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$Z \to ee$ cross section measurement in pp collisions at $\sqrt{s} = 7\,\text{TeV}$ with the ATLAS detector

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Summary. — This report presents the Z-boson cross section decay measurement in the electron channel in pp collisions at $\sqrt{s} = 7\,\text{TeV}$. The measurement has been performed with data taken in 2010 by the ATLAS experiment at LHC, corresponding to an integrated luminosity of about $36\,\text{pb}^{-1}$.

PACS 13.38.-b – Decays of intermediate bosons.
PACS 13.38.Dg – Decays of Z bosons.

1. – Electron identification and reconstruction in ATLAS

In ATLAS [1], electrons and photons are triggered in the pseudorapidity range $|\eta| < 2.5$, where the electromagnetic calorimeter (EM) has a fine segmentation in both lateral and longitudinal directions of the shower. The trigger makes use as well of the information coming from the Inner Detector which provides precise track reconstruction in the same pseudorapidity range. An electron seed is defined as a cluster in the second layer of the EM with transverse energy $E_T > 2.5\,\text{GeV}$. For the forward region ($|\eta| > 2.5$), electron candidates are defined as reconstructed clusters with $E_T > 5\,\text{GeV}$, their direction is defined as the barycentre of the cluster and the energy is the measured cluster energy.

2. – Z candidates event selection in the central and forward region

In order to select collisions, events are required to have at least one primary vertex formed by at least three tracks. After trigger requirements two electrons are required to be reconstructed passing the "medium" identification criteria [2] with $E_T > 20\,\text{GeV}$ and $|\eta| < 2.47$. Their charges have to be opposite, and the invariant mass of the e^+e^- pair has to be within the mass interval between 66 and 116 GeV. For the Z selection in the range of pseudo-rapidity $2.5 \leq |\eta| \leq 4.9$ a central electron passing the "tight" criteria [2] is required while a second electron with $E_T > 20\,\text{GeV}$ has to be reconstructed, no charge can be measured and the identification has to rely on calorimeter cluster shapes only.

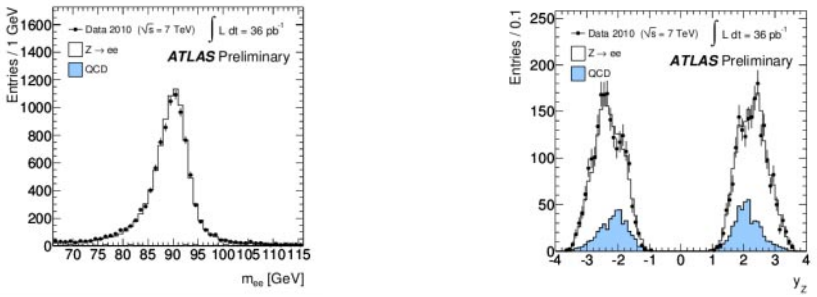

Fig. 1. – Invariant mass distribution of the Z candidates selected in the central region (left) and rapidity distribution for the forward Z candidates selection (right).

TABLE I. – *Values of the total $Z \to ee$ cross section measurement for central and forward region selection with statistic (stat), systematic (sys), luminosity (lum) and acceptance (acc) associated uncertainties.*

	$\sigma^{tot}_{Z/\gamma^*} \cdot \mathrm{BR}(Z/\gamma^* \to ee)$ (nb), $66 < m_{ee} < 116\,\mathrm{GeV}$
Z/γ^* Central	$0.972 \pm 0.010(\mathrm{stat}) \pm 0.034(\mathrm{sys}) \pm 0.033(\mathrm{lum}) \pm 0.038(\mathrm{acc})$
Z/γ^* Forward	$0.903 \pm 0.022(\mathrm{stat}) \pm 0.087(\mathrm{sys}) \pm 0.031(\mathrm{lum}) \pm 0.035(\mathrm{acc})$

3. – Analysis procedure and results

The total $Z \to ee$ cross section (σ_{tot}) [3] is measured using the following formula:

$$\sigma_{tot} = \sigma_Z \times BR(Z \to ll) = \frac{N - B}{A_Z \cdot C_Z \cdot L_{int}}\,. \tag{1}$$

N is the number of candidate events measured in data, B is the number of estimated background events, L_{int} is the integrated luminosity corresponding to the run selections and the trigger employed and finally A_Z and C_Z are factorised acceptances. C_Z is corrected for any discrepancy in recostruction and trigger efficiences between data and MC and determines the integrated cross section σ_{fid} within the fiducial regions of the measurement, while A_Z is introduced to extrapolate the measurement to the full kinematic region $\sigma_{tot} = \sigma_{fid}/A_Z$.

The final result of total $Z \to ee$ cross section measurements with 2010 data in both central and forward regions are reported in table I and fig. 1.

REFERENCES

[1] ATLAS COLLABORATION, *JINST*, **3** (2008) S08003.
[2] ATLAS COLLABORATION, *Electron and photon reconstruction and identification in ATLAS: expected performance at high energy and results at $\sqrt{s} = 900\,GeV$*, (2010) ATLAS-CONF-2010-005.
[3] ATLAS COLLABORATION, *JHEP*, **12** (2010) 060, arXiv:1010.2130 [hep-ex].