Measurement of the production cross section for Z/γ^* in association with jets in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

Estel Perez Codina
Institut de Física d'Altes Energies (IFAE)
Universitat Aunt'onoma de Barcelona (UAB)
Edifici Cn, E-08193 Bellaterra (Barcelona), SPAIN

1 Introduction

The measurement of Z/γ^*+jets production cross section is important since it provides a stringent test of perturbative QCD (pQCD) predictions. Z/γ^*+jets final states represent an important background in searches for new physics, and the Monte Carlo (MC) predictions for these processes need to be tuned and validated at the LHC energy domain using data. The results presented in this contribution [1] include both the electron and muon decay channels and use the full 2010 dataset corresponding to an integrated luminosity of 33 pb^{-1}.

2 Cross section measurement

The Z/γ^* candidates are selected online using single lepton triggers. Electrons with E_T>20 GeV and $|\eta|$<2.47 (excluding the range 1.37<$|\eta|$<1.52) are selected, and only muons with p_T>20 GeV and $|\eta|$<2.4 are considered. Events are required to have exactly two oppositely charged leptons with dilepton invariant mass 66<$m_{\ell^+\ell^-}$<116 GeV. Jets are reconstructed from topological clusters using the anti-k_T algorithm with distance parameter R=0.4. They are required to have p_T>30 GeV and $|\eta|$<2.8 and to be separated from the two leptons ΔR(lepton,jet)>0.5.

Background contamination is estimated using MC simulated samples, except for the QCD multijet contribution to the electron channel, where a data-driven method is employed. The background events represent a 6% to 14% (1% to 8%) of the selected sample in the electron (muon) channel for increasing jet multiplicity. The measured cross sections are corrected for detector effects to the particle level using bin-by-bin correction factors extracted from ALPGEN MC simulated samples. The total systematic uncertainty on the measured cross section varies between 13% to 24% with increasing jet multiplicity and jet p_T.

The cross section results are compared to next-to-leading order (NLO) pQCD predictions, as computed with MCFM using CTEQ6.6 PDFs and factorization and renormalization scale $\mu = H_T/2$ (H_T is the scalar sum of the p_T of all particles) where the predictions include non-perturbative corrections, and to leading order (LO) predictions including parton shower, as determined in ALPGEN, SHERPA and PYTHIA. The measured cross sections (Fig. 1) decrease by almost two orders of magnitude with increasing jet multiplicity and p_T (from 30 GeV to 120 GeV). The data are well described by NLO pQCD predictions as well as by LO+parton shower predictions from ALPGEN and SHERPA, while PYTHIA underestimates the measured cross section at high jet multiplicity.

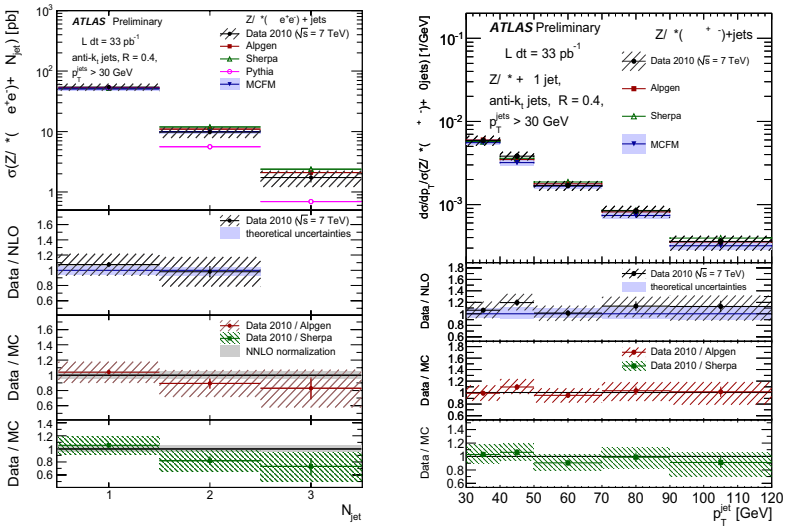

Figure 1: Measured cross section $\sigma_{N_{jet}}$ (black dots) in $Z/\gamma^*(\rightarrow e^+e^-)$+jets production as a function of the inclusive jet multiplicity (left) and measured inclusive jet cross section $d\sigma/dp_T^{jet}$ in $Z/\gamma^*(\rightarrow \mu^+\mu^-)$+jets production as a function of p_T^{jet} (right). The error bars indicate the statistical uncertainty and the dashed areas are the statistical and systematic uncertainties added in quadrature.

References

[1] ATLAS Coll., ATLAS-CONF-2011-042, http://cdsweb.cern.ch/record/1338571.