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Search for the Higgs boson and spin/parity studies of the Higgs-like particle at 125 GeV mass at D0

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We present the combination of searches for the Standard Model Higgs boson at a center-of-mass energy of $\sqrt{s}=1.96$ TeV, using the full Run 2 dataset collected with the D0 detector at the Fermilab Tevatron collider. The major contributing processes include associated production (WH or ZH) and gluon fusion ($gg \rightarrow H$), in which the Higgs boson further decays to two bottom quarks, two photons or two weak vector bosons. Both leptonic and hadronic decays of the weak bosons are considered. We also present searches for the Higgs boson in events with $l+\tau+X$, where $l=e,\mu$ and τ is a tau-lepton with a decay including hadrons, as well as a search for neutral supersymmetric Higgs bosons in the $bh \rightarrow bbb$ and $bbh \rightarrow bbbb$ final states. The significant improvements across the full mass range resulting from the larger data sets, improved analyses and inclusion of additional channels are discussed.

We further present tests of different spin and parity hypotheses for a particle H of mass 125 GeV produced in association with a vector boson and decaying into a pair of b-quarks. We use the combined analysis of the $WH \rightarrow lvbb$, $ZH \rightarrow \nu vbb$, and $ZH \rightarrow llbb$ channels using the full Run 2 dataset collected at a center-of-mass energy of $\sqrt{s}=1.96$ TeV with the D0 detector at the Fermilab Tevatron collider.

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