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Search for charged Higgs bosons in $H^+ \to Wh$ decays with the ATLAS detector

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Various theories predicting an extended Higgs sector predict also the existence of at least one set of charged Higgs bosons.

The main production mode of these new particles depends on their mass. For charged Higgs boson masses larger than the sum of the top and the bottom quark mass, the dominant production mode is expected to be in association with a top quark and a bottom quark (tbH^+) .

In the alignment limit of the Two-Higgs-Doublet Model (2HDM), heavy charged Higgs bosons with $m(H^+) > m(t) + m(b)$ decay almost exclusively via $box{H^+ \rightarrow tb}$. However, in other models such as the Next-to-Two-Higgs-Doublet Model (N2HDM), the Three-Higgs-Doublet model (3HDM) or in Higgs triplet models (e.g. Georgi-Machacek model), significant branching ratios for $H^+ \rightarrow W^+h$ are possible. The latter decay mode has so far been covered neither by ATLAS nor CMS.

This talk will present a search for charged Higgs bosons in $H^+ \to W^+ h$ decays with the ATLAS detector on the full Run-2 dataset. The analysis targets final states with the resolved topology containing five or more jets, one charged lepton and missing transverse momentum. The reconstruction of the charged Higgs boson decay is performed using boosted decision trees (BDTs). Furthermore the definition of signal and control regions is based on the output of the BDTs. Limits on $\sigma(pp \to tbH^+) \times BR(H^+ \to Wh)$ are obtained by a maximum likelihood fit to the reconstructed H^+ mass spectrum.

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