

Di-Jet Hadron Correlations In Central Au+Au Collisions

at $\sqrt{s_{NN}} = 200$ GeV at STAR

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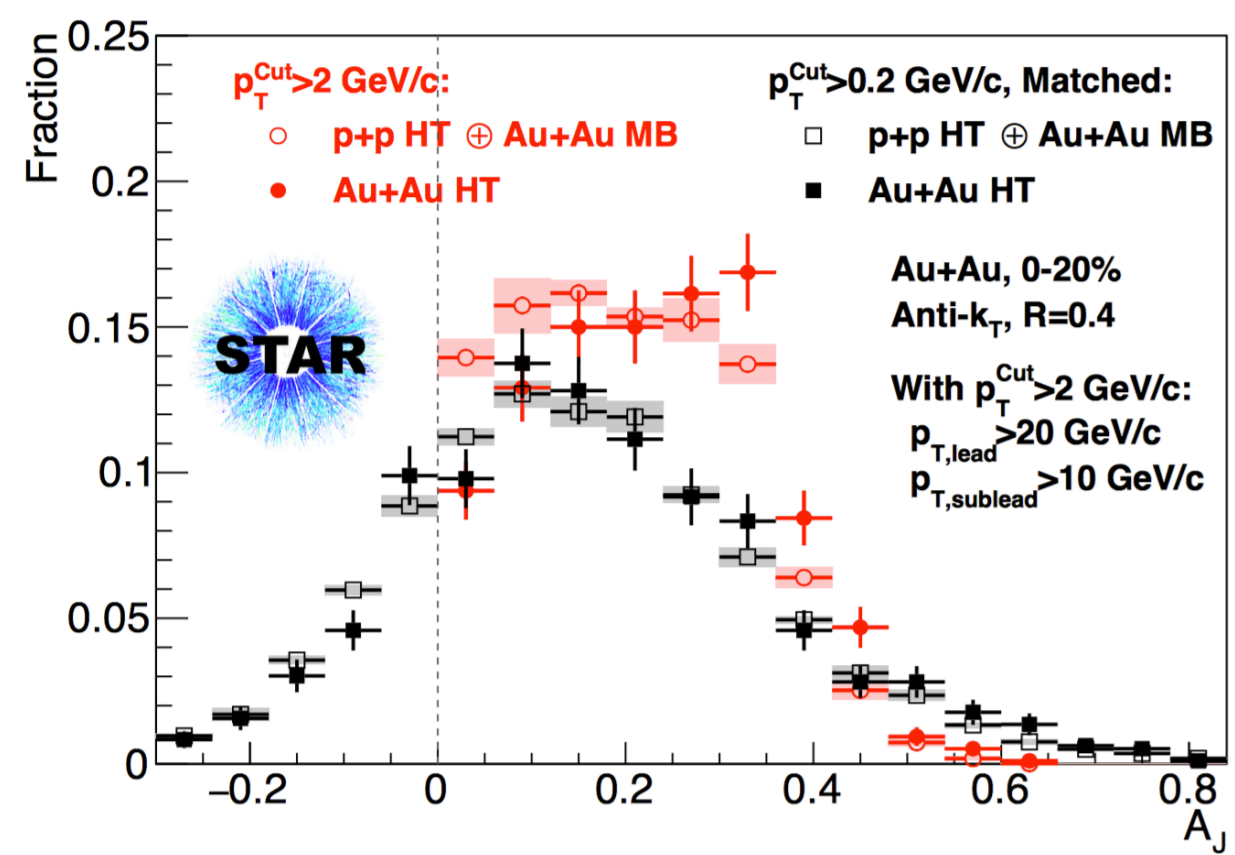
STAR



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 $p_T^{\text{cut}} > 2.0$ GeV/c on constituents, $p_T^{\text{lead}} > 20.0$ GeV/c and $p_T^{\text{sublead}} > 10.0$ 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



