

Heavy Higgs Bosons at 14 and 100 TeV

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Searching for Higgs bosons beyond the Standard Model (BSM) is one of the most important missions for hadron colliders. As a landmark of BSM physics, the MSSM Higgs sector at the LHC is expected to be tested up to the scale of the decoupling limit of $O(1)$ TeV, except for a wedge region centered around $\tan\beta \sim 3-10$, which has been known to be difficult to probe. In this talk, we present a dedicated study testing the decoupled MSSM Higgs sector, at the LHC and a next-generation pp-collider, proposing to search in channels with associated Higgs productions, with the neutral and charged Higgs further decaying into $t\bar{t}$ and $t\bar{b}$, respectively. In the case of neutral Higgs we are able to probe for the so far uncovered wedge region via $pp \rightarrow bbH/A \rightarrow b\bar{b}t\bar{t}$. Additionally, we cover the the high $\tan\beta$ range with $pp \rightarrow bbH/A \rightarrow b\bar{b}\tau\tau$. The combination of these searches with channels dedicated to the low $\tan\beta$ region, such as $pp \rightarrow H/A \rightarrow t\bar{t}$ and $pp \rightarrow t\bar{t}H/A \rightarrow t\bar{t}t\bar{t}$ potentially covers the full $\tan\beta$ range. The search for charged Higgs has a slightly smaller sensitivity for the moderate $\tan\beta$ region, but additionally probes for the higher and lower $\tan\beta$ regions with even greater sensitivity, via $pp \rightarrow t\bar{b}H^\pm \rightarrow t\bar{b}t\bar{b}$. While the LHC will be able to probe the whole $\tan\beta$ range for Higgs masses of $O(1)$ TeV by combining these channels, we show that a future 100 TeV pp-collider has a potential to push the sensitivity reach up to $\sim O(10)$ TeV.

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