Measurement of Momentum Flow Relative to the Dijet System in PbPb and pp Collisions at $\sqrt{s_{NN}}$ = 2.76 TeV

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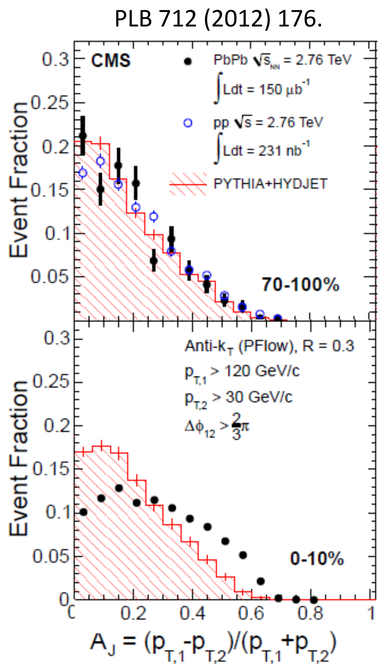
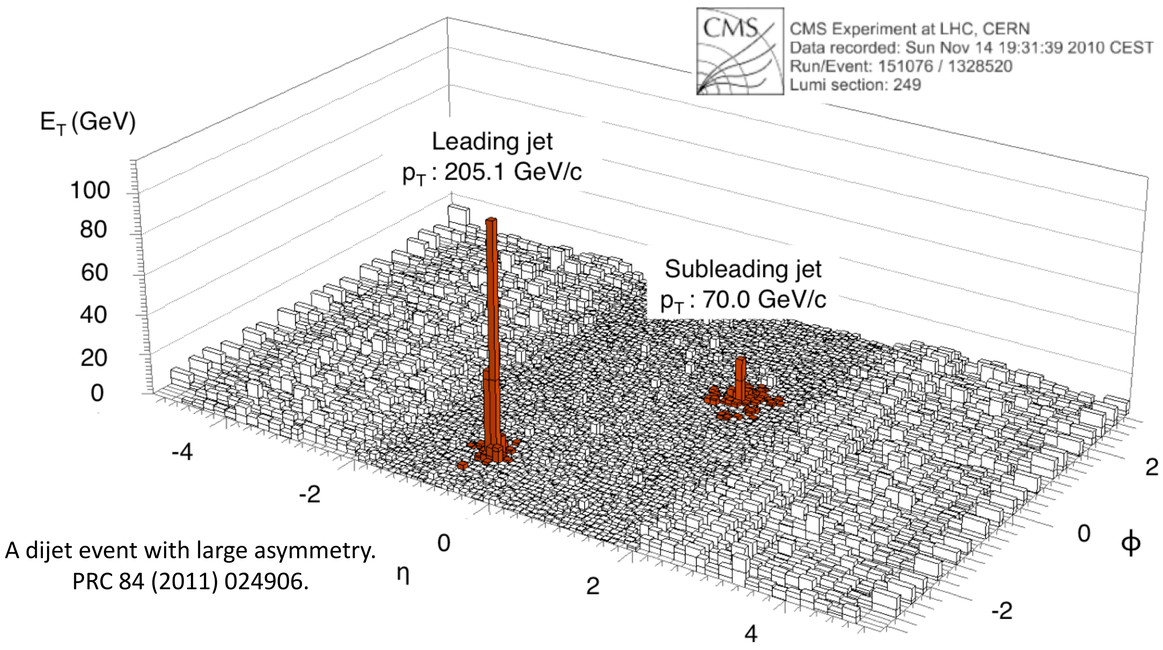
Motivation

An increase in the transverse momentum asymmetry, A_J, in dijet pairs has been observed in central (head-on) PbPb collisions relative to pp collisions at the LHC. This indicates the jets are modified as they travel through the hot, dense medium created in these collisions. The 'missing' transverse momentum of the dijet must show up somewhere else in the event to conserve momentum. Where in the event does this momentum end up, and how does it manifest itself?

PLB 712 (2012) 176.





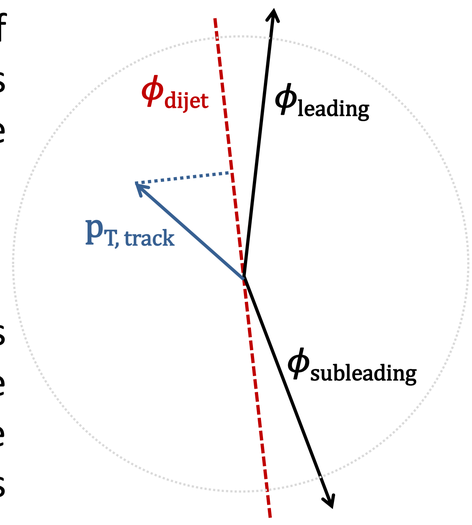
A dijet event with large asymmetry. PRC 84 (2011) 024906.