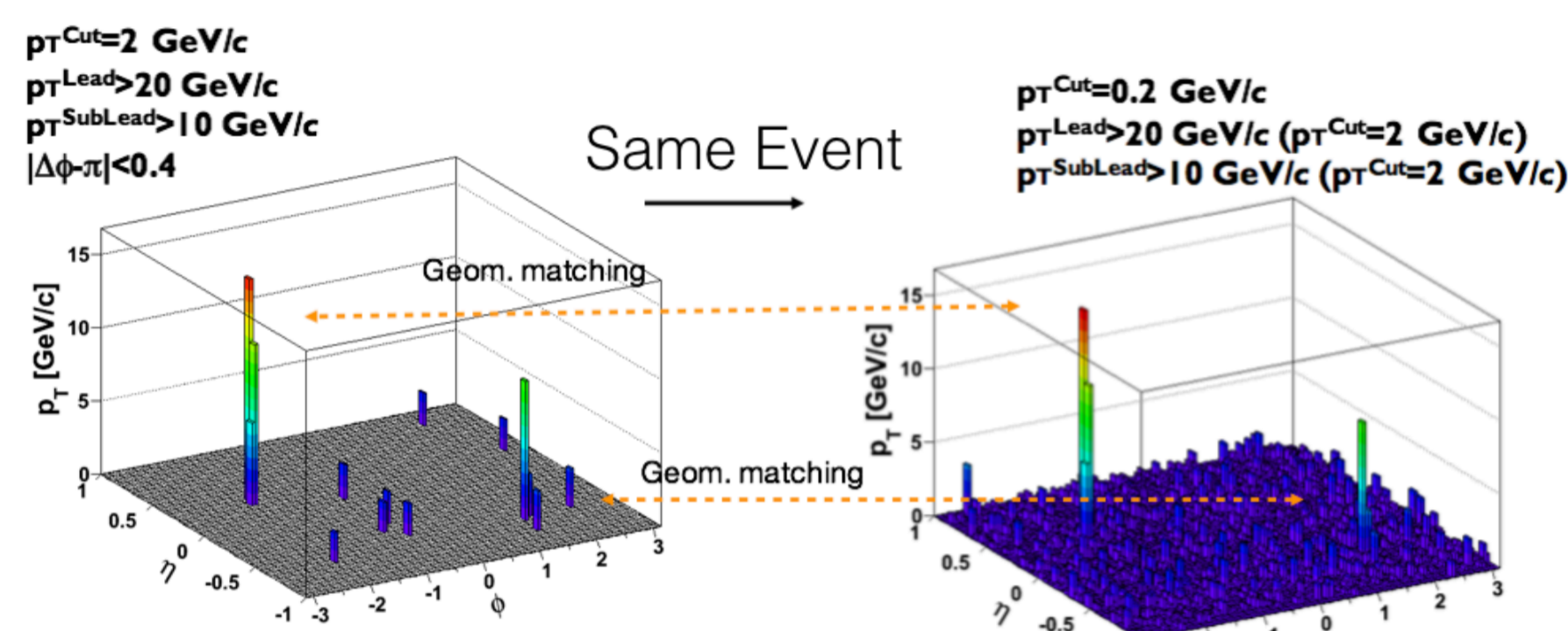
$$A_J = \frac{p_T^{\text{Lead}} - p_T^{\text{SubLead}}}{p_T^{\text{Lead}} + p_T^{\text{SubLead}}}$$

