Azimuthal correlations with high p_T multi-hadron cluster triggers in Au+Au collisions at sqrt(s) = 200 GeV from STAR

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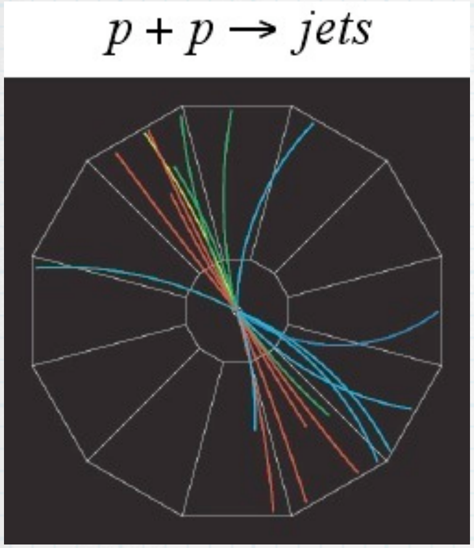
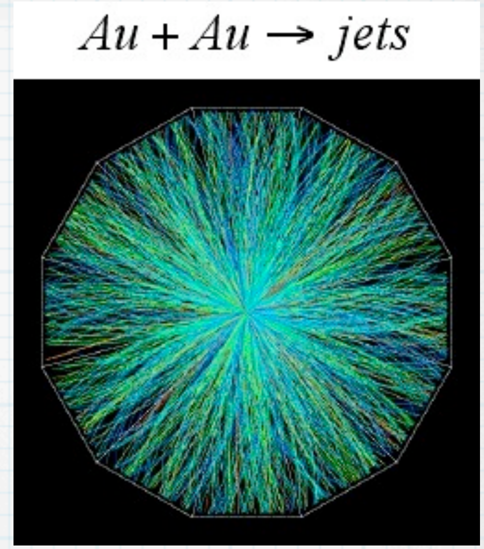
OUTLINE

- Introduction / Analysis Technique
- Explanation of multi-hadron trigger results
  - away-side yields in central Au+Au collisions and in pythia p+p collisions:
    - 10 to 12 GeV/c, 12 to 15 GeV/c, and 15 to 18 GeV/c
  - Ratios
    - multi-hadron to di-hadron away side yields
    - multi-hadron away side yields : data to pythia
  - Conclusions and Outlook

Introduction





* Measuring jets in HI collisions, much more difficult than in p+p collisions

* So far our major method in sorting jets from HI events is Di-hadron correlations

We look for a leading hadron which we assume carries most of the energy of the jet. We make associations between the leading hadron and other tracks.

Di-hadron Correlation

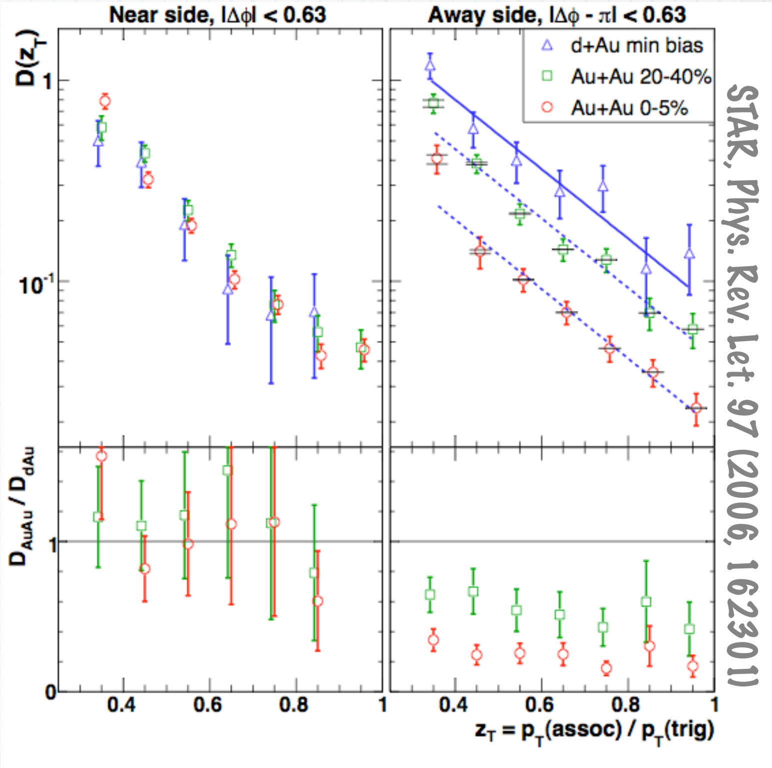
Introduction

* Using Di-hadron correlations we try to measure fragmentation functions

* Fragmentation function D(z) depends on z defined as $p_T/E_{T,jet}$

* The current method of Di-hadron correlation has limited sensitivity to true fragmentation functions

* We may be able to better constrain $E_{T,jet}$ with a multi-hadron trigger



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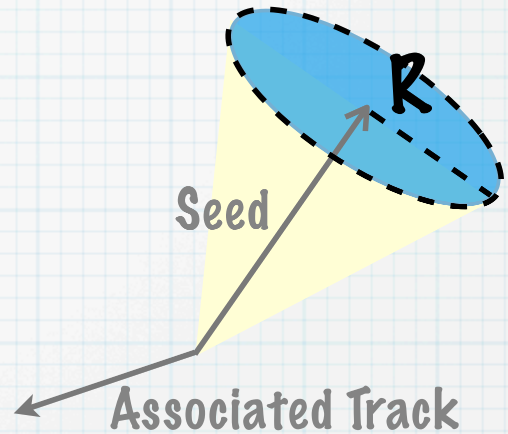
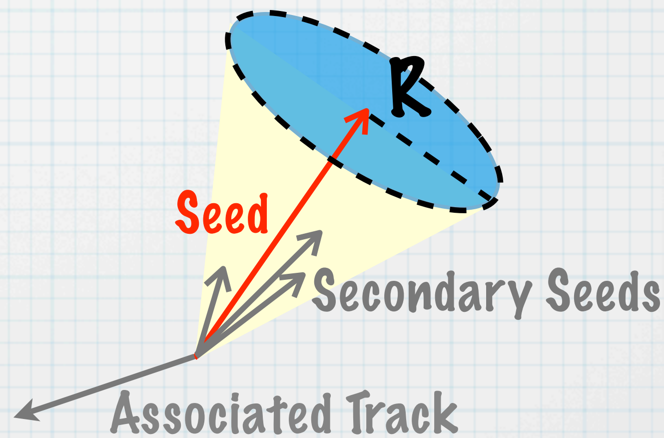
Multi-hadron Correlation Analysis Technique

* Collect all seed tracks $p_T > 5.0$ GeV
* Collect all "secondary seeds" with $p_T > 2, 3, 4$ GeV/c
* Cone $R=(\Delta\eta^2 + \Delta\phi^2)^{1/2}$ centered on each seed track
* Trigger p_T = sum of all associated tracks and secondary seeds in cone
* Study recoil (away-side) associated yield relative to trigger seed with the largest p_T
* Background estimate: uniform in $\Delta\phi$, normalize with ZYAM



