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Boosting the charged Higgs search using jet substructure at the LHC

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Charged Higgs bosons are predicted in variety of theoretically well-motivated new physics models with extended Higgs sectors. In this study, we focus on a type-II two Higgs doublet model (2HDM-II) and consider a heavy charged Higgs with its mass ranging from 500 GeV to 1 TeV as dictated by the $b \rightarrow s\gamma$ constraints which render $M_{H^\pm} > 480$ GeV. We study the dominant production mode $H^\pm t$ associated production with $H^\pm \rightarrow W^\pm A$ being the dominant decay channel when the pseudoscalar A is considerably lighter. For such a heavy charged Higgs, both the decay products W^\pm and A are relatively boosted. In such a scenario, we apply the jet substructure analysis of tagging the fat pseudoscalar and W jets in order to eliminate the standard model background efficiently. After performing the detailed detector simulation and applying the kinematical cuts, we present the LHC search sensitivities for the charged Higgs boson with mass up to 1 TeV in the $W^\pm A$ decay channel.

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