

# Measurement of the $W$ +Jets Production Cross Section with ATLAS

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## 1 Introduction

The associated production of jets with a  $W$  boson provides a testing ground for perturbative quantum-chromodynamics (pQCD) and an important background to other interesting processes in the Standard Model and beyond. Cross section measurements in both the electron and muon decay modes of the  $W$  boson are used to make a precise test of predictions from Monte Carlo simulations and next-to-leading order (NLO) pQCD calculations, extending an earlier ATLAS measurement [1] to a data sample of approximately  $33 \text{ pb}^{-1}$  [2] of proton-proton collisions produced at the LHC.

## 2 Method

$W$  bosons are identified by requiring a well-measured lepton ( $e, \mu$ ) with transverse momentum  $p_T > 20 \text{ GeV}$ , missing transverse energy  $> 25 \text{ GeV}$ , and transverse mass  $m_T > 40 \text{ GeV}$ . Figure 1 shows the data and expected backgrounds as a function of jet multiplicity. Jets are reconstructed using the anti- $k_T$  algorithm with distance parameter  $R = 0.4$  and required to have angular separation  $\Delta R > 0.5$  relative to the lepton, rapidity  $|y| < 2.8$ , and  $p_T > 20 \text{ GeV}$ . Results are quoted for this restricted phase space and unfolded to particle level, correcting for all known detector effects.

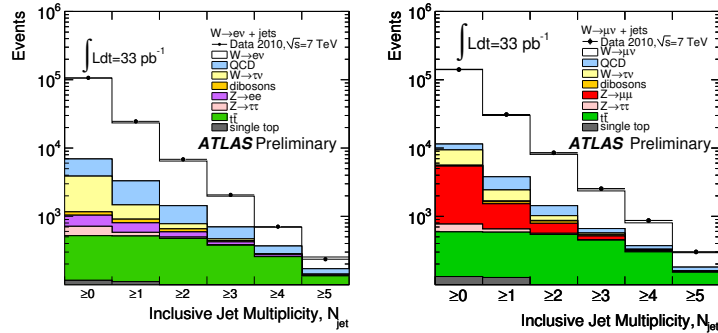


Figure 1: Uncorrected jet multiplicity for electron (left) and muon (right) channels.

### 3 Results & Discussion

The measurements include cross sections as a function of jet multiplicity and ratios of those cross sections, as well as differential cross sections as a function of jet multiplicity, jet transverse momentum, and the sum of transverse momenta of energetic jets and leptons in each event,  $H_T$ . All results are compared with particle level predictions for the same jet and lepton phase space, including NLO pQCD calculations from BLACKHAT-SHERPA [3] for up to three jets, and good agreement is observed. This is illustrated by Fig. 2, showing the cross section as a function of the first jet  $p_T$ , which suggests stronger agreement with NLO predictions (MCFM [4], shown for the jet  $p_T$  range measured in [1], and BLACKHAT-SHERPA) than leading order ones.

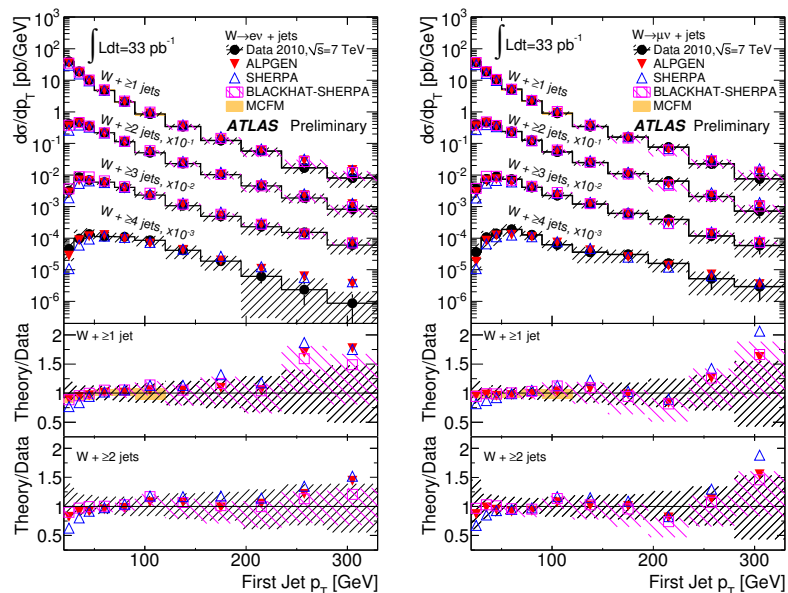


Figure 2: W+jets cross section as a function of the  $p_T$  of the first jet in the event for electron (left) and muon (right) channels. Uncertainties due to parton distribution functions, scale choice, and uncertainty in  $\alpha_s$  are shown for BLACKHAT-SHERPA.

### References

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- [2] G. Aad *et al.* [ATLAS Collaboration], ATLAS-CONF-2011-060.
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- [4] Campbell, J. M. *et al.*, Phys.Rev.D**68** (2003) [doi:10.1103/PhysRevD.68.094021].