

Study of the W^+W^- decays of the Higgs boson and measurement of the transverse momentum spectrum at 8 TeV with the CMS experiment

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The Higgs mechanism is an essential element of the Standard Model (SM), explaining the origin of mass and playing a key role in the physics of electroweak symmetry breaking. A suitable Higgs boson candidate, predicted by the Higgs mechanism, was found with a mass of $125 \text{ GeV}/c^2$ by the ATLAS and CMS experiments in the first CERN LHC run.

After the discovery, the accurate measurement of the Higgs boson properties has become one of the main goals of the LHC. The Higgs sector could in fact be more entangled with respect to what discovered so far and Beyond-Standard-Model effects could emerge from an accurate measurement of the couplings with fermions and bosons, *i.e.* from the knowledge of the Higgs boson production processes and decays. The $H \rightarrow W^+W^-$ channel is one of the most sensitive to these effects and the high branching fraction allows the statistics needed for a precision measurement to be easily collected.

Measurements of the production cross section of the Higgs boson times branching fraction of decay in a restricted part of the phase space (fiducial phase space) and its kinematic properties thus represent an important test for possible deviations from the SM predictions. In particular, it has been shown that the Higgs boson transverse momentum spectrum can be significantly affected by the presence of physics phenomena not predicted by the SM. In addition, these measurements facilitate tests of the theoretical calculations in the SM Higgs sector.

Measurements of the fiducial cross sections and of several differential distributions using the 8 TeV LHC data have been reported by the ATLAS and the CMS experiments for the $H \rightarrow ZZ \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ decay channels.

Here we report the first measurement at the LHC of the transverse momentum spectrum and the inclusive cross section times branching fraction for the Higgs boson production using $H \rightarrow W^+W^- \rightarrow e^\pm\mu^\mp\nu\nu$, based on proton-proton collision data collected by the CMS detector at a center-of-mass energy of 8 TeV. The Higgs boson transverse momentum is reconstructed using the lepton pair transverse momentum and missing transverse momentum. The differential cross section times branching fraction is measured as a function of the Higgs boson transverse momentum in a fiducial phase space defined to match the experimental acceptance in terms of the lepton kinematics and event topology. The measurements are compared to theoretical calculations based on the SM to which they agree within experimental uncertainties.