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Search for decays of the Higgs Boson into Muons In p-p Collisions with the CMS Detector

A search for events in which the recently discovered Higgs boson decays into a pair of muons is presented. The search was performed using the data collected by the CMS experiment at CERN during Run 2 of the LHC. The data comes from p-p collisions at $\sqrt{s}=13$ TeV, corresponding to an integrated luminosity of 35.9 fb⁻¹.

In the Standard Model (SM) once the mass of the Higgs boson is known, all its couplings get fixed, including the coupling to muons. Any significant deviations in the experimental results from the values expected from the SM predictions could indicate the onset of new physics. Therefore, it is very important to measure all possible decay channel parameters. The $H \rightarrow \mu^+ \mu^-$ is the only channel where the Higgs boson couples to the second generation of fermions that could be measured during Run 2 of the LHC. The Higgs coupling to fermions is proportional to the mass of the particles, and since the muons are very light, any measurement in this channel provides valuable information about the Higgs Yukawa coupling to fermions.

The small branching ratio of the $H \rightarrow \mu^+ \mu^-$ decay (2.4×10^{-4}) indicates that with the statistics collected by CMS during the Run 2, the expected number of events is also small. Therefore, any improvement in the event selection should be included in the analysis. I have focused in recovering events in which the final-state muons might have radiated photons (final-state radiation, FSR) and in correcting the resulting invariant mass distribution. Two techniques were implemented: a cut-based analysis and a multivariate analysis. A study of the impact of the FSR photon recovery in the Higgs mass reconstruction is presented.

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