- 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 $R=0.4$

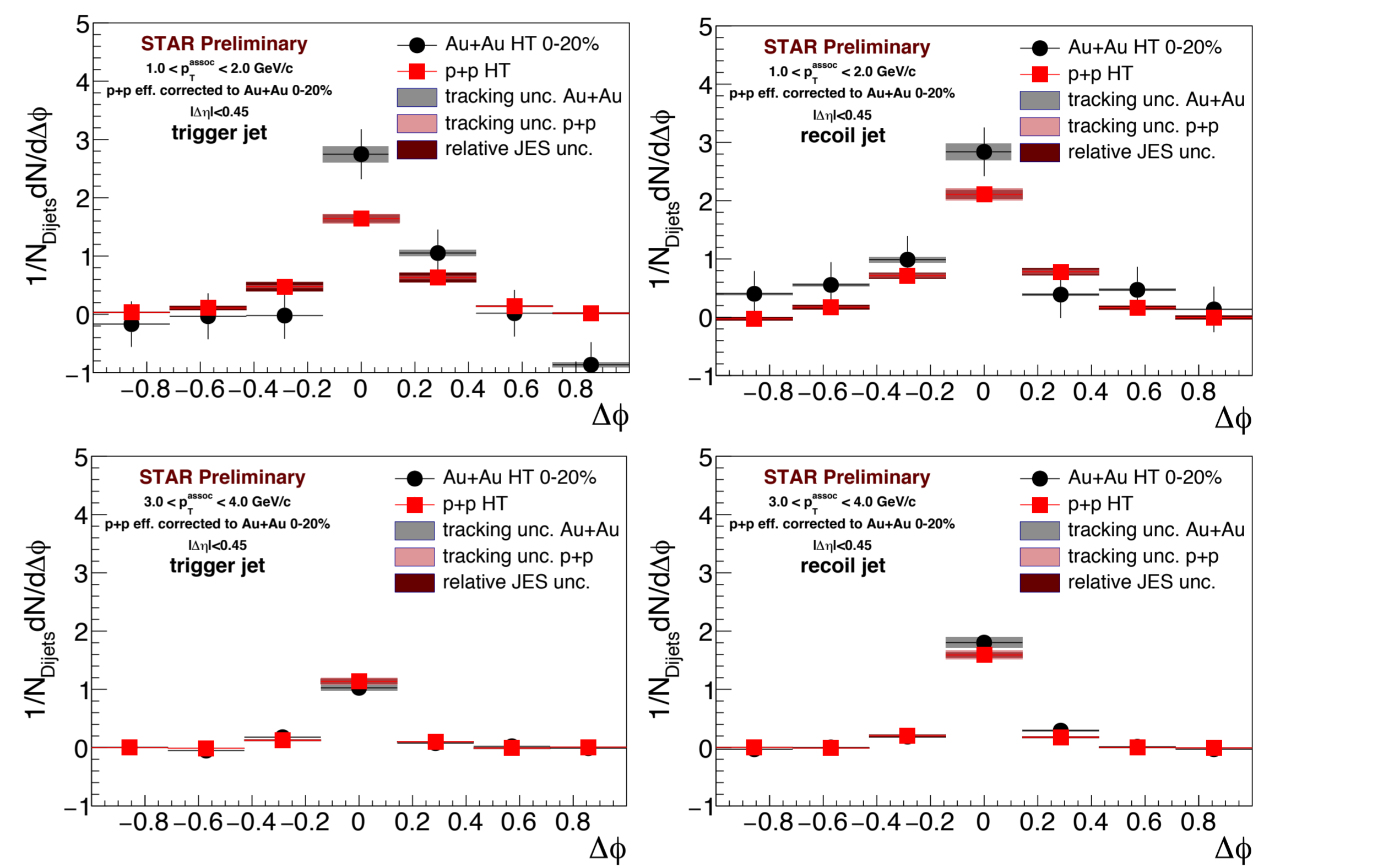
Di-jet selection for di-jet hadron correlations:

- 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 , $R=0.4$, $p_T^{\text{lead}} > 20$ GeV/c $p_T^{\text{sublead}} > 10$ GeV/c, back-to-back in $\Delta\phi$, with a constituent $p_T^{\text{cut}} > 2.0$ GeV/c \rightarrow full event clustered, matched geometrically to hard core jets
- Difference:** online trigger \rightarrow neutral energy bias. To compare Au+Au to p+p, require neutral tower with $E > 6$ GeV – this defines our trigger jet



