SEARCH FOR CHARGED HIGGS BOSONS IN PP COLLISIONS: RESULTS FROM $\sqrt{s} = 8$ TEV AND PROSPECTS FOR $\sqrt{s} = 13$ TEV

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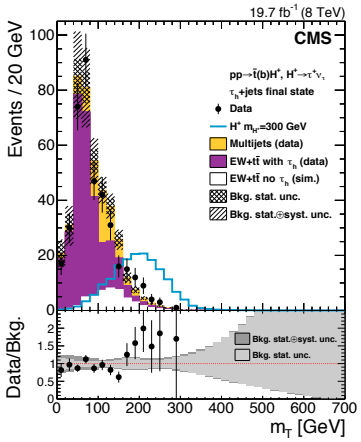
In 2012, an electrically neutral Higgs boson with a mass of 125 GeV was discovered by the CMS and ATLAS experiments at the CERN LHC [1, 2]. Its properties were found to be consistent with the predictions for the Standard Model Higgs boson [3]. The Standard Model is, however, known to be an incomplete description of the nature, and although models with an extended Higgs sector are constrained, they are not excluded by the discovery. The electrically charged Higgs bosons are predicted in models with at least two Higgs doublets, such as the Minimal Supersymmetric Standard Model.

Charged Higgs bosons are searched for in pp collisions at the CERN LHC collider in top quark decays $\mathrm{t\bar{t}} \to \mathrm{H^+W^-b\bar{b}}$ (assuming $m_{\mathrm{H^+}} < m_{\mathrm{t}}$) and in the direct production process $\mathrm{pp} \to \mathrm{\bar{t}bH^+}$ (assuming $m_{\mathrm{H^+}} > m_{\mathrm{t}}$). The results from the charged Higgs combination paper published in November 2015 are presented, based on data recorded by the CMS experiment in 2012 at the centre-of-mass energy of $\sqrt{s} = 8$ TeV [4]. In the experimentally most sensitive final state with hadronically decaying tau lepton and jets, the transverse mass of the charged Higgs boson (shown in the figure) can be reconstructed from the tau decay and the missing transverse energy. The results on the $\mathrm{H^+} \to \mathrm{t\bar{b}}$ channel are also discussed.



The observed transverse mass distribution with simulated signal. [4]

In June 2015, the LHC restarted its operation at record high centre-of-mass energy of $\sqrt{s} = 13$ TeV. The prospects for the discovery of charged Higgs bosons in this new energy regime are discussed, as well as the effect of high-luminosity conditions on the analysis.

[1] CMS Collaboration, Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC, Phys. Lett. B **716** (2012) 30, arXiv:1207.7235.

[2] ATLAS Collaboration, Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC, Phys. Lett. B **716** (2012) 1, arXiv:1207.7214.

[3] CMS Collaboration, Precise determination of the mass of the Higgs boson and tests of compatibility of its couplings with the standard model predictions using proton collisions at 7 and 8 TeV, Eur. Phys. J. C **75** (2015) 212, arXiv:1412.8662.

[4] CMS Collaboration, Search for charged Higgs bosons in pp collisions at $\sqrt{s} = 8$ TeV, JHEP **11** (2015) 18, arXiv:1508.07774.