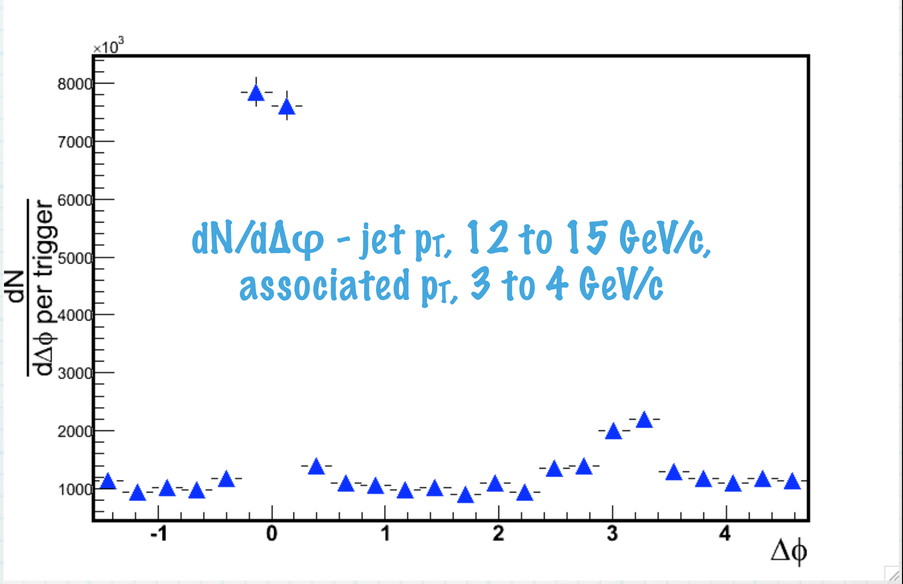
Di-hadron Correlation

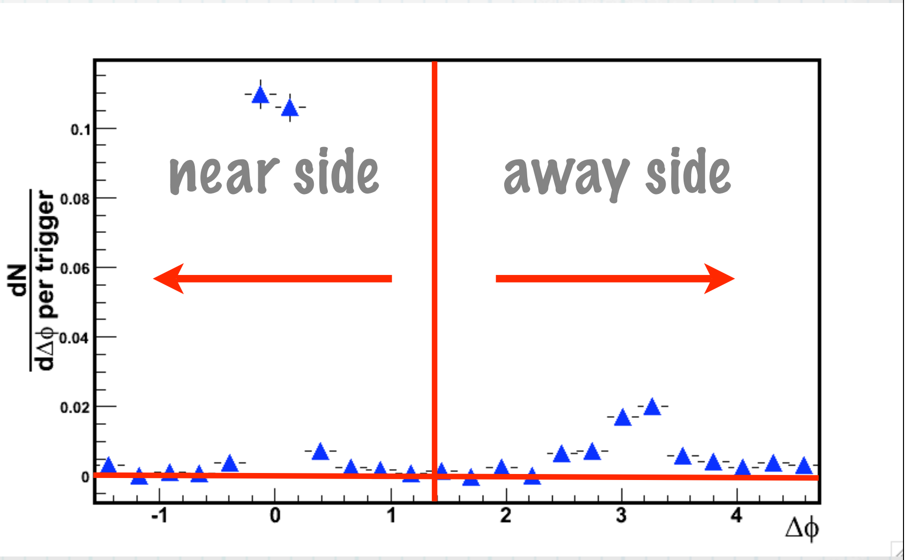


Multi-hadron Correlation

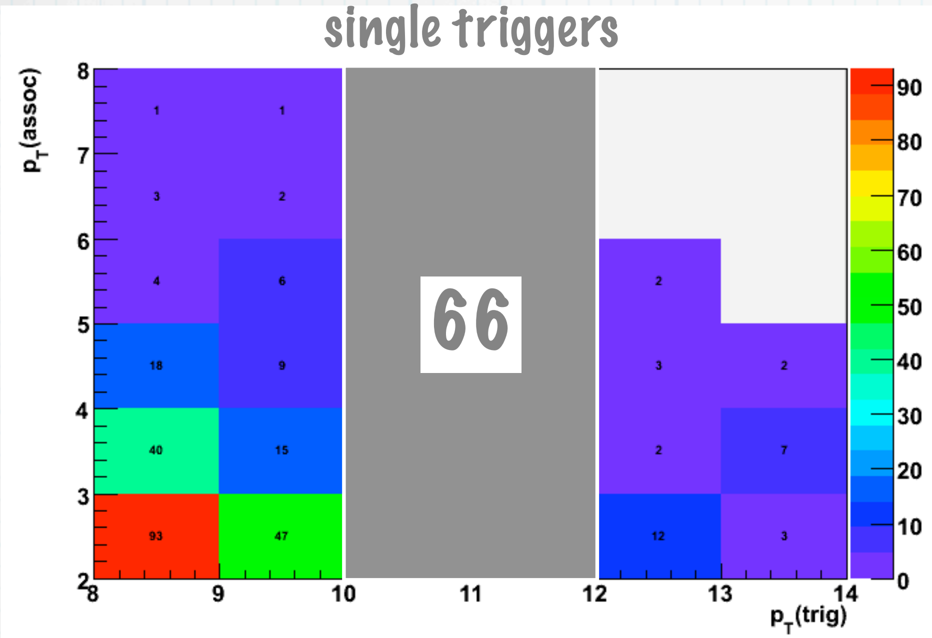
Analysis Technique - cont'd

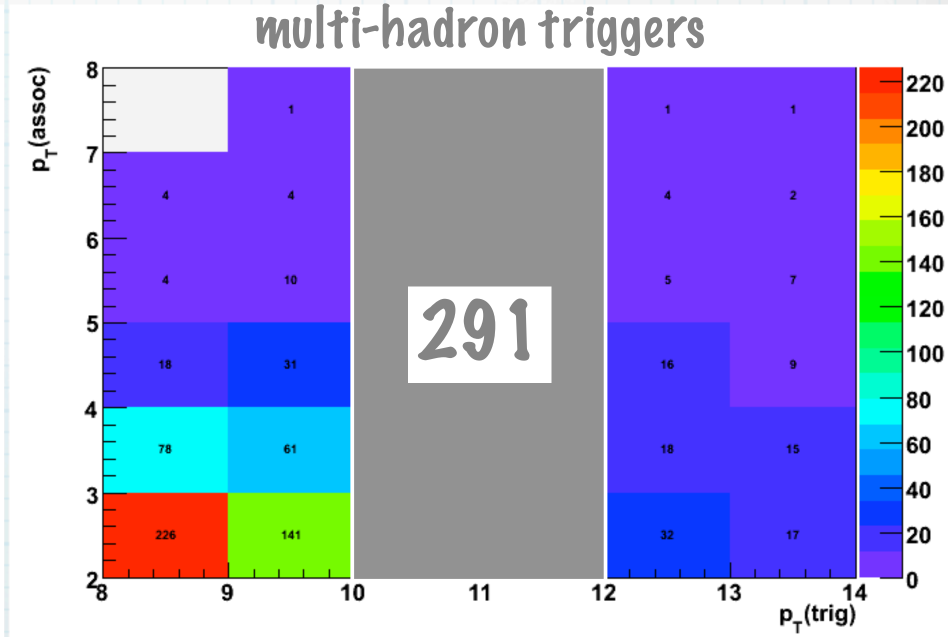
* Study recoil (away-side) associated yield relative to trigger seed with the largest p_T
* Background estimate: uniform in $\Delta\phi$, normalize with ZYAM
* Yields extracted for p_T (trig)
  * 10 to 12 GeV/c
  * 12 to 15 GeV/c
  * 15 to 18 GeV/c
* p_T (assoc)
  * 3 to 4, ... 10 to 11 GeV/c





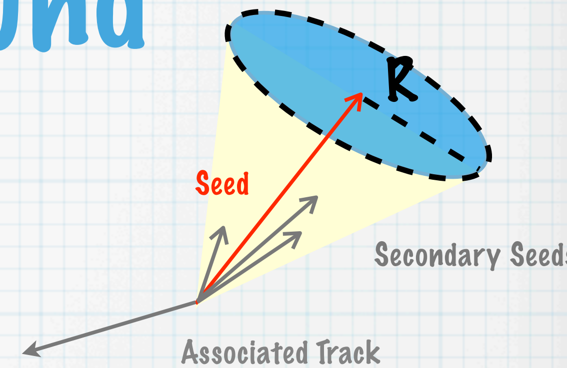
Comparison of single vs. multi-hadron trigger statistics - dAu



