U.S. DEPARTMENT OF ENERGY

A Multiplicity Selection Effect on the Long-range Dihadron Correlation Measurement in d+Au Collisions at RHIC

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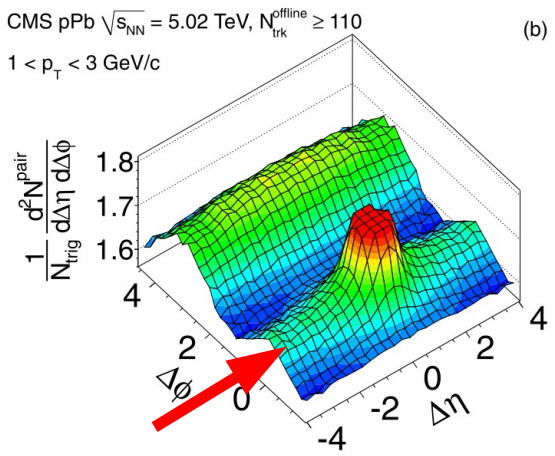
Outline

- Motivation
- Multiplicity selection effect on near-side jetlike yield
- Long-range near-side ridge
- Fourier coefficients
- Summary

Motivation

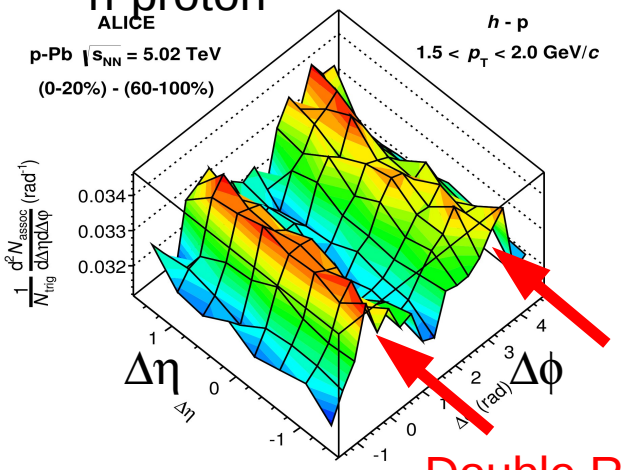
CMS pPb PLB 718 (2013) 795



Near-side Ridge

ALICE pPb 1307.3237

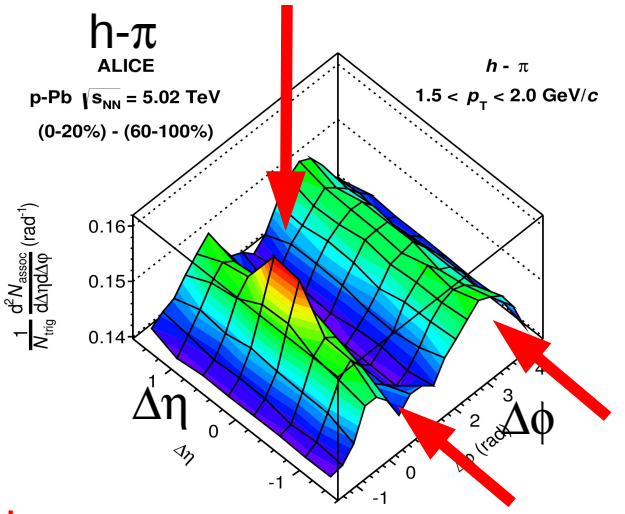
h-proton



Double Ridge

Jetlike correlation residue

h-π



Double Ridge

- Near-side ridge in pPb
- Double-ridge in high-mult. – low-multiplicity (for jets)
- Near-side jetlike yield multiplicity dependence?

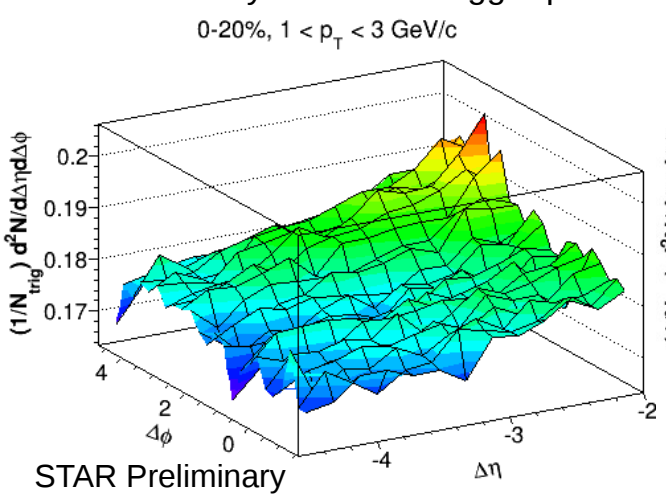
Dihadron $\Delta\eta-\Delta\phi$ Correlations

