Measurements of fully reconstructed jet cross-section and jet structure in pp collisions at √s=2.76 TeV with ALICE at the LHC

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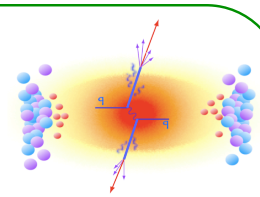
Jet properties are expected to be modified in the dense, colored medium formed in Pb-Pb collisions at the LHC. To quantify such modifications, the measurement of reference distributions in pp collisions is essential. Jets are reconstructed from charged tracks measured in the ALICE central barrel, as well as the neutral energy measured in the Electromagnetic Calorimeter (EMCal). In this poster, we present a measurement of the inclusive differential jet cross-section in pp collisions at √s = 2.76 TeV by combining Minimum-Bias and EMCal triggered events in ALICE. The bias of the EMCal trigger, which selects events with a shower in the EMCal of energy greater than 3 GeV, is corrected to extract the jet cross-section. Two different jet cone radii R=0.2 and R=0.4 are used to reconstruct jets, and the ratio of the cross-sections are reported. This provides first information on the jet energy profile.

INTRODUCTION



- Hard scattered parton in pp or AA collisions fragments into a "jet": a spray of correlated hadrons
- Full jet reconstruction -> initial scattering kinematics

Why measure jets in pp?

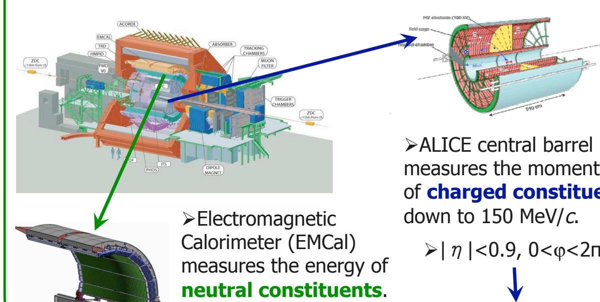
- Test of pQCD calculations on cross-section and jet structure.
- Reference for jet measurements in Pb-Pb at the same $\sqrt{s_{NN}}$ = 2.76 TeV.

Jet quenching in heavy-ion collisions

- QCD predicts that highly energetic partons lose energy in a quark-gluon plasma (QGP).
- Jet fragmentation pattern is modified due to parton-medium interactions.
- Probe to QGP properties.

ALICE APPROACH TO JET MEASUREMENT

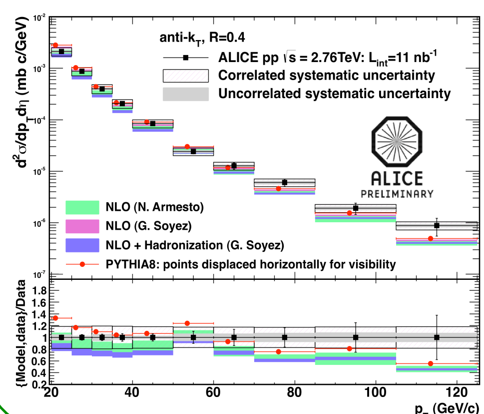
Measure jet constituents individually



- ALICE central barrel measures the momentum of **charged constituents** down to 150 MeV/c.
- $|\eta|$<0.9, 0<φ<2π
- Electromagnetic Calorimeter (EMCal) measures the energy of **neutral constituents**.
- $|\eta|$<0.7, 1.4<φ<3.14

reconstructed **JET**

INCLUSIVE JET CROSS-SECTION



- **Jet finding** [1]
  - anti-k$_T$ R = 0.4
  - Boost invariant recombination scheme
- **Jet selection**
  - $|\eta|$ < 0.3, 1.8 < φ < 2.7
  - $z_{leading}$ < 0.98: leading hadron momentum projection on jet axis to jet momentum
- **Agreement with NLO calculations within uncertainty**
  - Will improve after underlying event subtraction
- **NLO calculations**
  - Renormalisation and factorisation scale uncertainties

Jet energy scale (JES): the measured jet energy can shift from the true energy. The JES uncertainty is < 4%.

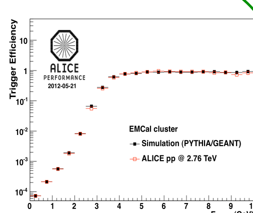
- Missing neutrons and K^0_L's: corrected using models.
- Tracking inefficiency: only a fraction of charged particles can be detected. Corrected via simulation.
- Energy double-counting: charged particles also shower in EMCal. Corrected via data-driven method and simulation.

Jet energy resolution: ~20%

- Fluctuation (E-by-E) in correction of jet energy scale.
- Tracking resolution: ~4% at p_T ~ 40 GeV/c
- EMCal energy resolution: ~3% at E ~ 40 GeV

CORRECTIONS

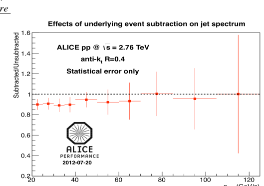
- **EMCal Level-0 trigger:** used in data-taking to ***extend the kinematic reach of jet spectrum***. However, it also induces ***bias on the jet population***.
- Estimated in simulation via incorporating the EMCal cluster turn-on curves and local inefficiency of the trigger system extracted from data.



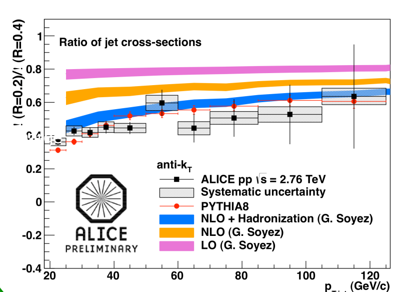
- **Detector effects:** bin-by-bin correction from simulation with all the detector effects built in.

$$C_{MC}(p_T^{low},p_T^{hi}) = \frac{\int_{p_T^{low}}^{p_T^{hi}} dp_T \frac{dF^{uncorr}_{measure}}{dp_T} \frac{d\sigma^{Particle}_{MC}/dp_T}{d\sigma^{Detector}_{MC}/dp_T}}{\int_{p_T^{low}}^{p_T^{hi}} dp_T \frac{dF^{uncorr}_{measure}}{dp_T}}$$

- **Underlying event:** not part of jet fragmentation
- Subtract on average from jet energy
- Effects shown in the plot on the right



JET PROFILE



- **Best agreement when hadronization is included**
- NLO ratio is equivalent to ratio of cross-sections calculated individually at NNLO [2]

SUMMARY & OUTLOOK

- First measurement of jet cross-section for pp at √s = 2.76 TeV. Agrees with NLO calculations + hadronization.
- The ratio of jet cross-sections is also reproduced by the NLO calculation within uncertainty
- A paper to be submitted

[1] M. Cacciari, G.P.Salam and G.Sovez, FastJet package.
[2] G. Soyez, "A simple description of jet cross-section ratios", Phys.Lett. B698 (2011) 59