Di-Jet Hadron Correlations In Central Au+Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV at STAR

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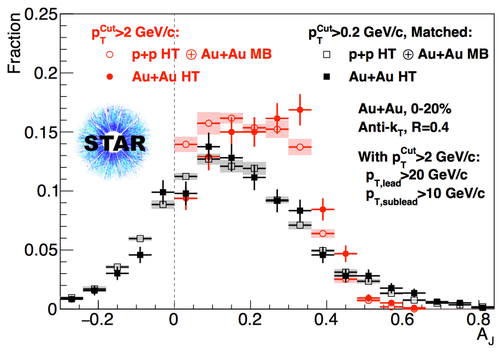
Abstract

For anti-k_T jets with a resolution parameter R = 0.4, previous measurements of the di-jet asymmetry A_J in central Au+Au collisions at STAR[1] indicate that the observed imbalance of an initial "hard-core" di-jet selection with $p_T^{cut} > 2.0$ GeV/c on constituents, $p_T^{lead} > 20.0$ GeV/c and $p_T^{sublead} > 10.0$ GeV/c is restored to the balance of the p+p reference when soft constituents are included. The lost energy is recovered in soft constituents within the jet radius of R = 0.4. With di-jet hadron correlations with respect to these di-jet pairs, we show that the trigger exhibits minimal modification when selected with a high energy neutral trigger, whereas the recoil jet shows signs of excess yield consistent with broadening and softening in the QGP medium.

A_J & Di-Jet Selection

$$A_J = \frac{p_T^{\mathrm{Lead}} - p_T^{\mathrm{SubLead}}}{p_T^{\mathrm{Lead}} + p_T^{\mathrm{SubLead}}}$$

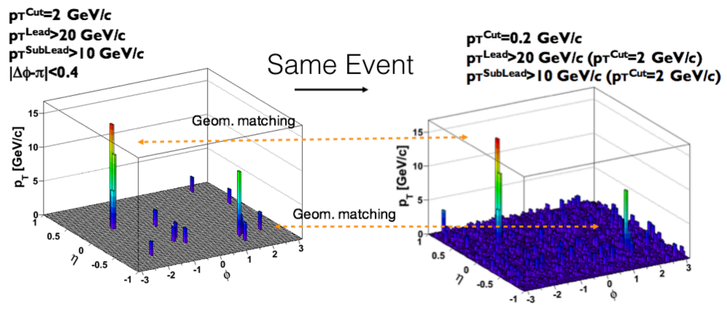


- A_J at STAR[1]: A "hard-core" di-jet sample selected with hard constituent cut during jet finding was more imbalanced than in p+p
- Balance restored to the level of the p+p reference when including soft constituents

→ "Lost" energy recovered within cone of R=0.4

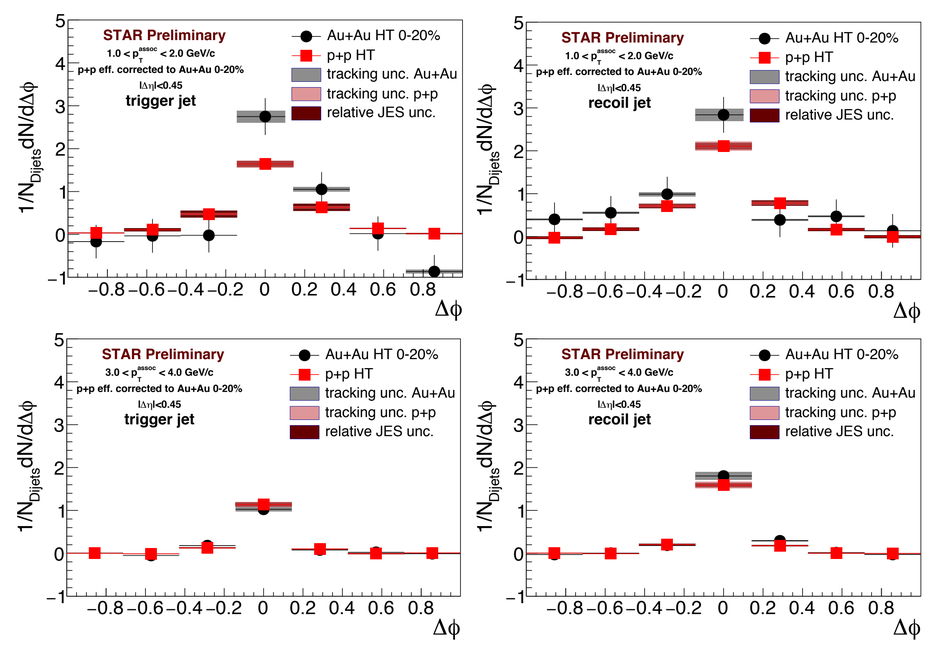
Di-jet selection for di-jet hadron correlations:

