Hard Probes 2020, Online

10th international Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions

Measurement of semi-inclusive jet fragmentation functions in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV in STAR

Poster 248. https://indico.cern.ch/event/751767/contributions/3775977/

Saehanseul Oh (LBNL) for **the STAR Collaboration**

Hard Probes 2020, Plenary Session – Flash Talks and Summary I

June 5th, 2020

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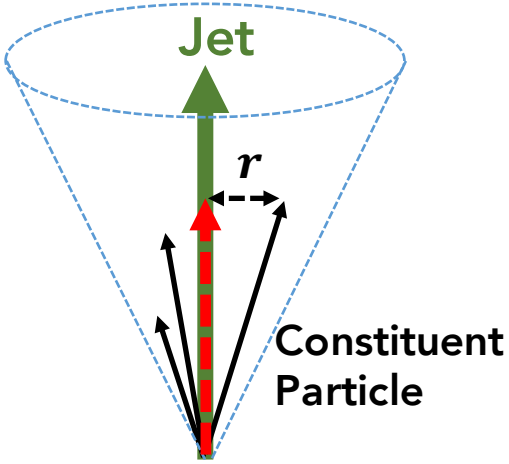
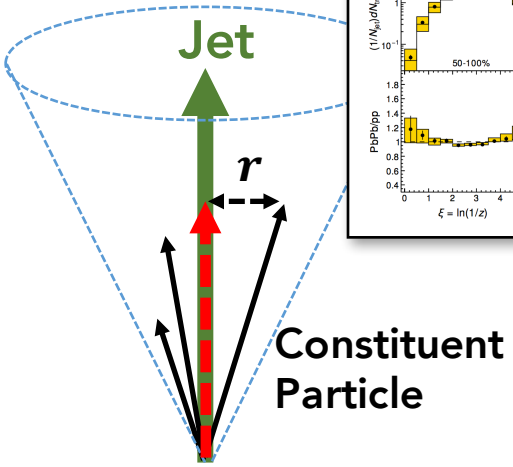
Jet Fragmentation Functions



$$z = \frac{p_{\mathrm{T,track}} \cos(r)}{p_{\mathrm{T,jet}}}$$

- Jets probe the strongly interacting QCD medium
  - Interactions between jets and the QCD medium modify the parton shower relative to that in vacuum
- Jet fragmentation function, $\frac{1}{N_{\mathrm{jet}}} \frac{\mathrm{d}N}{\mathrm{d}z}$
  - Distribution of longitudinal momentum fraction of particles with respect to the jet

Jet Fragmentation Functions



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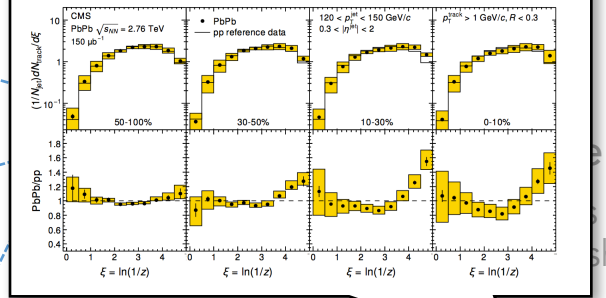
CMS, Phys. Rev. C **90** (2014) 024908