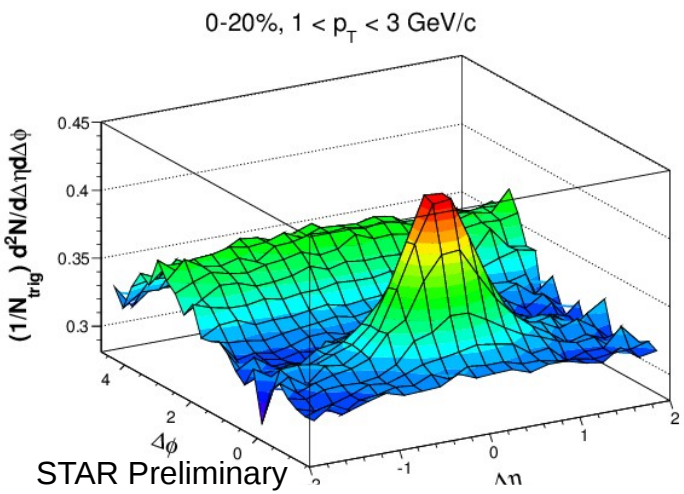
d+Au@200 GeV Run3

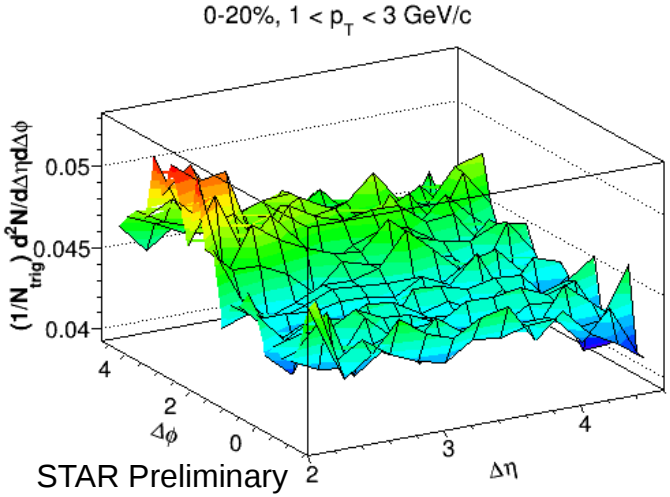
p_T: [1,3]x[1,3] GeV/*c*

Trigger-Associate

Normalized by number of trigger particles







TPC-FTPC (Au-going)

$-4.5<\Delta\eta<-2$

ZDC Energy

TPC-TPC

$-2<\Delta\eta<2$

FTPC Multiplicity or ZDC Energy

TPC-FTPC (d-going)

$2<\Delta\eta<4.5$

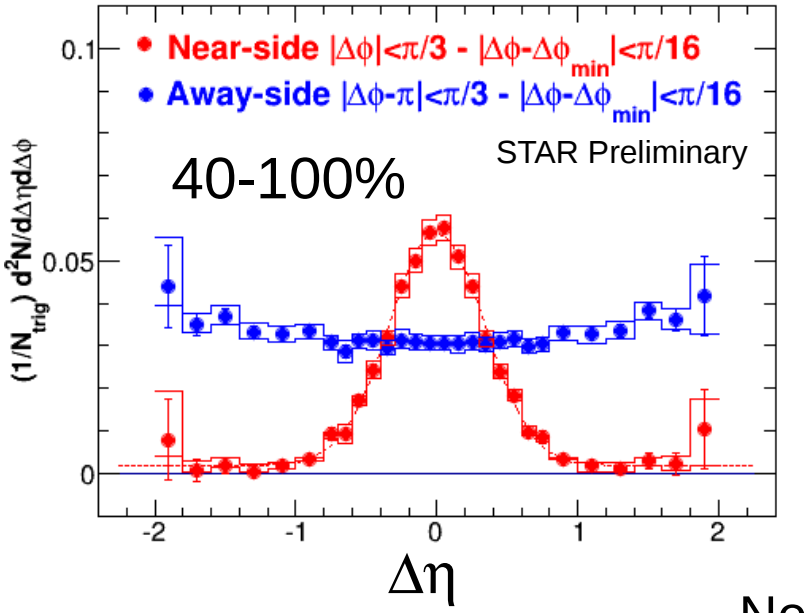
ZDC Energy

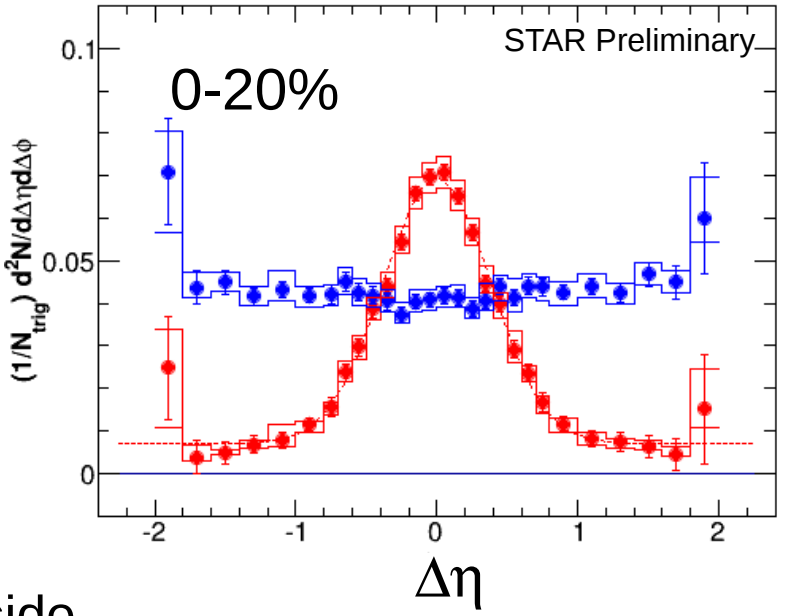
Background estimated by $\Delta\eta$-dependent ZYAM (Zero-Yield-At- Minimum)

Larger & Wider Near-side Jetlike Correlation in High-mult.

