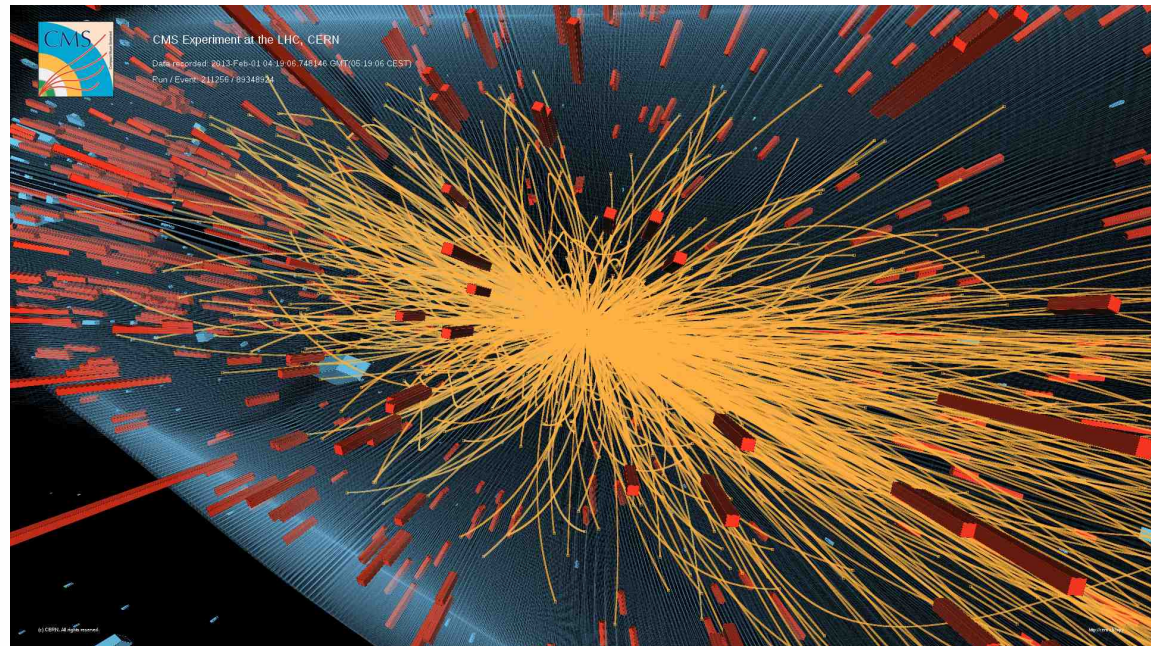
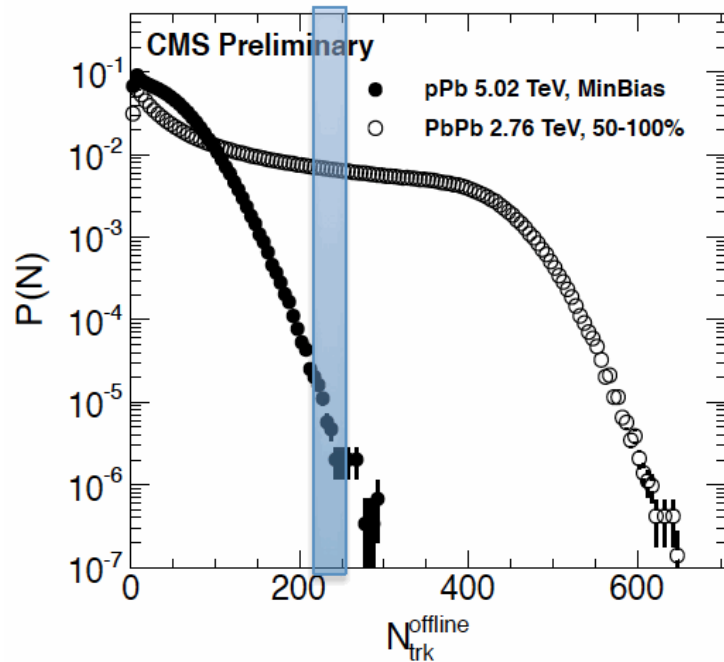


Jet, flow and correlation in pA and dA

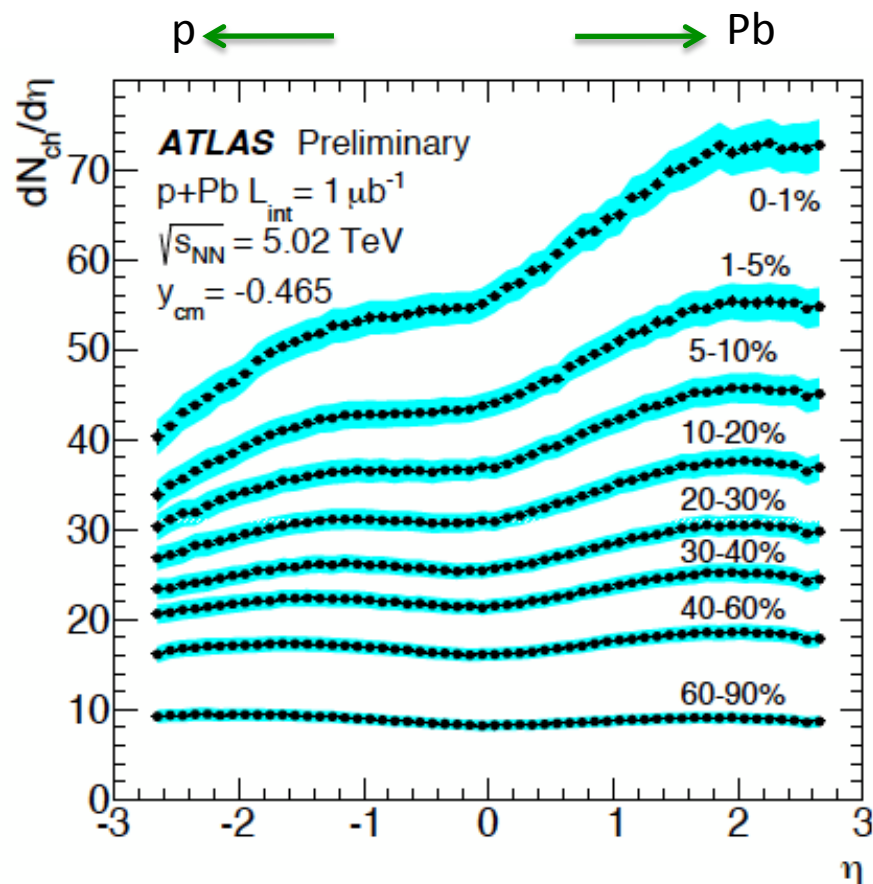
Shinichi Esumi, Univ. of Tsukuba

contents

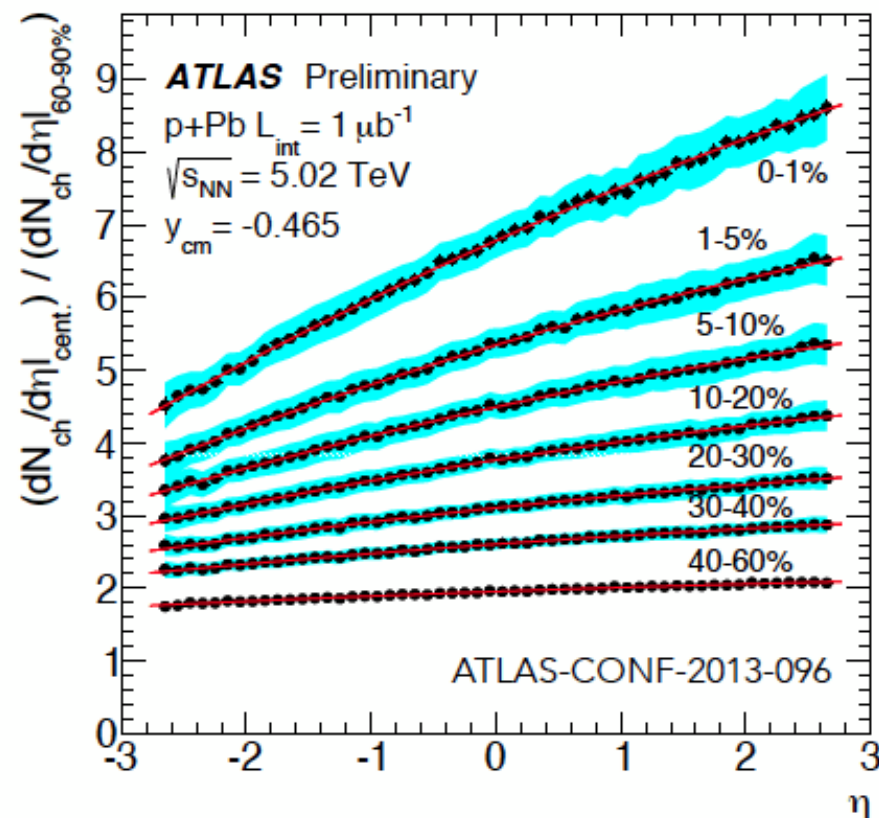
- Multiplicity, spectra, R_{pA} and jets
- Ridge-like correlation and flow



Multiplicity measurements from ATLAS



HP2013, S. Milov



Mean p_T as a function of N_{ch}

PLB 727 (2013) 371-380

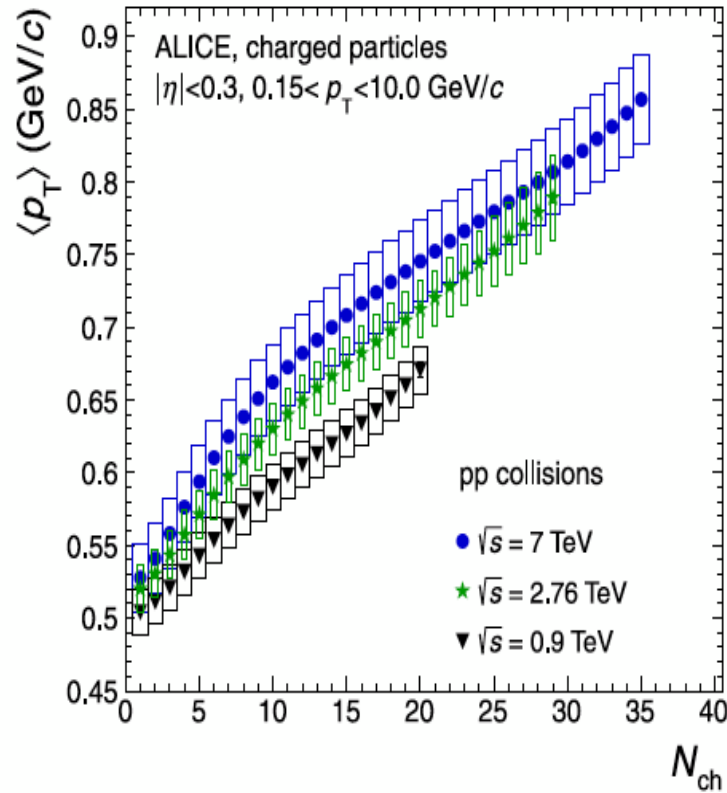


Fig. 1. Average transverse momentum $\langle p_T \rangle$ in the range $0.15 < p_T < 10.0$ GeV/c as a function of charged-particle multiplicity N_{ch} in pp collisions at $\sqrt{s} = 0.9, 2.76$, and 7 TeV, for $|\eta| < 0.3$. The boxes represent the systematic uncertainties on $\langle p_T \rangle$. The statistical errors are negligible.

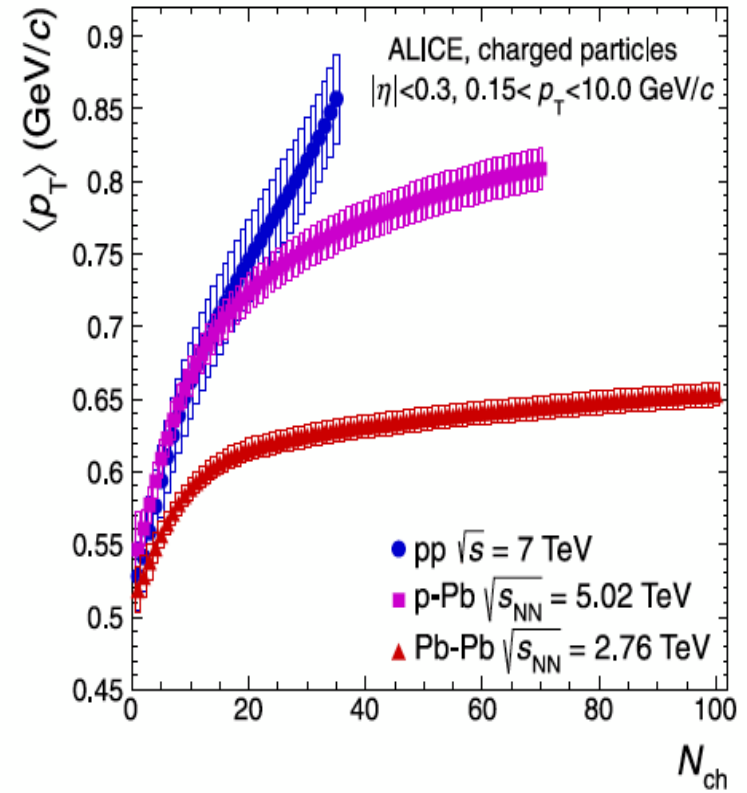
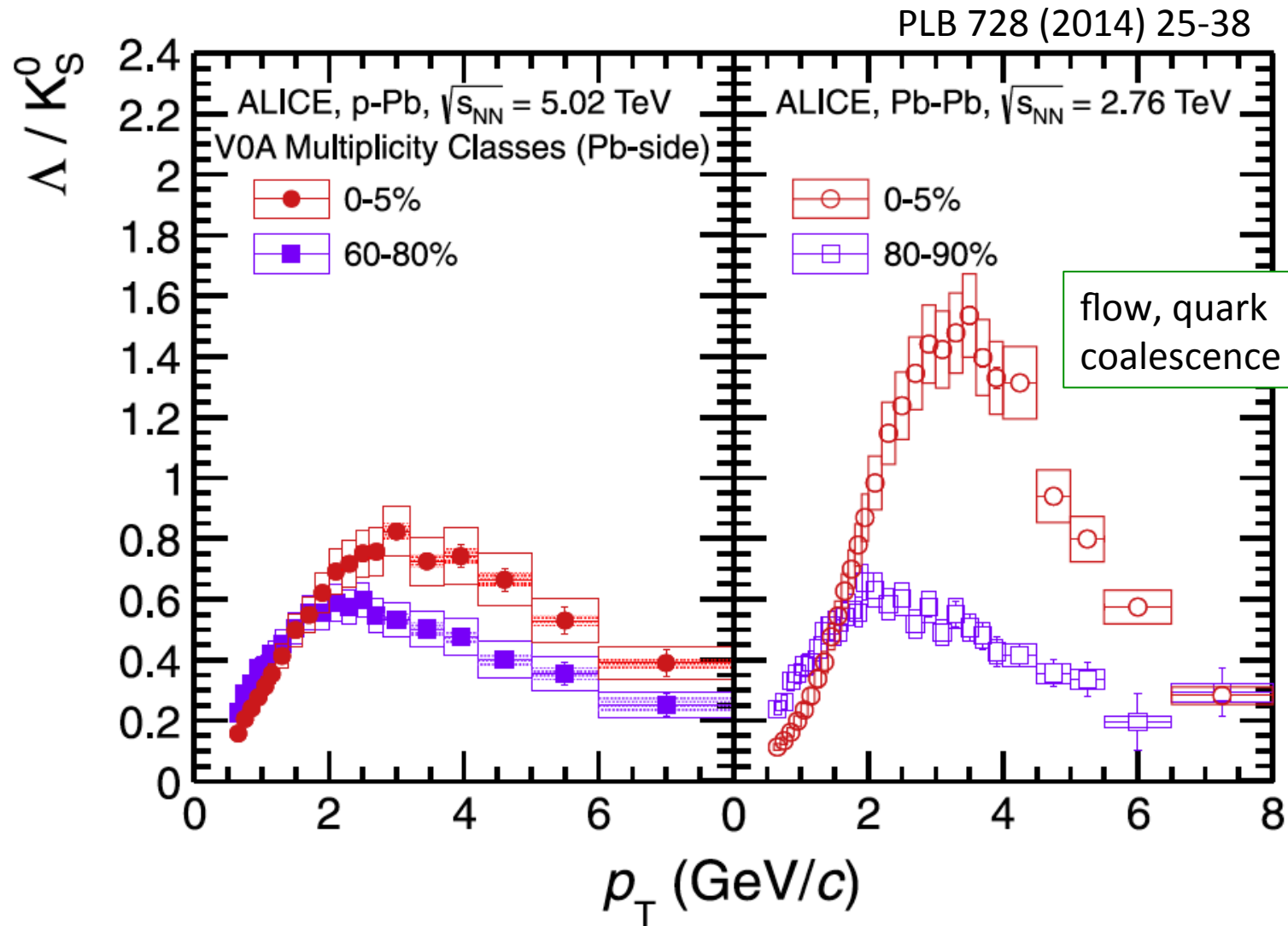
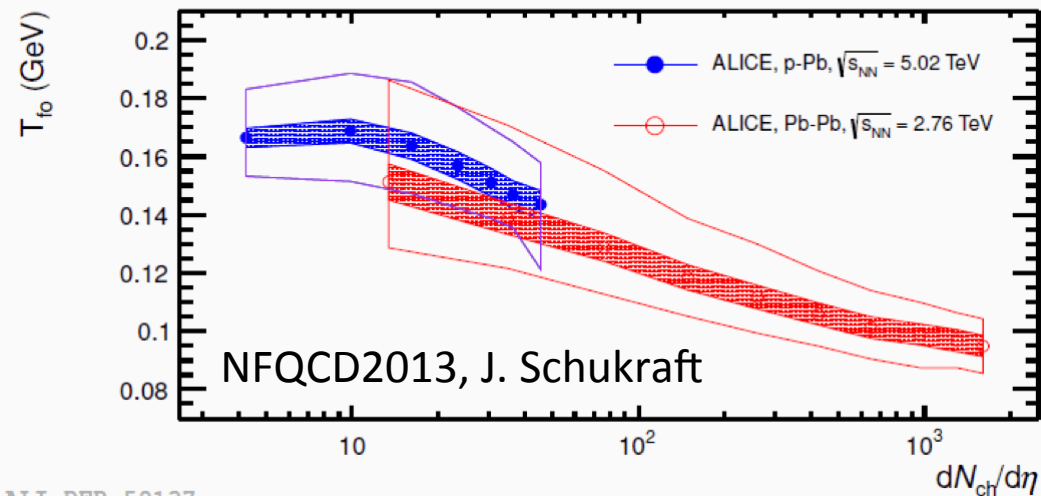
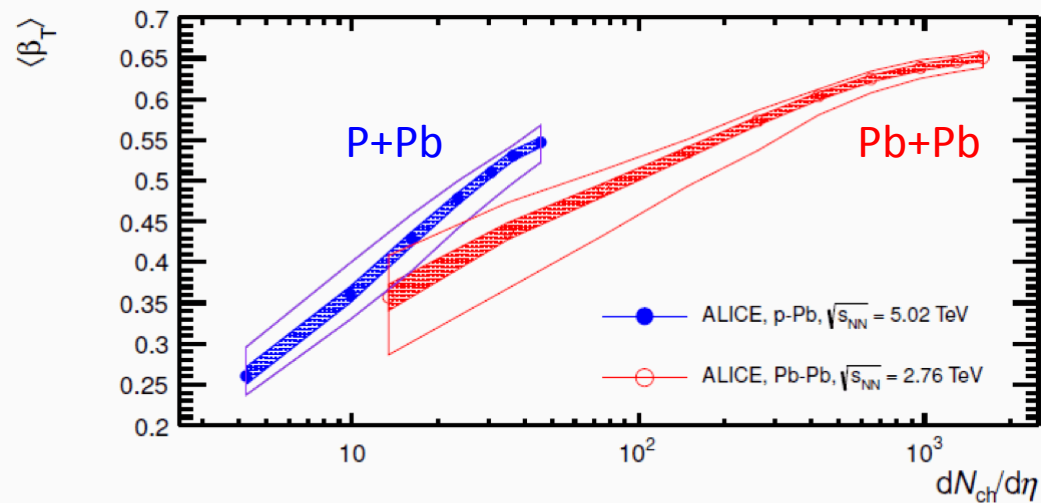


Fig. 2. Average transverse momentum $\langle p_T \rangle$ versus charged-particle multiplicity N_{ch} in pp, p-Pb, and Pb-Pb collisions for $|\eta| < 0.3$. The boxes represent the systematic uncertainties on $\langle p_T \rangle$. The statistical errors are negligible.