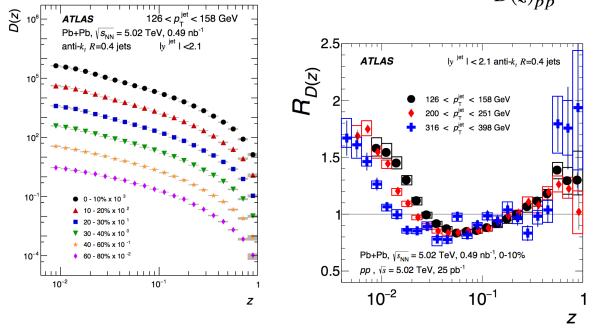


ATLAS, Phys. Rev. C **98** (2018) 024908

same quantity in PbPb collisions

after the jets have lost energy

$$R_{D(z)} \equiv \frac{D(z)_{\mathrm{PbPb}}}{D(z)_{pp}}$$



A. Sickles, Parallel E1 (Wed) 10:15

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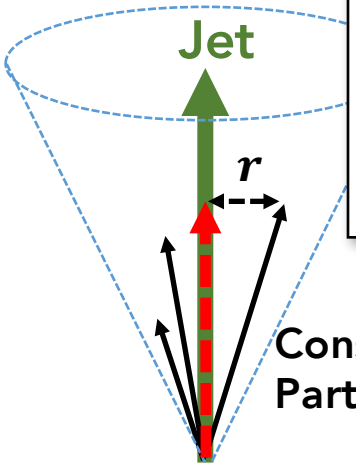

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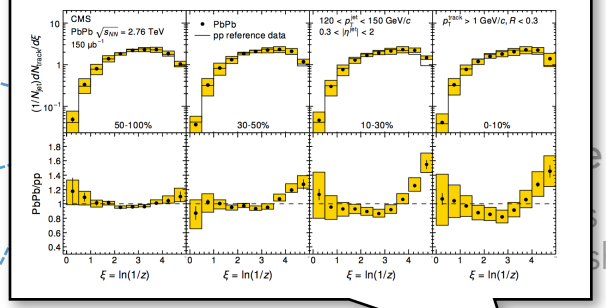

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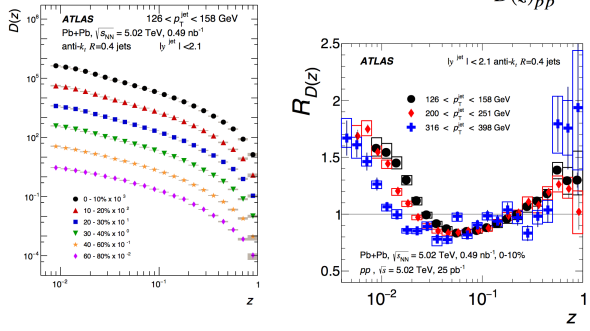

