GeV/c, $1 < p_T^{assoc} < 2$ GeV/c

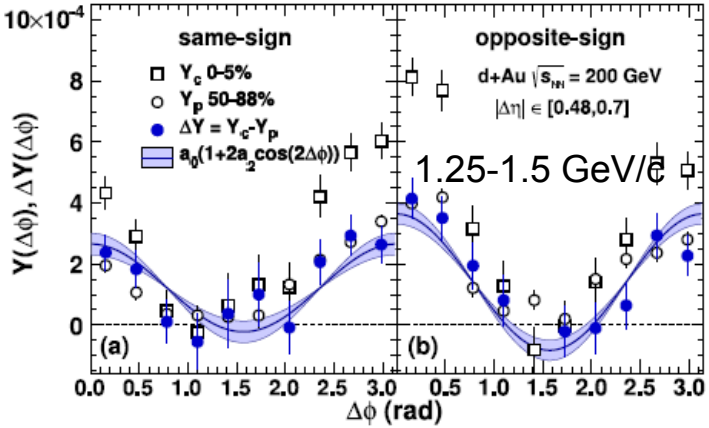


- ZYAM syst. error from different sizes of Δφ region for ZYAM.
- Efficiency corrected: 85 ± 5% .

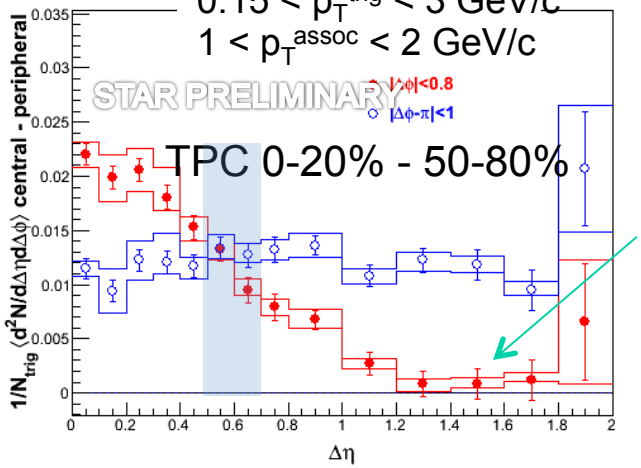
Ridge in d+Au?

F. Wang, RBRC workshop Apr. 2013

PHENIX, arXiv:1303.1794

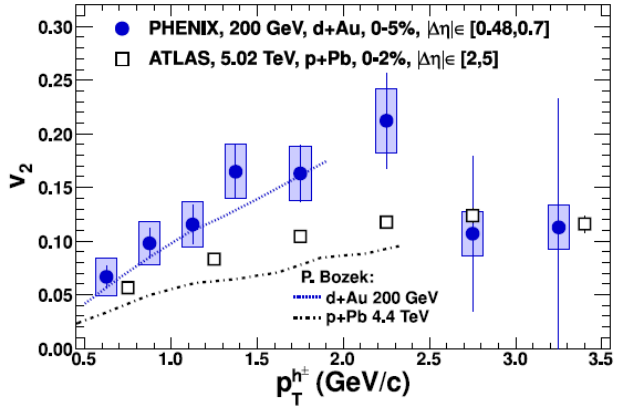


$0.15 < p_T^{trig} < 3$ GeV/c
$1 < p_T^{assoc} < 2$ GeV/c

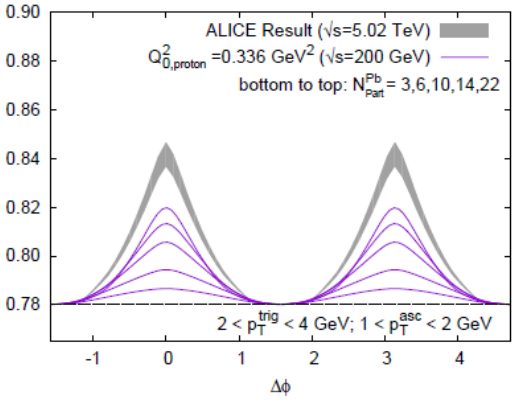


Minimal ridge

Bozek, PRC85 (2012)



Dusling and Venugopalan, arXiv:1302.7018



- Very little sign of a ridge at large $|\Delta\eta|$ in d+Au

Summary

New paradigm of higher harmonics as explanation for long-range Δη correlations

But multiple complications have led to interpretational difficulties: need acceptance

- Distinguish “long-range” from “short-range”, if that is even meaningful
  - Is short-range from jets? Or Δη-dependent v_n?
- “Long-range” not guaranteed to be uniform in |Δη|
- Probably need to look in more detail at Ση

Acceptance of RHIC experiments on the edge of distinguishability, esp. at low p_T where short-range peak is wide

Signal of a ridge structure in d+Au much weaker at RHIC than at LHC