d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*
FTPC Multiplicity





Y = 0.0459(10)
σ = 0.336(6)
Ped = 0.0019(4)
χ^2/ndf = 19/25

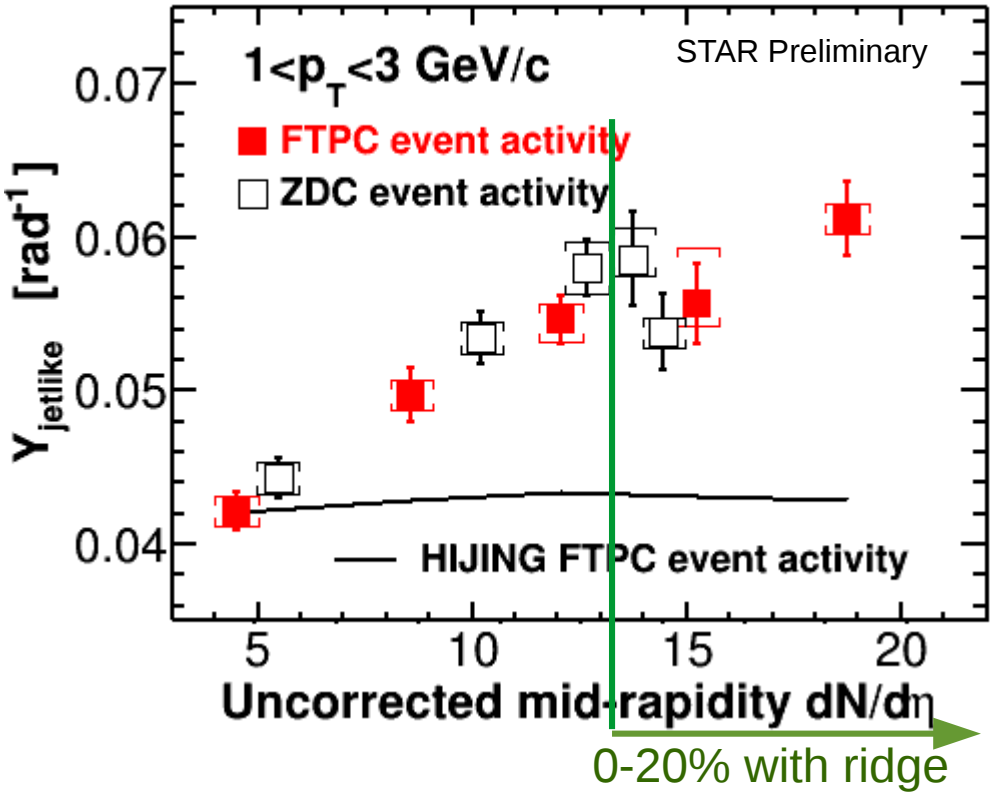
Near-side
Gaussian + Pedestal Fit

Y = 0.0594(18) Gaus. area
σ = 0.382(9) Gaus. width
Ped = 0.0070(8) Pedestal
χ^2/ndf = 19/25

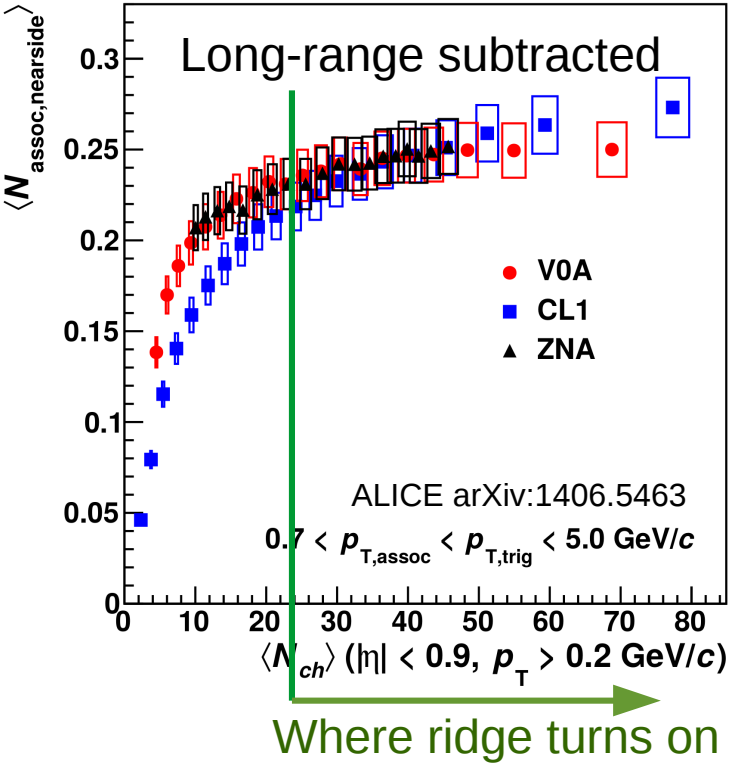
- Different jet shapes and yields between high-mult. and low-mult.