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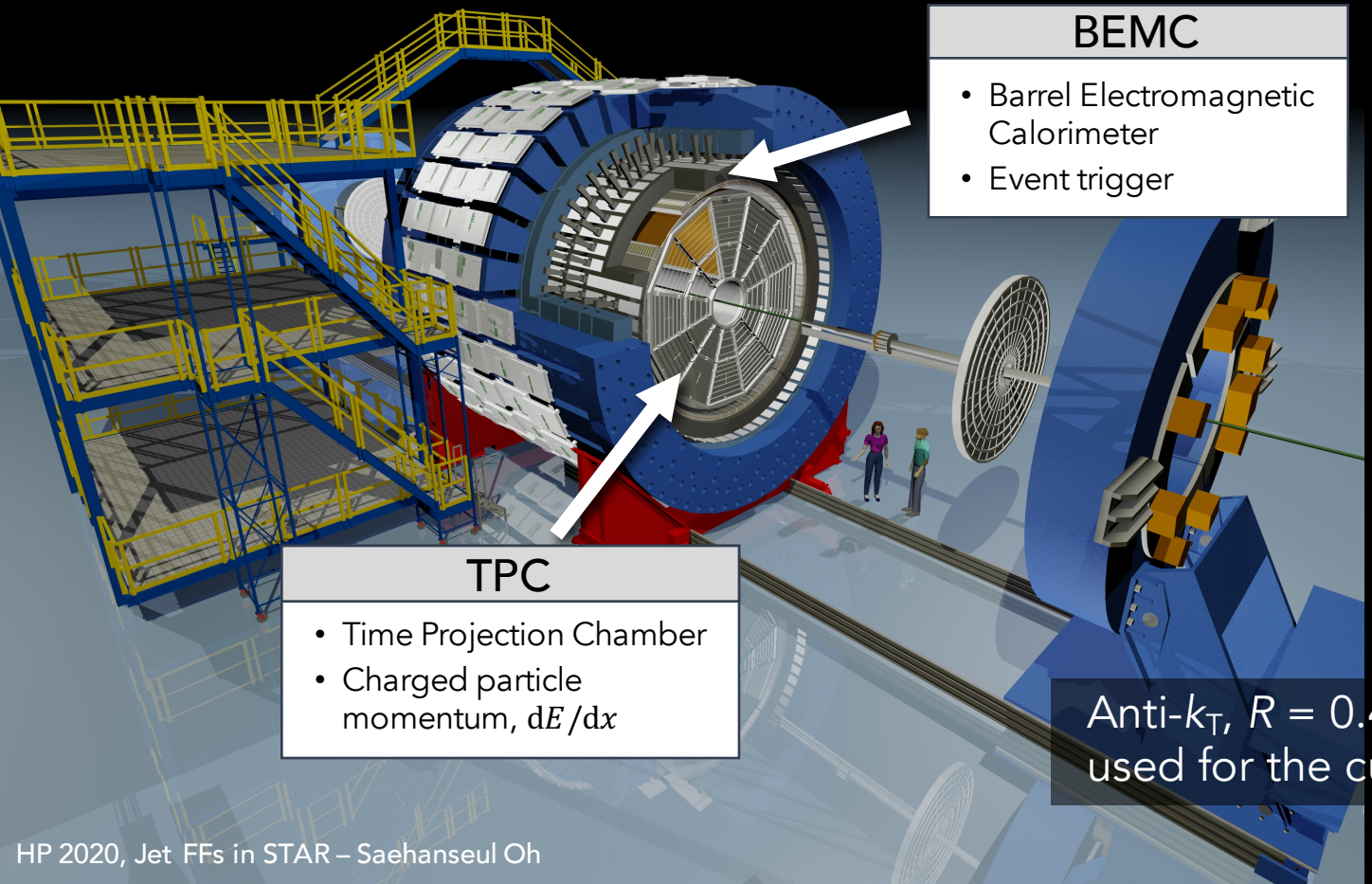
$$z = \frac{p_{\mathrm{T,track}}\cos(\alpha)}{p_{\mathrm{T,jet}}}$$

How does it change in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = **200 GeV** relative to the vacuum reference?

The STAR experiment



BEMC

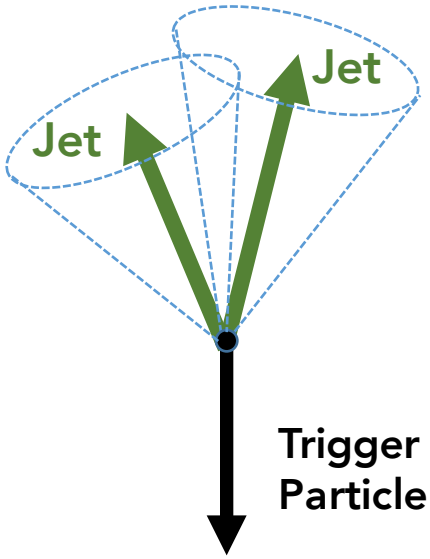
- Barrel Electromagnetic Calorimeter
- Event trigger

TPC

- Time Projection Chamber
- Charged particle momentum, $\mathrm{d}E/\mathrm{d}x$

Anti-k_T, R = 0.4, charged jets are used for the current analysis

Semi-inclusive jet measurement



- Semi-inclusive jet measurement
  - Jets are selected in the recoil region with respect to high momentum trigger particles (BEMC tower with $9.0 < E_{\mathrm{T}} < 30.0$ GeV), $|\varphi_{\mathrm{trig}} - \varphi_{\mathrm{jet}}| > \pi - \pi/4$
  - This enables us to subtract the **uncorrelated background contributions**

