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Higgs Production through Top-prime decays at the LHC

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We explore LHC signatures of vectorlike quarks, which are hypothetical fermions whose left- and right-handed components have the same electroweak quantum numbers. We consider interactions of such a quark, top-prime, with the top quark via a Yukawa coupling and with a bottom quark through a W boson. We look at Higgs production through the decay of the top-prime in a top-prime pair production channel through QCD at the LHC with $\sqrt{s} = 7$ TeV. Such a process depends only on the top-prime mass. In this channel, we consider semi-leptonic W -boson decays. This choice is dictated by the reduction of QCD background and a higher cross section than the corresponding much cleaner di-leptonic channel. We suggest a background discrimination strategy involving b -tagging and a lepton in the final state. The possibility of the top-prime decaying into a light ($120 \text{ GeV}/c^2$) and a relatively heavier Higgs ($150 \text{ GeV}/c^2$) will be explored. The mixing angle between the top and the top-prime, which is a parameter of the model, has been chosen judiciously so that the analysis remains as model independent as possible.

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