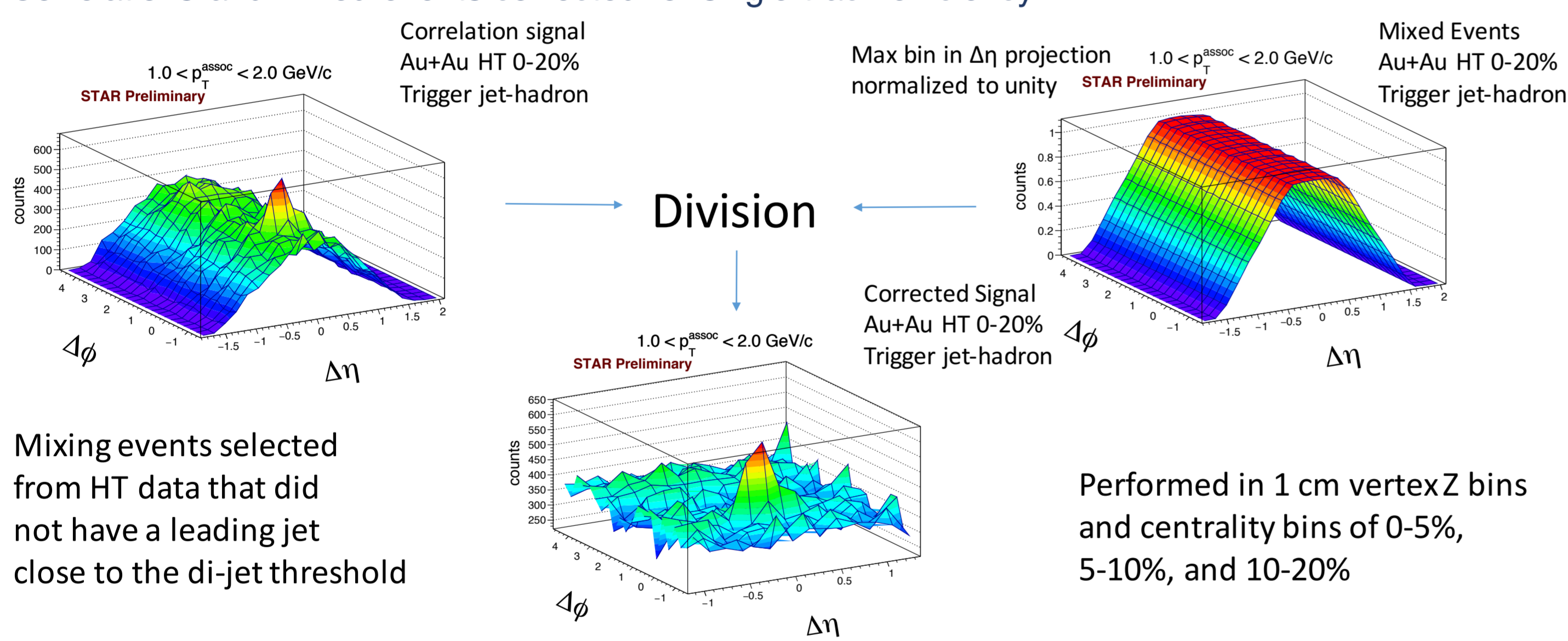
$\Delta\phi$ Di-jet Hadron Correlations

- Flow (v_n) subtraction: subtract large $\Delta\eta$ ($0.45 < \Delta\eta < 1.0$) from signal region ($|\Delta\eta| < 0.45$)