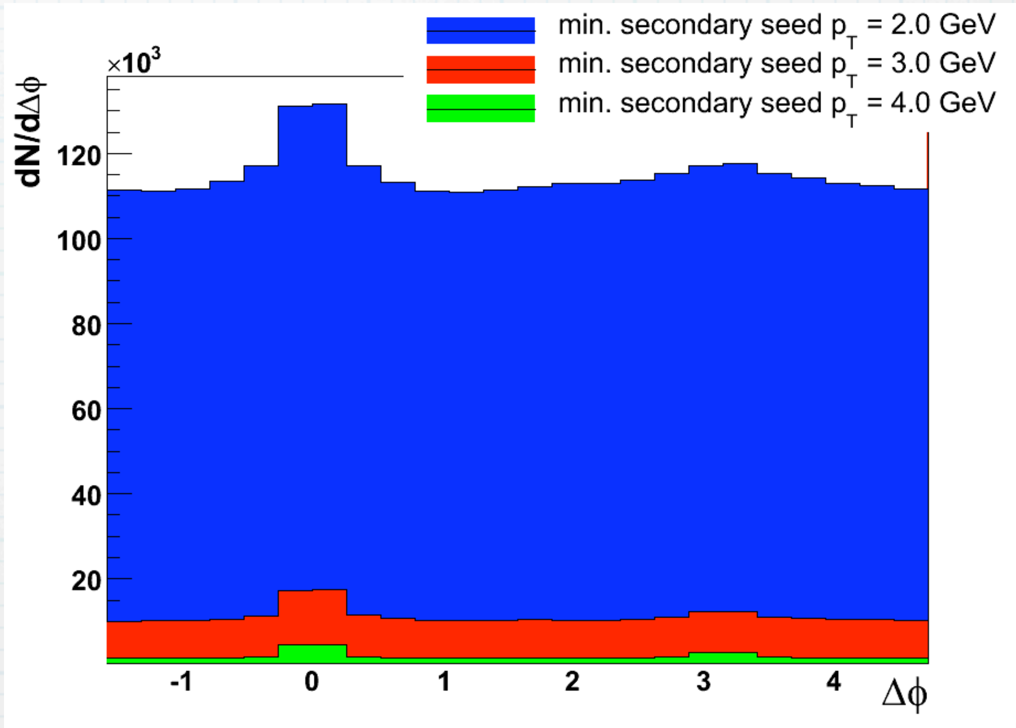


- allowing clusters add up to p_T(trig), not just requiring a single particle to carry p_T(trig) we have more triggers, but a different trigger bias
- For instance:
  - a 10 GeV Di-hadron trigger = a 10 GeV hadron
  - a 10 GeV Multi-hadron trigger = 8 + 2 GeV, or 5+3+2 GeV, or ...

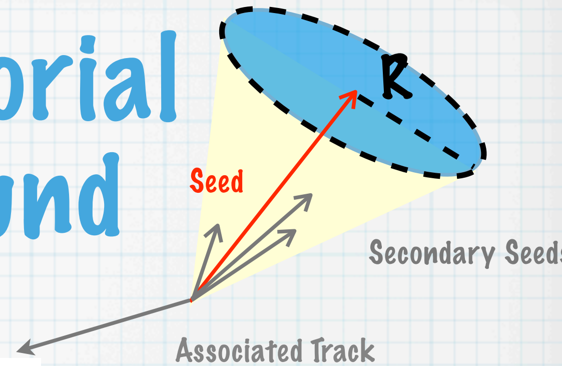
Combinatorial Background



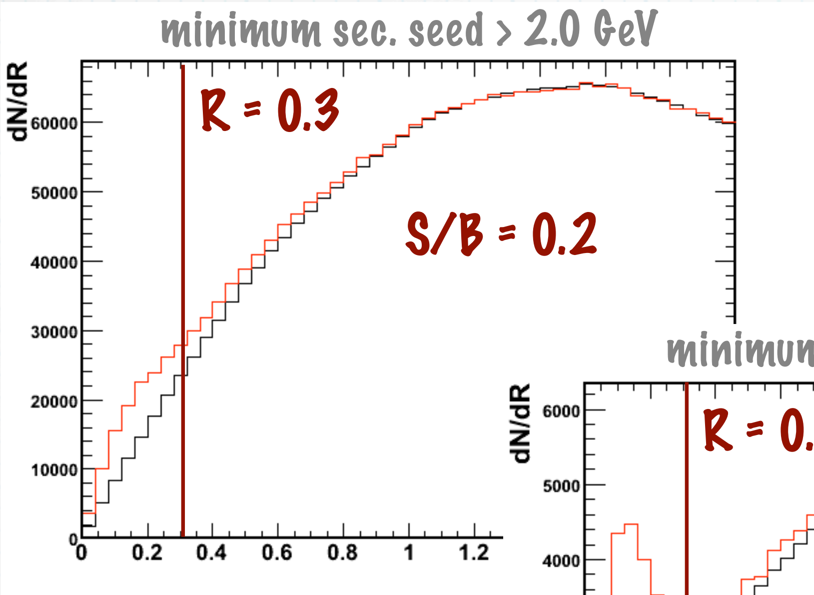
* random combinations occur in the multi-hadron algorightm
* p_T seed > 5.0 GeV/c
  * we vary the minimum secondary seed p_T to test the effect of combinatorial background in Au+Au