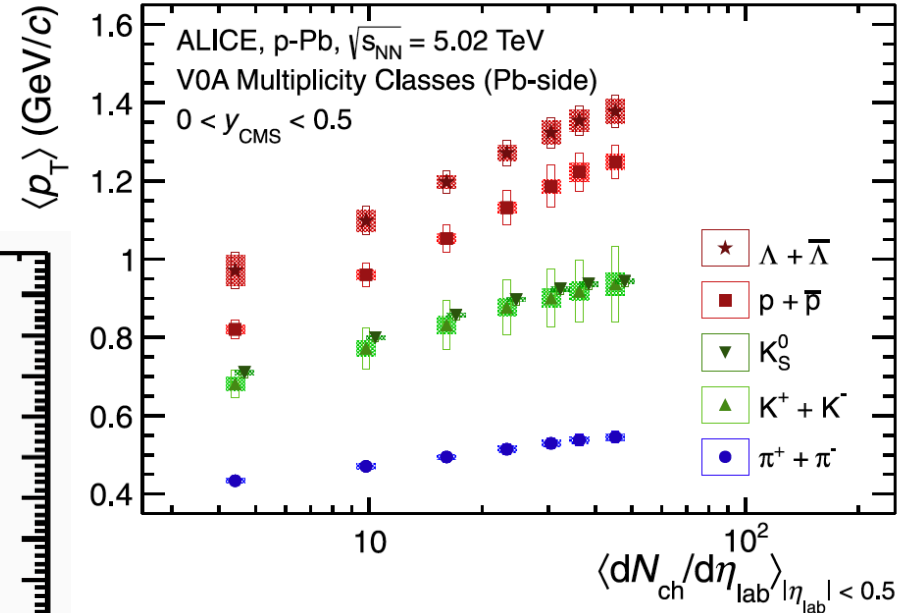
Baryon/Meson ratio



Hadron spectra



ALI-DER-58137



PLB 728 (2014) 25-38

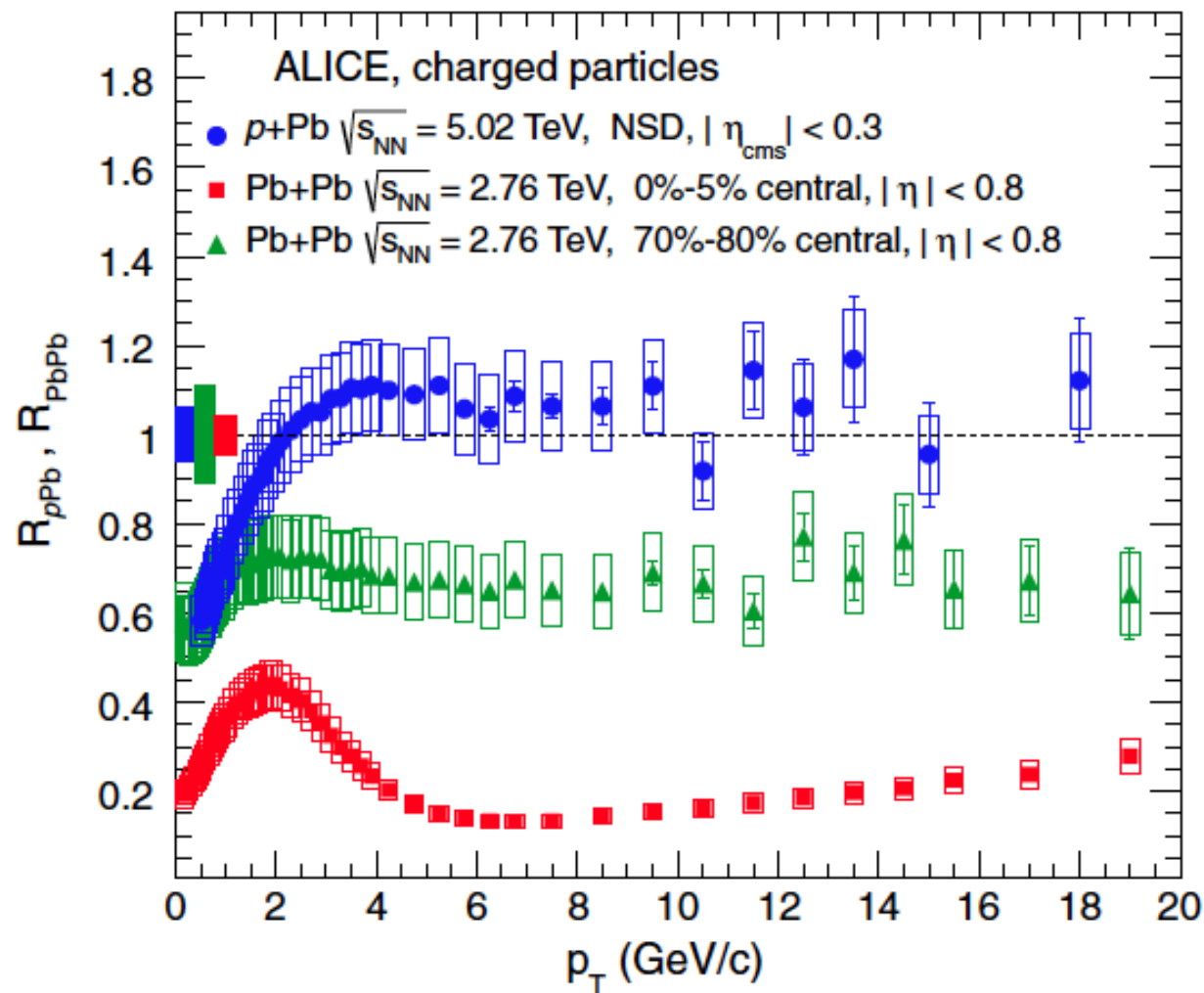
Fitting on π , K, p, Λ spectra with Blast-Wave (hydro inspired) functional form to extract freeze-out parameters (T_{fo} , β_T)

R_{pA} vs R_{AA}

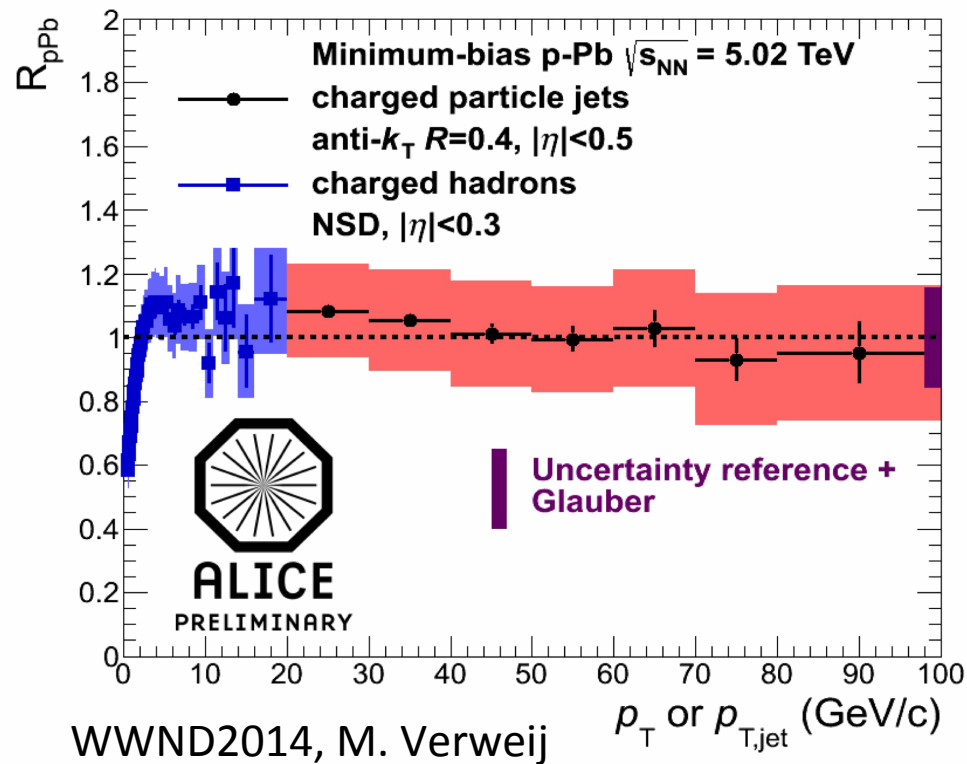
PRL 110, 082302 (2013)

pA as a controlled
experiment for
comparison to AA

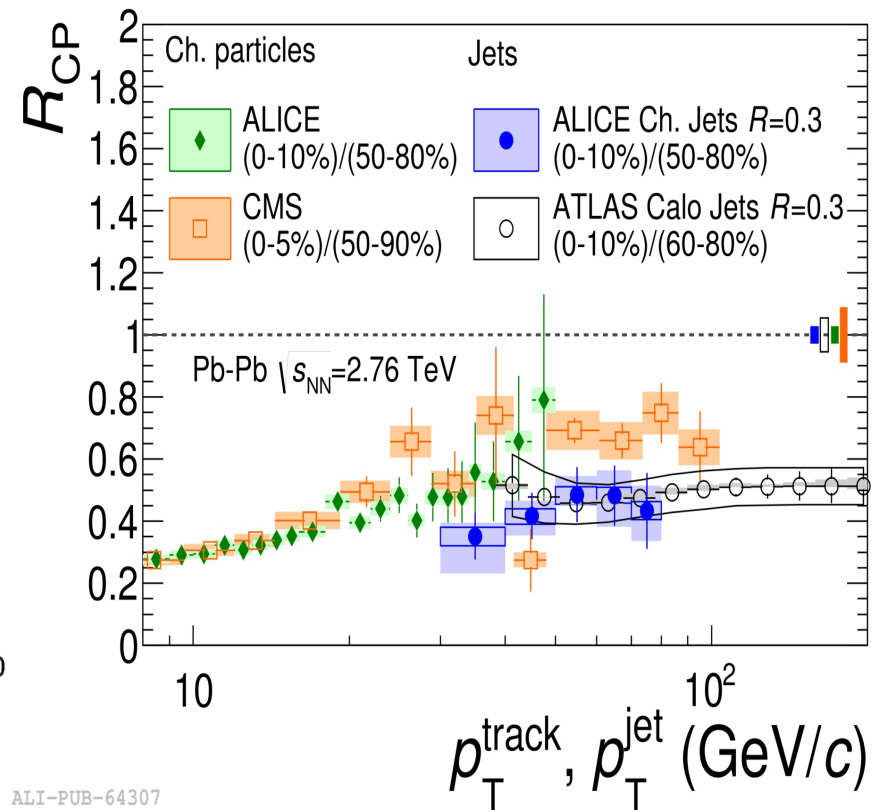
This provides that the
suppression in AA is not
an initial state effect



Jet R_{pPb} (p+Pb 5.02TeV) vs Jet R_{CP} (Pb+Pb 2.76TeV)



