# Measurement of photon-jet correlations in p+p and central Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV by STAR

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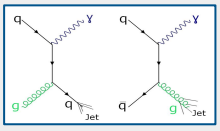
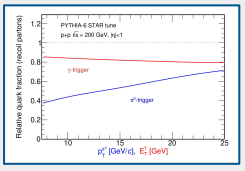
## Abstract

We report the semi-inclusive distribution of fully-reconstructed jets recoiling from a direct photon trigger in pp and central Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. This observable provides an incisive probe of the Quark-Gluon Plasma generated in high-energy nuclear collisions. Direct photons are measured using the STAR Barrel Electromagnetic Calorimeter (BEMC). Jet reconstruction is carried out by the anti-$k_T$ algorithm with jet resolution parameters R = 0.2 and R = 0.5, utilizing neutral energy measured in the BEMC and charged-particle tracks measured in the Time Projection Chamber (TPC). This measurement extends a recently reported STAR measurement of the same observable, which used charged-particle jets, to fully-reconstructed recoil jets. The status of the analysis will be reported, and its physics prospects will be discussed.

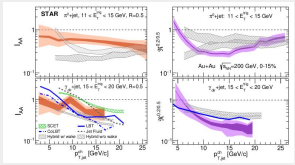
## Motivation

- γ+jet→reference scale for jet quenching dominated by quark energy
- $\pi^0$+jet→ path length and quark vs. gluon dependence on energy loss
- Full jets provide higher fidelity reconstruction of parton energy (cf. recent publication by STAR only including charged particles in reconstruction)




(arXiv:2309.00156)

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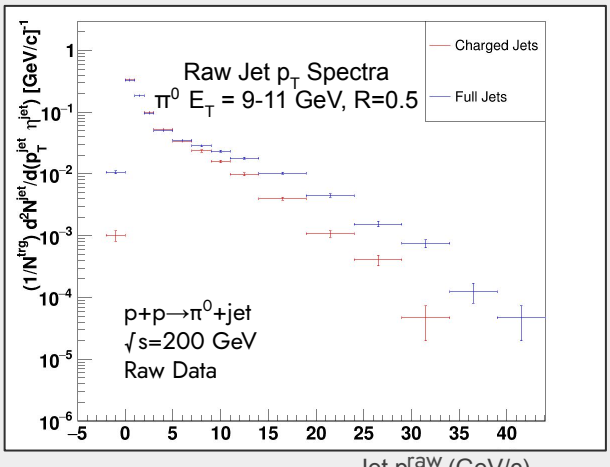
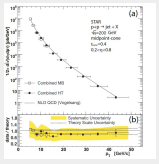
## Jet Reconstruction

- Full reconstruction (neutral and charged particles) using anti-$k_T$, R = 0.2, 0.5
- Jet axis within $\pi \pm \frac{\pi}{4}$ relative to $\pi^0$ or γ trigger




## Fully Reconstructed Jets Measured by STAR

- STAR has done full jet reconstruction for p+p at √s= 200 GeV previously



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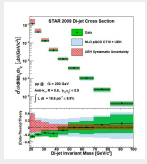

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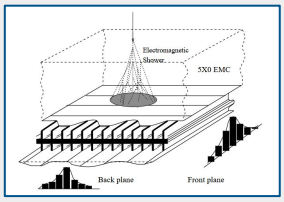
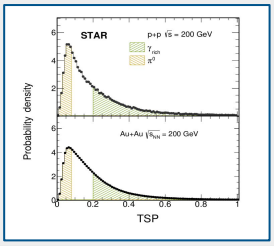
## $\pi^0$/γ discrimination

- BSMD measures shower shape for distinguishing γ/$\pi^0$triggers
- $\pi^0$ decays into two photons decreasing Transverse Shower Profile (TSP)

$$\mathrm{TSP} = \frac{E_{\mathrm{Tower}}}{\sum_i e_i \, r_i^{1.5}}$$

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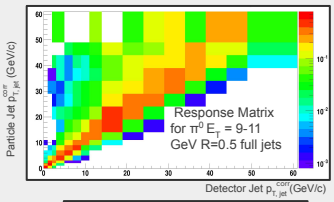
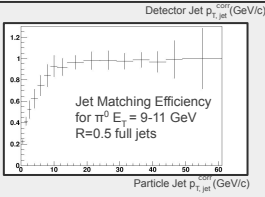
## Corrections

- Response matrix from detector simulation will be used in unfolding
- In Au+Au, corrections for heavy ion background will include event mixing




## Prospects

- Systematic uncertainty evaluation is ongoing
- Future comparisons with theoretical models will help infer QGP properties

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The STAR Collaboration