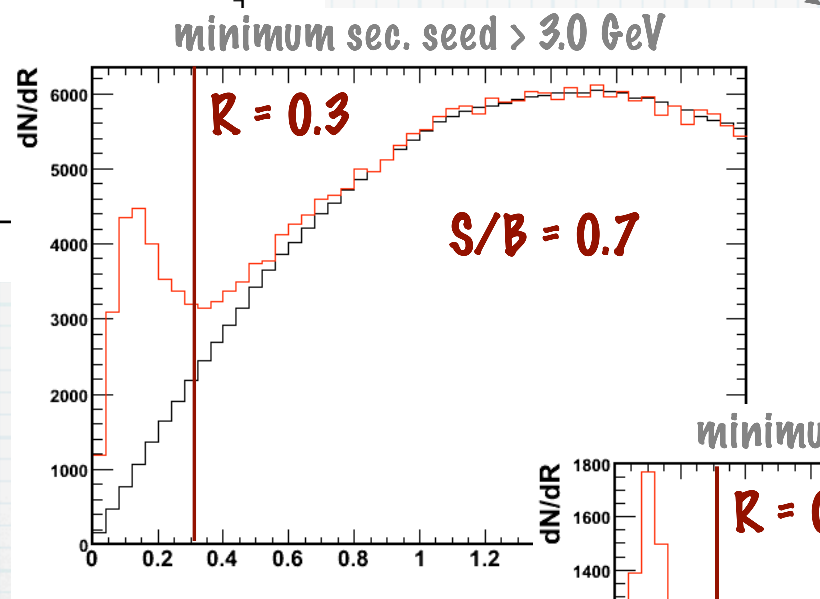


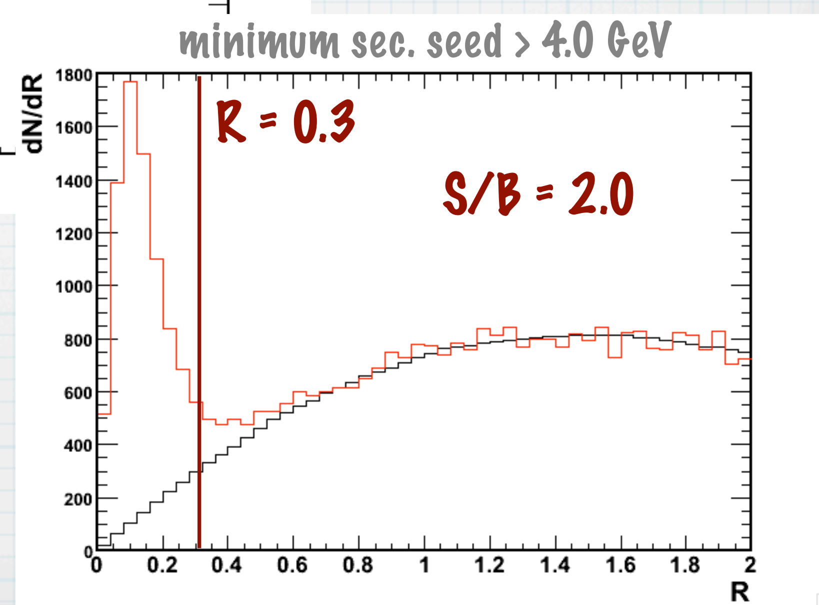
Combinatorial Background



* red = signal
* black = untriggered background



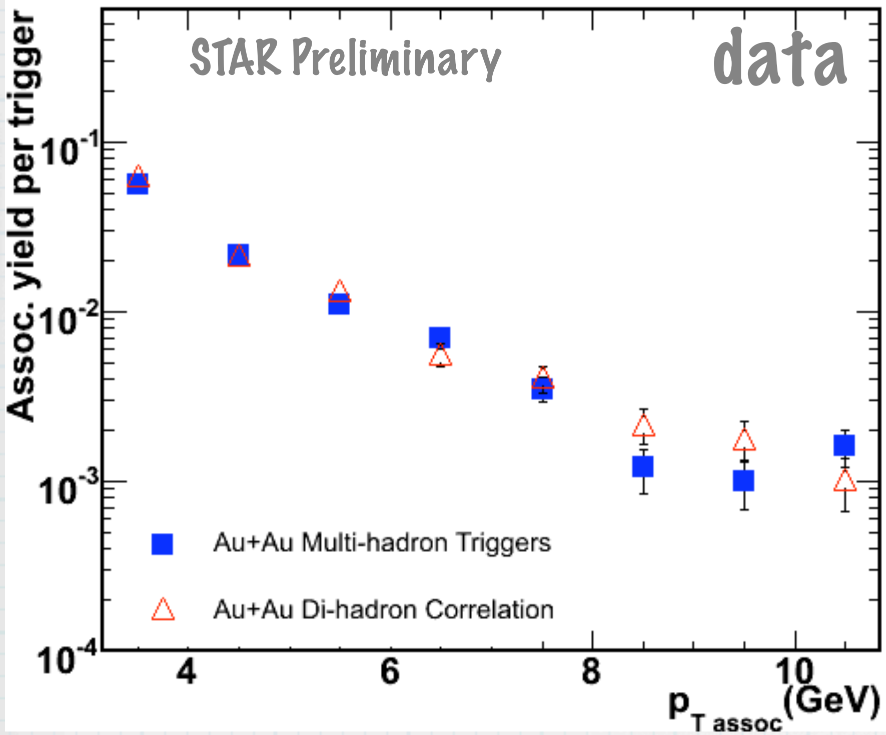


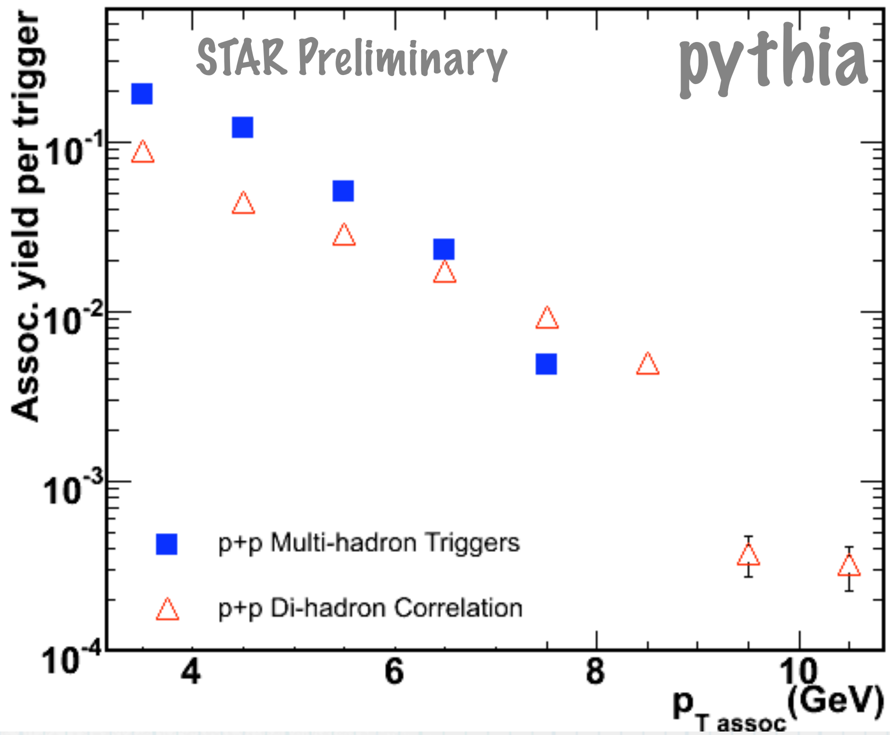


* R is defined between the multi-hadron trigger and associated track
* for background estimate, R is defined between a multi-hadron trigger and associated track from another event

