Measurement of inclusive charged jet cross section in pp collisions at $\sqrt{s} = 5.02$ TeV with ALICE at the LHC

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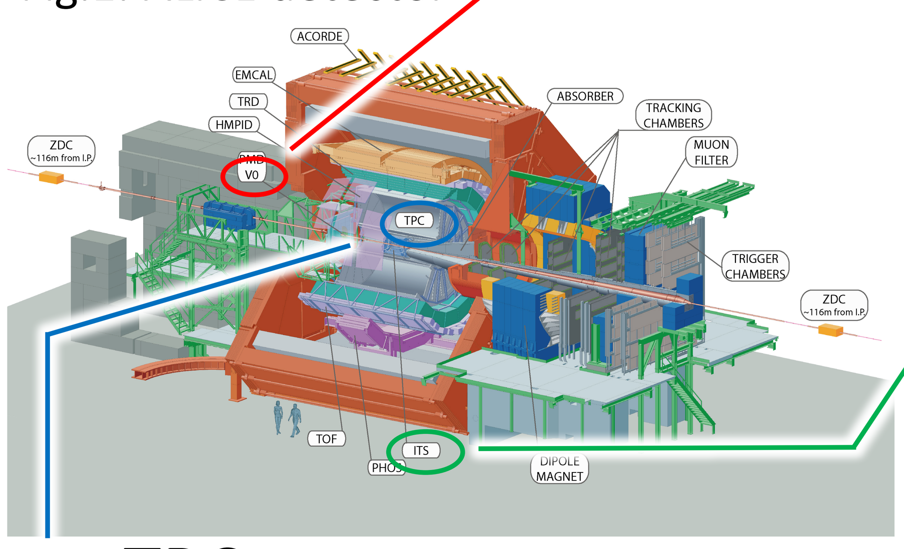
Physics motivation

The measurement of jet cross sections with the ALICE detector is of twofold interest. First, the study of jet production in pp collisions provides a test for perturbative Quantum Chromo Dynamics (pQCD). Second, jets measured in heavy-ion collisions are a well established tool to probe the Quark Gluon Plasma (QGP). We can obtain a reference for heavy ion collisions from the measurement of the pp collisions.

ALICE experiment

ALICE is one of the major LHC experiments, with as main goal to study the QGP. In this study, the ALICE V0 detector is used to trigger minimum bias events. The central barrel charged particle tracking system is used to detect charged particles. The tracking system consists of a Time Projection Chamber (TPC) and Inner Tracking System (ITS)

Fig.1: ALICE detector



- V0
  - 32+32 scintillators
  - Acceptance: 2.8<η<5.1 (V0A) −3.7<η<−1.7 (V0C)
- ITS
  - Consists of 3 type silicon detectors
    - Silicon Pixel Detector (SPD)
    - Silicon Drift Detector (SDD)
    - Silicon Strip Detector (SSD)
  - Acceptance (Full tracking w/ TPC): |η|<0.9
- TPC (Time projection chamber)
  - Filled with Ar-CO_2 (9:1)
  - Max drift time: 92 μs
  - Acceptance (Full tracking): |η|<0.9

Analysis details

- For this study, 25.5 M minimum bias events are analyzed.
- Jet reconstruction: Anti-k_T algorithm[1] implemented in the FastJet[2].
- Track selection: Charged track p_T > 0.15 GeV/*c*, a uniform efficiency in η and φ.
- The measurements are corrected to the particle level.
- Figure 2 shows the jet response matrix of true($p_{T,gen}^{jet,ch}$) versus reconstructed($p_{T,det}^{jet,ch}$) jet p_T from a full detector simulation, used for the Singular Value Decomposition unfolding method[3].
- The validity of the unfolding is demonstrated by an MC closure test shown in Figure 3. Good agreement between the truth and unfolded spectrum is found.