Near-side Jetlike Yield Multiplicity Dependence

d+Au@200 GeV



p+Pb @ 5.02 TeV

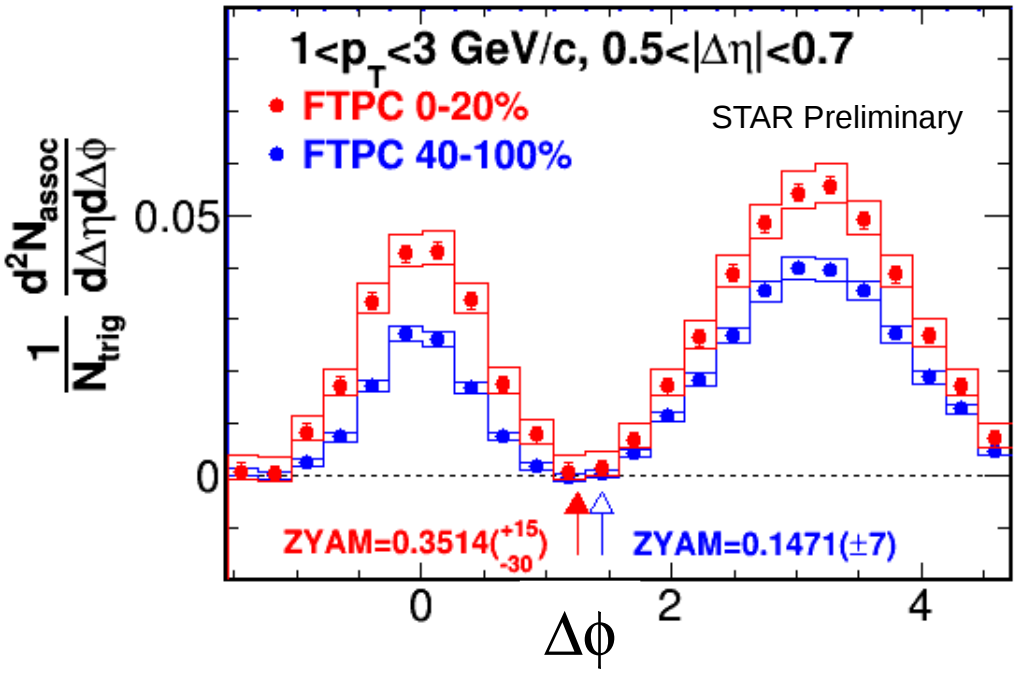


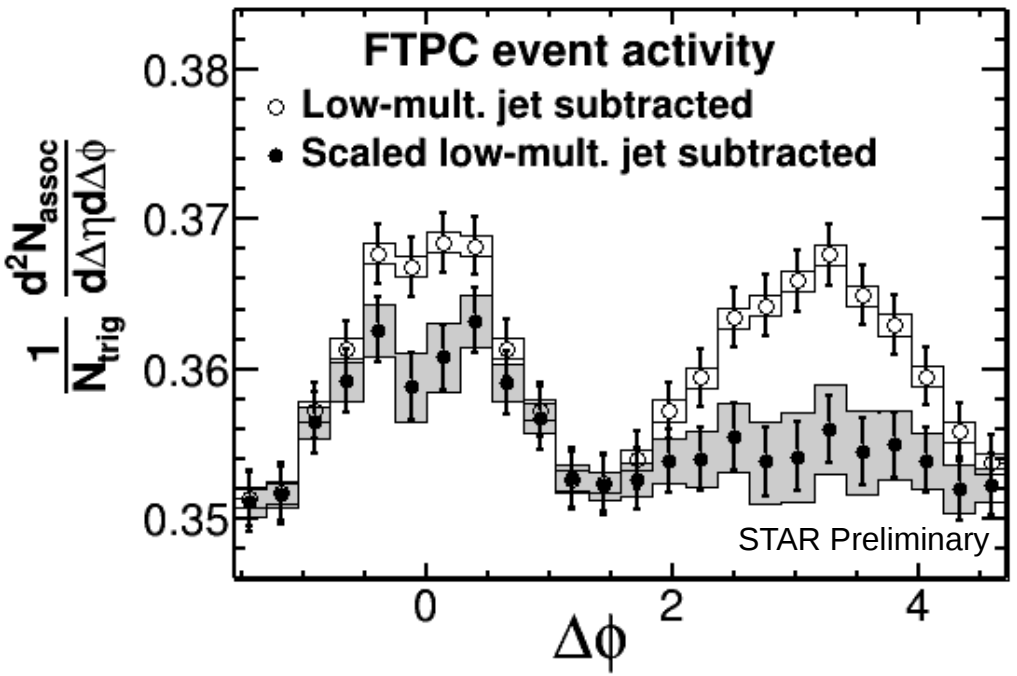
- Near-side jetlike yield increases as multiplicity

Near-side Jetlike Correlation Subtraction

d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*
FTPC Multiplicity





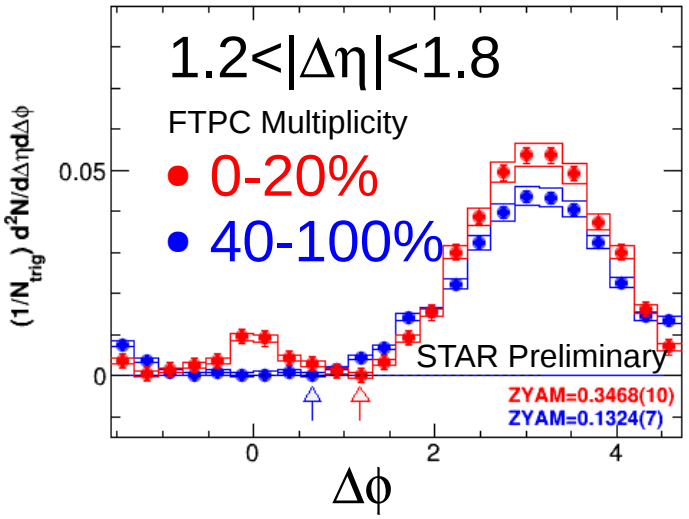
- High-mult. (before ZYAM) – jet in low-mult. → Double Ridge
- High-mult. (before ZYAM) – scaled jet in low-mult. → Away-side diminished