ALI-DER-63814

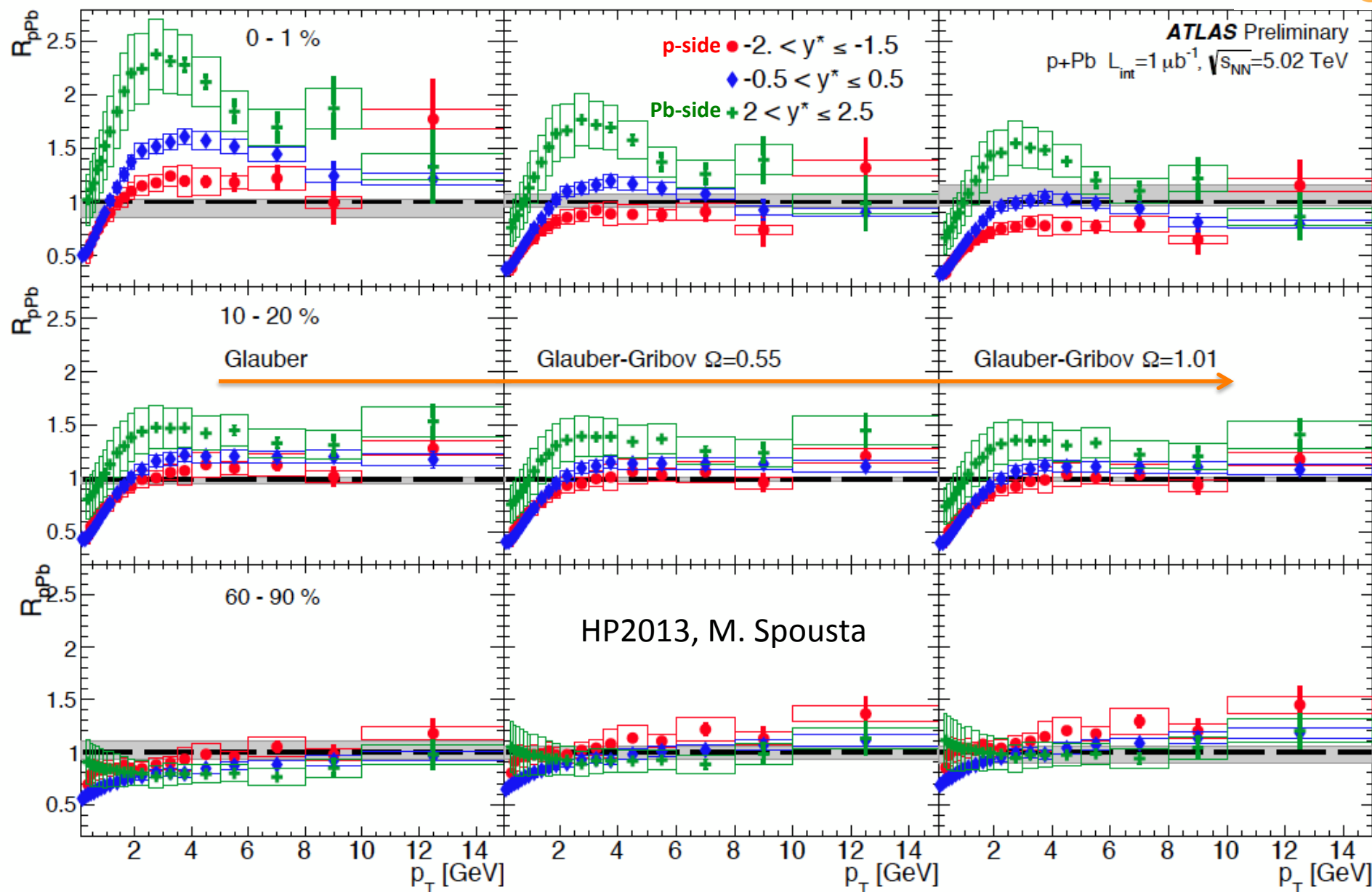


ALI-PUB-64307

No significant suppression of Jet observed for min. bias pPb at 5TeV

Centrality and η dependences

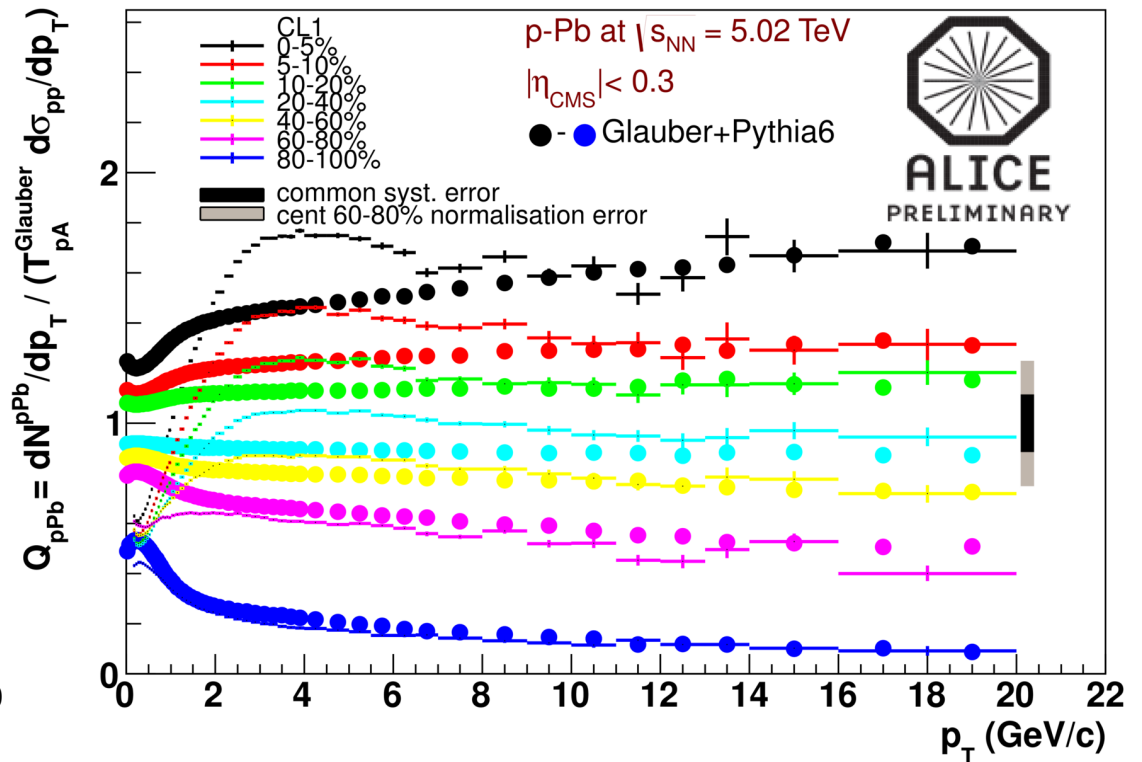
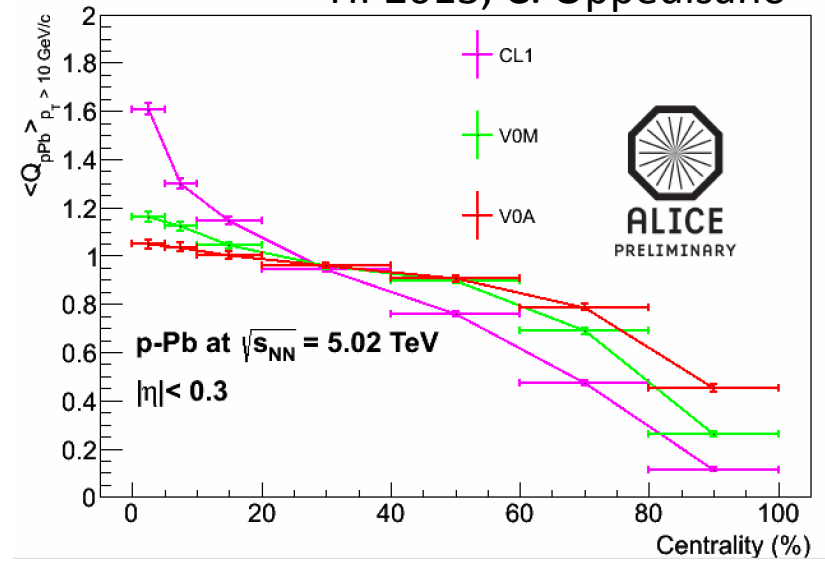
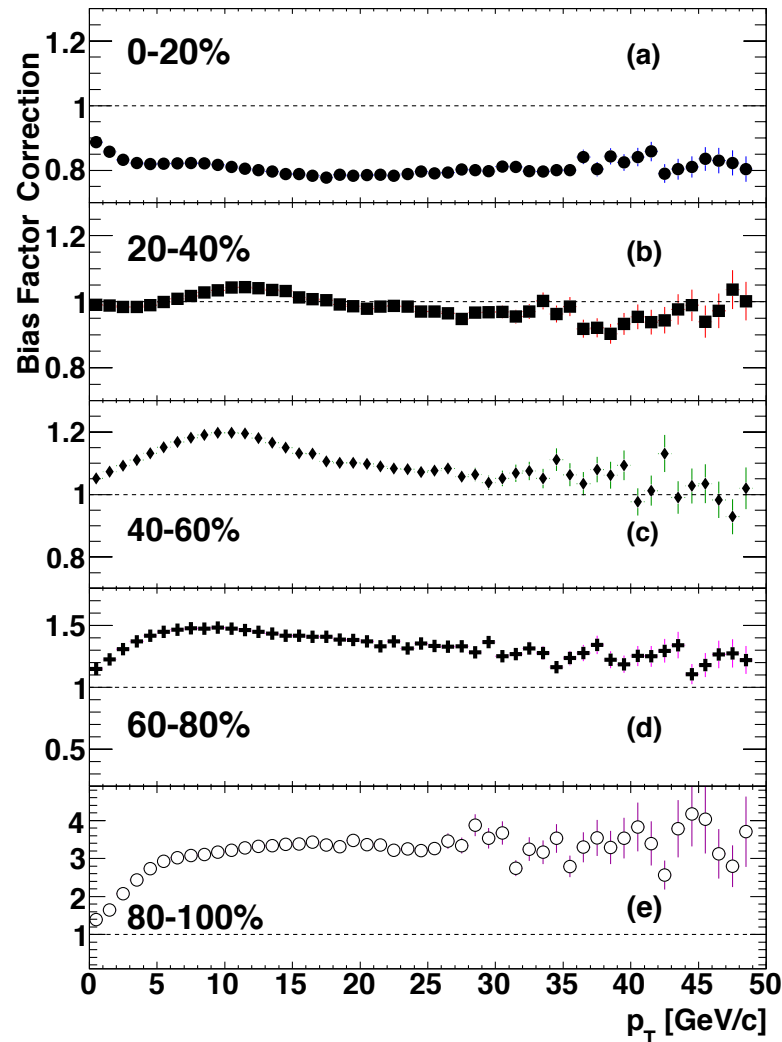
Glauber-Gribov
- color fluctuation (Ω)



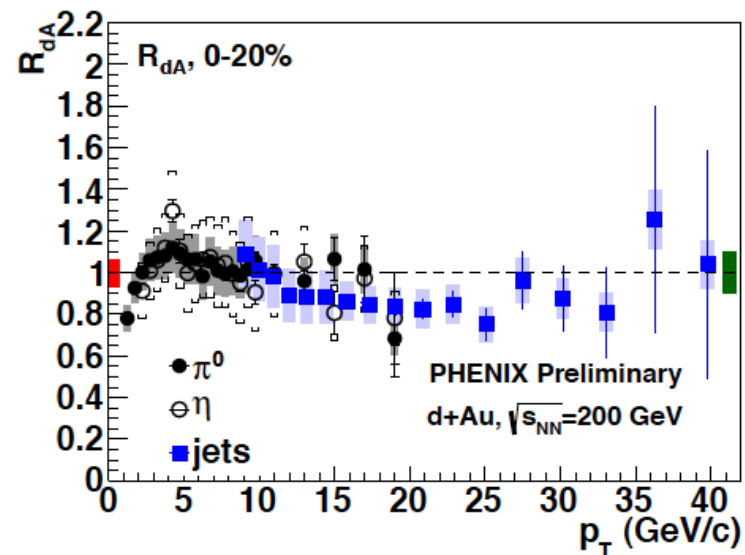
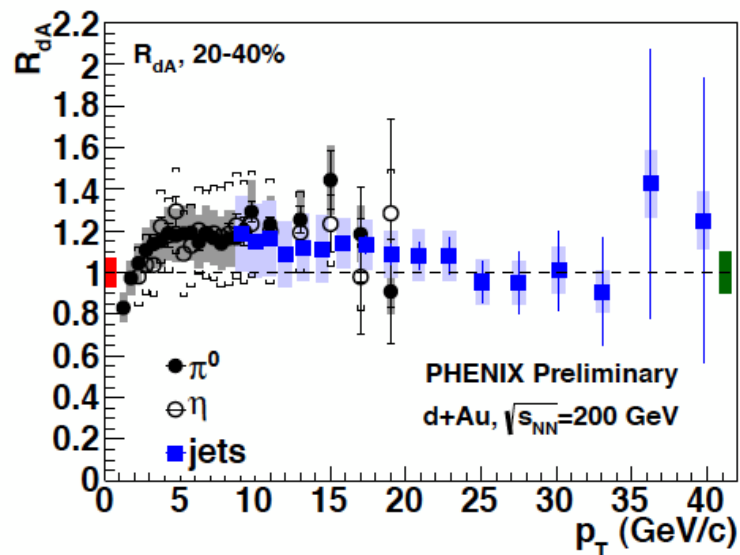
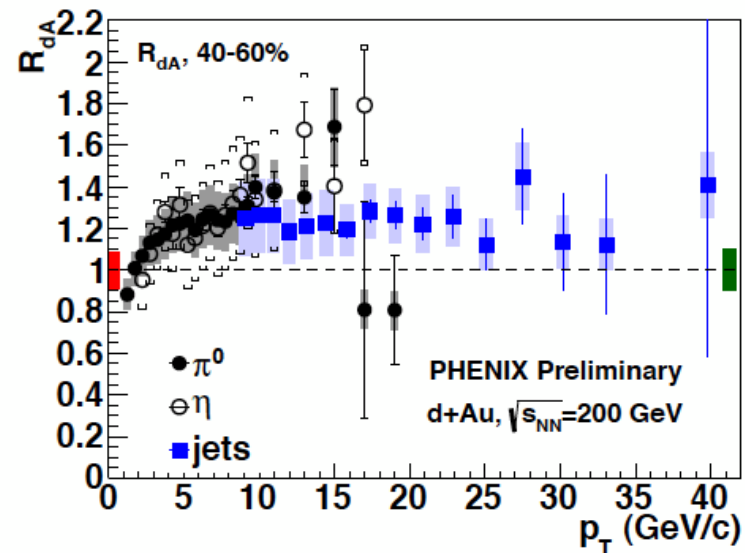
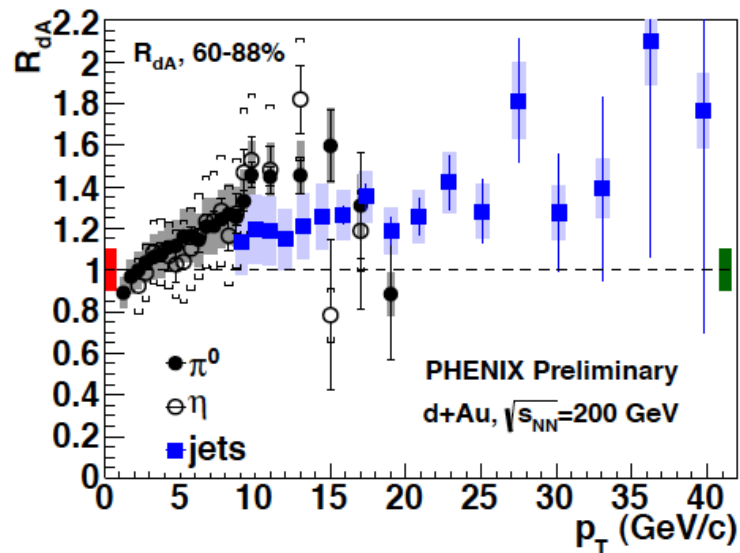
Centrality Bias Correction ($\propto 1/Q_{pPb}$)

pPb 5TeV Hijing

arXiv:1310.4793

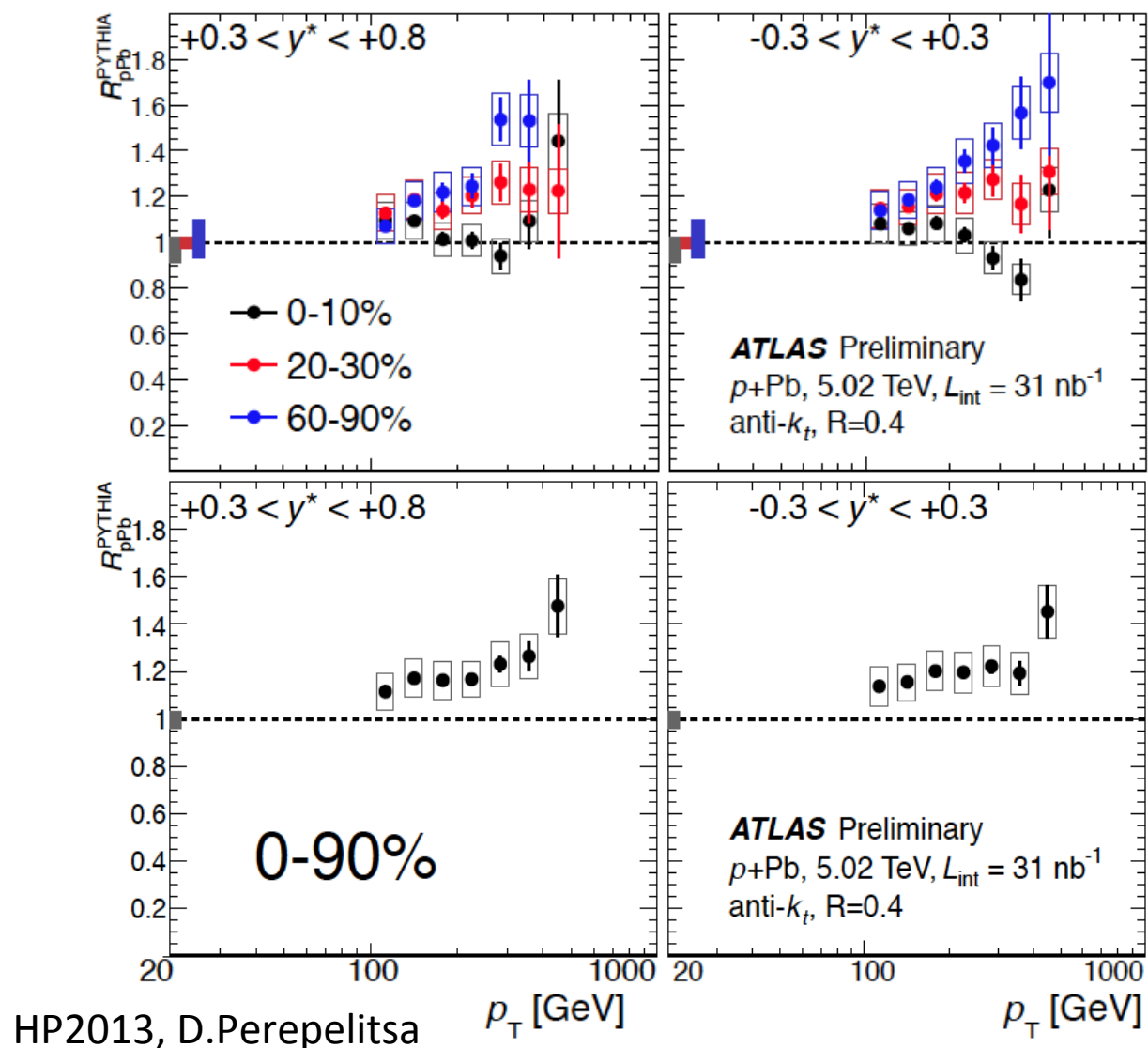


RHIC-PHENIX --- R_{dAu} of π^0 and jet ---



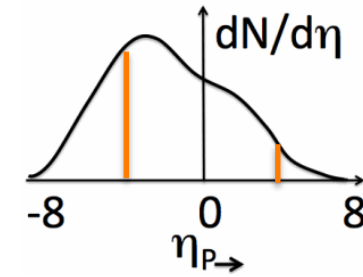
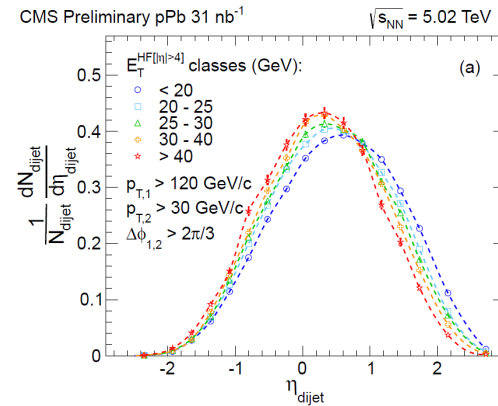
LHC-ATLAS --- R_{pPb} of jet w.r.t. pythia ---