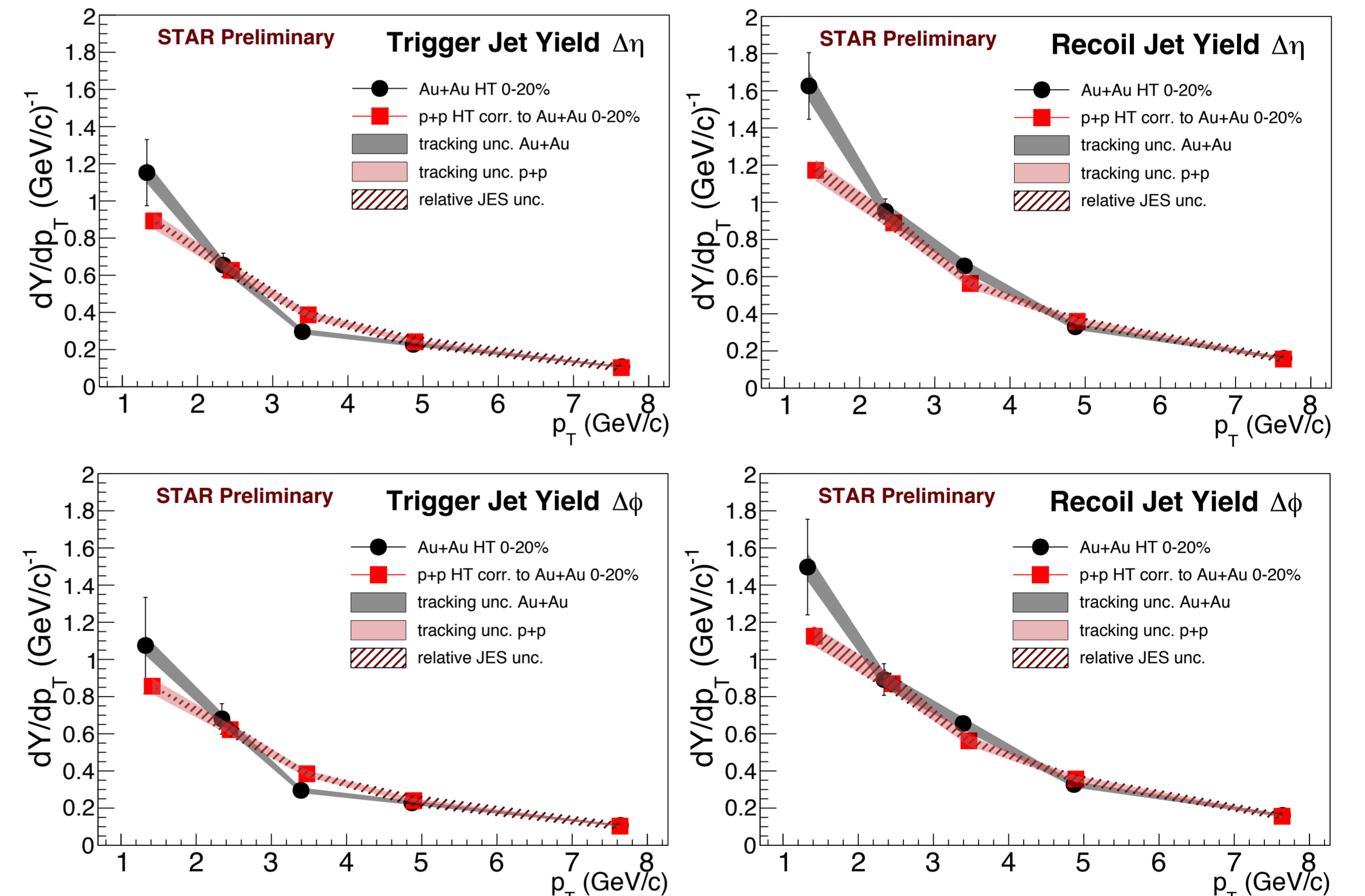
Trigger Jet & Recoil Jet Hadron Correlation Corrections

- Di-jet hadron correlations in $\Delta\eta = \eta^{\text{jet}} - \eta^{\text{hadron}}$ and $\Delta\phi = \phi^{\text{jet}} - \phi^{\text{hadron}}$ 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