- Jets found with neutral & charged energy – correlations done with charged tracks
- Similar to A_J – use hard background to reduce combinatoric jets
- Anti-k_T, R=0.4, $p_T^{lead} > 20$ GeV/c $p_T^{sublead} > 10$ GeV/c, back-to-back in Δφ, with a constituent $p_T^{cut} > 2.0$ GeV/c → full event clustered, matched geometrically to hard core jets
- **Difference:** online trigger –> neutral energy bias. To compare Au+Au to p+p, require neutral tower with E > 6 GeV – this defines our trigger jet



Δφ Di-jet Hadron Correlations

- Flow (v_n) subtraction: subtract large Δη (0.45<|Δη|<1.0) from signal region (|Δη| < 0.45)

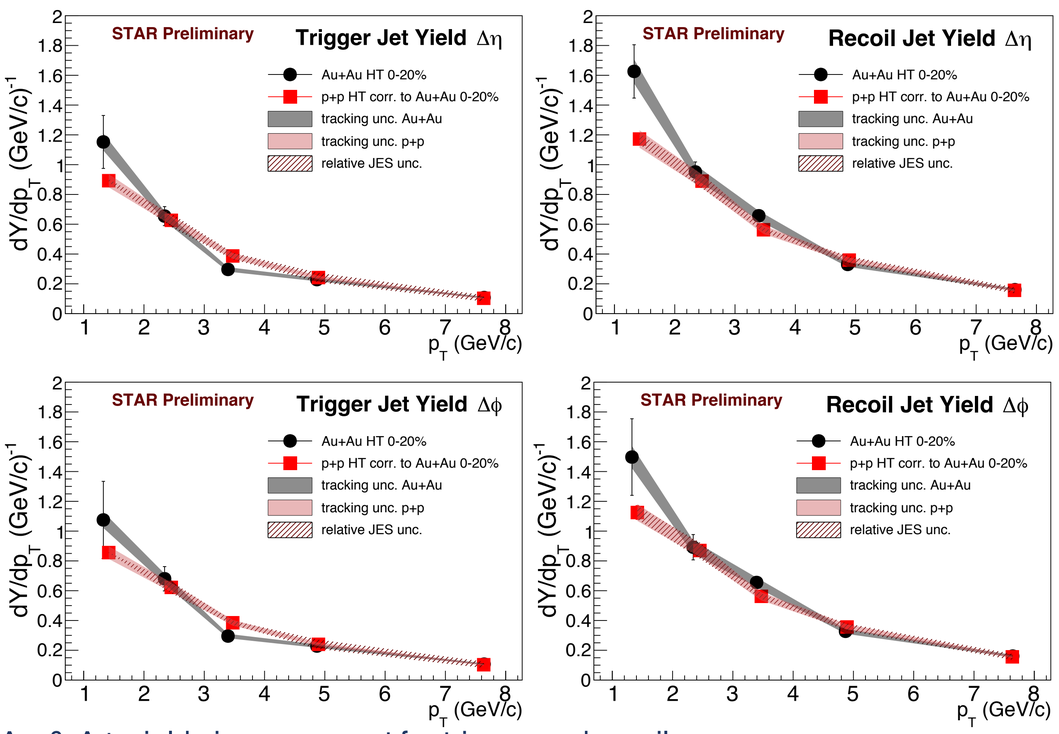


Yield(Y) in Δφ: bin counting in |Δφ| < 0.71

Yields

- Au+Au: additional "correlated" yield from background fluctuations above 2.0 GeV/c due to jet definition

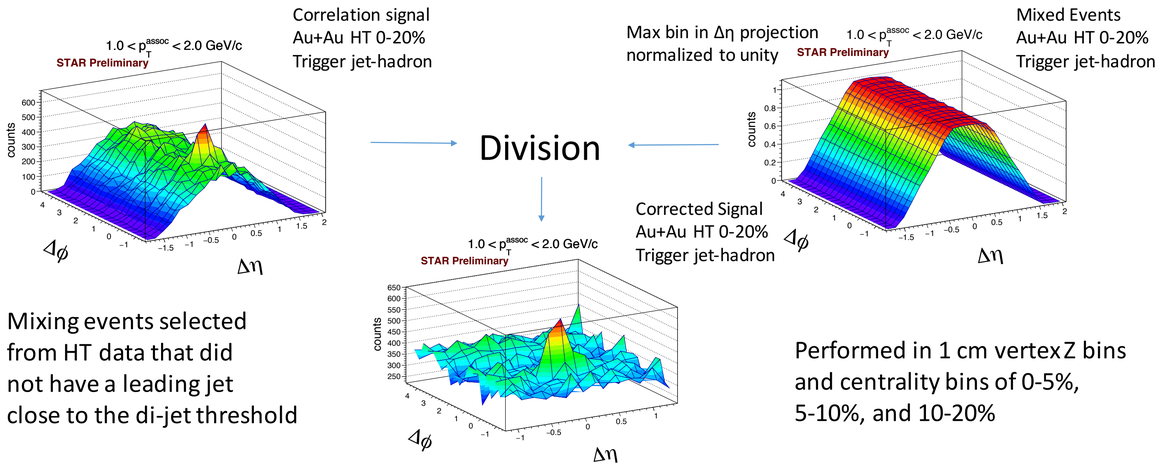
→ Au+Au yields corrected using p+p embedded in Au+Au minimum bias data by estimating excess embedding event contribution to yield