ATLAS-CONF-2013-105

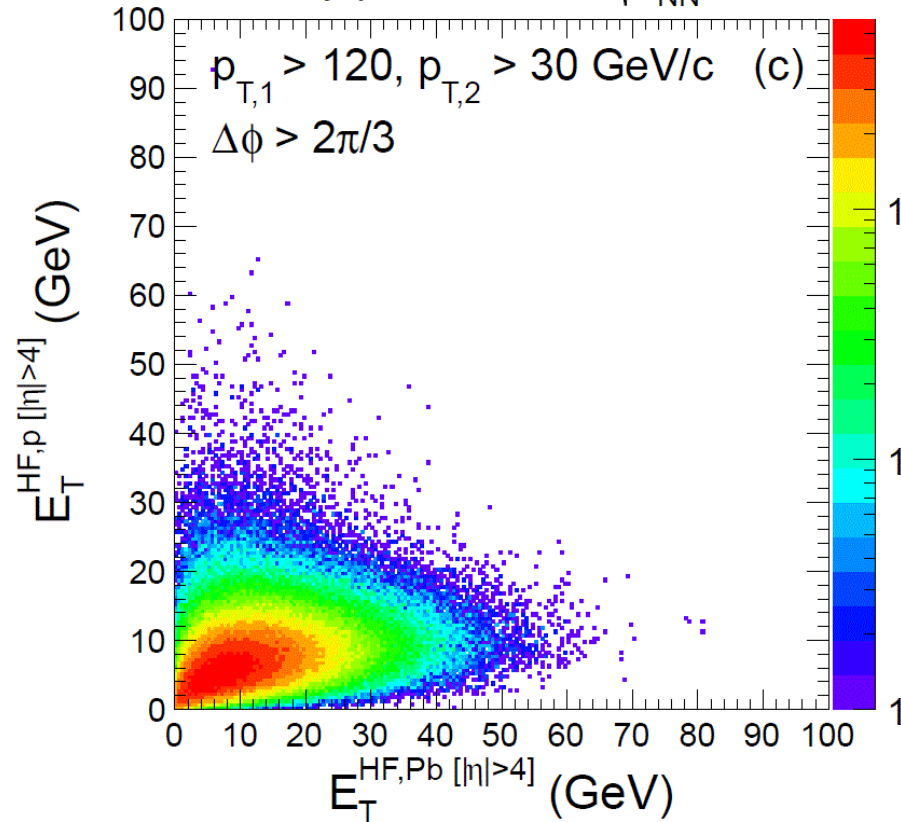


Di-jet η shift vs centrality

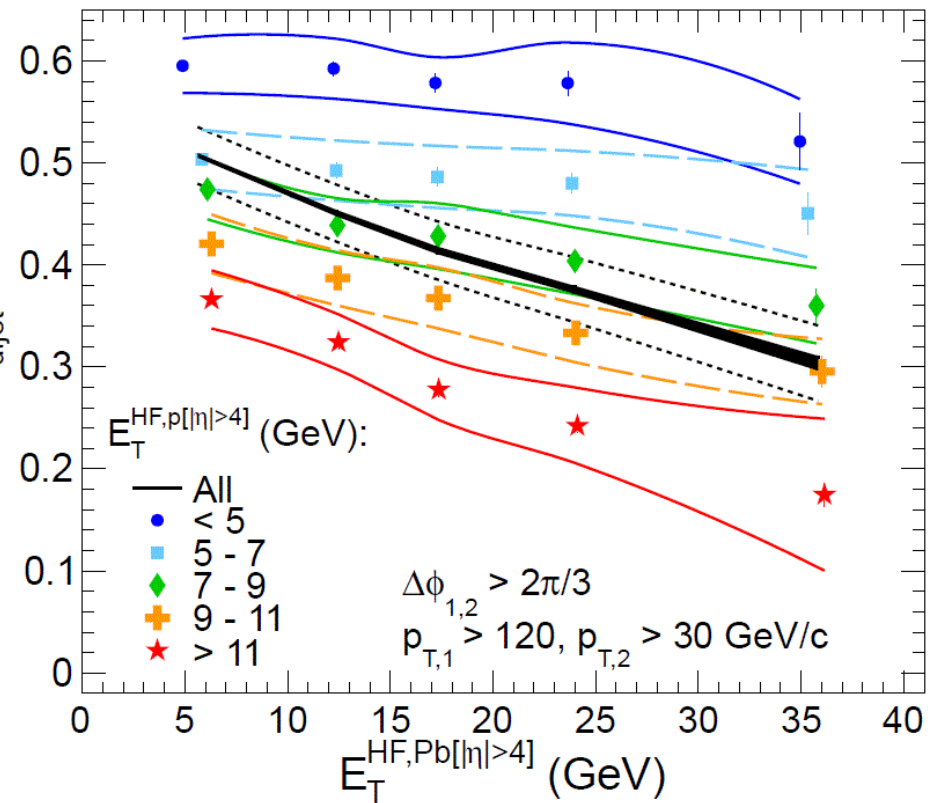
HP2013, D. Gulhan



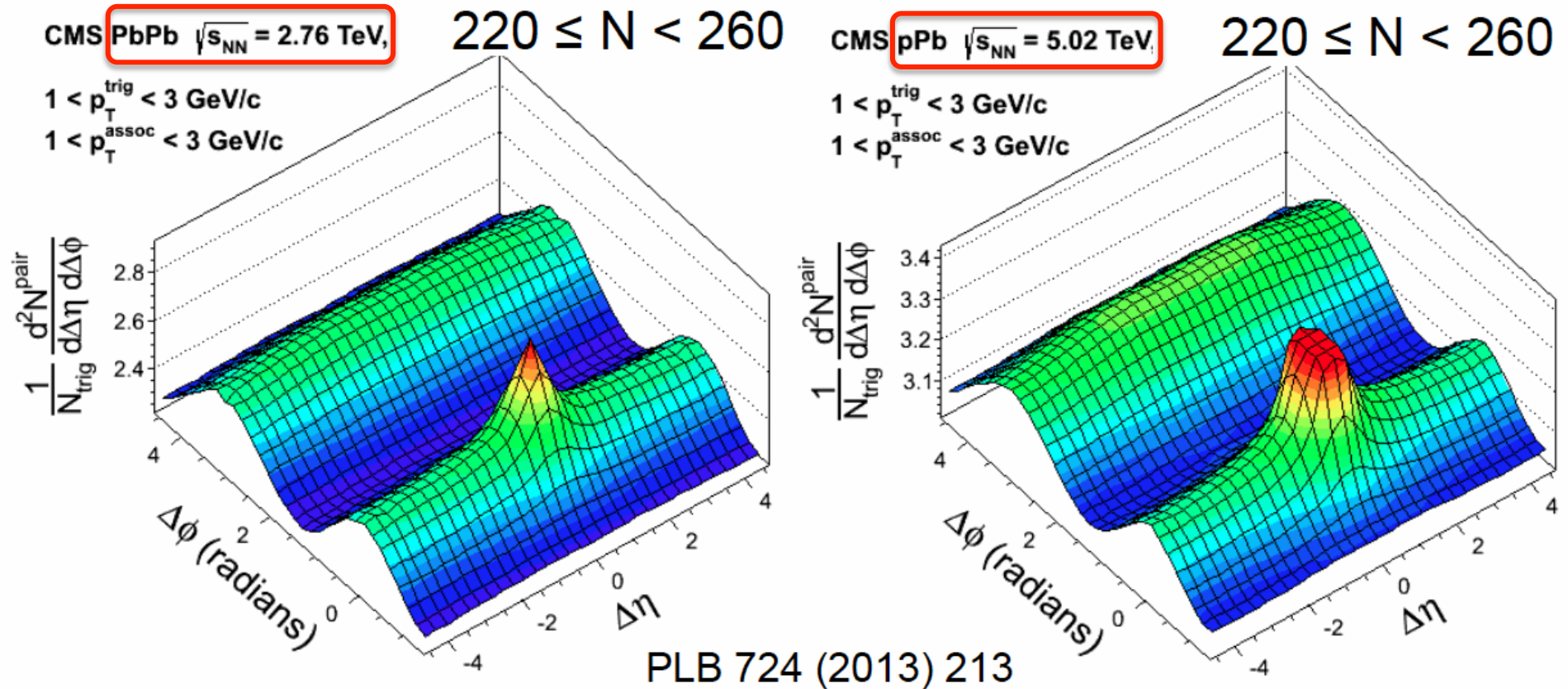
CMS Preliminary pPb 31 nb⁻¹ $\sqrt{s_{NN}} = 5.02$ TeV



CMS Preliminary pPb 31 nb⁻¹ $\sqrt{s_{NN}} = 5.02$ TeV



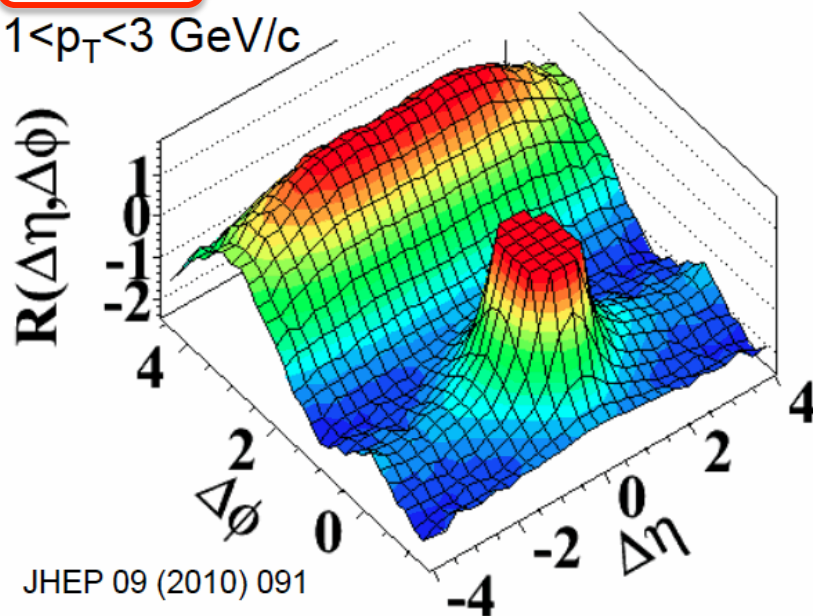
ridge/ v_n between Pb+Pb and p+Pb



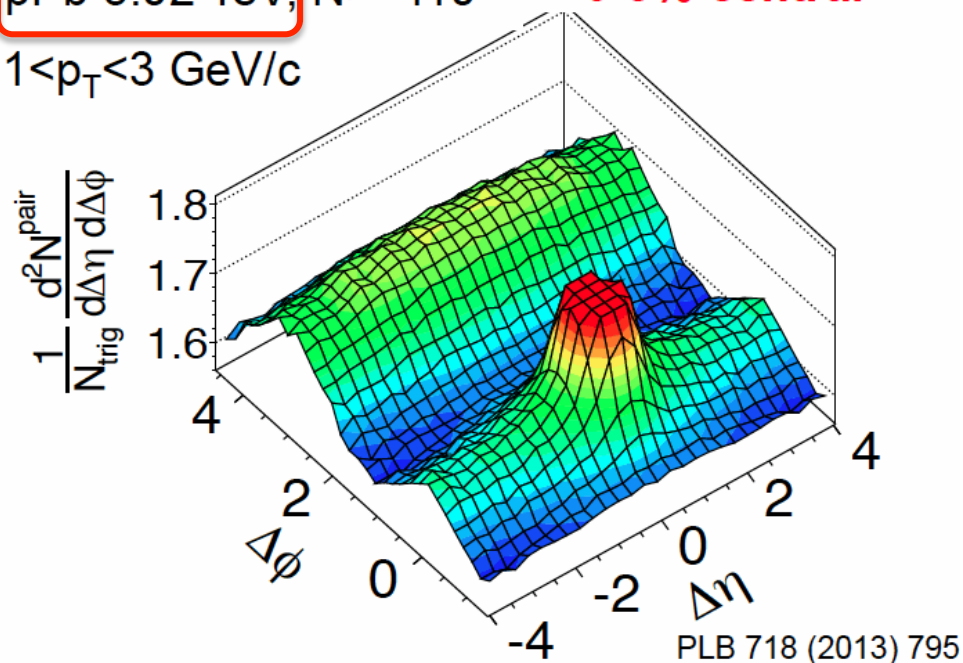
→ more jet-like

ridge/ v_n between p+p and p+Pb

pp 7 TeV, $N \geq 110$ **0.0007% central**
 $1 < p_T < 3$ GeV/c



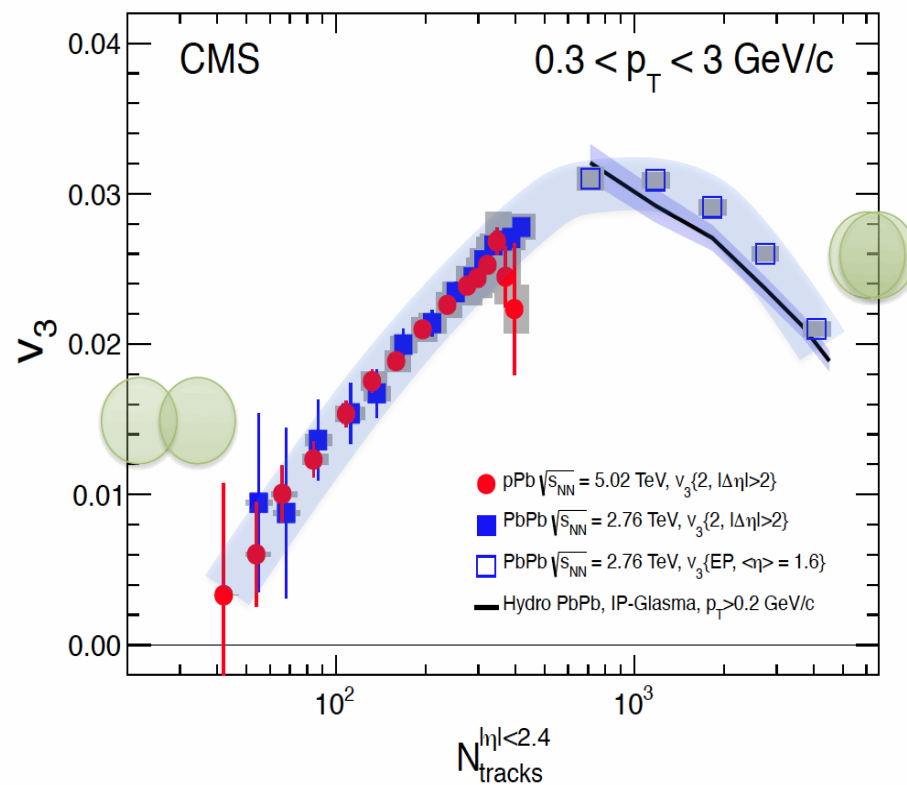
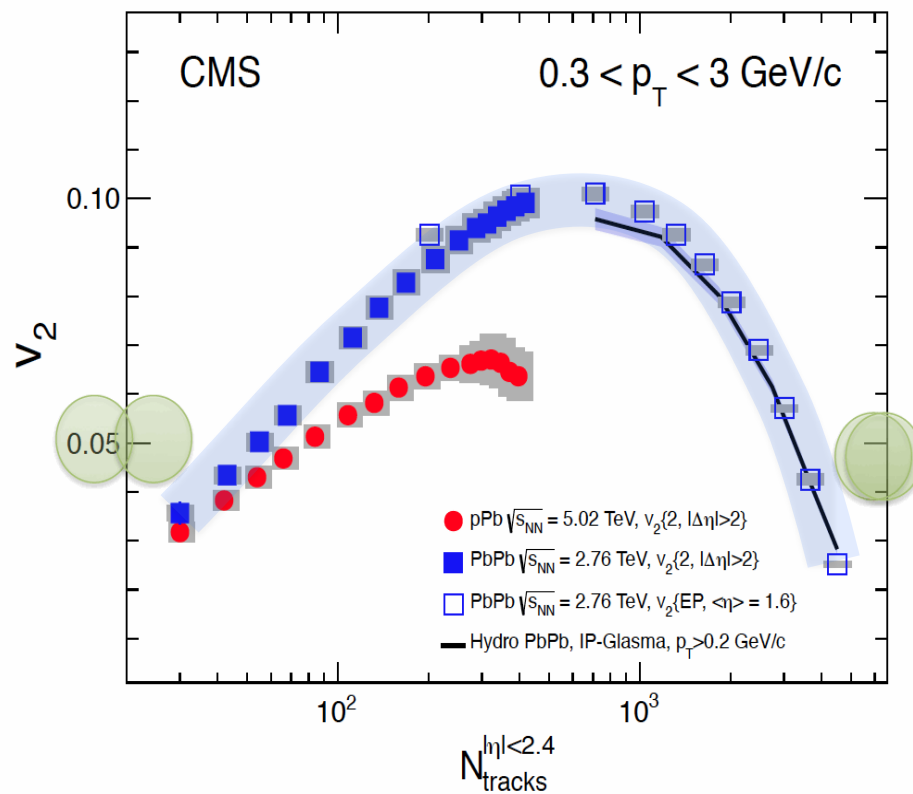
pPb 5.02 TeV, $N \geq 110$ **0-3% central**
 $1 < p_T < 3$ GeV/c



more jet-like

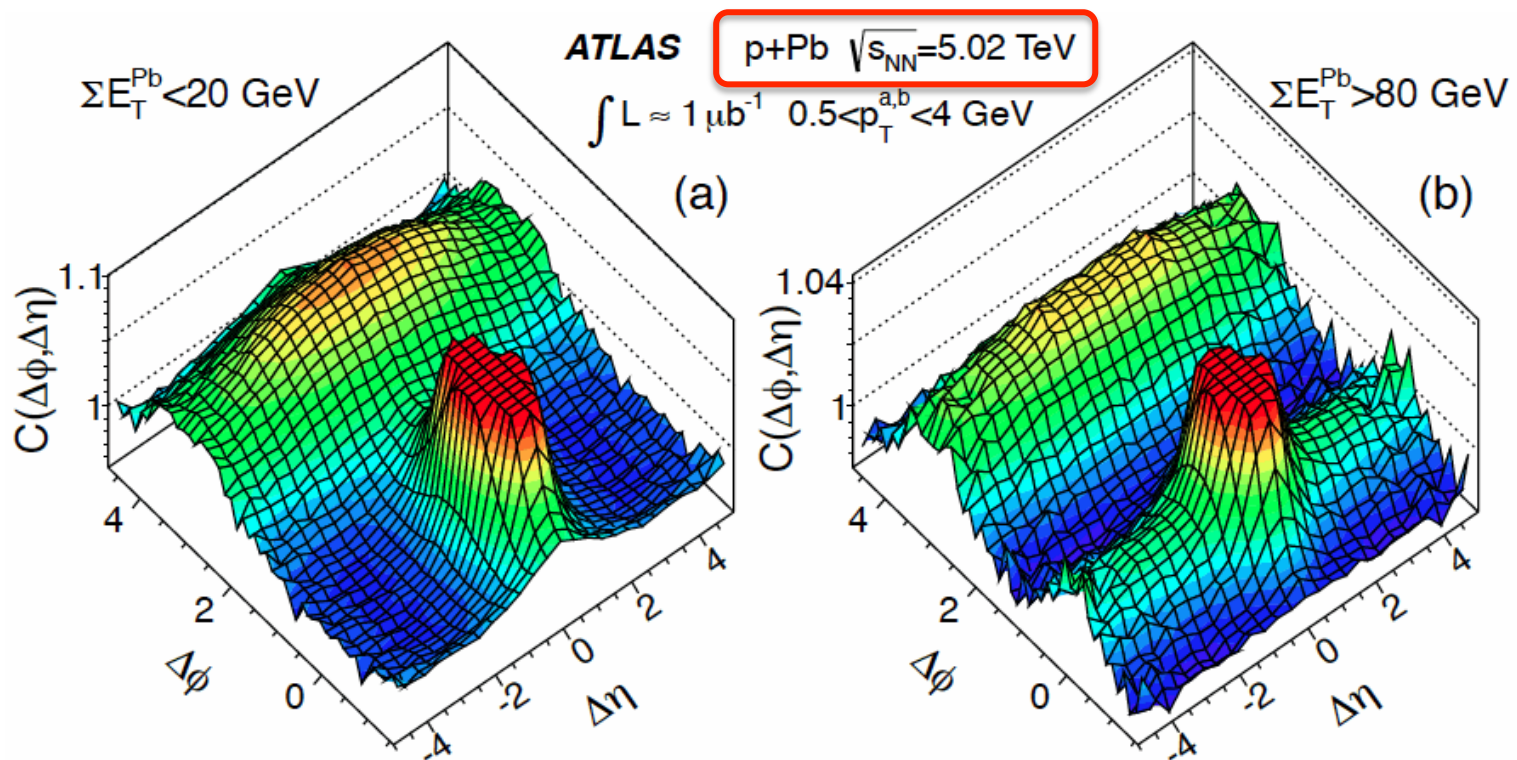


v_2 and v_3 between p+Pb and Pb+Pb --- CMS ---



HP2013, W. Li

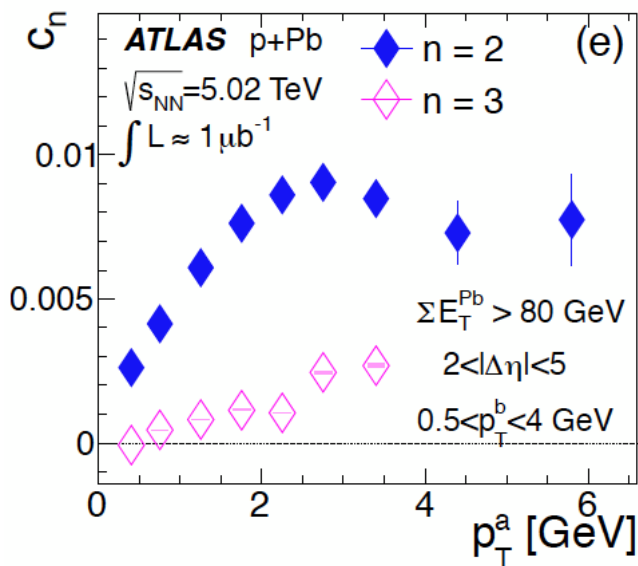
ridge/ v_n between peripheral and central collisions