Away Side Yields: 10 GeV/c < p_T(trig) < 12 GeV/c

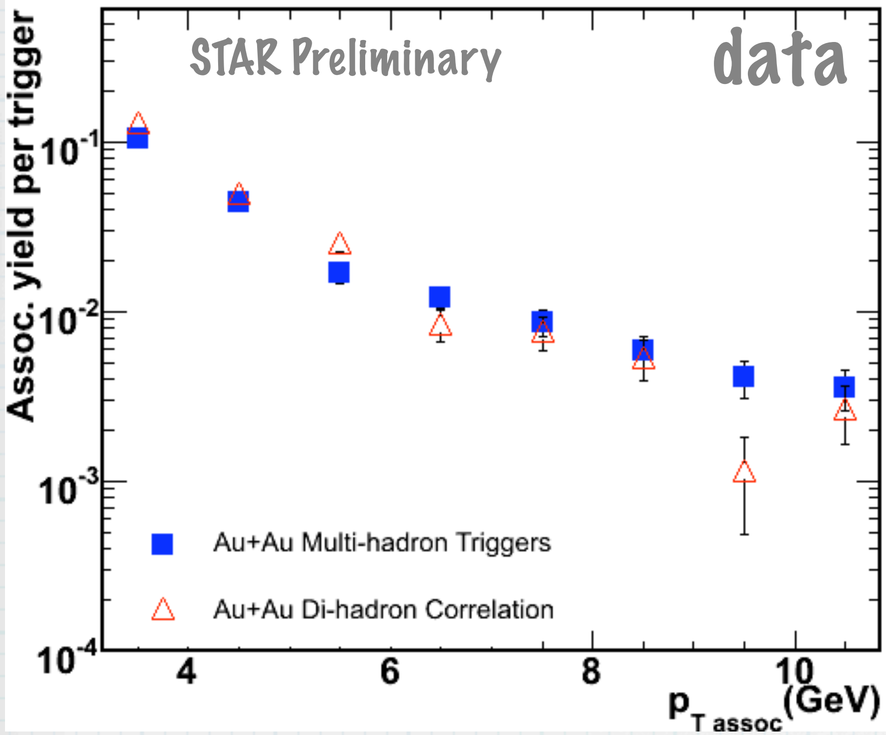
Min. sec. seed cut = 3.0 GeV

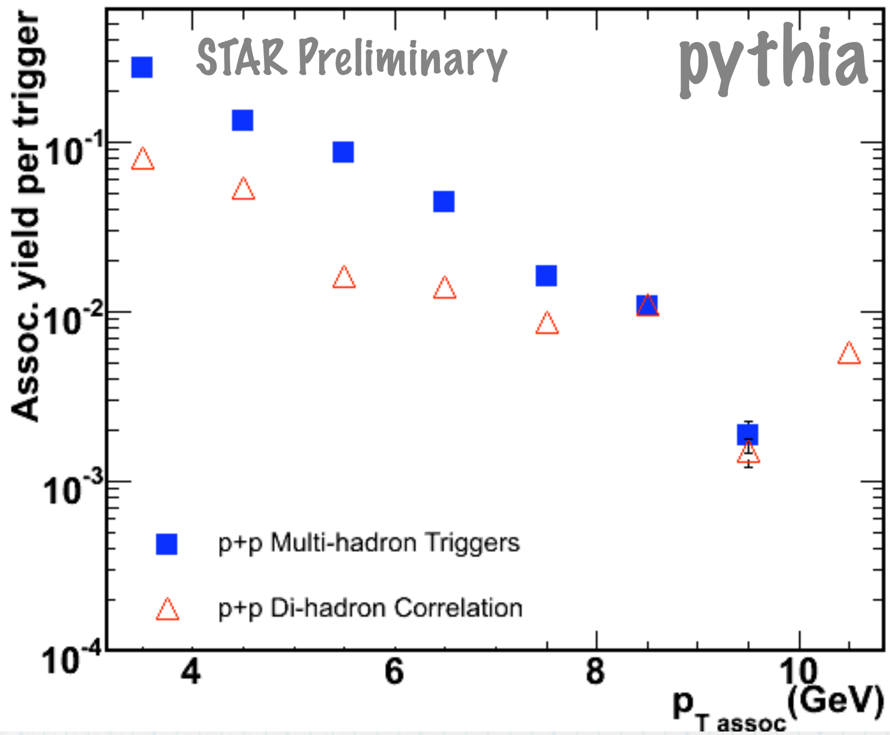




Away Side Yields: 12 GeV/c < p_T(trig) < 15 GeV/c

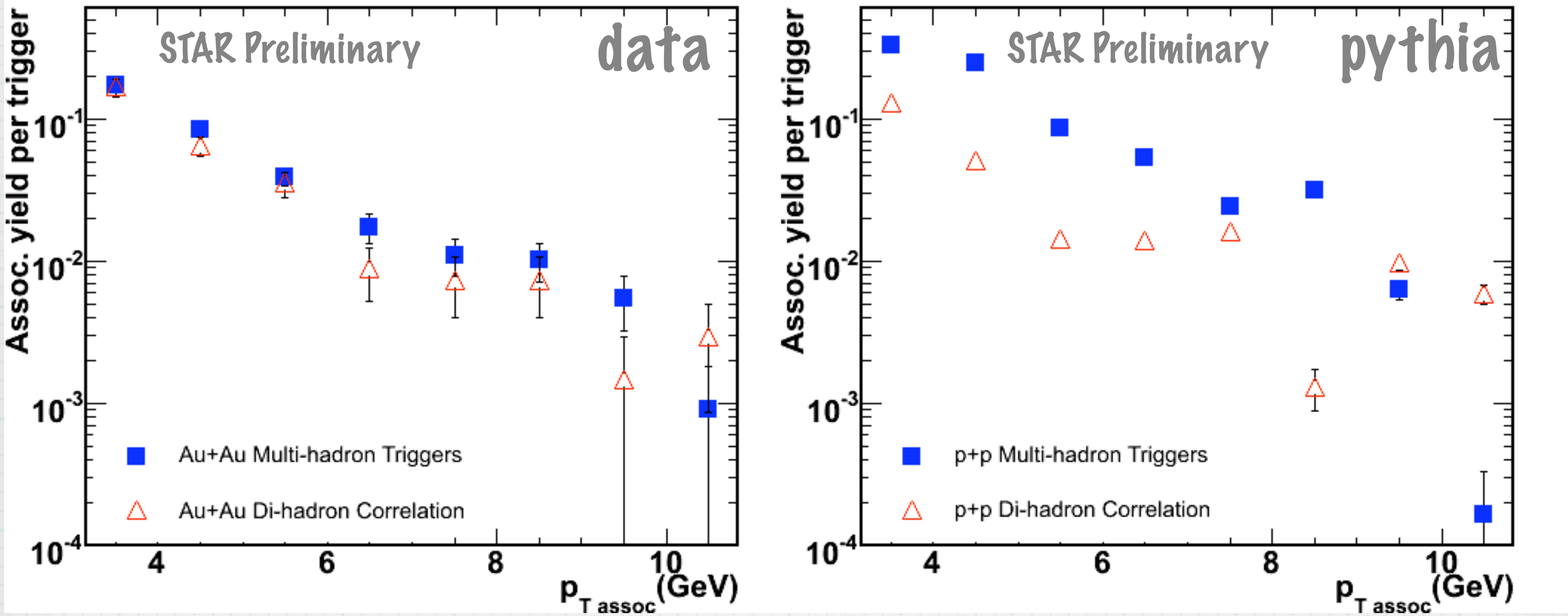
Min. sec. seed cut = 3.0 GeV





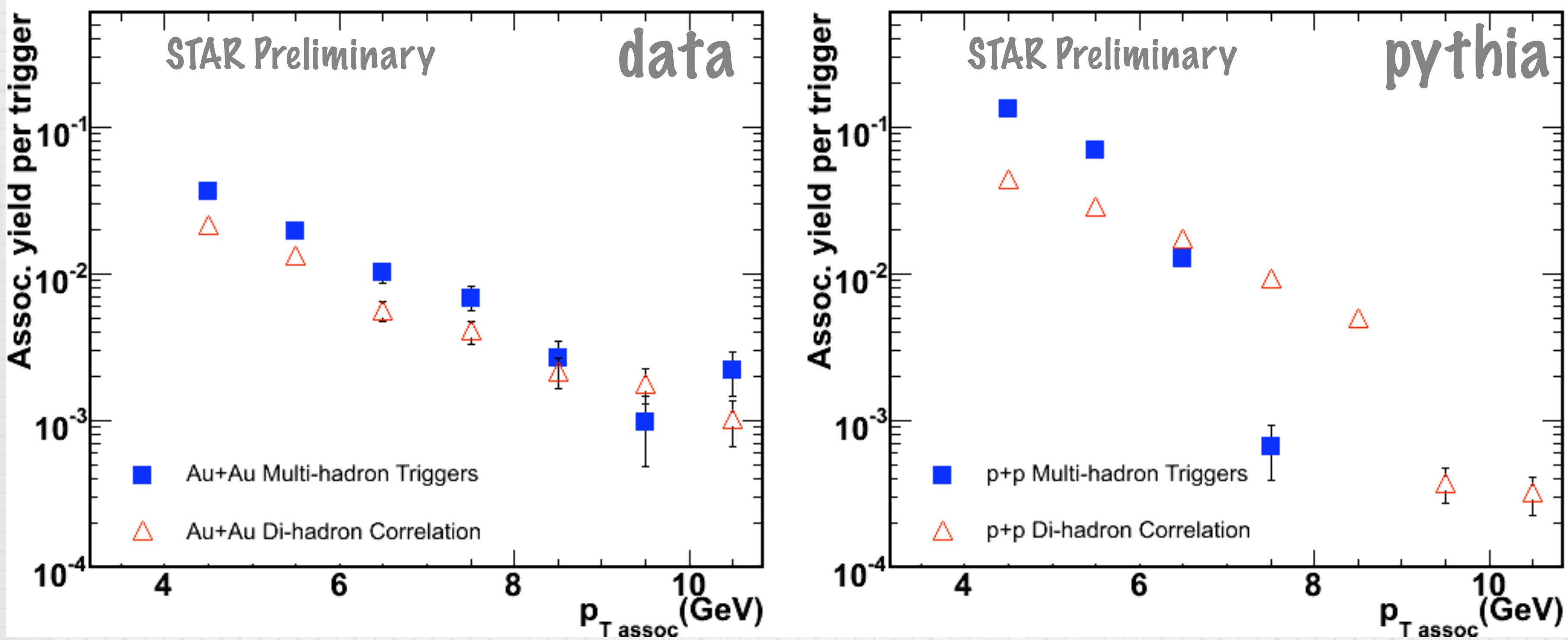
Away Side Yields: 15 GeV/c < p_T(trig) < 18 GeV/c