Near-side Long-range Correlations

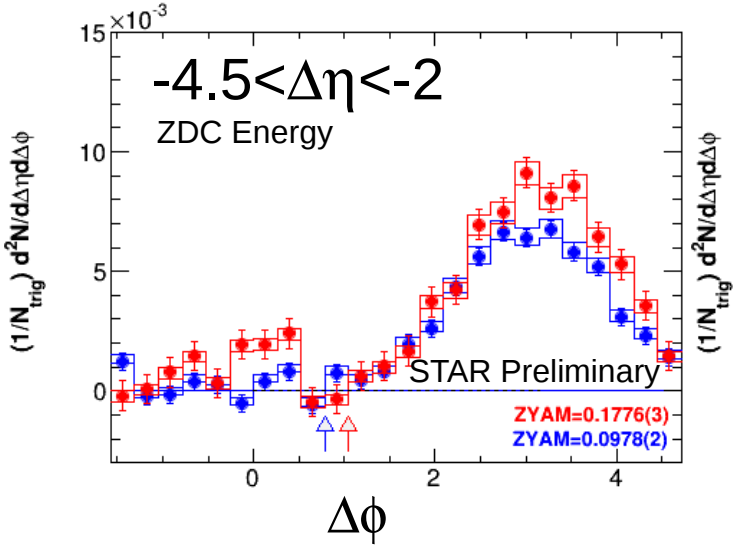
d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*

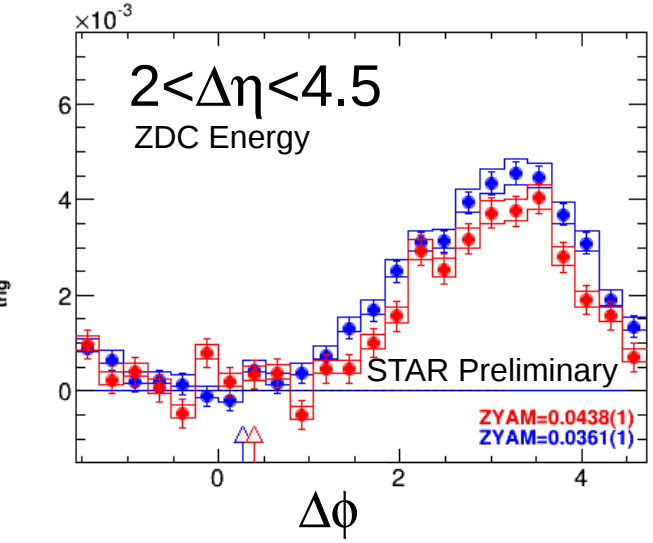
TPC-TPC



TPC-FTPC Au



TPC-FTPC d

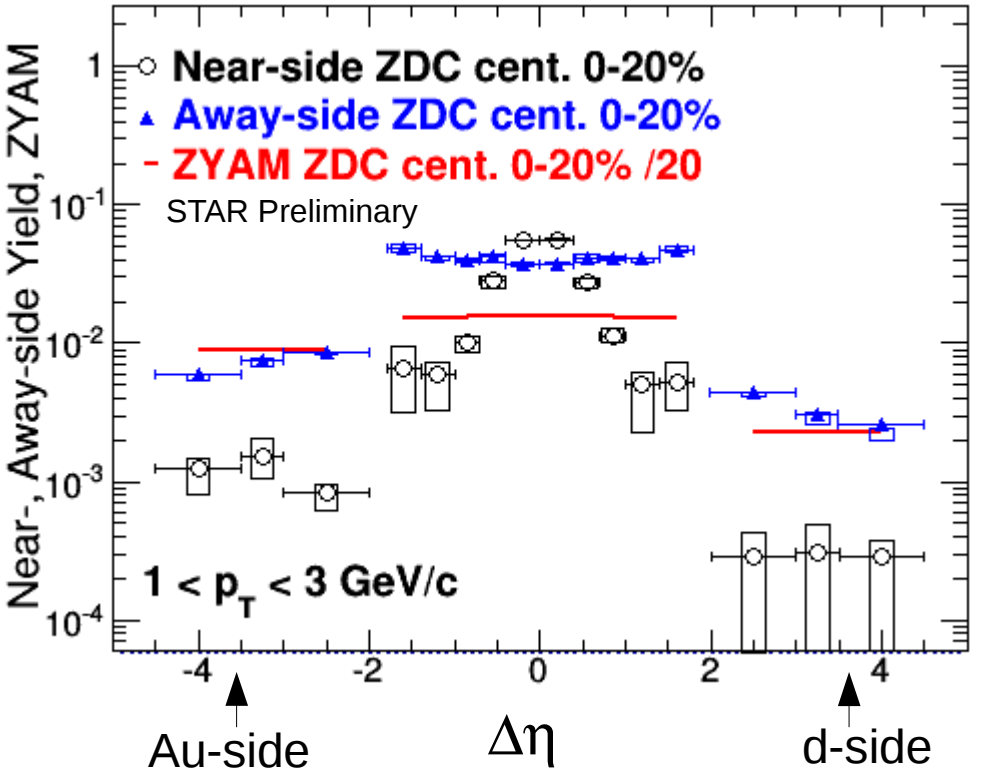


- Near-side long-range correlation extends to Au-going side

Near-side Yield Δη Dependence

d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*



- Away-side yield: dominated by jets in d+Au
- ZYAM: underlying event, related to medium