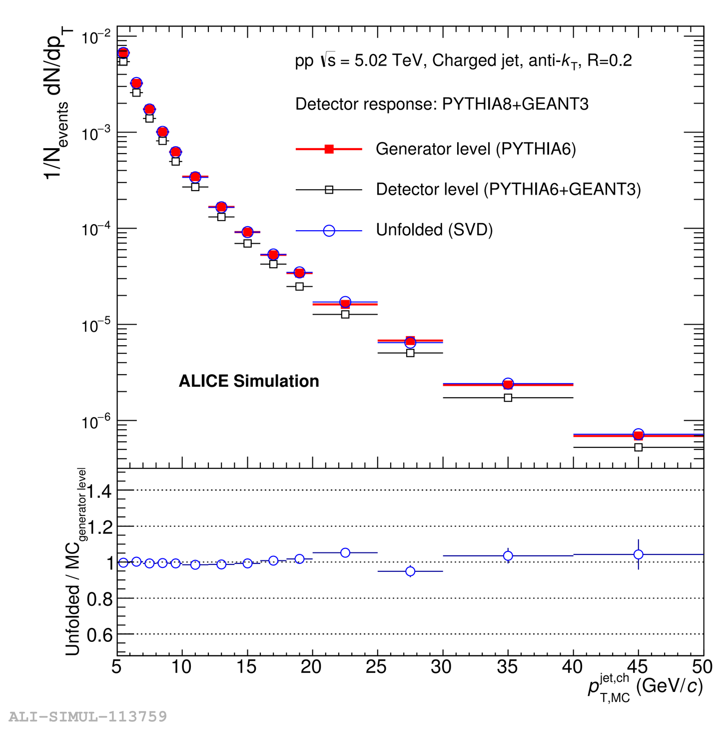


Fig. 3: MC closure test: unfolded detector level spectrum compared to the generator truth. Particle and detector level spectra from different event generators (PYTHIA8 and PYTHIA6 + GEANT3) are used.

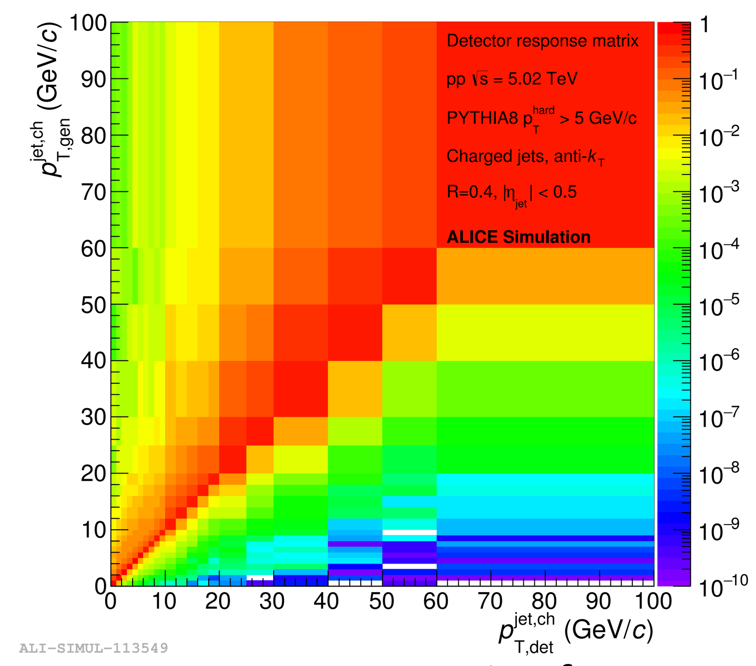


Fig.2: Detector response matrix of true versus reconstructed jet p_T from full detector simulation

[1] JHEP 0804:063,2008
[2] Eur.Phys.J. C72 (2012) 1896
[3] Nucl. Instrum. Meth. A 372 (1996) 469

- Sources of systematic uncertainties:
  - Tracking efficiency
  - Tracking resolution
  - Secondary contribution
  - UE subtraction
  - Unfolding
  - Cross section normalization

