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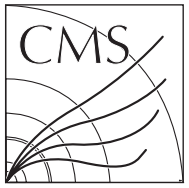

The Compact Muon Solenoid Experiment

Conference Report

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Measurement of the Higgs transverse momentum spectrum in $\mathrm{H} \rightarrow \mathrm{WW} \rightarrow 2l2\nu$ at 8 TeV

Lorenzo Russo for the CMS Collaboration

Abstract

A measurement of the Higgs boson transverse momentum spectrum, performed by the CMS experiment data at the LHC, is presented. The analysis selects $\mathrm{H} \rightarrow \mathrm{WW} \rightarrow 2l2\nu$ decays in the data sample of proton-proton collisions at $\sqrt{s} = 8$ TeV, corresponding on integrated luminosity of 19.4/fb . The Higgs boson transverse momentum is reconstructed using the transverse momentum of oppositely charged lepton pair (e, μ) and the missing transverse energy due to the two neutrinos in the final state. The differential cross section is obtained as a function of the Higgs boson transverse momentum in a fiducial phase space. The inclusive cross section times branching fraction is measurement to be $\sigma(\mathrm{fid}) = 39 \pm 8\,(\mathrm{stat.}) \pm 9\,(\mathrm{syst.})$ fb. This result is in agreement with theoretical calculation based on Standard Model.

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Measurement of the Higgs transverse momentum spectrum in $H \to W^+W^- \to 2\ell 2\nu$ at 8 TeV

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Summary. — A measurement of the Higgs boson transverse momentum spectrum, performed by the CMS experiment data at the LHC, is presented. The analysis selects $H \to W^+W^- \to 2\ell 2\nu$ decays in the data sample of proton-proton collision at $\sqrt{s} = 8$ TeV, corresponding on integrated luminosity of 19.4 fb^{-1}. The Higgs boson transverse momentum is reconstructed using the transverse momentum of oppositely charged lepton pair (e, μ) and the missing transverse energy due to the two neutrinos in the final state. The differential cross section is obtained as a function of the Higgs boson transverse momentum in a fiducial phase space. The inclusive cross section times branching fraction is measurement to be $\sigma_{\rm fid}$= 39 $\pm$ 8 (stat.) $\pm$ 9 (syst.) fb. This result is in agreement with theoretical calculation based on Standard Model.

An important test for possible deviations from the Standard Model predictions is represented by the measurement of the Higgs boson transverse momentum (p_T^H). The spectrum can be significantly affected by the beyond Standard Model phenomena. In addition allows one to test the existing theoretical calculations in SM Higgs sector [1, 2]. Similar measurements have been already performed by CMS and ATLAS experiments in the ZZ and $\gamma\gamma$ decay channels. The measurement reported here is the *first* transverse momentum measurement in the WW decay channel [3]. The analysis is performed in $H \to W^+W^- \to 2\ell 2\nu$ channel ($\ell = e, \mu$), with two opposite charged leptons and neutrinos in the final state. This channel has a larger cross section times branching ratio that exceeds by a factor of 5 the $H \to \gamma\gamma$ channel and by a factor of 85 the $H \to ZZ \to 4\ell$ channel. The measurement, based on $\sqrt{s} = 8$ TeV LHC data, follows the already published $H \to W^+W^- \to 2\ell 2\nu$ measurement [4], with the difference that this analysis is inclusive in the number of jets, given the correlation between jets multiplicity and p_T^H. This allows to reduce significantly the uncertainty related to the theoretical modelling of additional jets produced in association with the Higgs boson. The main backgrounds are the non resonant WW, for $p_T^H < 50$ GeV, and the $t\bar{t}$ pair production, for $p_T^H > 50$ GeV. The fiducial phase space is defined by requiring: two leptons ($e^{\pm}$, $\mu^{\mp}$) in $|\eta| < 2.5$ with p_T greater than 20 GeV and 10 GeV for the leading and subleading lepton, respectively; the presence of ν_e and ν_μ with no E_T^{miss}; $m_{\ell\ell} > 12$ GeV; $p_T^{\ell\ell} > 30$

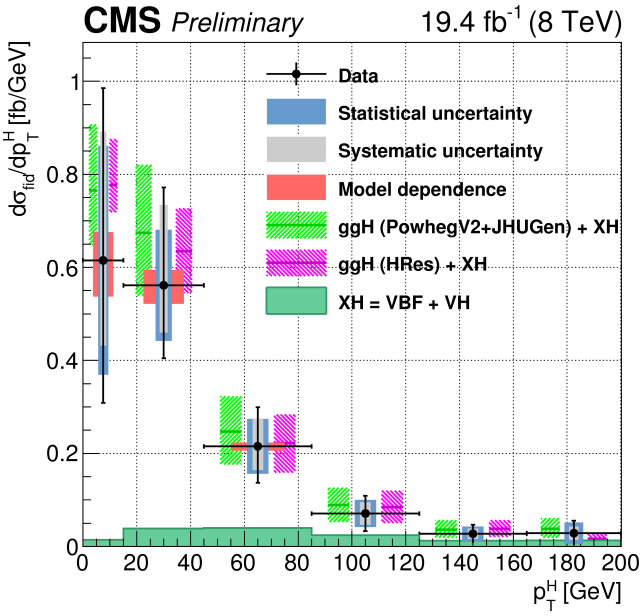

Fig. 1. – Differential Higgs boson production cross section as a function of Higgs boson p_T, after applying the unfolding procedure.The vertical bars on the data points correspond to the sum in quadrature of the statistical and systematic uncertainties. The pink (and back-slashed filling) and green (and slashed filling) lines and areas represent the SM theoretical estimates in which the acceptance of the dominant $gg \to H$ contribution is modelled by HRES and POWHEGV2, respectively.

GeV and $m_T^{\ell\ell E_T^{miss}} = \sqrt{2p_T^{\ell\ell} E_T^{miss}(1-\cos\Delta\phi(\ell\ell, E_T^{miss}))} > 50$ GeV. The analysis events selection is close to the fiducial phase space but with tighter cuts on E_T^{miss} (>20 GeV) and on $m_T^{\ell\ell E_T^{miss}}$ (> 60 GeV). Experimentally, the Higgs boson transverse momentum is reconstructed as: $\vec{p}_T^{\,H} = \vec{p}_T^{\,\ell\ell} + \vec{E}_T^{\,miss}$. The analysis is performed in six bins due to the MET resolution and to limit the migration effects. The signal is extracted in each p_T^H bin with a 2D fit on $m_{\ell\ell}$ and $m_T^{\ell\ell E_T^{miss}}$ which are mostly uncorrelated. To facilite a comparision to the theoretical prediction an unfolding procedure is set up. This procedure corrects for detectors resolution and efficiency effects: the unfolded spectrum is shown in Fig.1. The final inclusive inclusive cross section times branching fraction is: $\sigma_{\rm fid}$= 39 $\pm$ 8 (stat.) $\pm$ 9 (syst.) fb. The result is in good agreement with theoretical predictions.

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