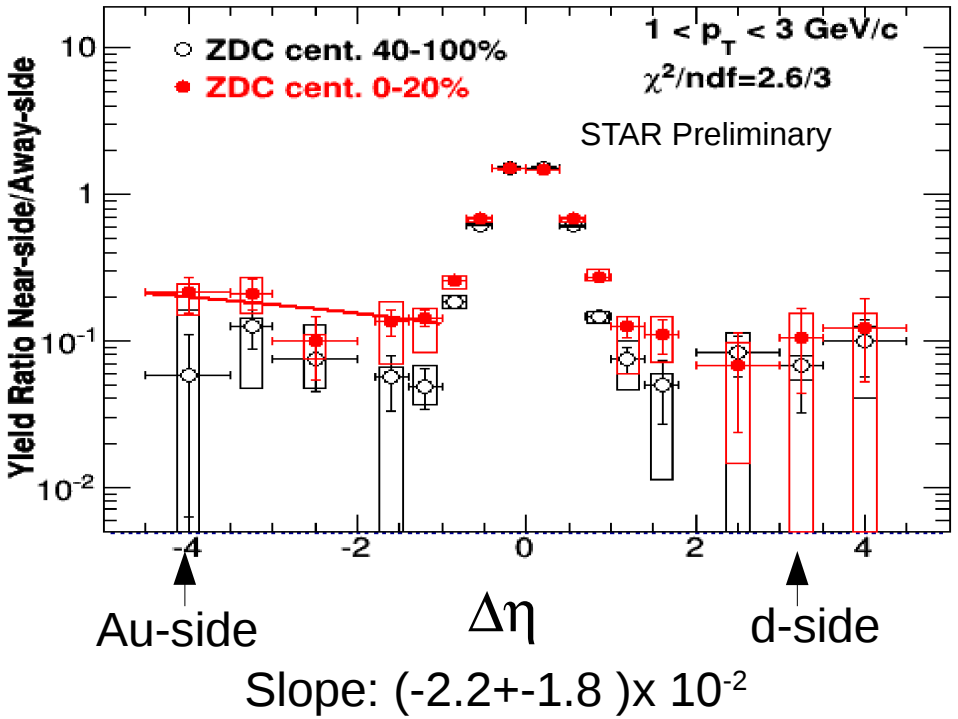
Near-side Yield Δη Dependence

d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*

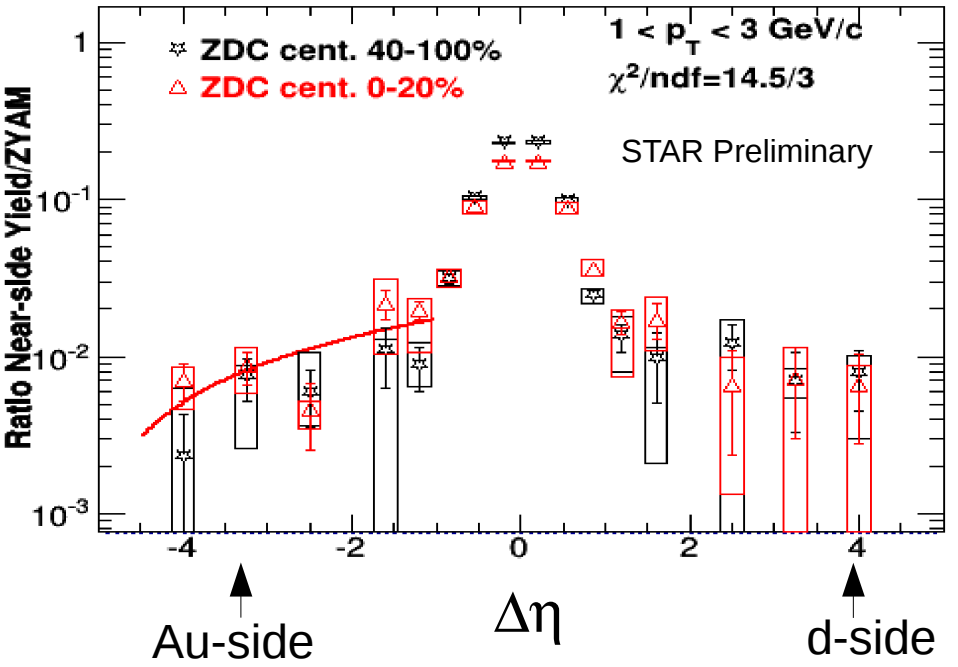
Fit with first order Polynomial:

