Novel Methods for Measuring the Fragmentation Function of Jets in Heavy Ion Collisions Using Jet-Hadron Correlations

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1. Introduction

1.1 Motivation

Jets are a unique probe of the properties of the Quark Gluon Plasma (QGP). Jets' fragmentation functions are of particular interest because they are modified by energy loss in the QGP.

2. Models

No reconstruction efficiency correction in [1]→ parameterized p_T-dependent efficiency roughly matching ALICE efficiency in [2]

2.1 TennGen

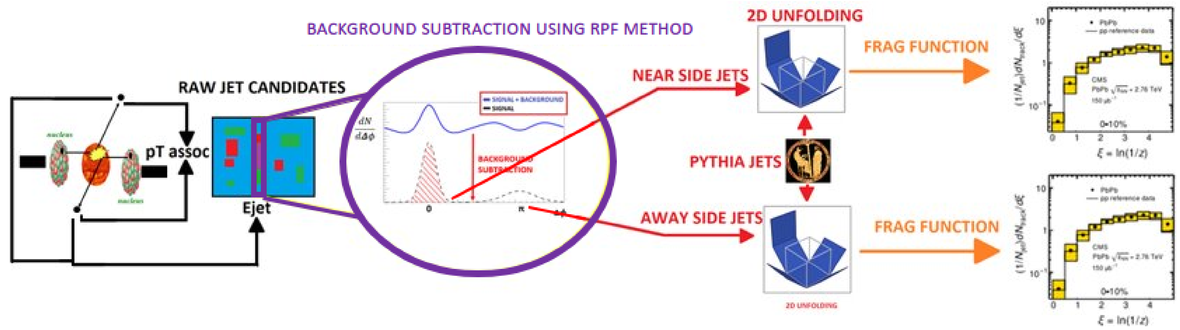
For N_{ch} from [3]. Even n ψ_n at $\phi = 0$, odd n at random ϕ.

- Throw random p_T from Blast Wave [4] fit to [5].
- Use that p_T to determine v_n from fits to [6]. v_1 roughly matches [7, 8, 9].
- Throw random ϕ from azimuthal distribution with those v_n.
- Throw random η from flat distribution within $-0.9 < \eta < 0.9$

Combination of Pythia generator and TennGen generator.

- Truth Level: Primary Pythia particles
- Reconstructed Level: Primary Pythia particles $\pi^{+/-/0}$, $K^{+/-}$, p, $\bar{p}$ from TennGen, a data-driven random number generator
- Throw random ϕ from azimuthal distribution with those v_n.
- Throw random η from flat distribution within $-0.9 < \eta < 0.9$

3. Process Overview



4. Correlation functions

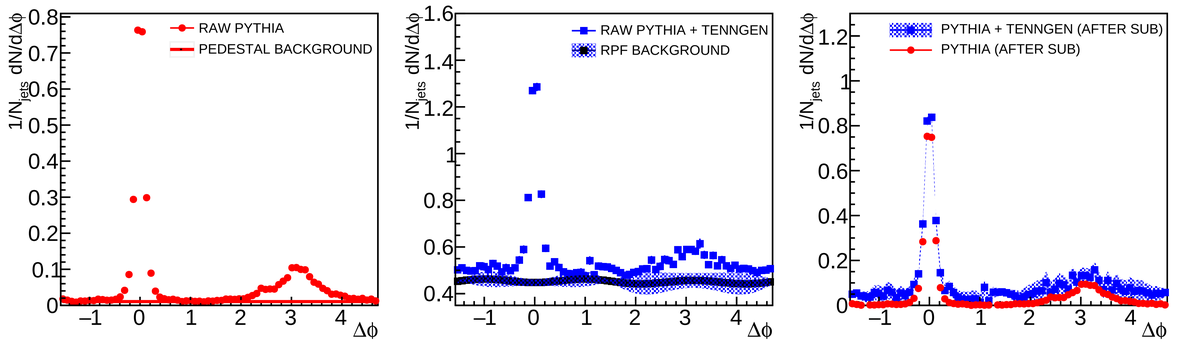


Figure 2: *Examples of Correlations Functions and Subtraction Methods for p_T^{jet} = 8-9 GeV and $p_T^{assoc.}$ = 3-4 GeV for Pythia and Pythia + TennGen.*

- Pedestal method applied to red points (Pythia).
- Reaction Plane Fit method[10] applied to blue points (Pythia + TennGen).
- Agreement of to within error bars; signal is recovered.