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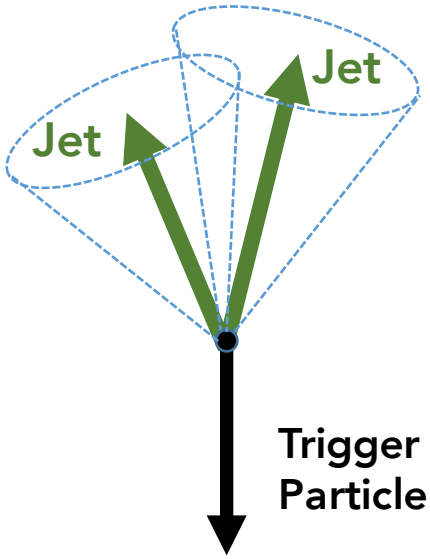

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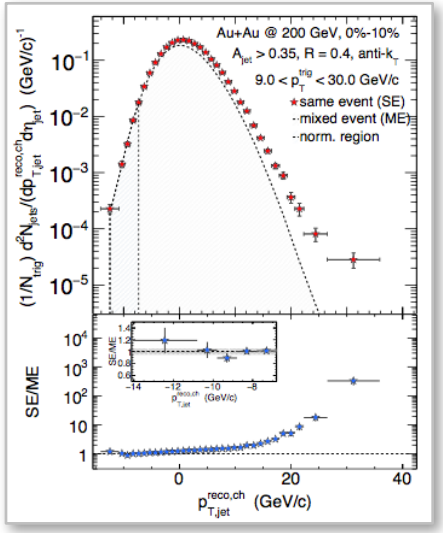
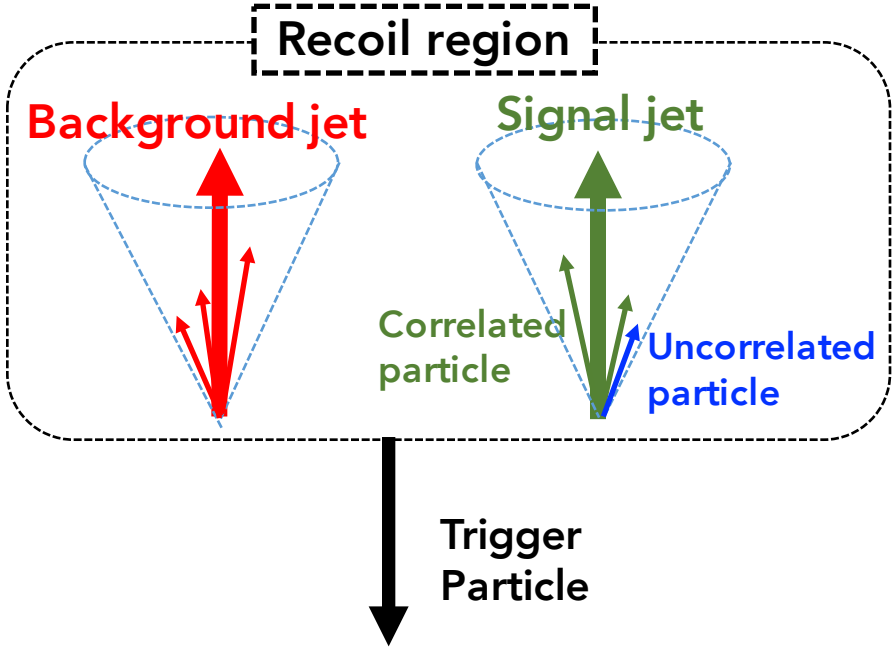


STAR, Phys. Rev. C 96 (2017) 24905

- Semi-inclusive charged jet p_{T} spectra in Au+Au collisions
- Combinatorial jet subtraction via a mixed-event method

