

# $W/Z$ boson production in leptonic final states at the ATLAS experiment

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## 1 Event selection

The analysis presented here [1] is based on about  $35 \text{ pb}^{-1}$  of integrated luminosity collected in 2010 by the ATLAS experiment in  $pp$  collisions at 7 TeV. Events are selected using a single-lepton trigger requirement with a nominal threshold of transverse momentum  $p_T > 13 \text{ GeV}$  for muons and of transverse energy  $E_T > 15 \text{ GeV}$  for electrons.

Electrons are required to have pseudorapidity  $|\eta| < 2.47$  and  $E_T > 20 \text{ GeV}$ ; electrons from the transition region between the barrel and endcap calorimeters,  $1.37 < |\eta| < 1.52$ , are not used. The analysis has been performed including also  $Z$  bosons having one electron as described and another (*forward*) electron with  $2.5 < |\eta| < 4.9$ .

Muons are reconstructed combining an inner detector track with a muon spectrometer track; they are required to have  $p_T > 20 \text{ GeV}$ ,  $|\eta| < 2.4$  and they also must pass an isolation requirement which considerably reduces the QCD background.

$W$  candidates are selected requiring missing transverse energy  $E_T^{\text{miss}} > 25 \text{ GeV}$  in addition to an high-pt lepton and transverse mass  $m_T > 40 \text{ GeV}$ .  $Z$  candidates are selected requiring two high-pt same flavor and opposite sign leptons having the invariant mass within 66 and 116 GeV.

For both channels electroweak backgrounds are estimated from Monte Carlo simulation; QCD background, due to multi-jet production or  $\pi/K$  decays, is estimated from data, extrapolating from control regions: we use isolation/ $E_T^{\text{miss}}$  for  $W \rightarrow \mu\nu$  and isolation/ $M_{\mu\mu}$  for  $Z \rightarrow \mu\mu$ , while we fit the  $M_{ee}$  distribution relaxing selection cuts for  $Z \rightarrow ee$  and instead we fit  $E_T^{\text{miss}}$  distribution with inverted identification criteria for the electron in case of  $W \rightarrow e\nu$ .

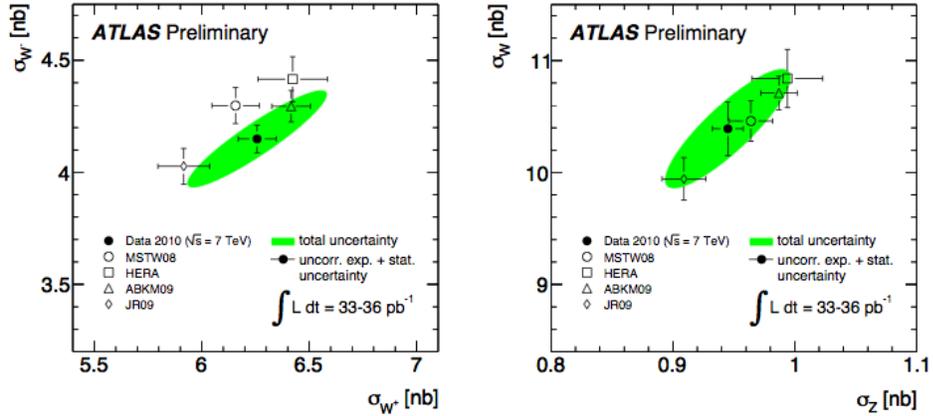


Figure 1: Measured and predicted  $W^+$  vs.  $W^-$  (left) and  $W$  vs.  $Z$  (right) cross sections times leptonic branching ratios; the systematic uncertainties on the luminosity and on the acceptance extrapolation are treated as fully correlated.

## 2 Results

In total 84103  $W^+$ , 55163  $W^-$  and 11669  $Z$  candidates are selected in the muon channel, while for the electron channel we find 72207  $W^+$ , 49103  $W^-$ , 9721  $Z$  with both electrons in the central region and 4000  $Z$  candidates with a forward electron.

The measured cross sections and their ratio, with their statistical, systematic, luminosity and acceptance extrapolation uncertainties are ( $\ell = e, \mu$ )

$$\begin{aligned} \sigma_W^{\text{tot}} \cdot \text{BR}(W \rightarrow \ell\nu) &= (10.391 \pm 0.022(\text{sta}) \pm 0.238(\text{sys}) \\ &\quad \pm 0.353(\text{lum}) \pm 0.312(\text{acc})) \text{ nb}, \\ \sigma_{Z/\gamma^*}^{\text{tot}} \cdot \text{BR}(Z/\gamma^* \rightarrow \ell\ell) &= (0.945 \pm 0.006(\text{sta}) \pm 0.011(\text{sys}) \\ &\quad \pm 0.032(\text{lum}) \pm 0.038(\text{acc})) \text{ nb}, \\ R_{W/Z} &= 10.906 \pm 0.079(\text{sta}) \pm 0.215(\text{sys}) \pm 0.164(\text{acc}), \end{aligned}$$

where the main systematic uncertainties arise from uncertainties in the luminosity, the  $E_T^{\text{miss}}$  resolution and scale and the acceptance. These measurements are in good agreement with NNLO QCD computations using different proton PDF sets as shown in Figure 1.

## References

- [1] See ATLAS-CONF-2011-041 (<http://cdsweb.cern.ch/record/1338570>).