Results

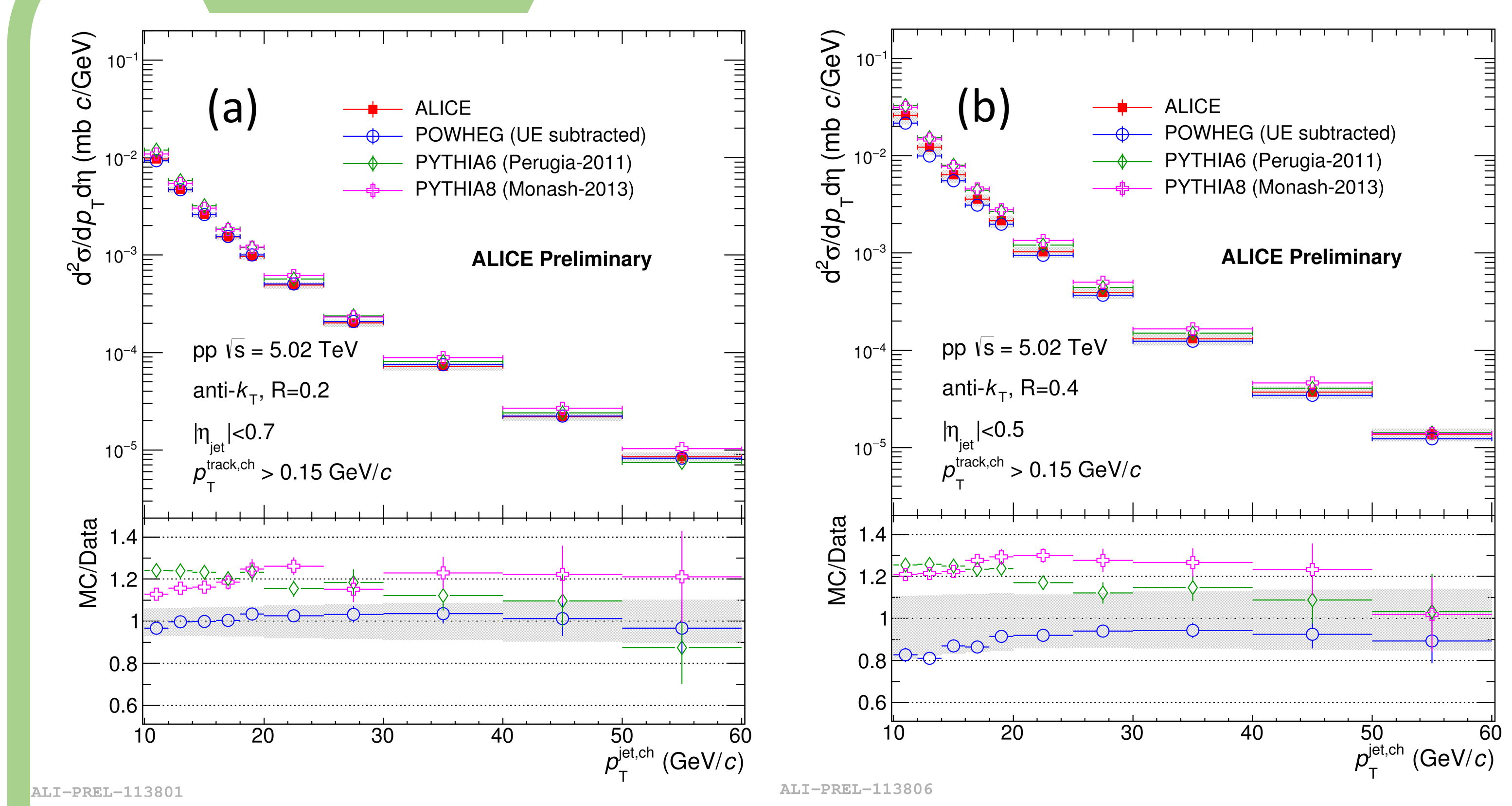


Fig.4: Charged jet cross section (a) R=0.2 (b) R=0.4

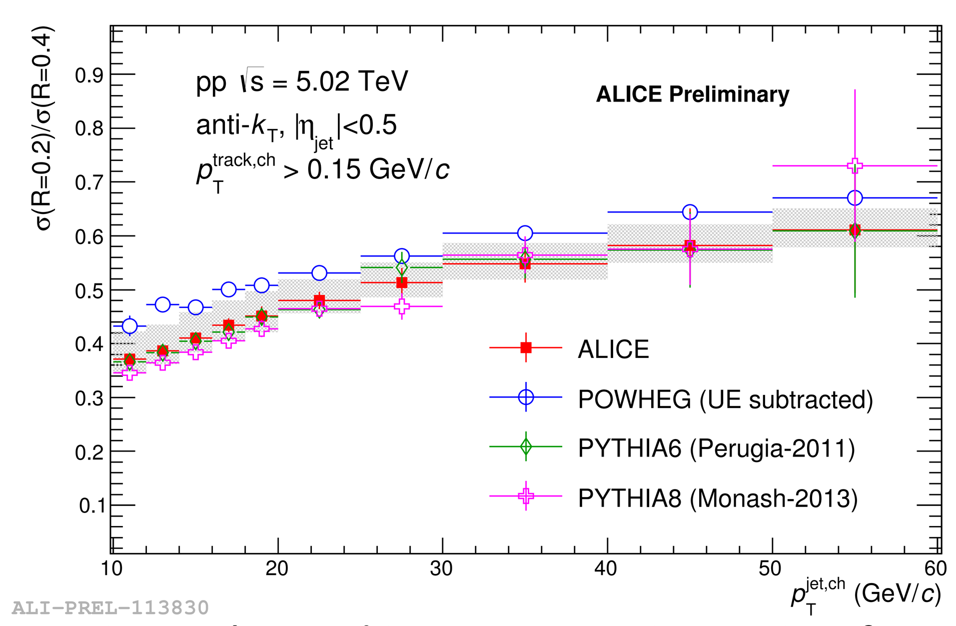


Fig.5: Charged jet cross section ratio of R=0.2 jets to R=0.4 jets

- The charged jet cross sections are well described by POWHEG NLO calculations.
- The cross section ratio R=0.2 / R = 0.4 is sensitive to the jet structure and rises as function of jet p_T, indicating stronger collimation at high $p_{T,jet}$. The ratio is well described by PYTHIA6, PYTHIA8 as well as POWHEG NLO calculations.

Summary and prospects

- Charged jet cross sections for R=0.2 and R = 0.4 are presented.
- The cross sections are well described by POWHEG NLO calculations.
- The charged jet cross section ratio is well described by PYTHIA6, PYTHIA8 and POWHEG.
- The measurements serve as a reference for PbPb collisions at the same $\sqrt{s_{NN}}$.
- The ALICE calorimeters will be included to extend the analysis to full jets.