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Flavour change proofs in the Higgs bosons production at the LHeC

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We analyse the prospects for observing the charged CP-even Higgs boson (H^\pm) in their decays to flavour violating $b\bar{c}$ channels (including charge conjugation) at the proposed Large Hadron electron Collider (LHeC), with $\sqrt{s} \approx 1.3 TeV$, the framework of a Two Higgs doublet Model Type III (2HDM-III), assuming a four-zero texture in the Yukawa matrices and a General Higgs potential. We consider theoretically consistent scenarios in agreement with current experimental data from flavour and Higgs physics. We investigate the charged current production process $ep \rightarrow \nu_e H^\pm q$ in presence of flavour violating decays of the charged Higgs boson, that leads to a $3 - jets + slashed E_T$ signature. We demand two jets, one tagged b-jet and one light-flavour jet, all in central rapidity region. The remaining jet (originated by the remnant quark q is tagged forward or backward regions and this together with a central jet veto (not more than one light flavour jet) are essential criteria to enhance the signal-to-background rates. We consider the most relevant standard model (SM) backgrounds, treating $c - jets$ separately from light-flavour and gluon ones.

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