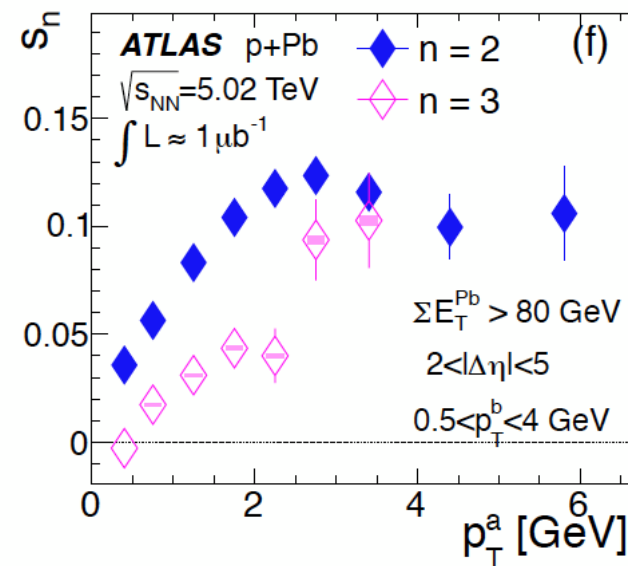
PRL110, 182302 (2013)

v_2 and v_3 in p+Pb --- ATLAS ---

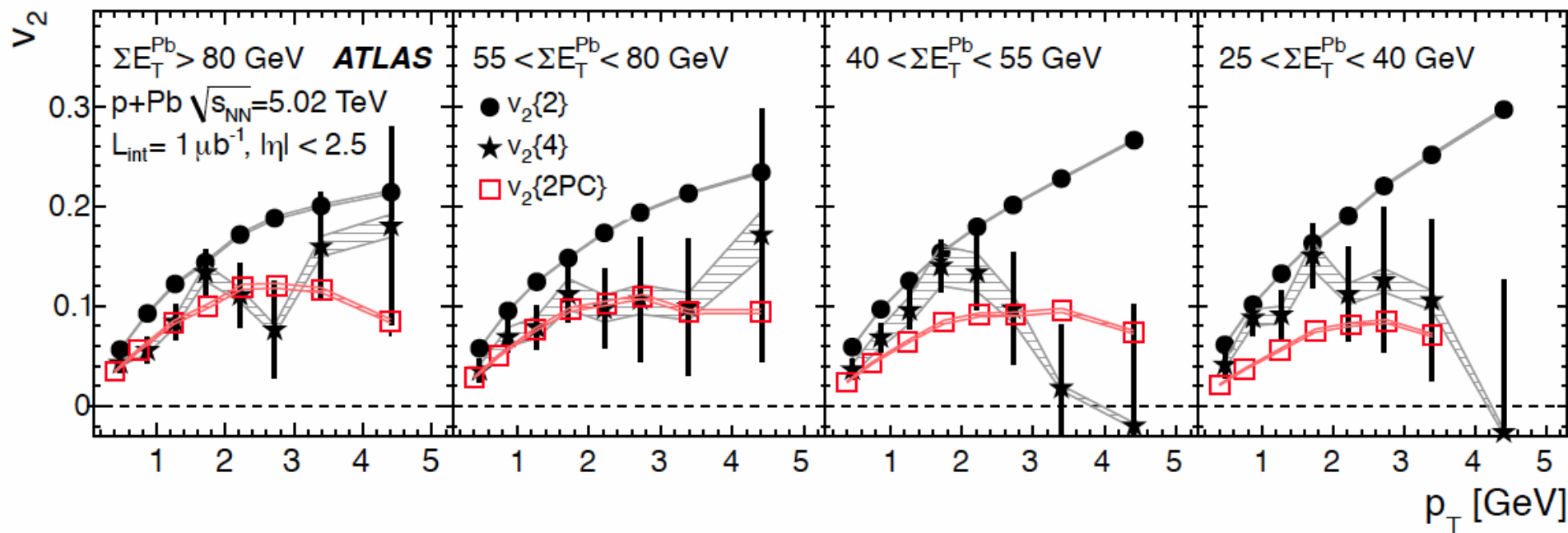
$v_2 \sim 10\%$
 $v_3 \sim 5\%$
 at $p_T \sim 2 \text{ GeV}/c$
 in central p+Pb collisions



Phys. Rev. Lett. 110, 182302 (2013)



Phys. Lett. B 725 (2013)

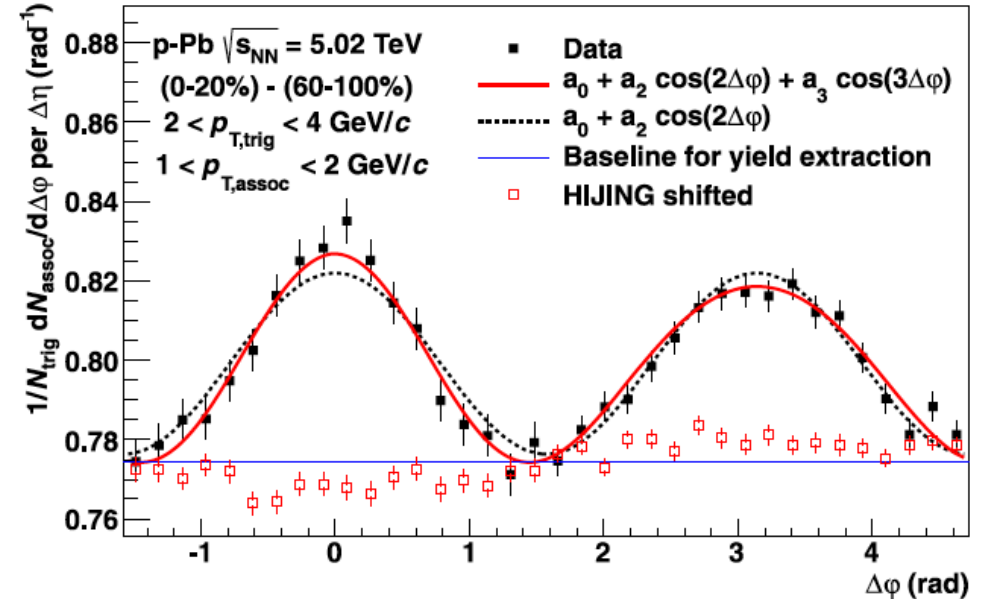
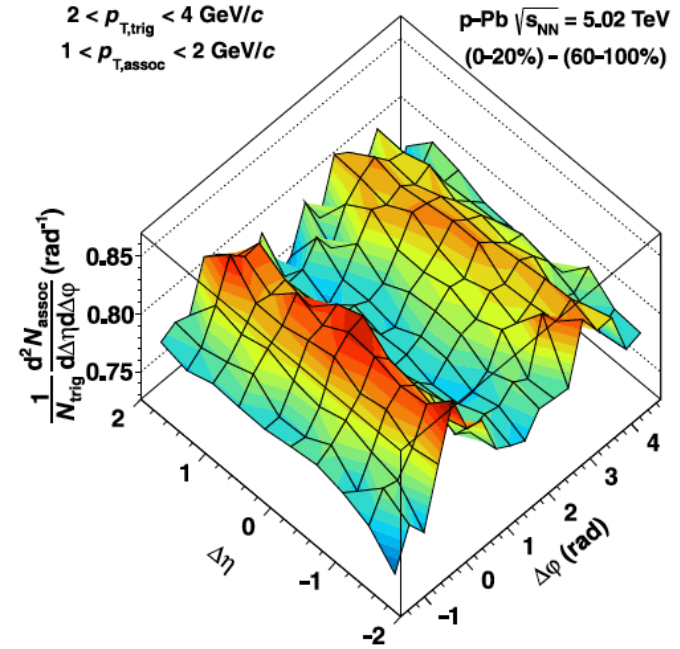
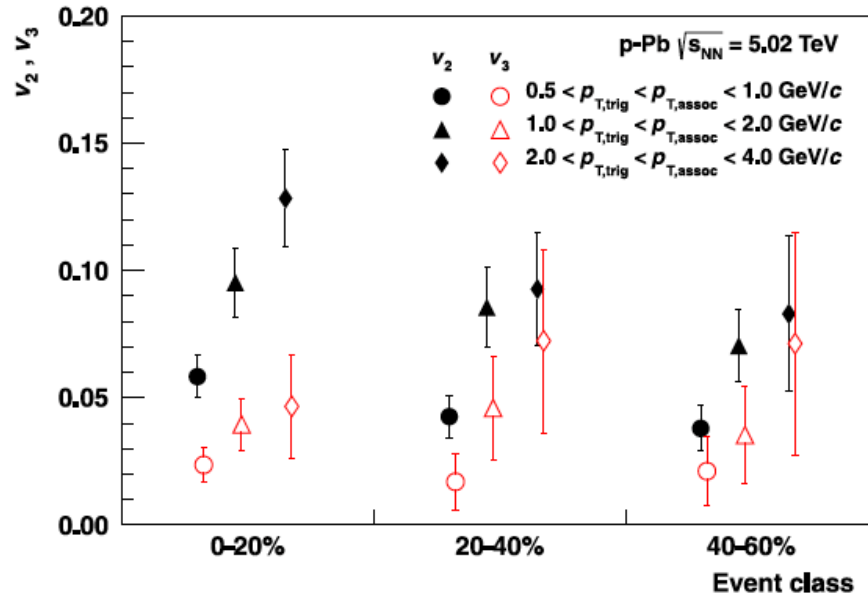


Double ridge in p+Pb --- ALICE ---

Central – Peripheral subtraction of
associate yield per trigger

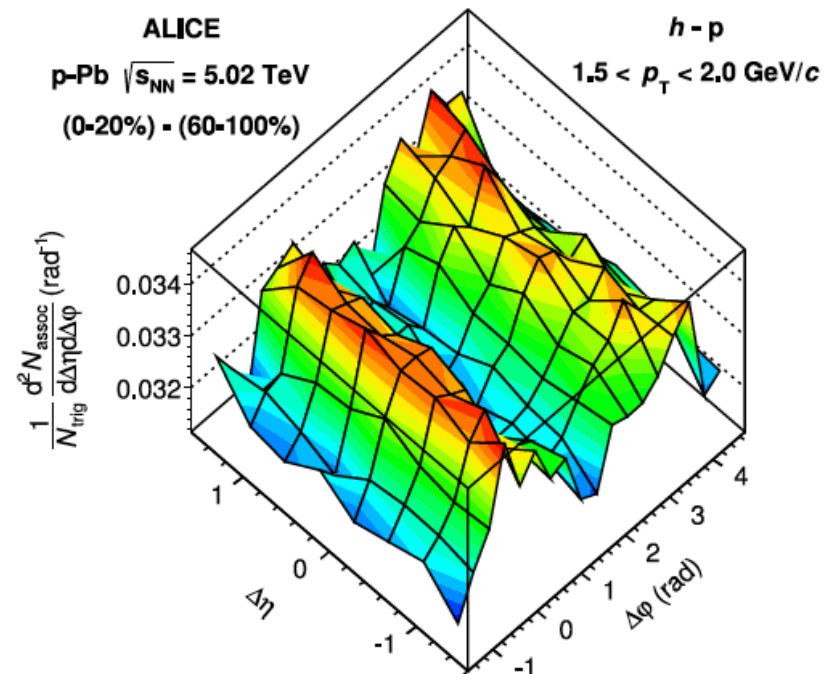
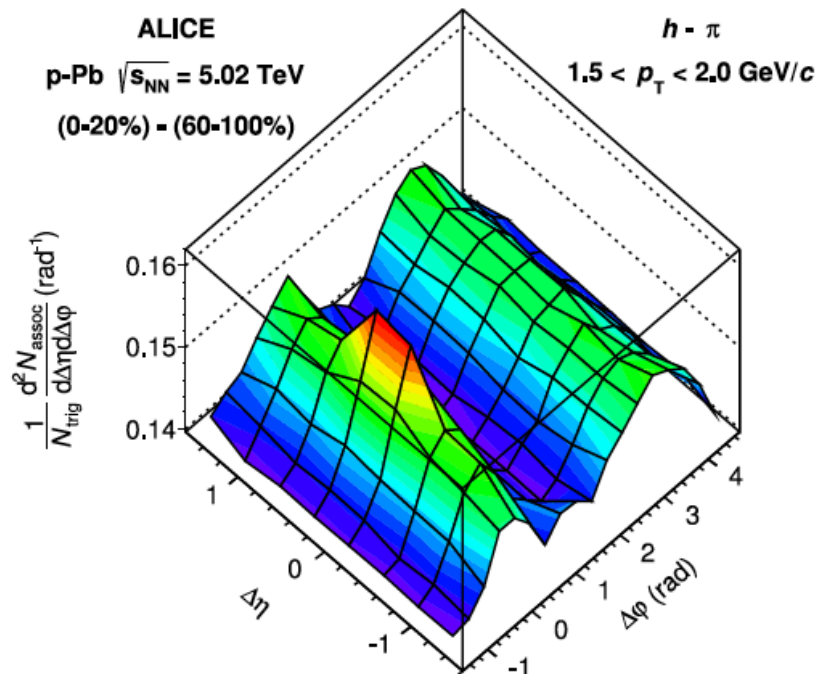
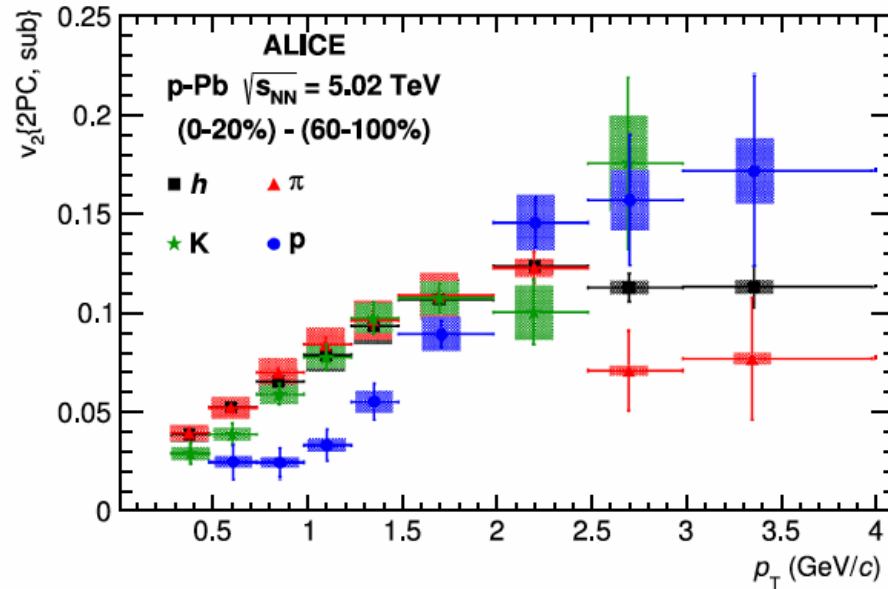
Assumption : no change in jet shape

PLB 719 (2013) 29-41

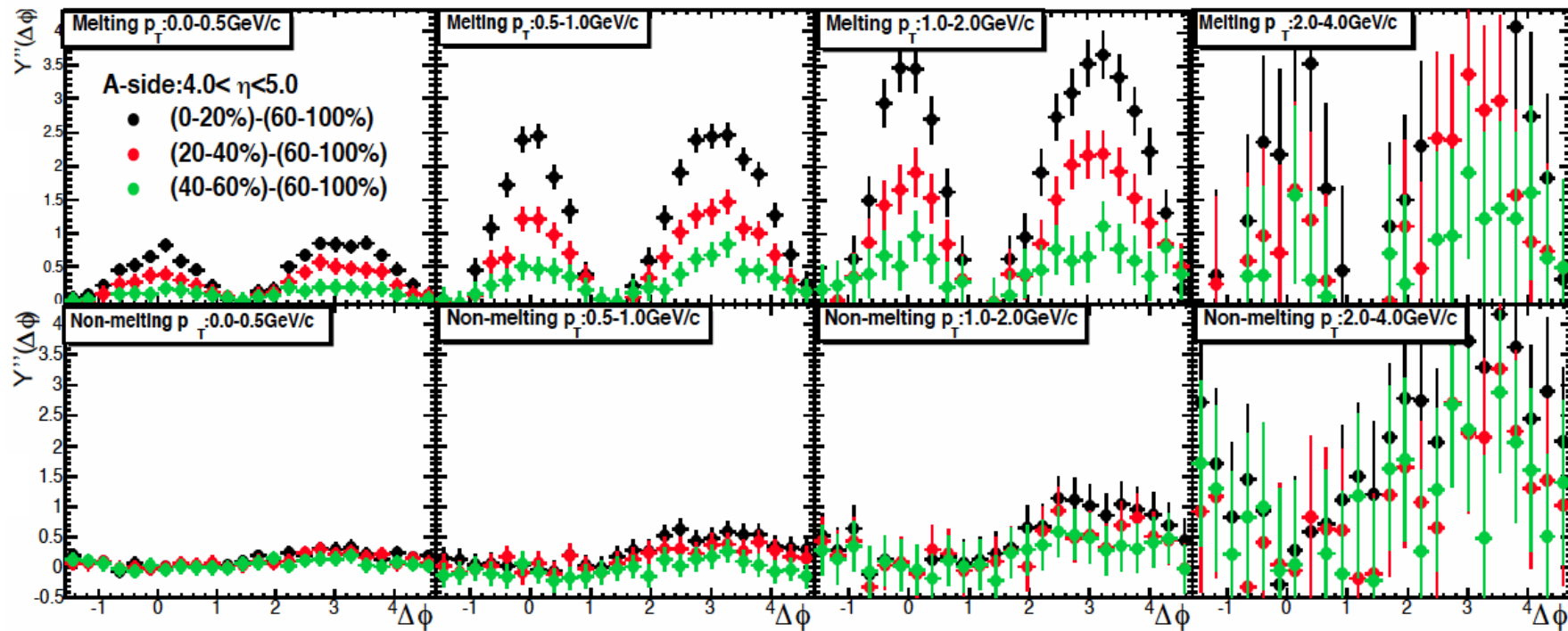


Particle identified double ridge in pA --- ALICE ---

similar to the “hydro-like” mass dependence of $v_2(p_T)$ as seen in AA collision as well as the baryon-meson difference at middle p_T region



AMPT simulation p+Pb 5TeV (string-melting on/off) for ALICE backward-central $\Delta\phi$ correlation ($|\Delta\eta|=3\sim 6$)