5. Response Matrices

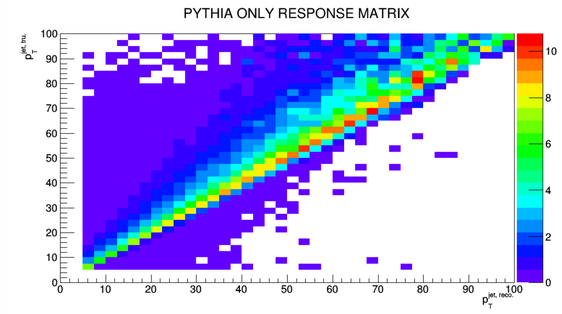


Figure 3: *Projection of PYTHIA only Response Matrix along jet axes*

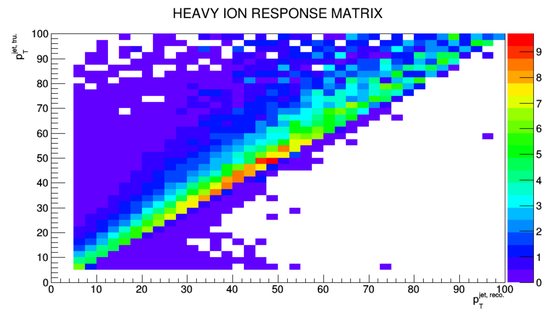


Figure 4: *Projection of PYTHIA + TennGen Response Matrix along jet axes*

6. Results

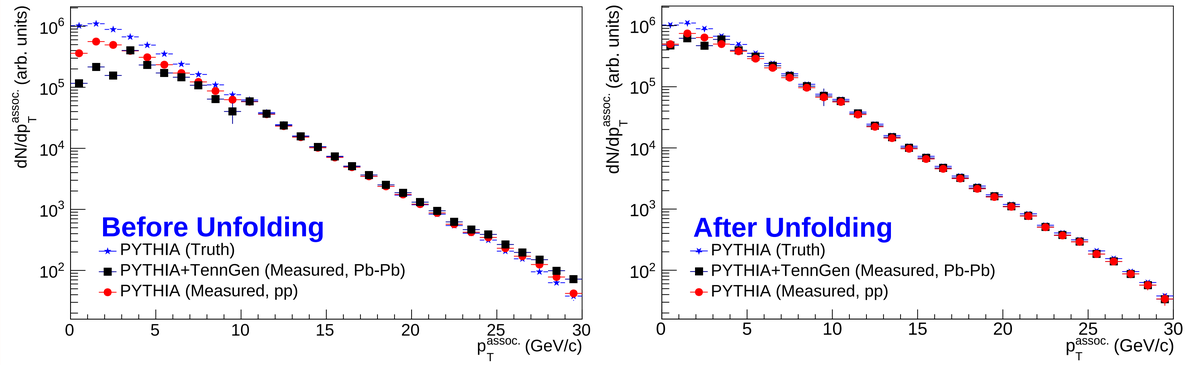


Figure 5: *Momentum spectra of particles for $10 < p_T^{jet} < 30$ GeV/c for Pythia at truth level, Pythia including detector effects, and Pythia+TennGen with the background subtracted (left) before unfolding and (right) after unfolding.*

- Pedestal subtraction recovers truth level Pythia
- Reaction Plane Fit[10] subtraction also recovers truth level Pythia
- Unfolding method shows a good correction for detector effects
- Bias of 3 GeV present explains kinks at low $p_T^{assoc.}$
- Demonstrates a good baseline for correlations method
- Future Work: Apply method to data

References

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