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The Hunt for the Rest of the Higgs Bosons

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We assess the current state of searches at the LHC for additional Higgs bosons in light of both direct limits and indirect bounds coming from coupling measurements of the Standard Model-like Higgs boson. Given current constraints, we identify and study three LHC searches that are critical components of a comprehensive program to investigate extended electroweak symmetry breaking sectors: production of a heavy scalar or pseudoscalar with decay to $t\bar{t}$; $b\bar{b}$ and $t\bar{t}$ associated production of a heavy scalar or pseudoscalar with decay to invisible final states; and $t\bar{t}b\bar{b}$ associated production of a charged Higgs with decay to $b\bar{t}$. Systematic experimental searches in these channels would contribute to robust coverage of the possible single production modes of additional heavy Higgs bosons.

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