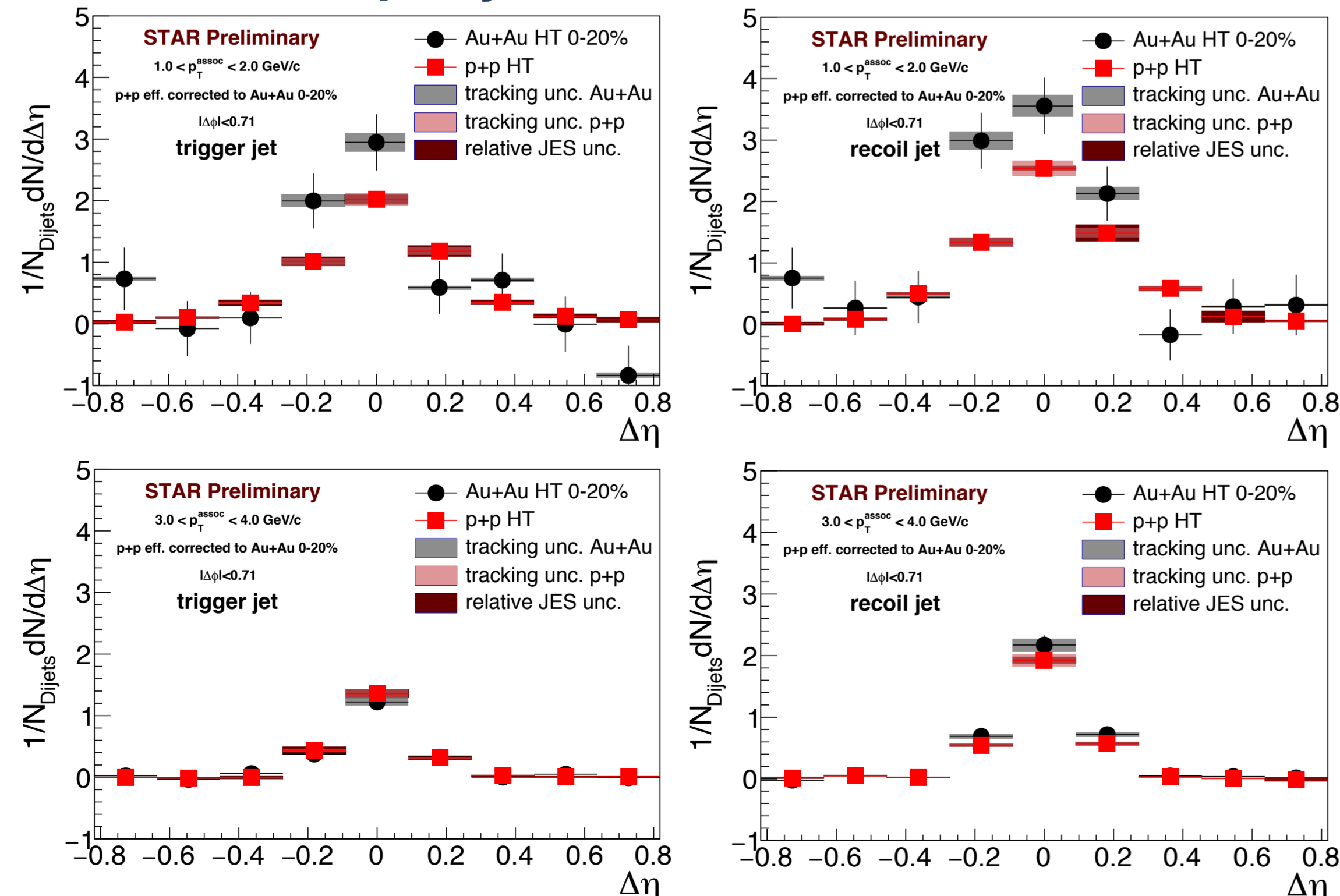
Yields

- 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



- $\Delta\eta$ & $\Delta\phi$ 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 \rightarrow expect large population of balanced di-jets diluting measurement when integrating over all A_J

$\Delta\eta$ Di-jet Hadron Correlations



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

Conclusion

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