Min. sec. seed cut = 3.0 GeV



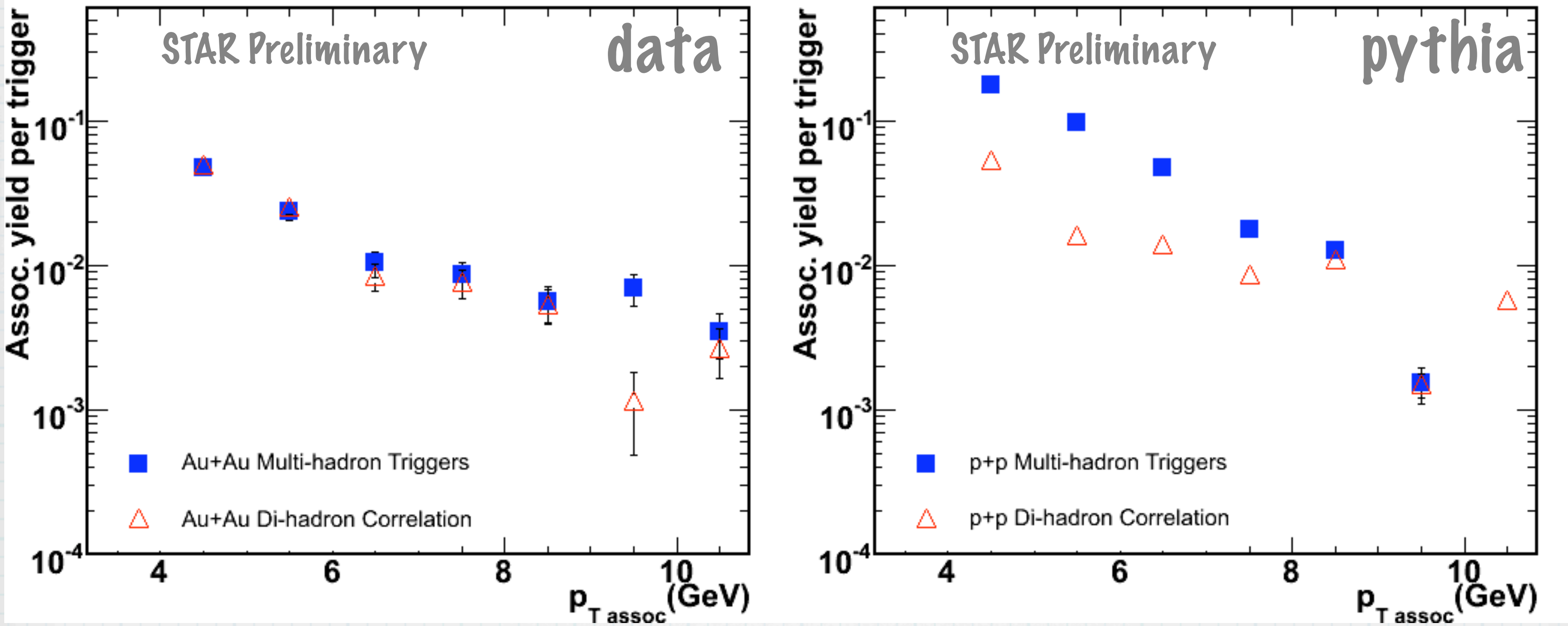
Away Side Yields: 10 GeV/c < p_T(trig) < 12 GeV/c

Min. sec. seed cut = 4.0 GeV



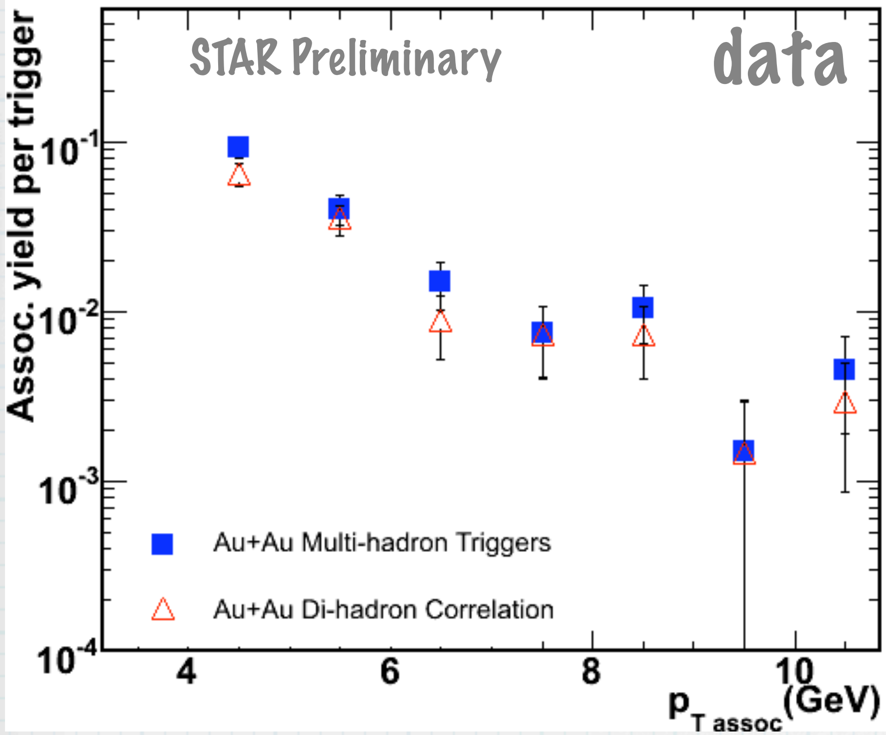
Away Side Yields: 12 GeV/c < p_T(trig) < 15 GeV/c