Near-side / Away-side Yields



Slope: (-2.2+-1.8)x 10^{-2}

Near-side Yield / ZYAM



Slope: (4+-1)x 10^{-3}

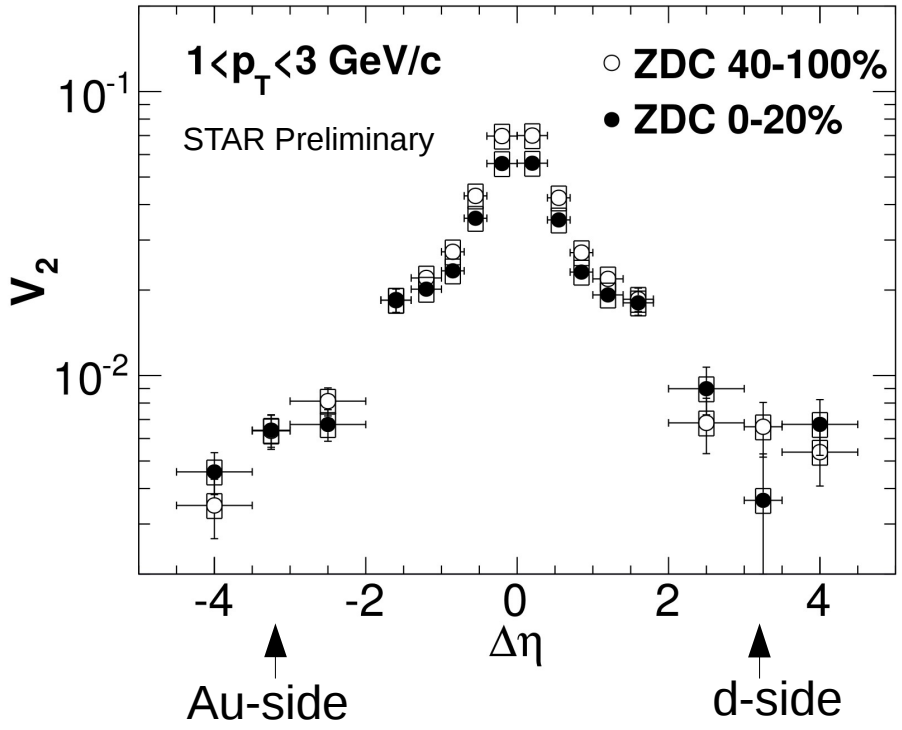
- Ridge proportional to away-side (ratio independent of Δη)
- Ridge doesn't scale with ZYAM underlying event

Fourier Coefficient V_2

d+Au@200 GeV

p_T: [1,3]x[1,3] GeV/*c*

$$V_2 = \langle \cos(2\Delta\phi) \rangle$$



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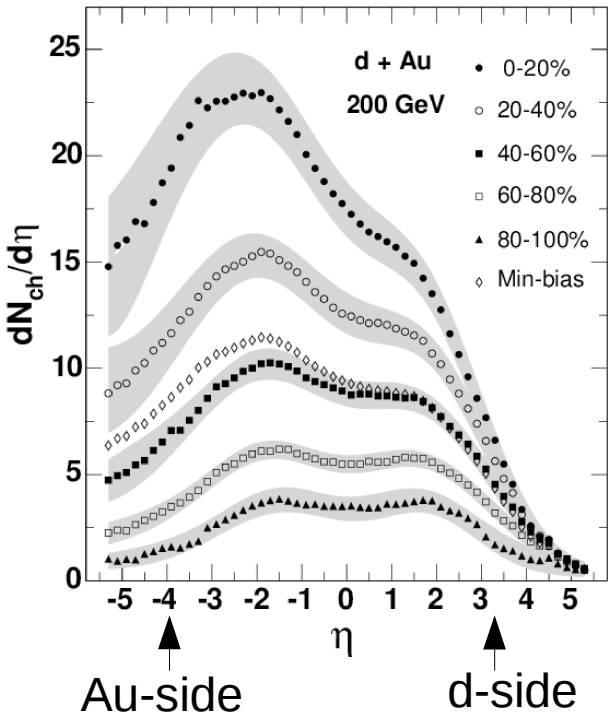
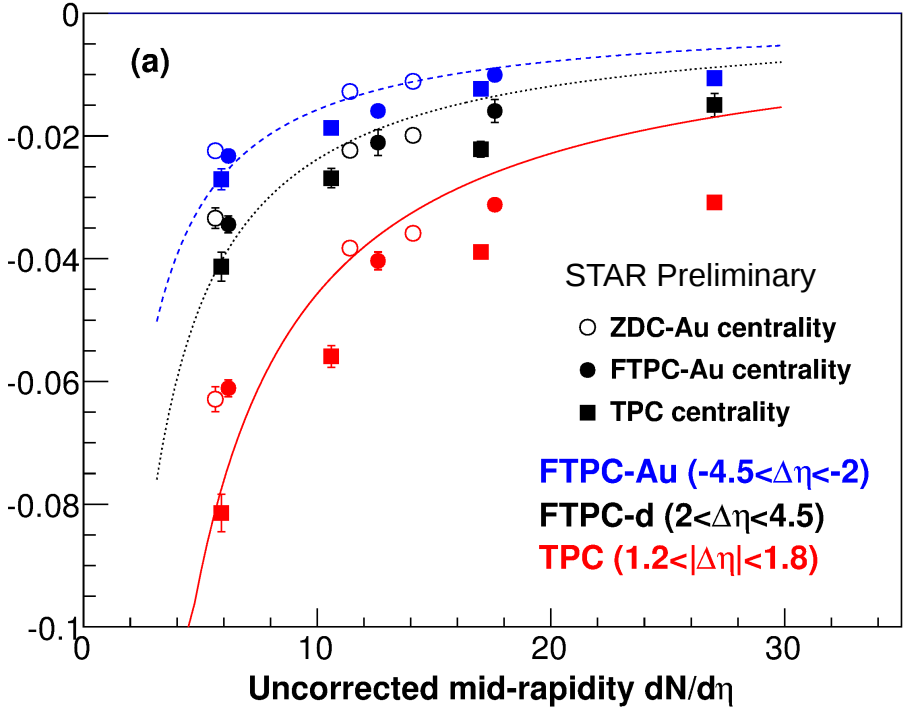


