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New charged Higgs boson discovery channel at the LHC

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The ATLAS and CMS experiments have an ambitious search program for charged Higgs bosons. The two main searches for H^\pm at the LHC have traditionally been performed in the $\tau\nu$ and tb decay channels, as they provide the opportunity to probe complementary regions of the Minimal SuperSymmetric Model (MSSM) parameter space. Charged Higgs bosons may decay also to light quarks, $H^\pm \rightarrow cs/cb$, which represent an additional probe for the mass range below m_t . In this work, we focus on $H^\pm \rightarrow \mu\nu$ as an alternative channel in the context of two Higgs doublet model type III. We explored the prospect of looking $pp \rightarrow tbH^\pm$, followed by $H^\pm \rightarrow \mu\nu$ signal at the LHC. Such a scenario appears in 2HDM type-III where couplings of the charged Higgs are enhanced to $\mu\nu$. Almost all the experimental searches rely on the production and decay of the charged Higgs are taken into account. We show that for a such scenario, the above signal is dominant for most of the parameter space, and $H^\pm \rightarrow \mu\nu$ can be an excellent complementary search. Benchmarks points are proposed for further Monte Carlo analysis.

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