Fragmentation functions

- Fragmentation functions (FF) $D(z)$ and $D(p_T)$ are defined as:

$$D(z) = \frac{1}{N_{ix}} \frac{dN_{ix}}{dz} \quad \text{and} \quad D(p_T) = \frac{1}{N_{ix}} \frac{dN_{ix}}{dp_T^2}$$

- FF were measured in seven centrality bins for $R=0.2$, 0.3 and 0.4 jets with $p_T$ above 85, 92 and 100 GeV/c.

To avoid region at the detector edge and region with reduced efficiency FF were measured in $0 < |\eta| < 1.0$ and $1.2 < |\eta| < 1.9$.

- To reduce the effects of the underlying event (UE) broadening of the jet position, for $R=0.3$ and 0.4 the jet direction was taken from that of the closest matching $R=0.2$ jet when a matching was found.

- FF were corrected for track reconstruction inefficiency on the per-particle basis.

- The contribution of the UE was evaluated using a grid $R=0.4$ cones that spanned the full coverage of the inner detector.

- Measured distributions were unfolded using a one-dimensional Singular Value Decomposition (SVD) method implemented in RooUnfold.

- Unfolded FF for seven centrality bins with the distributions for different centralities multiplied by successive values of two are shown.

Motivation

- Collisions between lead nuclei at the LHC are thought to produce a quark-gluon plasma (QGP).
- One predicted consequence of QGP formation is the quenching of jets.
- Jet quenching can potentially both soften the spectrum of momentum of hadrons inside the jet and reduce the total energy of the jet.

- A complete characterization of the effects of jet quenching requires measurements of both the single-jet suppression and the jet fragment distributions.

Track reconstruction performance

- Charged particle reconstruction efficiency was evaluated separately in each of the seven centrality bins and two pseudorapidity intervals.

- All important track parameters are well modeled in MC - agreement is mostly within a few percent.

Centrality dependence

- To evaluate centrality dependence of the fragmentation functions, ratios were calculated of the FF distributions in six centrality bins to the FF measured in the peripheral, 60-80% bin.

- The ratios of $D(z)$ distributions show an enhanced yield of low-$z$ fragments and a suppressed yield of fragments at intermediate $z$ values for all centralities.

- The size of observed modifications at low, intermediate, and high $z$ decreases gradually from central to peripheral collisions.

- The ratios of the $D(p_T)$ distributions show the same features as the $D(z)$ ratios - the ratios have the same trends and similar magnitudes.

- Similar features as for $R=0.4$ jets were observed also for $R=0.2$ and 0.3 jets.

- To quantitatively evaluate the effects of the modifications, the differences in FF $\Delta D(z) = D(z)_{per} - D(z)_{60-80}$ and $\Delta D(p_T) = D(p_T)_{per} - D(p_T)_{60-80}$ were calculated along with the integrals over suppression and enhancement regions.

- The result is that excess at low $p_T$ is carried by less than one particle and suppression at intermediate $p_T$ is carried by ~ 1 particle.

- Extended $D(z)$ distributions show that ratio continues growing below $z=0.02$.

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