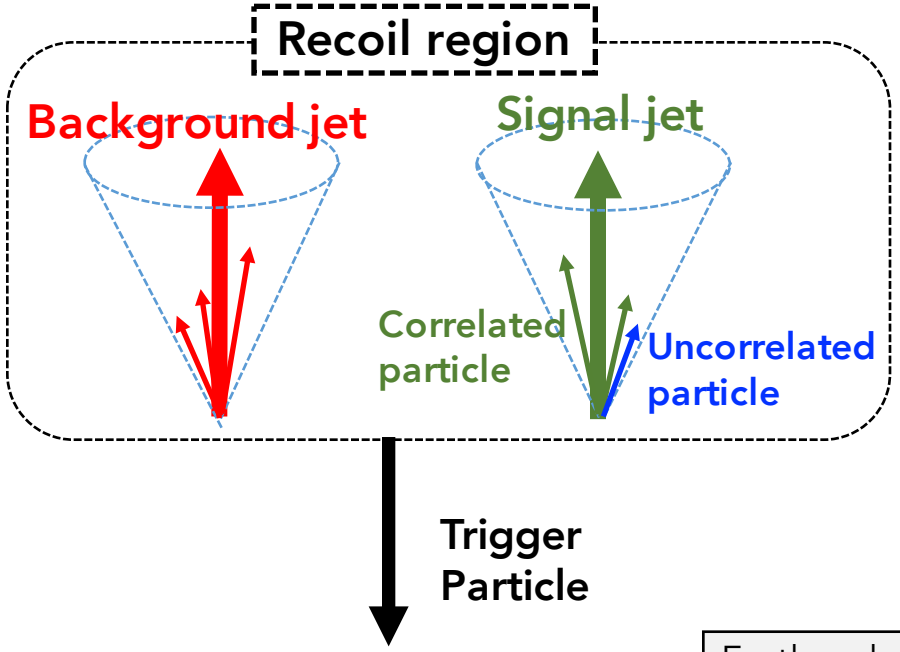
Now the subtraction extended to two dimensions: $(p_{\mathrm{T,jet}}, z)$

Semi-inclusive jet measurement - Corrections



- Corrections
  - In the recoil region, there are signal jets, correlated to the trigger particle, and background jets, uncorrelated to the trigger particle
  - In signal jets, there are uncorrelated particles
  - Contributions from background jets and uncorrelated particles in signal jets are estimated via a mixed-event method, and subtracted

Semi-inclusive jet measurement - Corrections



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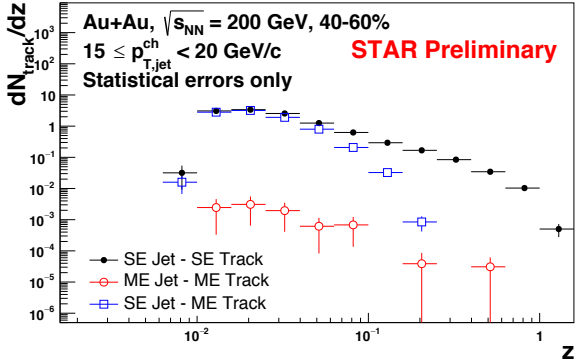
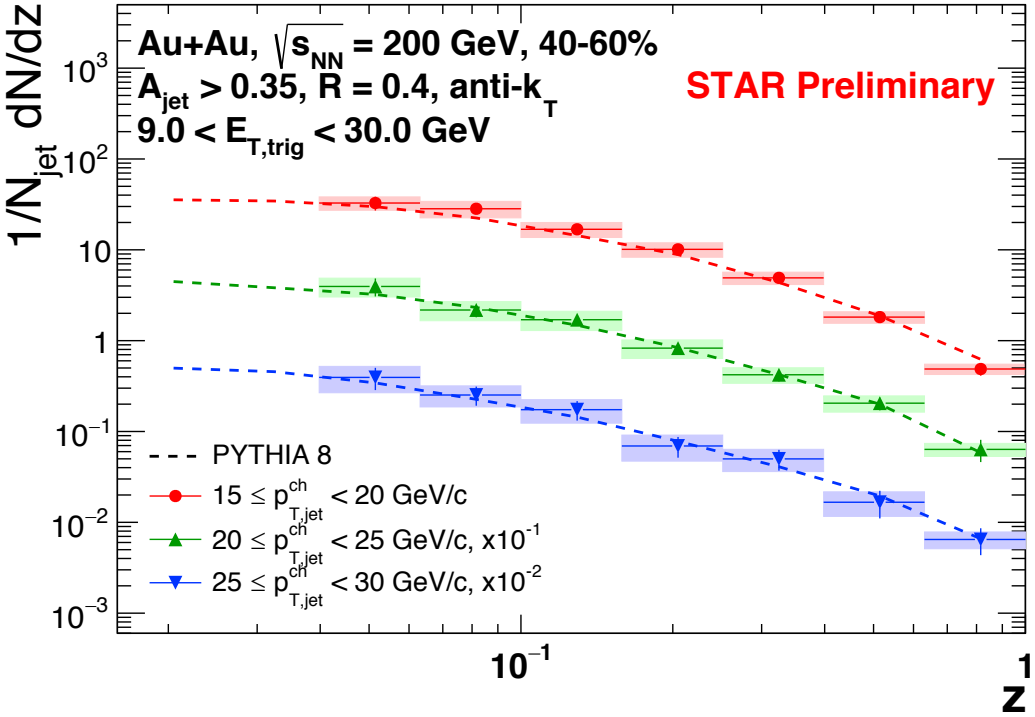
Further details in the poster

