Measuring the inclusive cross section for W-boson and Z-boson production in pp collisions at $\sqrt{s} = 5\text{TeV}$ with the CMS detector at the LHC

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The inclusive cross section of vector boson production in proton-proton collisions at the LHC is one of the key measurements for constraining the standard model. The measurement at $\sqrt{s} = 5\text{TeV}$ is reported. The analysis includes systematic uncertainties from theoretical predictions as well as detector performance effects. A fit on the combined results from different center of mass energies is used to further constrain PDFs.

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I. INTRODUCTION

The inclusive cross section of vector boson production in proton-proton collisions at the LHC is one of the key measurements for constraining the standard model. The measurement at $\sqrt{s} = 5\text{TeV}$ is reported. The analysis includes systematic uncertainties from theoretical predictions as well as detector performance effects. A fit on the combined results from different center of mass energies is used to further constrain PDFs.

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1. Generator-Level Acceptance

The detector acceptance is an important theoretical value for the extraction of the inclusive cross-section from the measured fiducial cross-section. The acceptance is defined as the ratio of events whose decay products fall within the kinematic acceptance region of the detector to the total number of events. As a baseline, events are simulated using the next-to-leading-order Monte Carlo aMC@NLO with NNPDF3.0 parton distribution function set and PYTHIA 8 parton showering and hadronization. The error on the simulated distribution is estimated by comparing the acceptances to those derived using higher-order tools, such as RESBOS and DYRES.

The fiducial region of the detector accepts only muons of $p_T > 25\text{GeV}$ and $|\eta| < 2.4$ and electrons with $p_T > 25\text{GeV}$ and $|\eta| < 1.4442$ or $1.566 < |\eta| < 2.5$. An additional constraint is imposed on the Z channel that $60\text{GeV} < m_z < 120\text{GeV}$.

The generator-level acceptance is considered for post-FSR particles for several decay channels. A summary of the acceptances and their statistical uncertainty is given in table **??**.

Process	A_{Gen}(Post-FSR)
$Z \to \mu^+\mu^-$	0.440 ± 0.001
$Z \to e^+e^-$	0.406 ± 0.001
$W^+ \to \mu^+\nu$	0.572 ± 0.001
$W^+ \to e^+\nu$	0.547 ± 0.001
$W^- \to \mu^-\bar{\nu}$	0.536 ± 0.001
$W^- \to e^-\bar{\nu}$	0.515 ± 0.001

TABLE I: Gen-level acceptance from aMC@NLO with NNPDF3.0 and Pythia8 for signal processes $Z \to l^+l^-$ and $W \to l\nu$

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