- Δη & Δφ yields in agreement for trigger and recoil
- Trigger jet: Au+Au consistent with p+p – no significant modification
- Recoil jet: hints of excess low p_T yield, not significant within current uncertainties → expect large population of balanced di-jets diluting measurement when integrating over all A_J

Trigger Jet & Recoil Jet Hadron Correlation Corrections

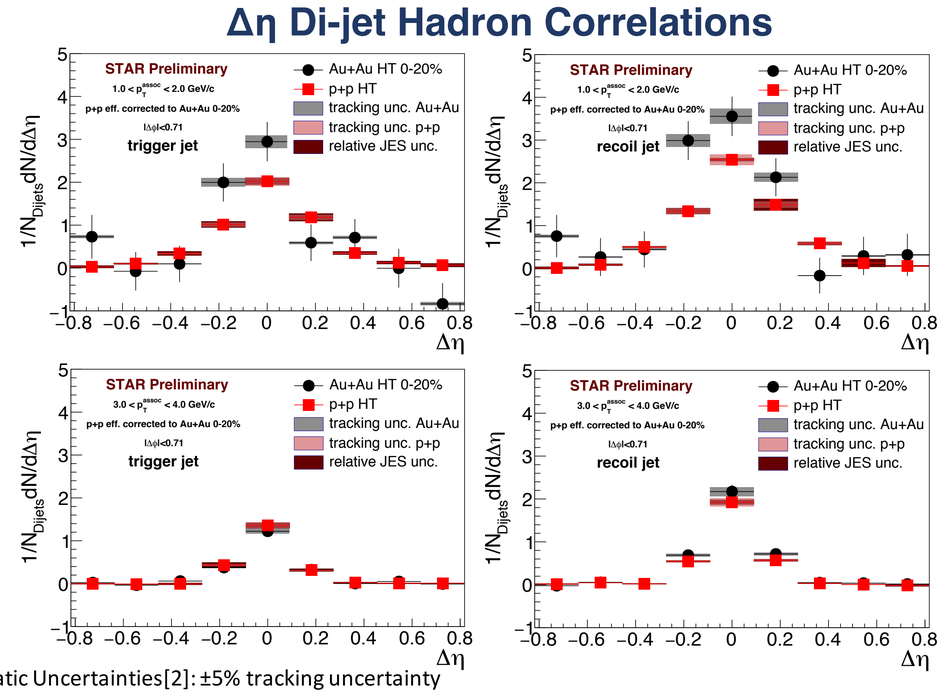
- Di-jet hadron correlations in $\Delta\eta = \eta^{jet}-\eta^{hadron}$ and $\Delta\phi = \phi^{jet}-\phi^{hadron}$ for both trigger and recoil jets
- Corrected for pair acceptance effects by a mixed-event method
- Correlations and mixed events corrected for single-track efficiency



Mixing events selected from HT data that did not have a leading jet close to the di-jet threshold

Performed in 1 cm vertex Z bins and centrality bins of 0-5%, 5-10%, and 10-20%

Δη Di-jet Hadron Correlations



Systematic Uncertainties[2]: ±5% tracking uncertainty (Au+Au & p+p)
Correcting p+p to Au+Au detector level - JES uncertainty: ±2% relative tower energy scale added in quadrature with ±7% relative tracking eff (p+p only)

Yield(Y) in Δη: bin counting, |Δη| < 0.45

Conclusion

- Trigger jet: no significant modification with respect to to p+p → surface bias
- Recoil jet: hint of excess yield, limited by uncertainties
- Expect large population of balanced di-jets diluting measurement when integrated over A_J → differential measurements
- Pursue more differential measurements with larger statistics, year 14 data
- Building on A_J analysis → possibility of jet-geometry engineering

References

[1] Adamczyk L *et al.* (STAR) arXiv:1609.03878 [nucl-ex].
[2] Adamczyk L *et al.* (STAR) Phys. Rev. Lett. 112, no. 12, 122301 (2014)

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