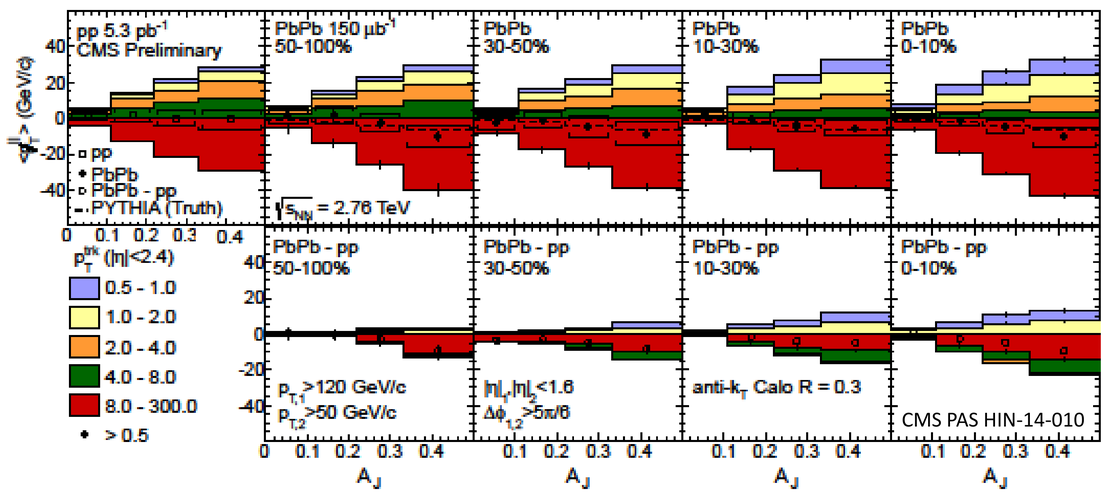
Missing p_T Distribution vs. Asymmetry

To characterize the spectrum of particles balancing the leading jet's larger transverse momentum, define the missing p_T:

$$p_T^{\parallel} = \sum_i -p_T^i \cos(\phi_i - \phi_{dijet})$$

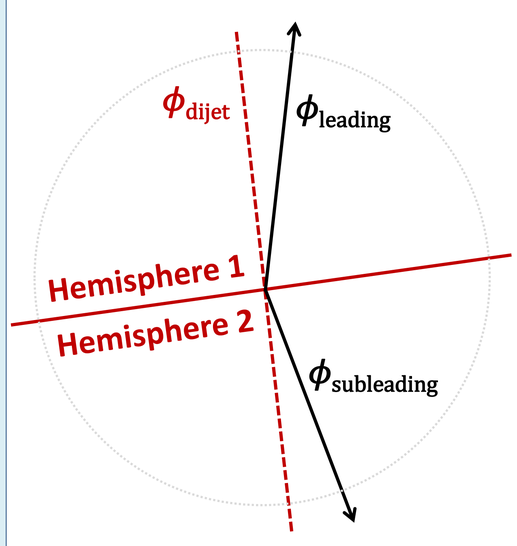
This is the sum of the track p_T's projected onto the dijet axis. Positive missing p_T points towards the subleading jet, and negative points towards the leading jet.





The low p_T fraction of the transverse momentum in central PbPb events tends to point more towards the subleading side than pp.

Charged Particle Multiplicity Difference

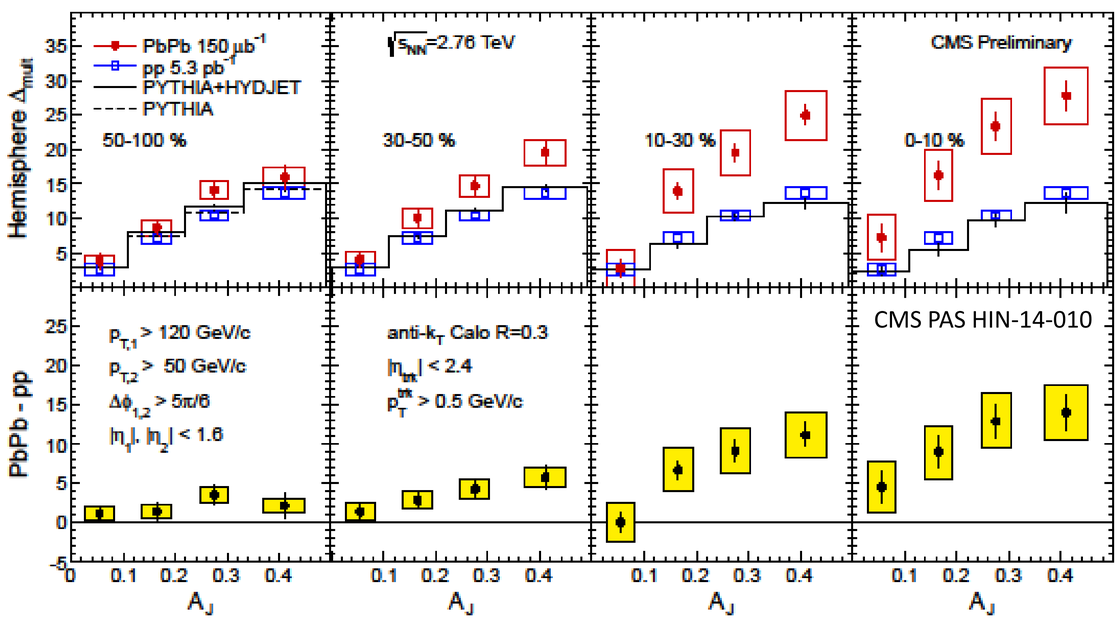


In order to ensure cancellation of the PbPb underlying event in our observables, define the dijet axis:

$$\phi_{dijet} = \tfrac{1}{2}\left(\phi_{leading} + (\pi - \phi_{subleading})\right)$$