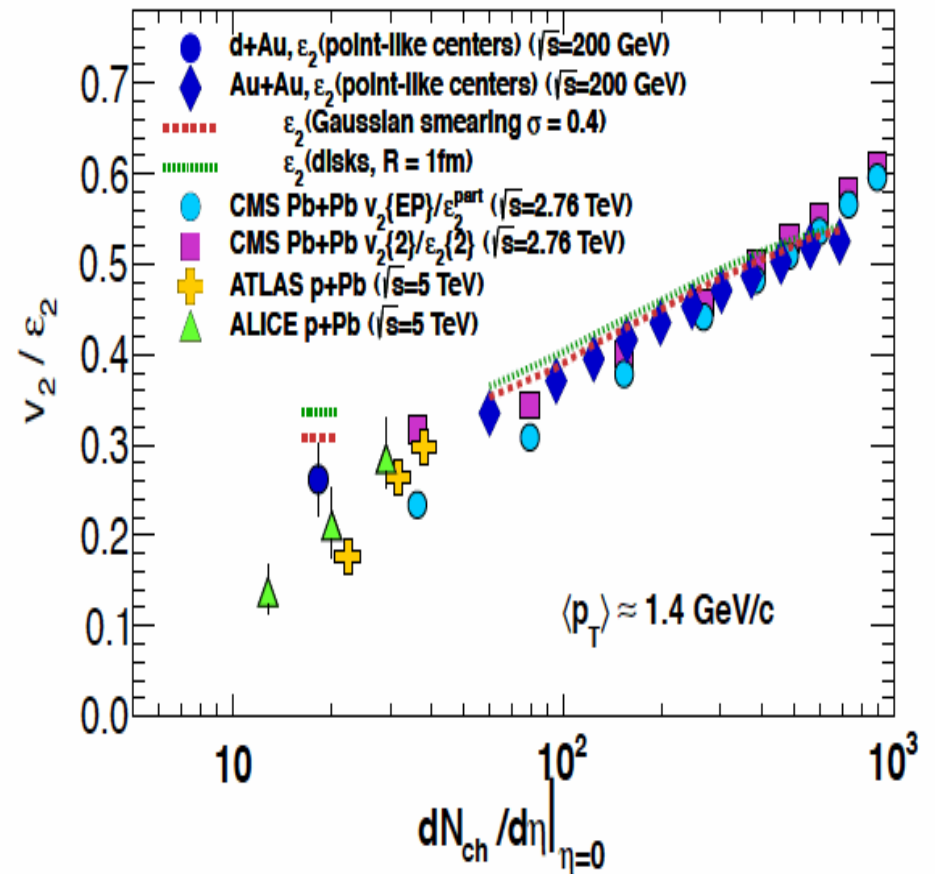
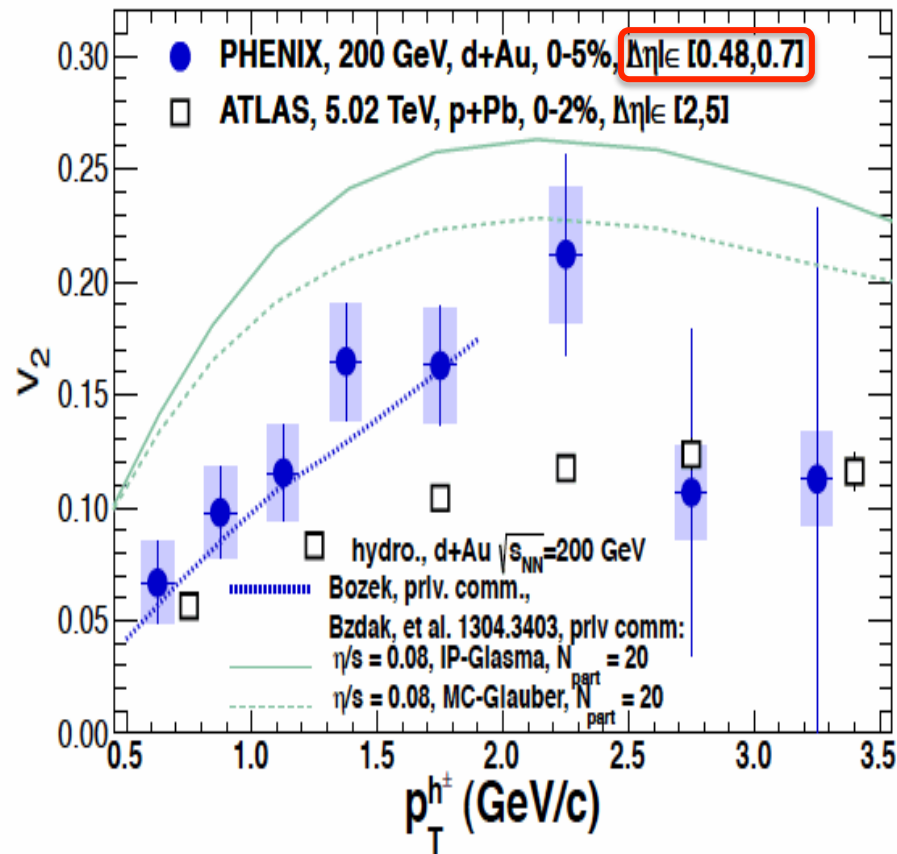
A-side : Pb-going side
C-side : p-going side

JPS 2014/Mar, Kazuki Oshima, Univ. of Tsukuba

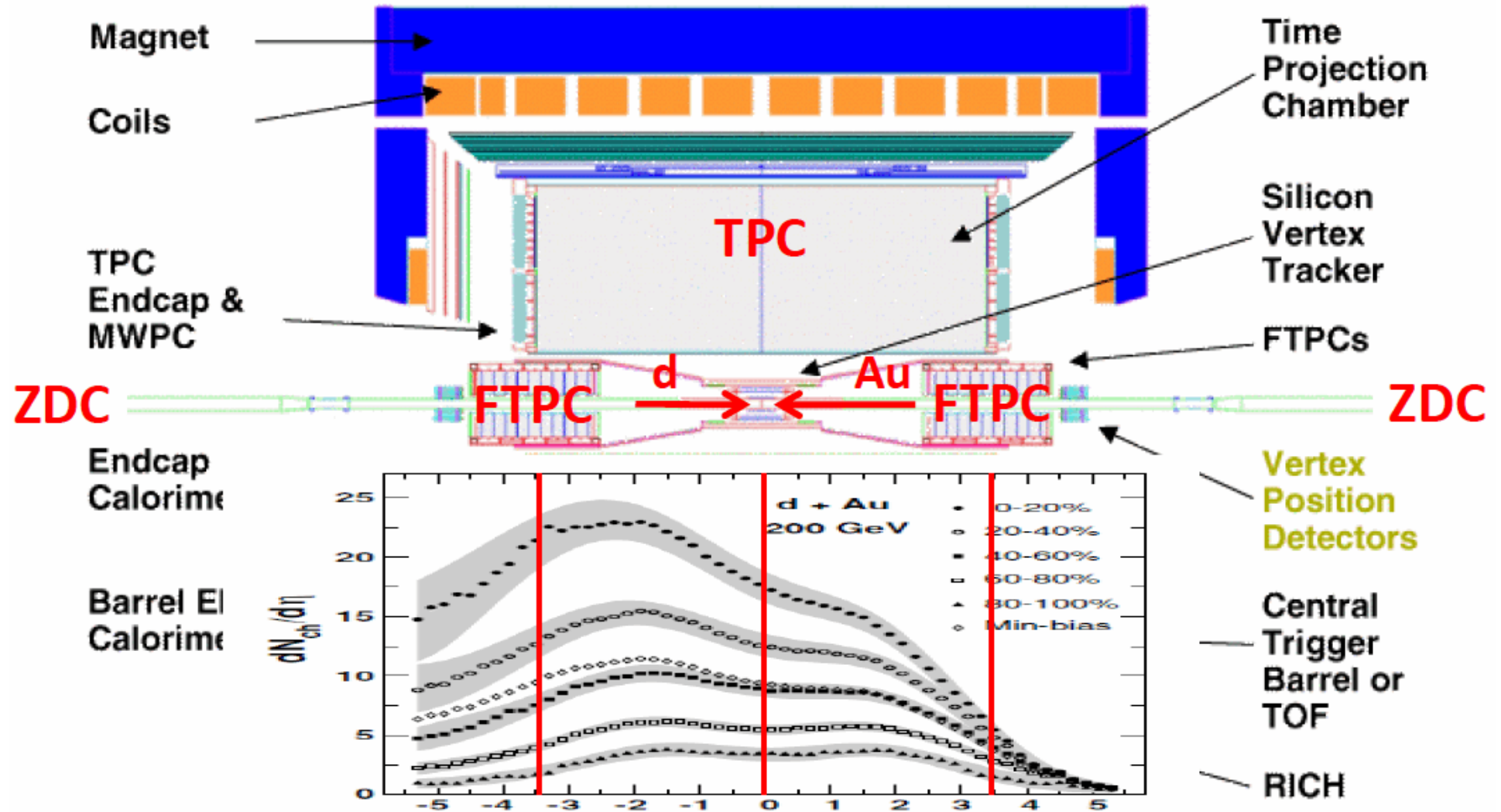
LHC-RHIC comparison (p+Pb 5TeV) – (d+Au 200GeV)

--- $v_2(p_T)$ and $v_2/\varepsilon_2(dN_{ch}/d\eta)$ ---

PRL 111, 212301 (2013)

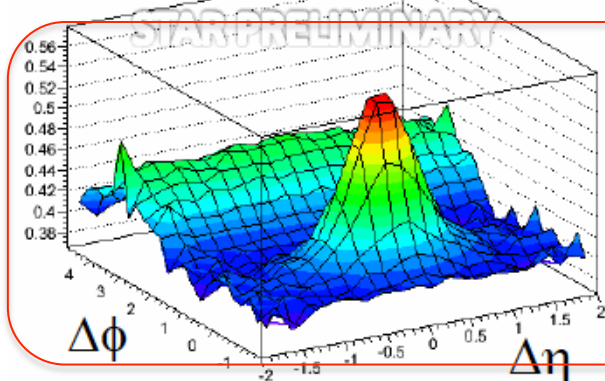


RHIC-STAR acceptance



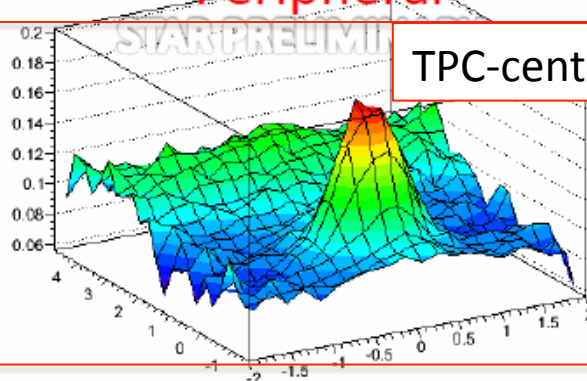
0-20%, $1 < p_T < 3$ GeV/c

Central



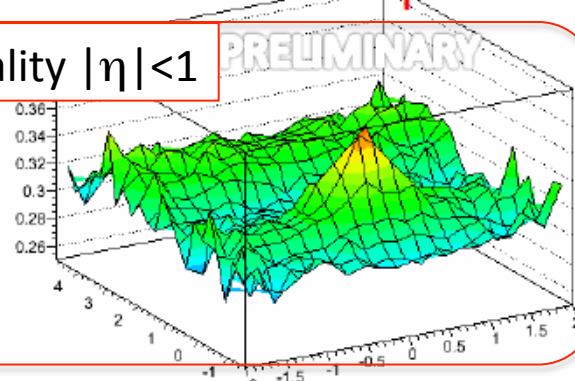
50-80%, $1 < p_T < 3$ GeV/c

Peripheral

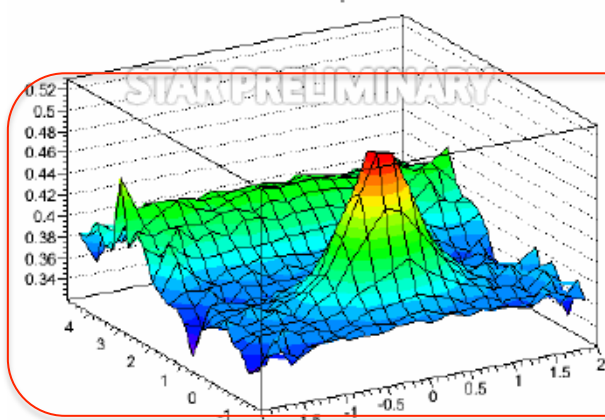


Central – Peripheral

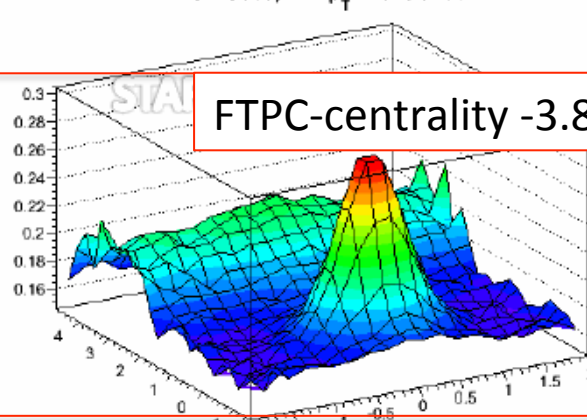
TPC-centrality $|\eta| < 1$



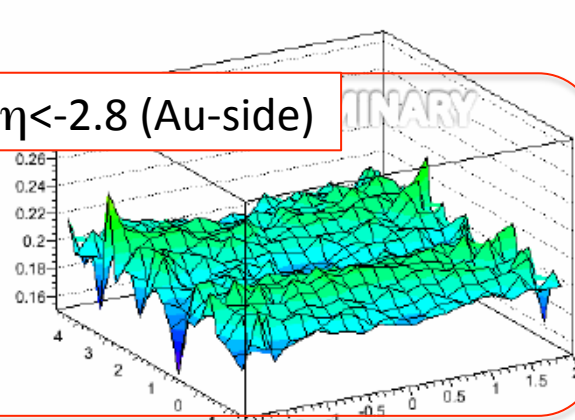
0-20%, $1 < p_T < 3$ GeV/c



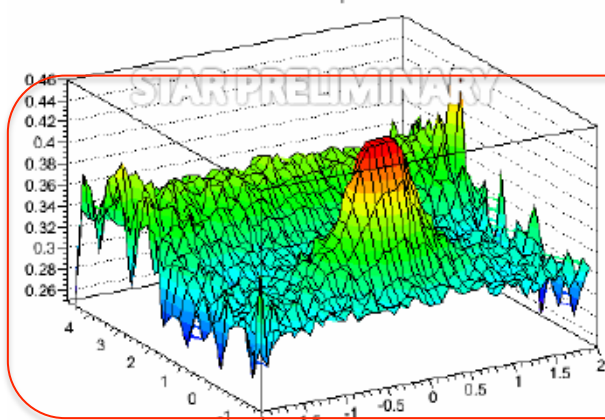
40-100%, $1 < p_T < 3$ GeV/c



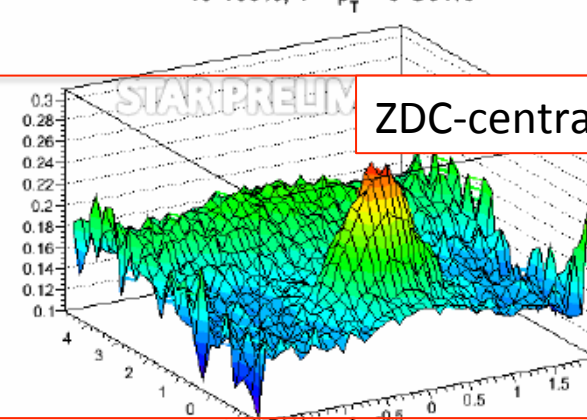
FTPC-centrality $-3.8 < \eta < -2.8$ (Au-side)



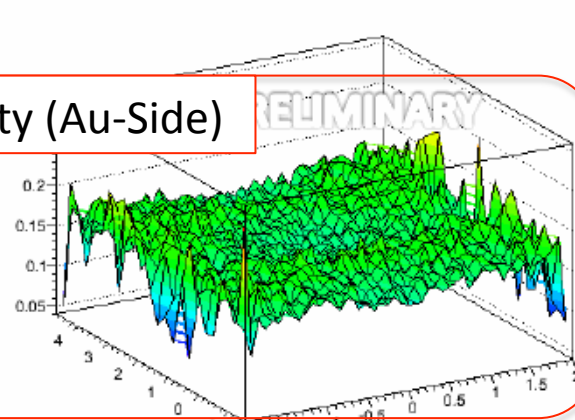
0-20%, $1 < p_T < 3$ GeV/c



40-100%, $1 < p_T < 3$ GeV/c



ZDC-centrality (Au-Side)

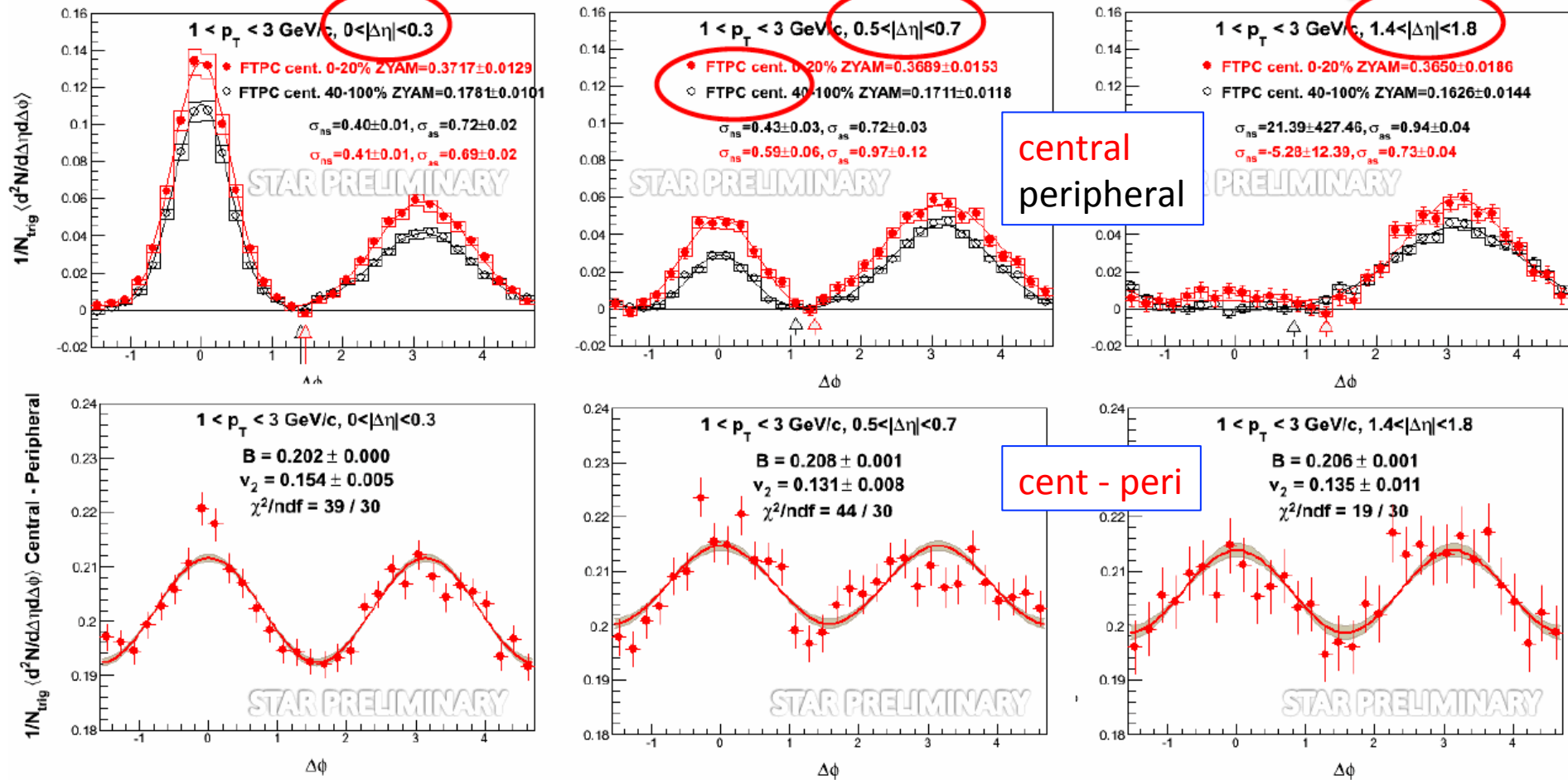


$\Delta\eta$ dependence of $\Delta\phi$ correlation (central – peripheral)