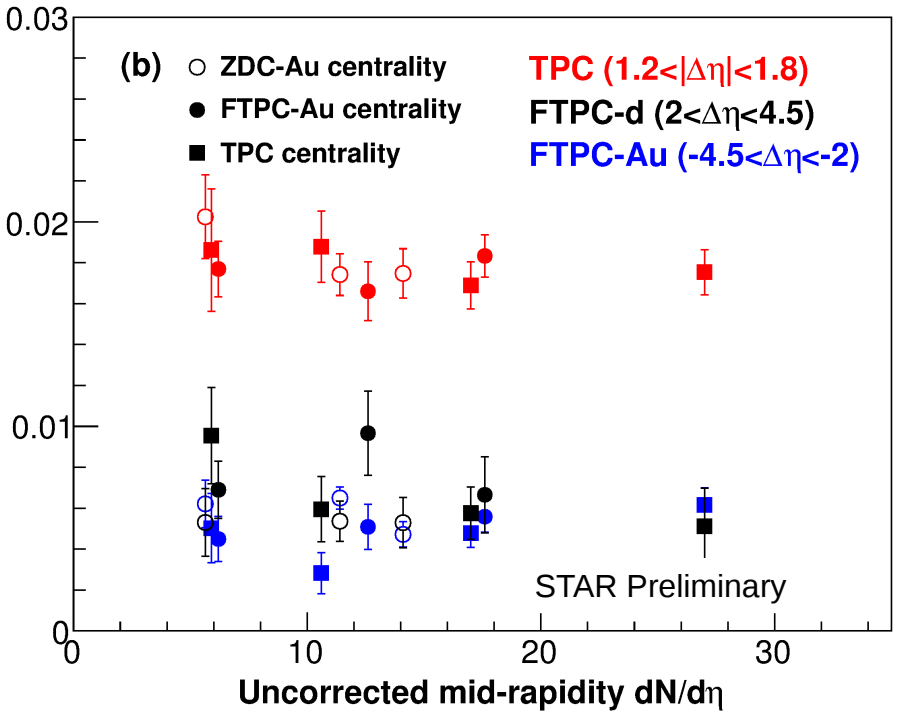
- Near-side ridge observed in Au-side high-mult. collisions
- Same V_2 for: high-mult. and low-mult., Au- and d-going side

Fourier Coefficients vs. Multiplicity

$V_1 = \langle \cos(\Delta\phi) \rangle$



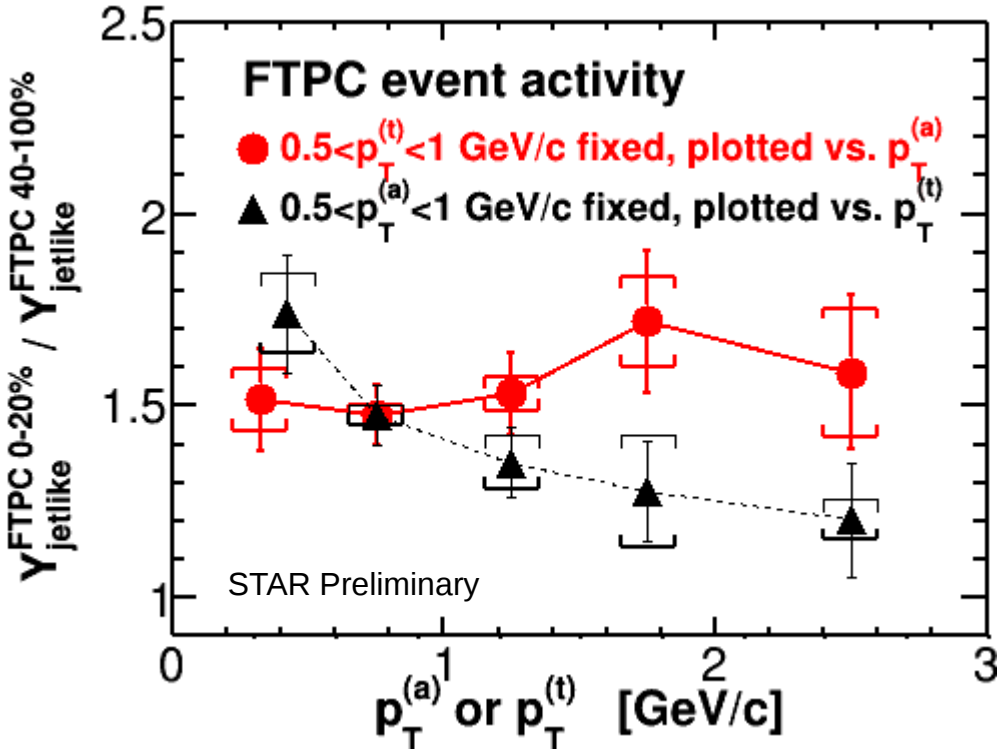
$V_2 = \langle \cos(2\Delta\phi) \rangle$



- Larger negative V_1 in low-mult. hides the V_2 shape
- V_2 are same in high-mult. and low-mult. collisions

Conclusion

- Event with high-multiplicity selects larger near-side jetlike yield
- Near-side long-range ridge is observed to extend to Au-going side in d+Au @200GeV
- Same V_2 in high-multi. and low-multi., Au-going and d-going side;
  Large negative V_1 in low-multi., d-going side.


FTPC event activity
0.5<p_T^(t)<1 GeV/c fixed, plotted vs. p_T^(a)
0.5<p_T^(a)<1 GeV/c fixed, plotted vs. p_T^(t)
STAR Preliminary
Y^FTPC 0-20% jetlike / Y^FTPC 40-100% jetlike
p_T^(a) or p_T^(t) [GeV/c]
2.5
2
1.5
1
0
1
2
3