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Kinematic properties of jets produced in pp collisions at $\sqrt{s} = 900$ GeV at LHC with the ATLAS detector

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Summary. — In December 2009, the Large Hadron Collider (LHC) has successfully produced the first proton-proton (pp) collisions at the center-of-mass energies of $\sqrt{s} = 900\,\text{GeV}$ and $\sqrt{s} = 2.35\,\text{GeV}$. Preliminary results are presented on first studies of jet kinematic properties at $\sqrt{s} = 900\,\text{GeV}$, using a Minimum Bias (MB) sample collected by the ATLAS experiment. The measurements are compared to predictions from Monte Carlo (MC) simulations implementing phenomenological models of non-diffractive processes and including a full simulation of the detector response. MC simulations modeling soft pp collisions provide a reasonable description of the data.

PACS 13.87.-a – Jets in large-Q^2 scattering.
PACS 13.87.Ce – Production.

1. – Introduction

The inclusive jet production has the largest cross section in hard scattering processes of proton collisions and this allows to perform the first jet measurements with the early data of LHC at $\sqrt{s} = 900\,\text{GeV}$. Over 1 million collision events were collected in December 2009 with the ATLAS apparatus using a MB trigger during collisions with stable proton beams.

2. – Event selection

For this measurement, data were collected using the L1 MBTS trigger of the ATLAS detector [1]. Offline cuts on the MBTS hits and LAr calorimeter end-cap timing are used to select good collision candidates [2]. This selection is aimed at having a "robust" timing measurement and at removing contamination of events produced by the beam halo, interactions of one proton beam with the beam pipe gas or muons from cosmic rays. Jets are reconstructed using the anti-$k_\perp$ jet algorithm with distance parameter $R = 0.6$ [3] and formed by topological clusters [4]. Only uncalibrated jets reconstructed in the pseudorapidity region $|\eta| < 3.2$ with $p_T^{EM} > 4\,\text{GeV}$ have been selected. A further selection on jets has been done based on their reconstruction quality [2]. For the purpose

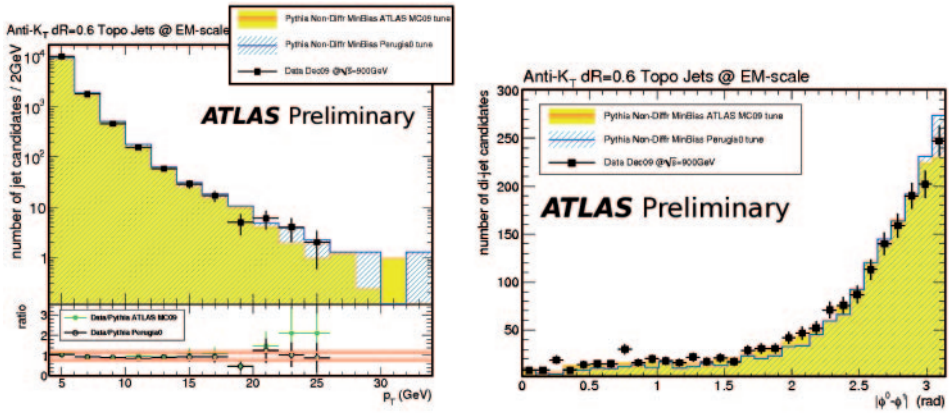

Fig. 1. – Jet distributions obtained at the electromagnetic scale. Left: transverse momentum p_T at the electromagnetic scale. Right: azimuthal-angle difference $\Delta\phi$ of the two most energetic jets in the event.

of comparing the present measurement to different phenomenological models describing non-diffractive MB processes, several MC samples were generated using the PYTHIA 6.4.21 [5] with different tuned [6].

3. – Results

Figure 1 illustrates the inclusive-transverse momentum distributions of jets and the azimuthal opening angle of dijets as measured with the ATLAS detector, showing a reasonable agreement to MC predicitons. MC simulation distributions are scaled to data by applying a normalization factor obtained by the relative ratio Data/MC in the second bin of the jet multiplicity histogram. Only statistical uncertainties are shown.

4. – Conclusions

The ATLAS detector has been operating and collecting data with high efficiency at $\sqrt{s} = 900\,\text{GeV}$ in winter 2009. The jet production measurements and the kinematic distributions are in good agreement with the MC predictions.

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