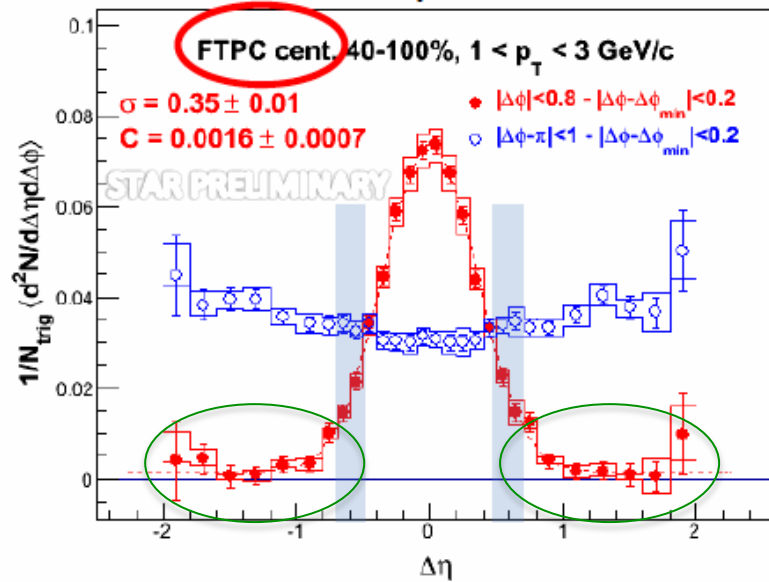
--- RHIC-STAR ---

HP2013, F. Wang

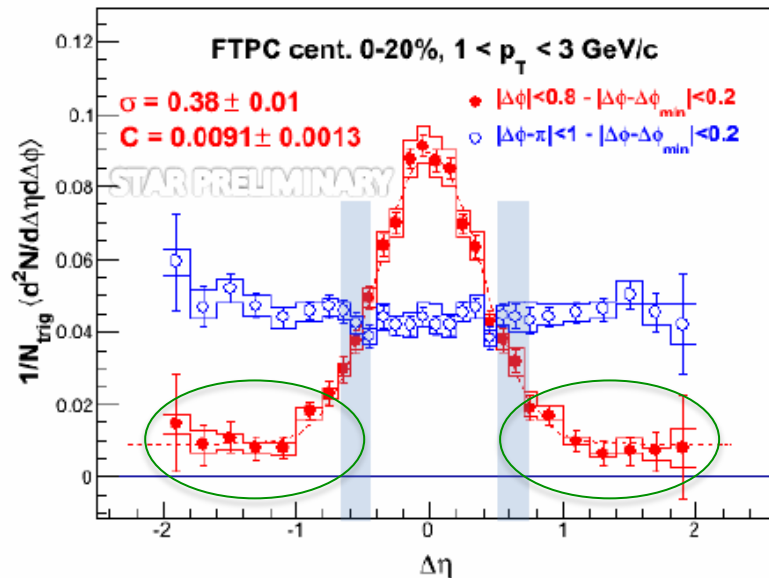
$|\Delta\eta|$ selection



Peripheral



Central

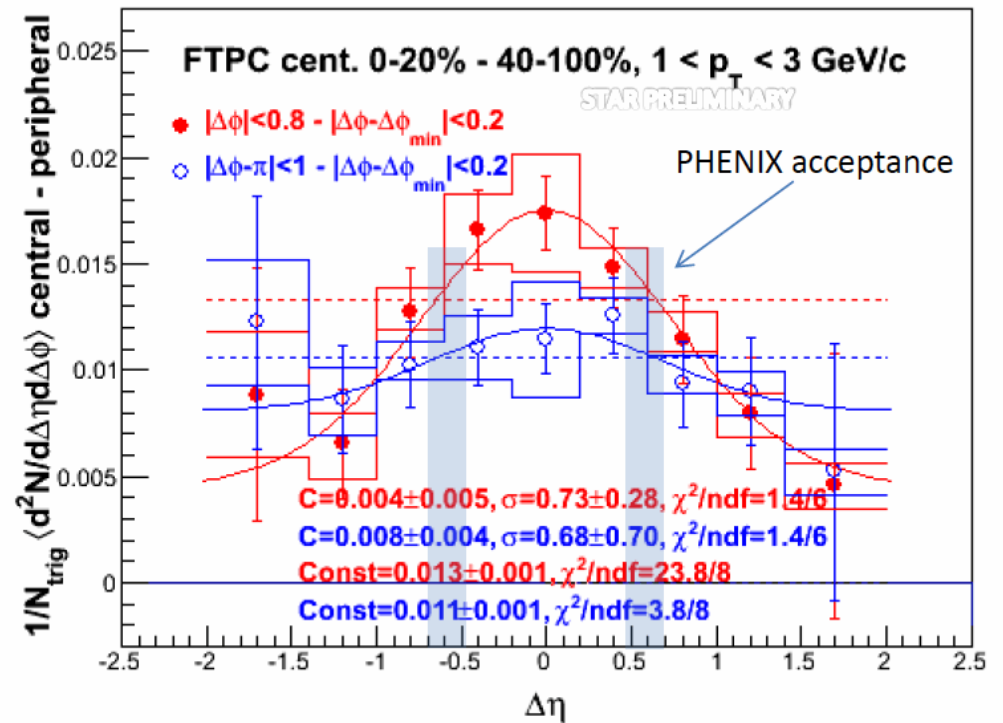


$\Delta\eta$ correlation (central – peripheral)