Corrected dN/dz = Black – Red – Blue



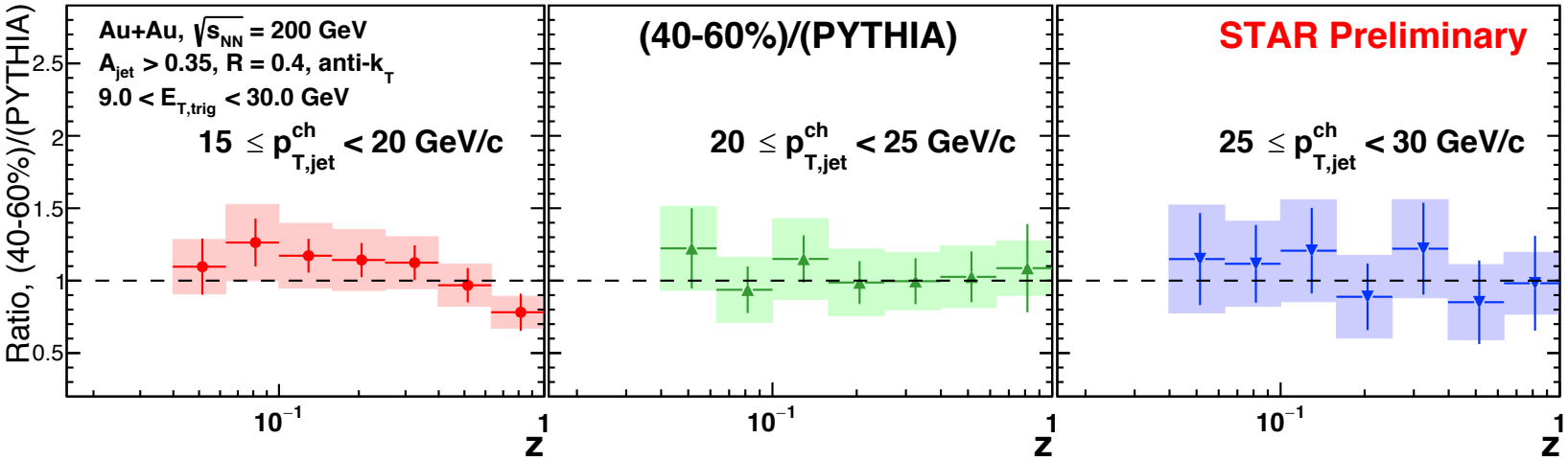
Results



- Fully unfolded jet fragmentation functions for **40-60%** centrality class and three $p_{\mathrm{T,jet}}$ ranges

- PYTHIA 8 (Monash 2013, tuned to LHC) for the same $p_{\mathrm{T,jet}}$ ranges

Results



- Ratios of jet fragmentation functions, (Au+Au 40-60%)/(PYTHIA 8)
- The ratio remains near 1

  → Tangential jet selection with a high-p_T trigger particle and recoil jets? Short path-length in medium or little jet-medium interactions in 40-60% centrality? …

- **Fragmentation functions for *p*+*p* and central Au+Au events**
- **Semi-inclusive jet spectra in 40-60% centrality**

On their way!