

Search for an Invisible Decaying Higgs Boson in Dilepton Events at CDF

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The recent discovery of an Higgs-boson-like particle at the LHC, consistent with findings by the CDF and DØ collaborations at the Tevatron, completes our picture of the SM.

However, the SM does not give answers to many fundamental questions, for example how to understand the value of the electroweak scale i.e. the value of the Higgs mass within the model itself. One therefore has to test the SM nature of this Higgs state, once its discovery is fully confirmed.

As the measurements for more channels of the Higgs boson decay become available, a comprehensive picture of the properties of the Higgs state becomes possible. In this frame one must consider whether or not the Higgs sector is as simple as envisioned in the SM.

Since the properties of the standard model Higgs are precisely known, such measurements serve as a window to physics Beyond the Standard Model (BSM).

One such property is the Higgs decay width. In the SM, the width of the Higgs boson is calculated to be $\Gamma_H = 4$ MeV. Intrinsic detector resolution is on the order of a few GeV in the most well-measured channels. Therefore, direct limits are inherently weak, with $\Gamma_H < 1000\Gamma_H^{SM}$, leaving room for Physics Beyond the Standard Model (BSM). In particular, the Higgs decay width to invisible particles serves as a sensitive probe of BSM physics because the Standard Model background is small. The presence of massive, invisible BSM particles could significantly increase this width.

The invisible Higgs decay channel is also important in the search for additional Higgs bosons. While additional SM-like Higgs bosons have been excluded over a wide range of masses, those with exotic decay modes remain a possibility. In this work, we perform a search at CDF for invisible Higgs decays in proton anti-proton collision events produced at the Tevatron collider at $\sqrt{s} = 1.96$ TeV, corresponding to an integrated luminosity of $\approx 9.7 fb^{-1}$.

One of the cleanest signatures in searching for this process is when the Higgs boson is produced in association with a Z boson that decays to a charged dilepton pair. In this analysis we model the ZH signal assuming the SM production cross section and a $H \rightarrow$ invisible branching ratio of 100%. We investigate several Higgs mass hypotheses from 115 to 150 GeV/c^2 , and place 95% Credibility Level limits in the Bayesian approach on Higgs boson production in this final state are presented.

Is this an abstract for a New Perspectives presentation?

Poster

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