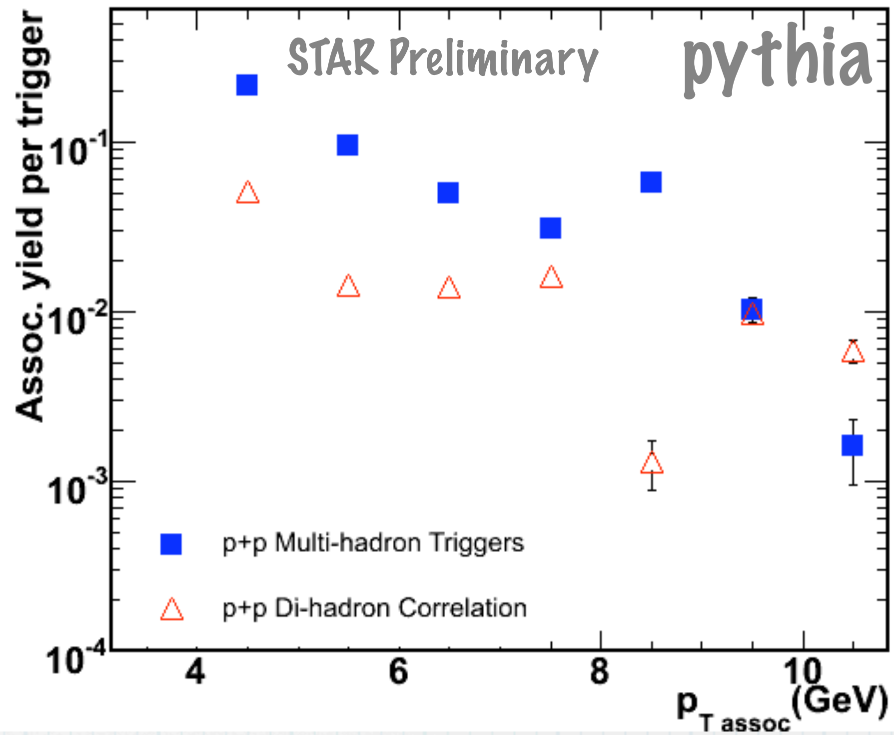
Min. sec. seed cut = 4.0 GeV



Away Side Yields: 15 GeV/c < p_T(trig) < 18 GeV/c

Min. sec. seed cut = 4.0 GeV

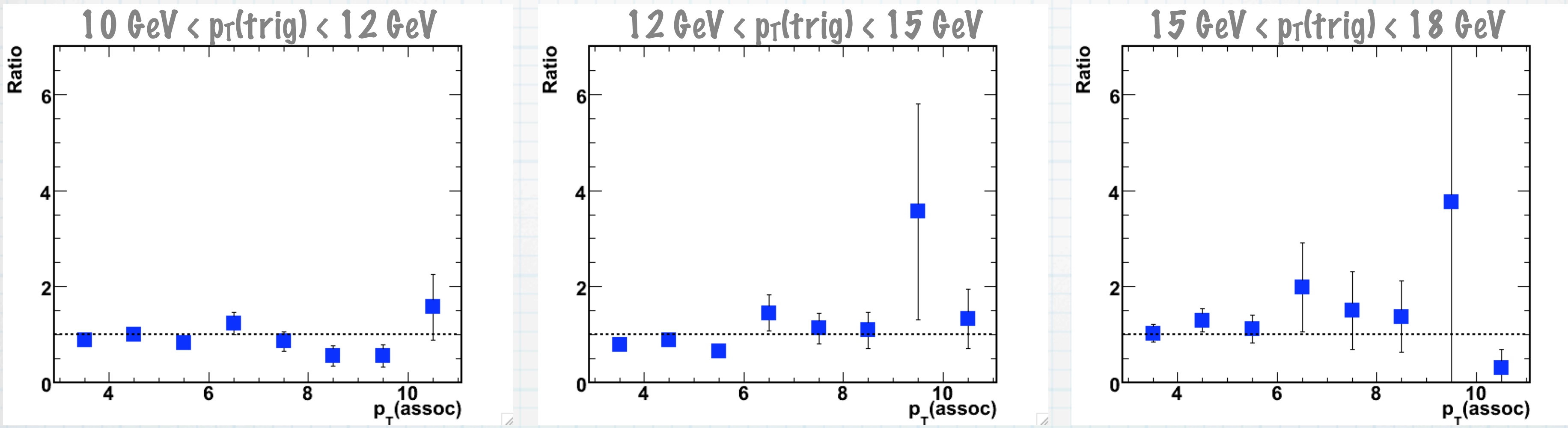




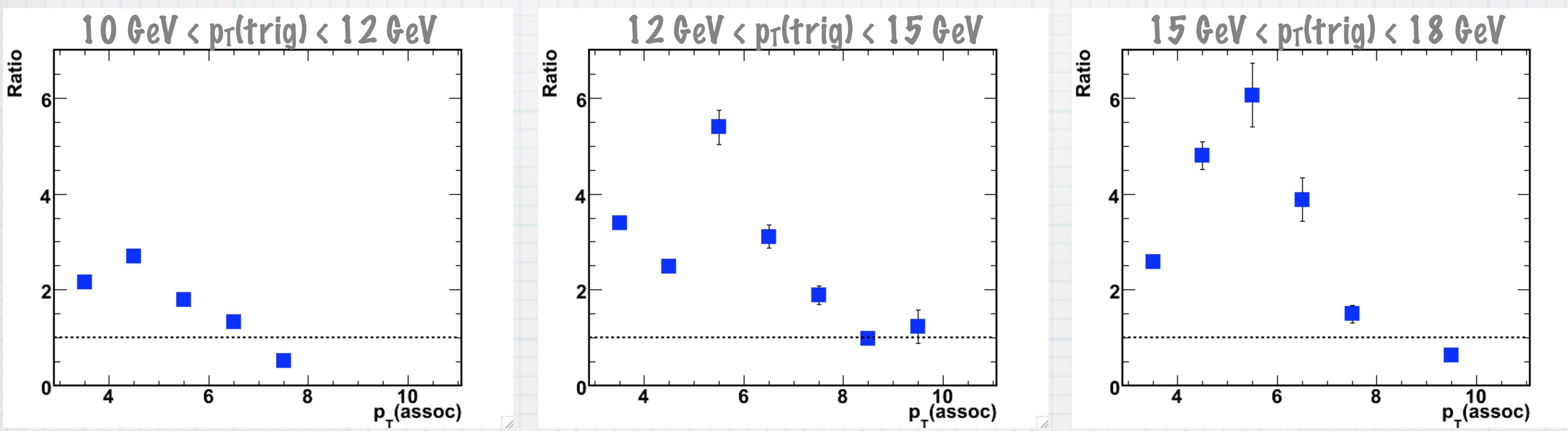
Ratios: Multi-hadron Away Side Yield to Di-hadron Away Side Yield

- Min. sec. seed cut = 3.0 GeV -

data



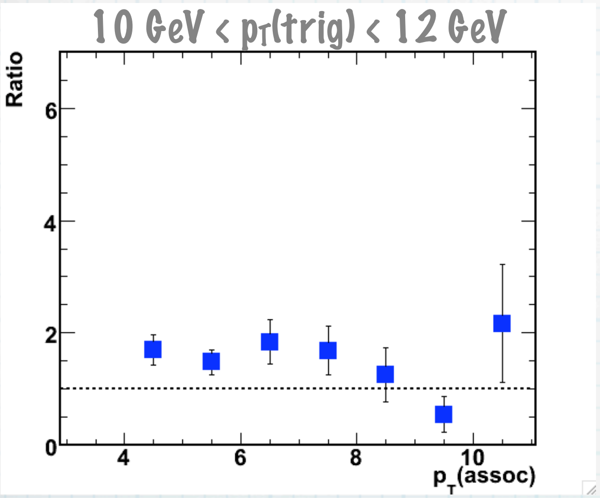
pythia

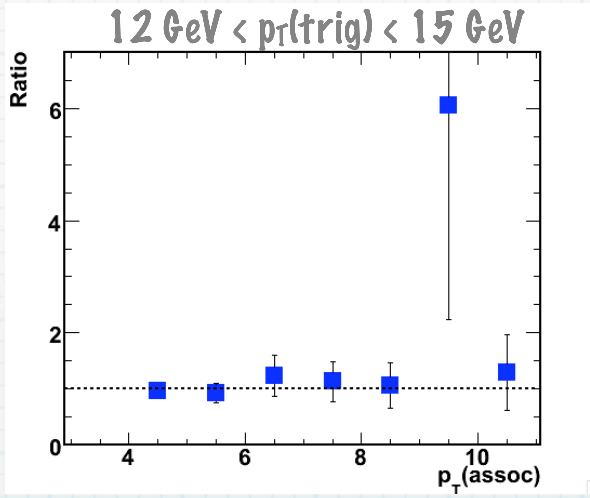


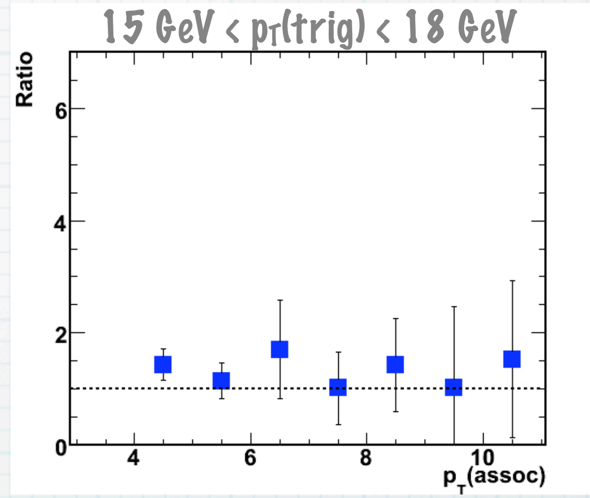
Ratios: Multi-hadron Away Side Yield to Di-hadron Away Side Yield

