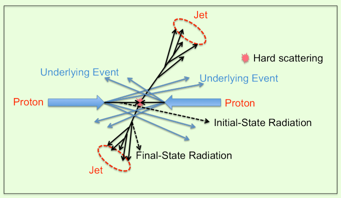
Jet production measurements with the ALICE Experiment in pp collisions at the LHC

S. K. Prasad for the ALICE Collaboration, Wayne State University, Detroit (email : sprasad@cern.ch)

Motivation

- Study/Compare the performance of four jet finder algorithms (anti-k_t, k_t, SISCone and UA1 cone finder).
- Establish a knowledge base and reference for jet measurements in pp collisions and eventually comparison with Pb--Pb collisions.
- Eventually measure and compare jet production cross sections to predictions from event generators such as PYTHIA.

❖ Jets are the collimated spray of particles originating from the fragmentation of hard scattered partons in pp collisions.



❖ Jets provide a proxy to the high p_T hard partons produced in elementary hard scatterings.

❖ In pp collisions they will be used to test the perturbative quantum chromodynamics (pQCD) and event generators. In A--A collisions they will be used to probe the properties of the hot and dense medium produced [1].

In each event, jets are reconstructed using the following algorithms :

- ***Fastjet k_t*** : A sequential recombination clusterizer [2].
- ***Fastjet anti-k_t*** : A sequential recombination clusterizer with negative power [3].
- ***UA1 cone finder*** : A cone algorithm using seeds [4].
- ***SISCone*** : A seedless cone algorithm [5].

Analysis details

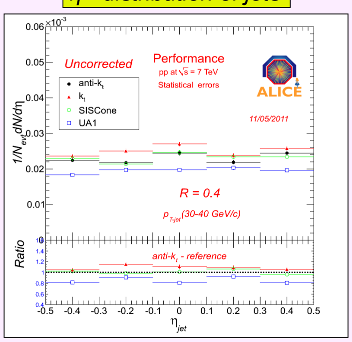
- Analysis is done for pp collisions at $\sqrt{s}$ = 2.76 and 7 TeV.
- **Event selection** : Minimum bias collisions, **Vertex (*Vz*) selection** : $|Vz|$ < 8 cm.
- Total number of events **= 3.6×10^8** at 7 TeV and **1.5×10^7** at 2.76 TeV.
- Central tracking detectors are used.
- Charged tracks within $|\eta|$ < 0.9 are accepted.
- **Track selection** : Minimum number of TPC clusters > 70, Chi2 per cluster TPC < 4, Maximum DCA to VtxZ : 3.2, Maximum DCA to VtxXY : 2.4.

Jet reconstruction

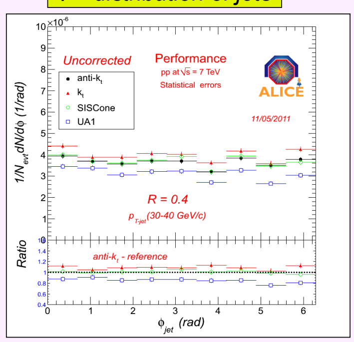
- Jets within $|\eta|$ < 0.5 are accepted.
- Threshold applied on track's p_T for jet reconstruction : 150 MeV/c for SISCone, k_t and anti-k_t and 1 GeV/c for UA1 cone finder.
- Cluster size (Cone radius) : R = 0.4 (in η-Φ space).
- No background subtraction, no correction.

Results and discussion

η - distribution of jets

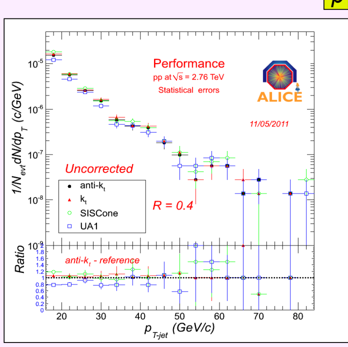


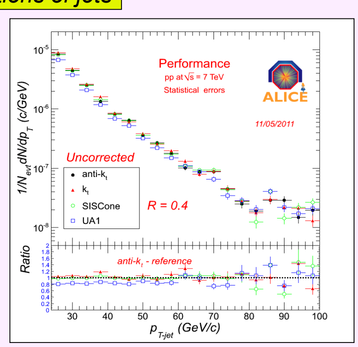
Φ - distribution of jets



- Results obtained from anti-k_t, k_t and SISCone agree with each other within ±15%, UA1 cone finder is slightly low since it uses a higher threshold (1 GeV/c) for track's p_T.
- Response is uniform in both η and Φ.
- Similar results are obtained for pp collisions at $\sqrt{s}$ = 2.76 TeV.

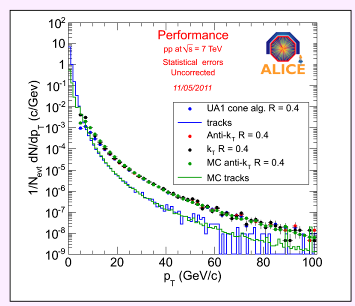
p_T - distributions of jets





- Results obtained from anti-k_t, k_t and SISCone agree with each other, UA1 cone finder results are slightly lower since it uses a higher threshold (1 GeV/c) for track's p_T.

Comparison with simulation



- The uncorrected spectra quantitatively agree with uncorrected reconstructed spectra from PYTHIA.

Summary and outline

- Charged jets (uncorrected) are measured using UA1 cone finder, SISCone, k_t and anti-k_t algorithms for pp collisions at $\sqrt{s}$ = 2.76 and 7 TeV.
- Results obtained with SISCone, anti-k_t and k_t are in good agreement while cross sections obtained with the UA1 differs slightly (~20%).

References

[1] U. A. Wiedemann, arXiv:0908.2306 [hep-ph], 2009.
[2] S. D. Ellis and D. E. Soper, Phys. Rev. D48, 3160, 1993.
[3] M. Cacciari, G. P. Salam and G. Soyez, arXiv:0802.1189 [hep-ph], 2008.
[4] G. C. Blazey et al. , arXiv:hep-ex/0005012, 2000
[5] G. P. Salam and G. Soyez, arXiv:0704.0292 [hep-ph], 2007.