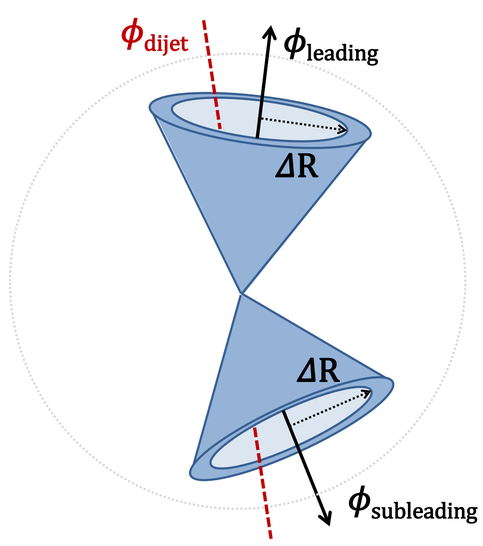
Count the number of charged particles in hemisphere 2 and subtract the number in hemisphere 1. This defines the charged particle multiplicity difference, Δ_{mult}:

$$\Delta_{mult} = N_{trk}\big|_{hemisphere\ 2} - N_{trk}\big|_{hemisphere\ 1}$$



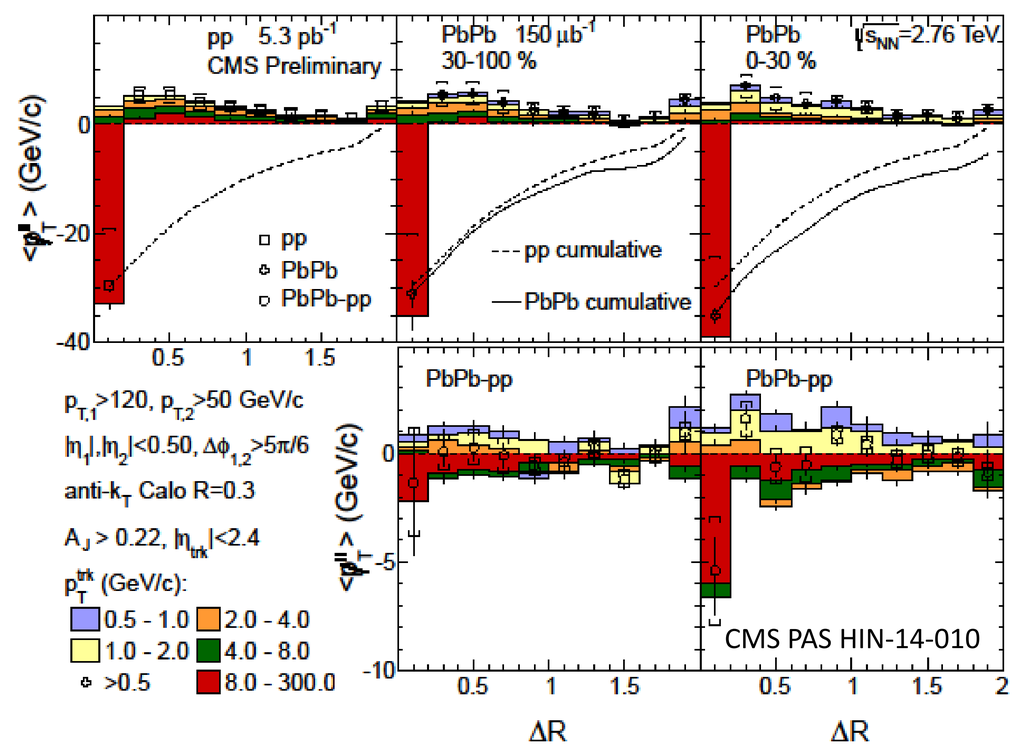
The subleading side of the dijet in central PbPb events contains more charged particles on average than pp.

Missing p_T Angular Dependence



The angular relationship between the missing momentum and the dijet is calculated by calculating the missing p_T of particles in concentric rings around the two jets. The radius of the rings is:

$$\Delta R = \sqrt{(\phi_{track} - \phi_{jet})^2 + (\eta_{track} - \eta_{jet})^2}$$



The PbPb low p_T excess in missing p_T extends to large angular distances away from the dijet axis.

• *Preliminary*: Measurement of momentum flow relative to the dijet system in PbPb and pp collisions at sqrt(s_NN) = 2.76 TeV, https://twiki.cern.ch/twiki/bin/view/CMSPublic/PhysicsResultsHIN14010