- Min. sec. seed cut = 4.0 GeV -

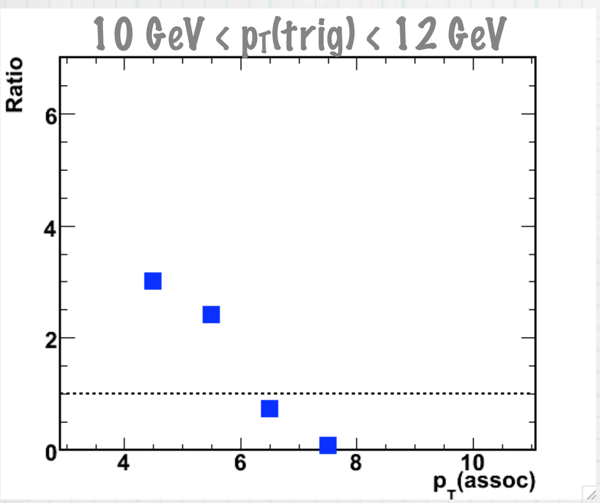
data

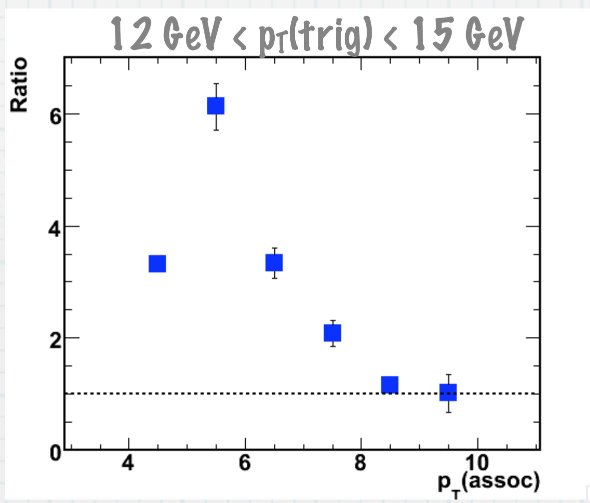


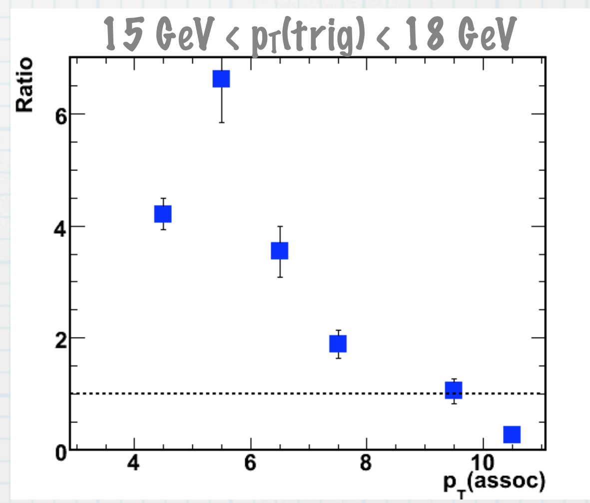




pythia

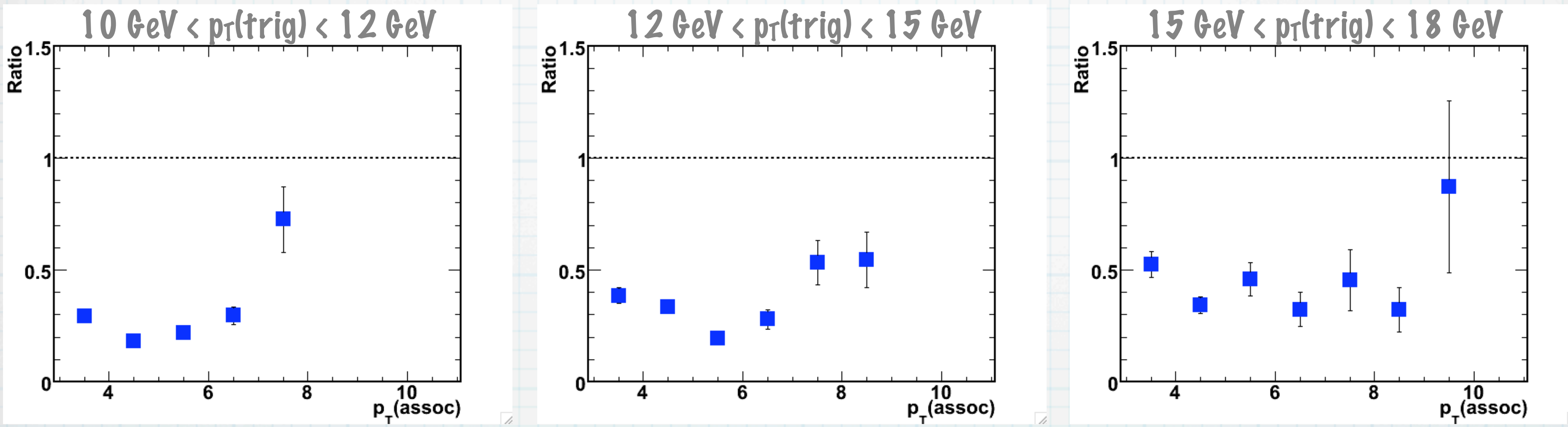




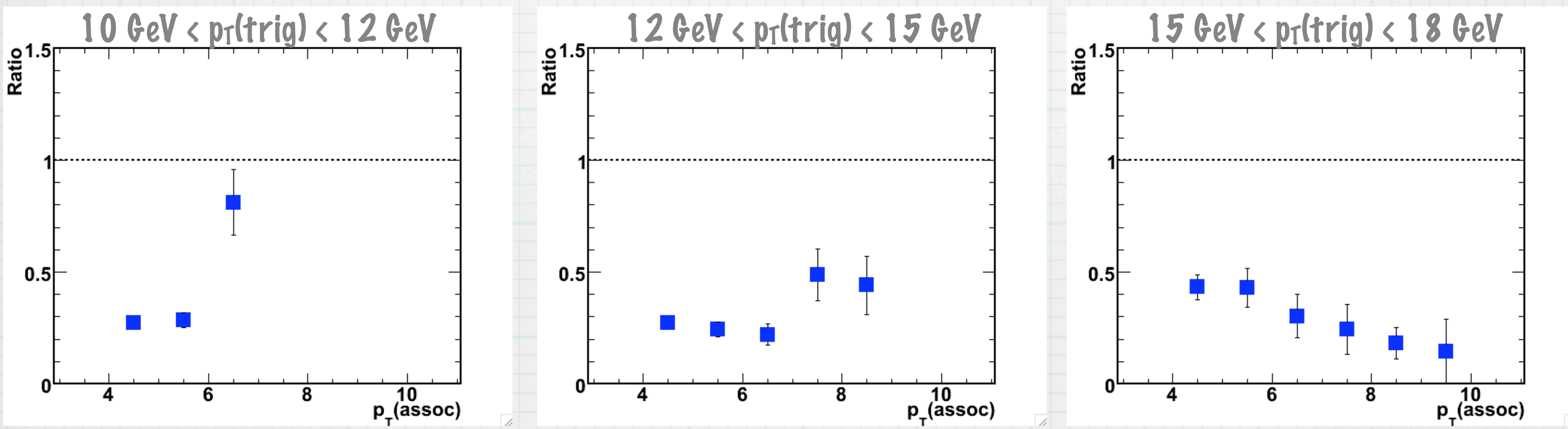


Ratios: Multi-hadron Away Side Yield - Data to Pythia

min. secondary seed cut = 3.0 GeV/c



min. secondary seed cut = 4.0 GeV/c



Conclusions and Outlook

* We have investigated Multi-hadron triggers as the next step toward full jet reconstruction ...
  * We see that a cone radius of ~ 0.3 and a minimum secondary seed cut of 4.0 GeV maximizes the signal to background ratio
  * The yields on the away side for Multi-hadron correlations are consistent with the yields observed via Di-hadron measurements
  * Multi-hadron trigger correlations extend di-hadron correlation measurements to a lower z_T range
* Method is promising, more work is needed
  * Calculate corrected yield with an estimate of the background cluster yield
  * Look at Multi-hadron triggers in other systems: p+p, d+Au

BACKUP SLIDES