--- RHIC-STAR ---

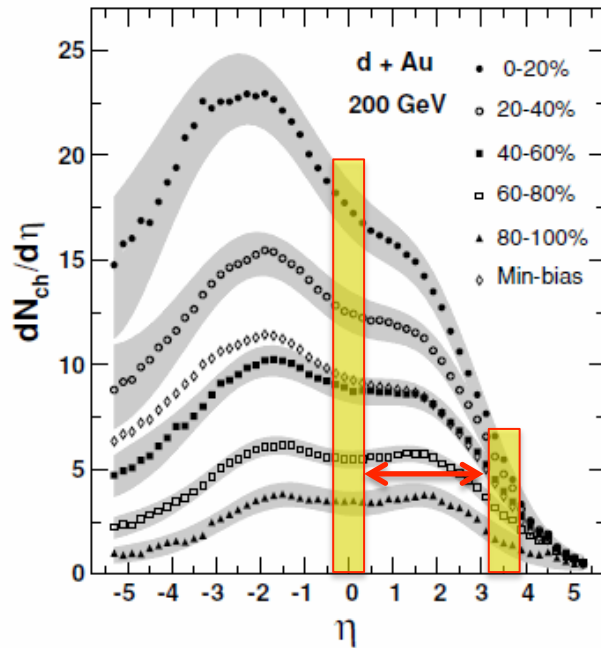
HP2013, F. Wang

Central – Peripheral

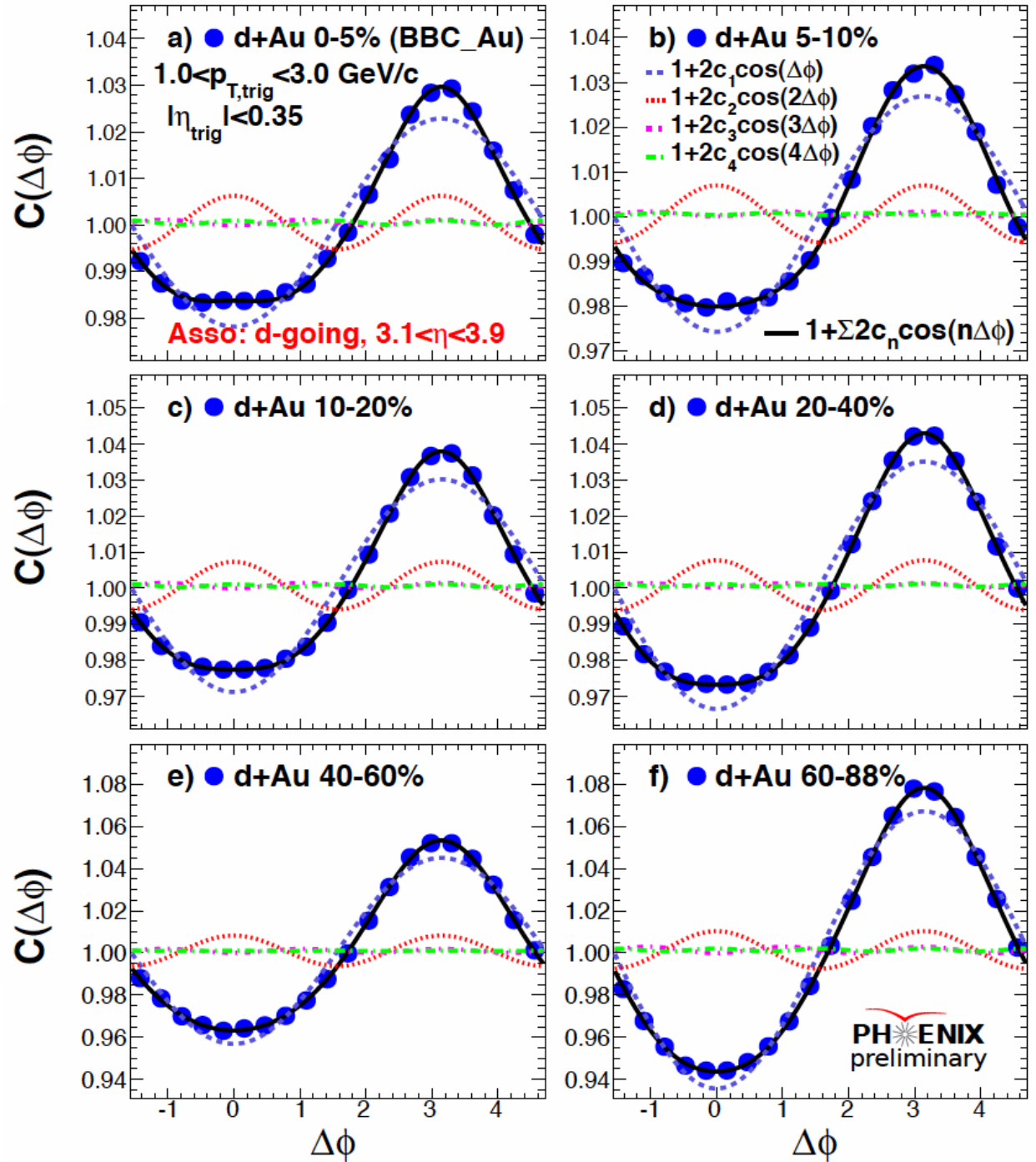


RHIC-PHENIX Large $\Delta\eta$ correlation

(1) central-forward



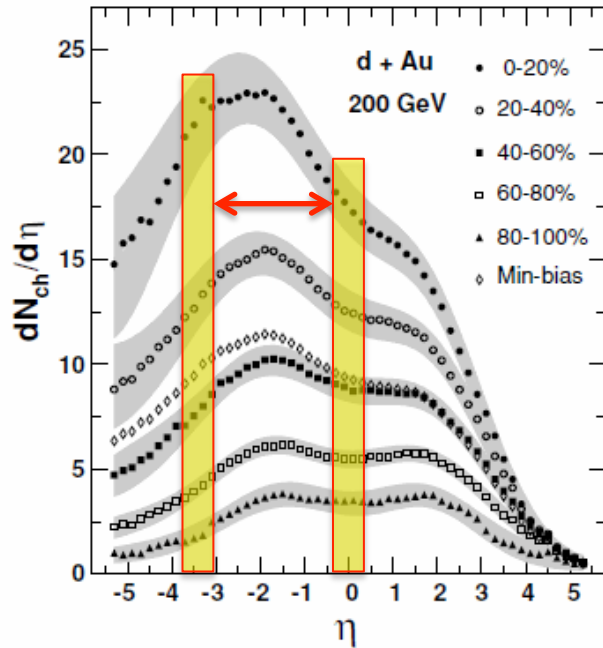
HP2013, S. Huang



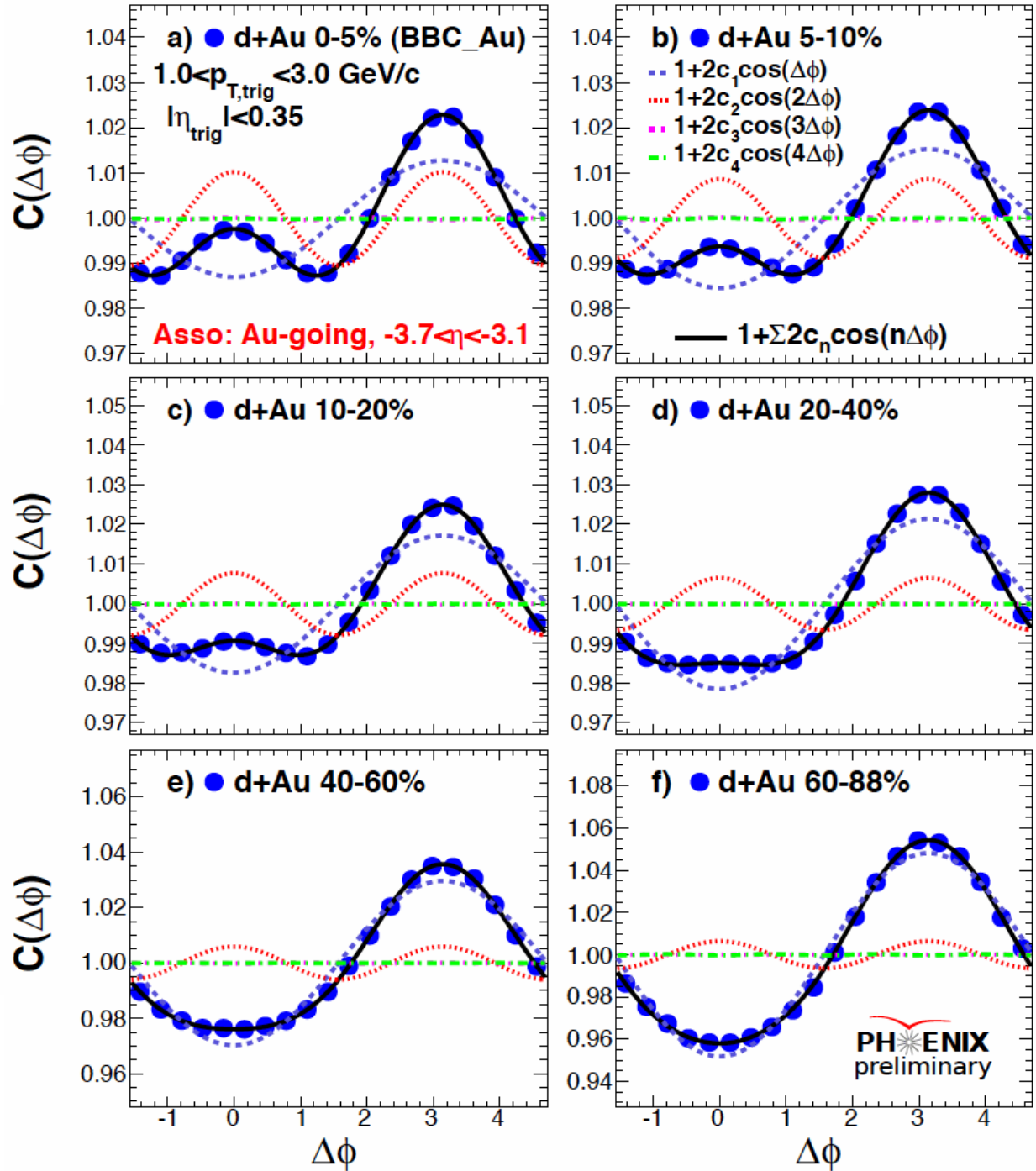
RHIC-PHENIX

Large $\Delta\eta$ correlation

(2) central-backward



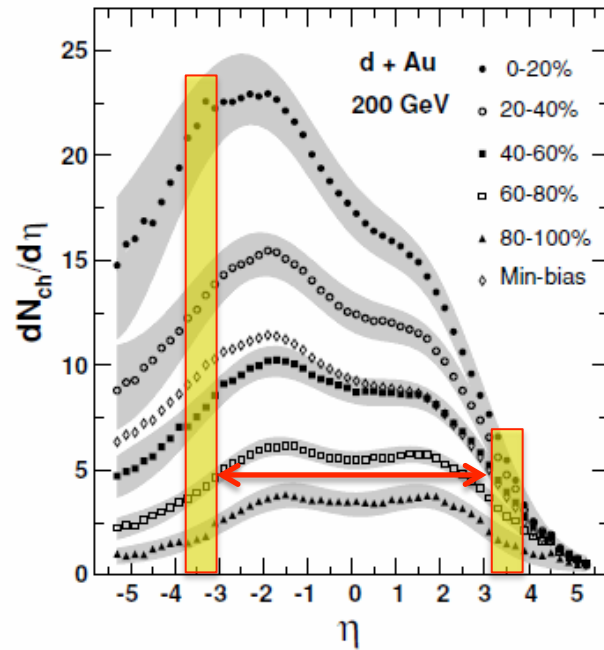
HP2013, S. Huang



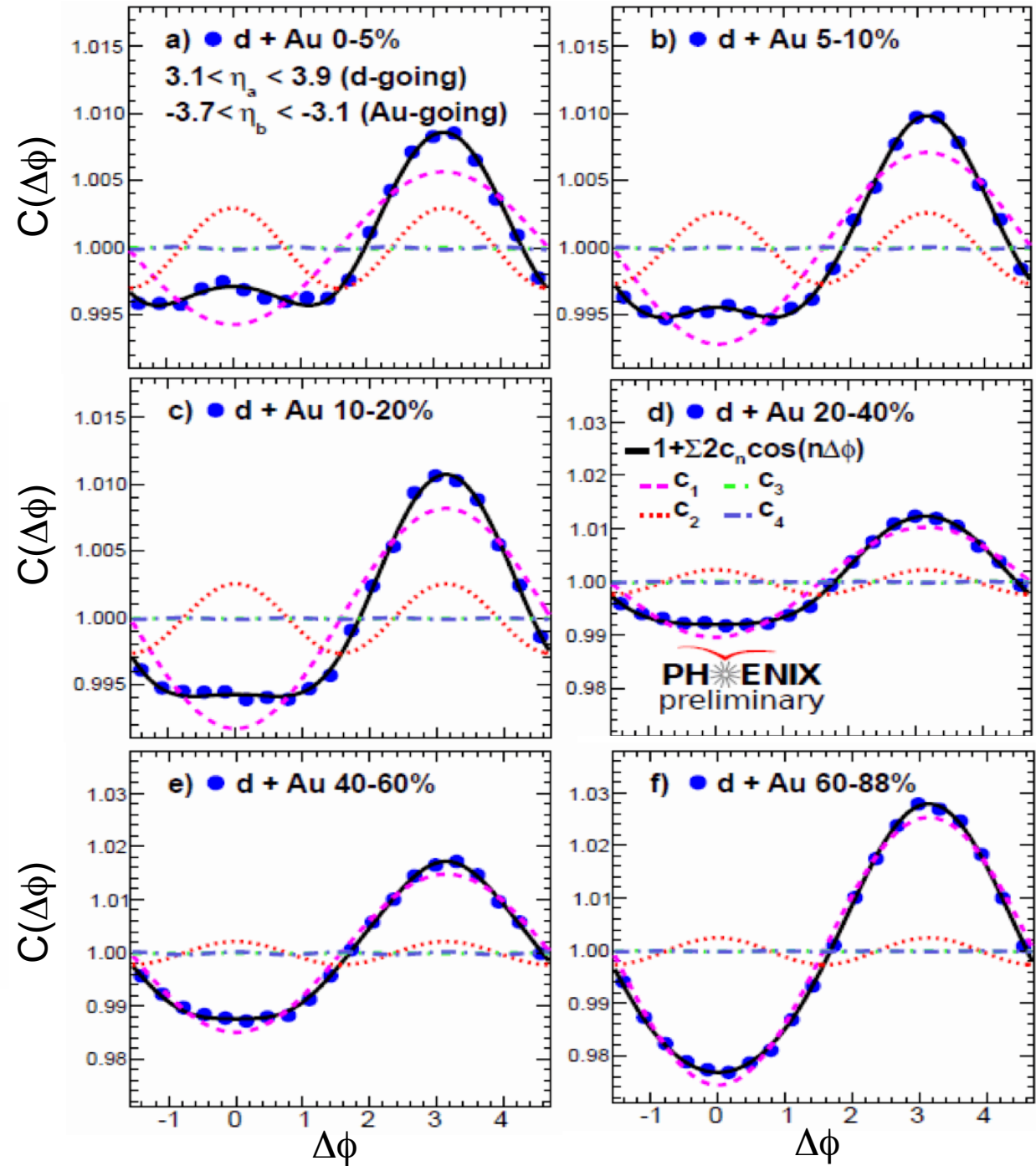
RHIC-PHENIX

Large $\Delta\eta$ correlation

(3) forward-backward

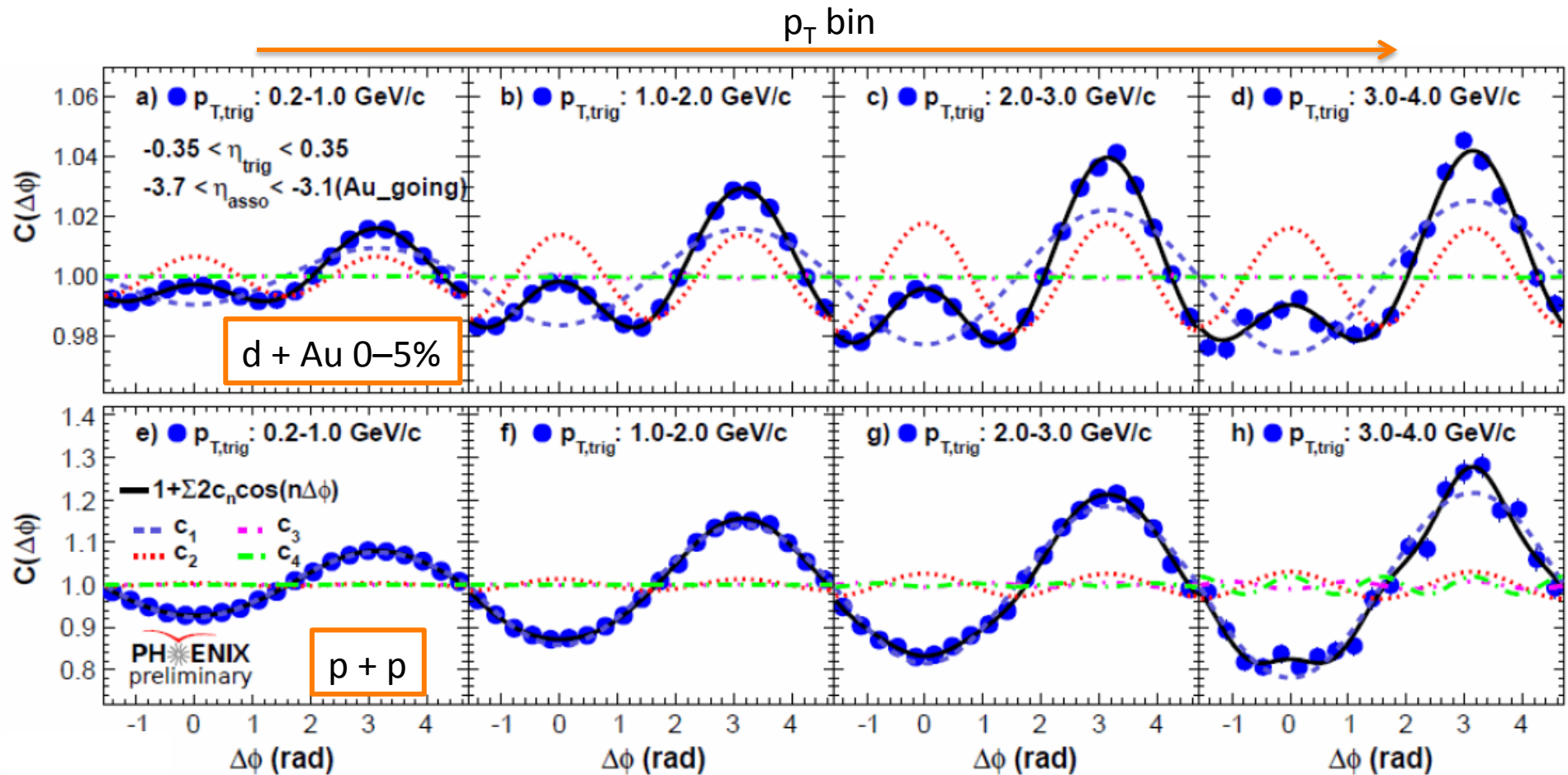


HP2013, S. Huang



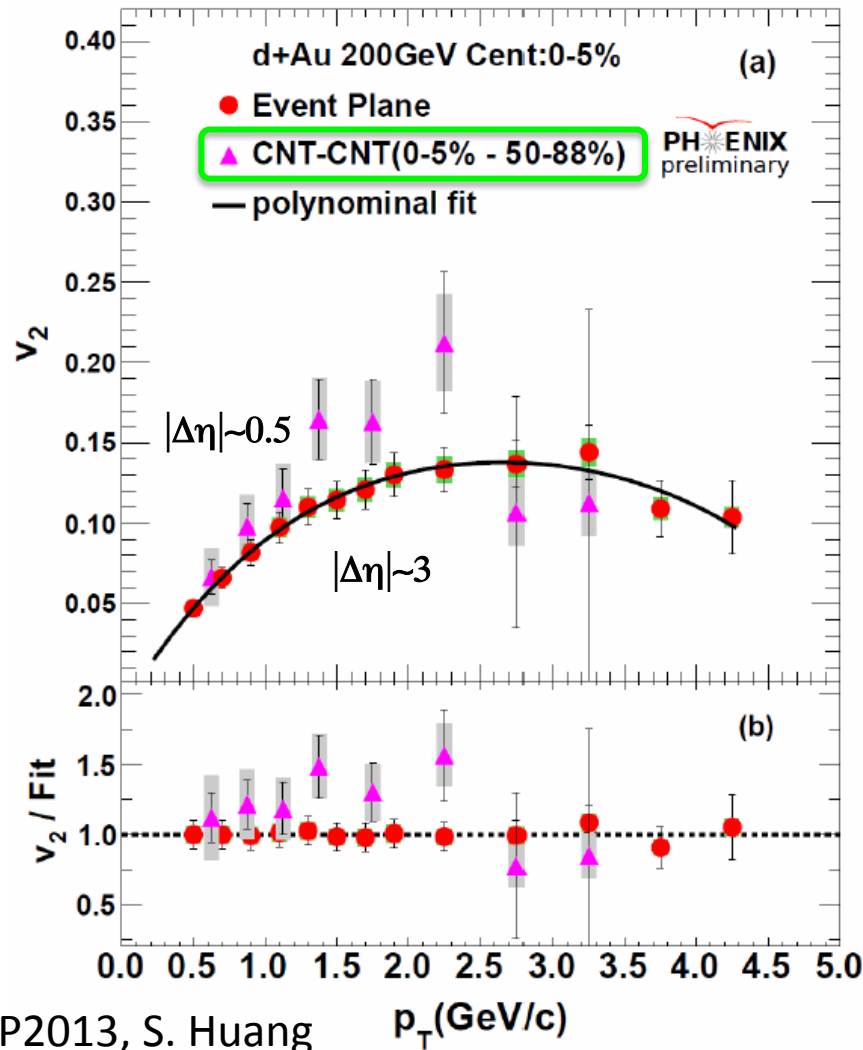
p_T dependence of central-backward correlation in d+Au and p+p collisions at 200GeV

HP2013, S. Huang

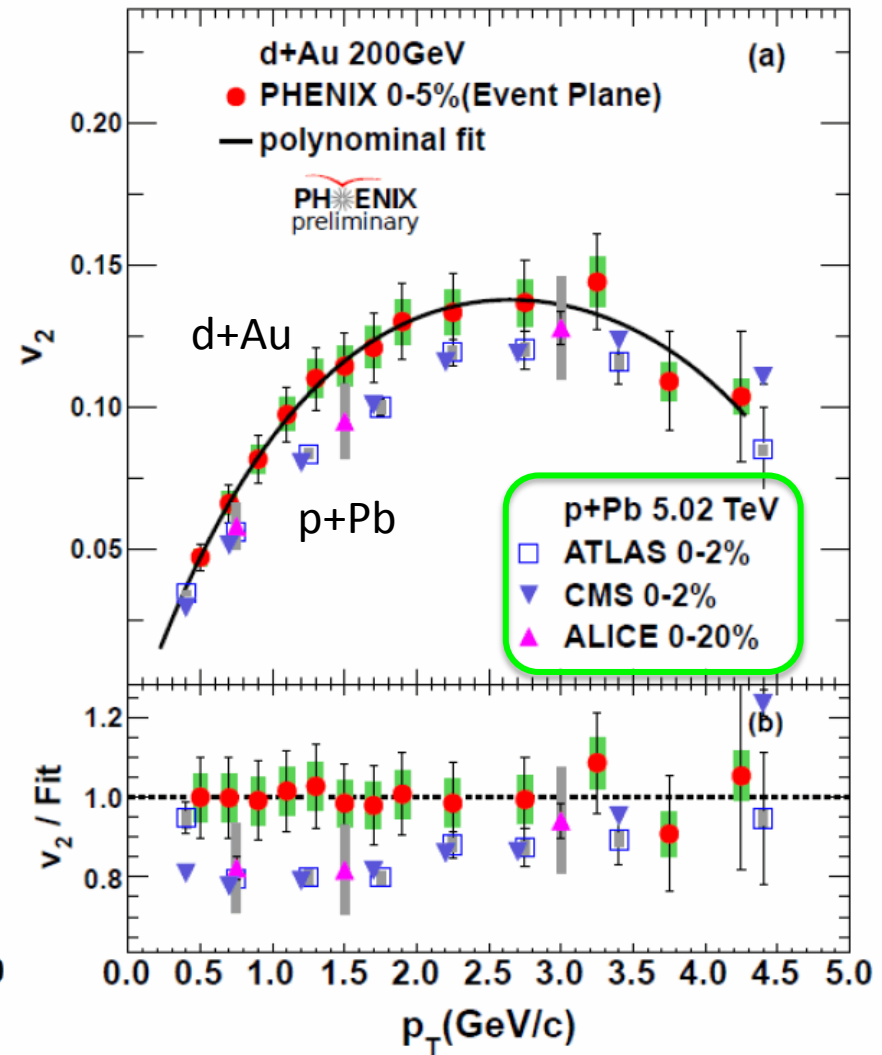


v_2 measured w.r.t. forward $\Phi_{E.P.}$ in d+Au 200GeV

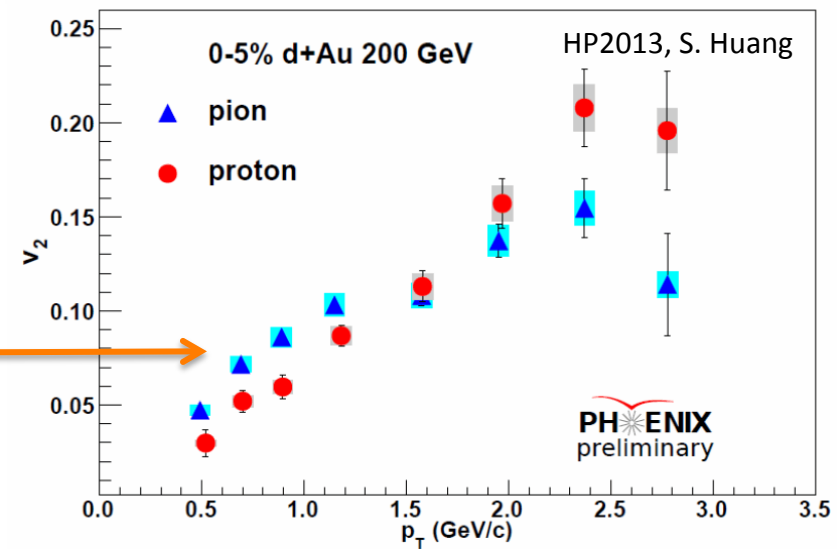
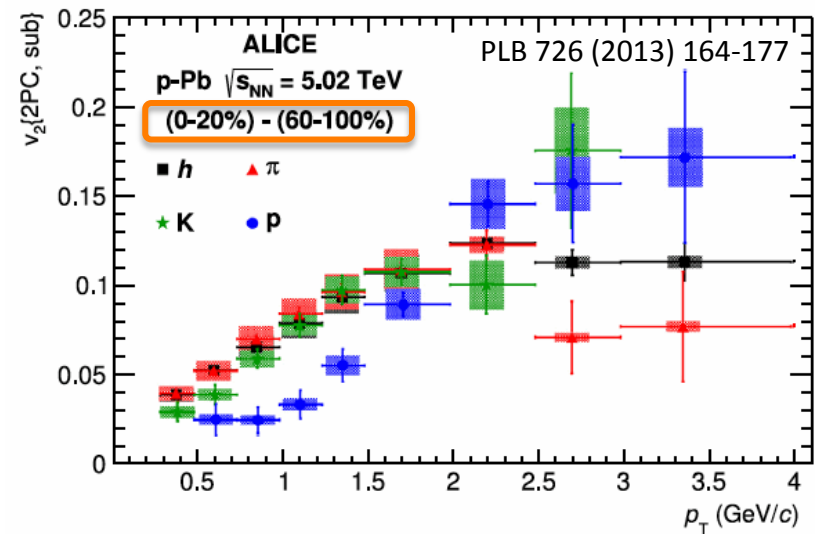
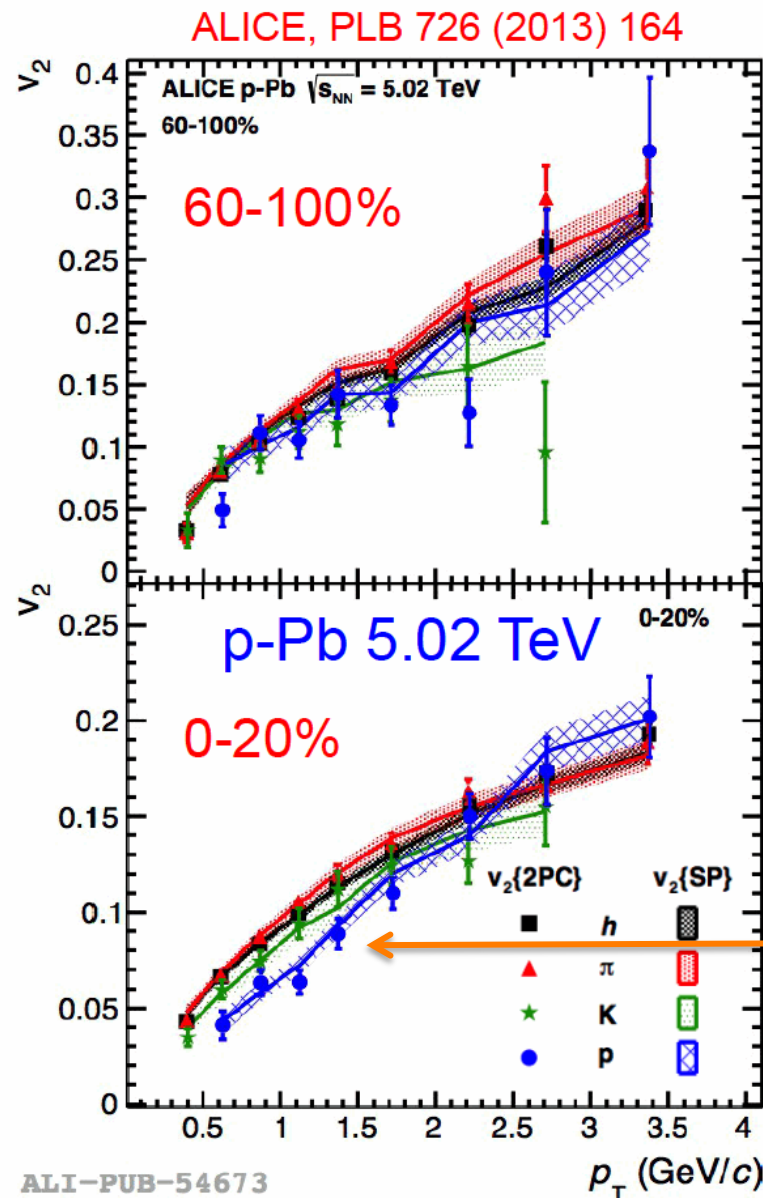
comparison to $v_2\{2PC\}$



comparison to LHC p+Pb



v_2 of identified particles in p+Pb and d+Au



Summary

- Multiplicity, spectra, R_{pA} and jets
- Ridge-like correlation and flow