

Searches for the Higgs boson at the Tevatron

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INTRODUCTION

The Higgs boson is a crucial piece of the standard model (SM) of elementary particles and interactions. Within the SM, vector boson masses arise from the spontaneous breaking of electroweak symmetry due to the existence of the Higgs particle. The most interesting region to search for the Higgs is the mass range between 115 and 127 GeV/c^2 where the both the ATLAS and the CMS experiments have found some excesses [1, 2]. The Tevatron experiments can contribute to the understanding of this region by analyzing the data collected through the years of 2001-2011.

HIGGS SEARCH AT THE TEVATRON

The SM Higgs boson H is predicted to be produced in association with a W or Z boson at the Fermilab Tevatron $p\bar{p}$ collider and its dominant decay mode is predicted to be into a bottom-antibottom quark pair ($b\bar{b}$), if its mass m_H is less than 135 GeV/c^2 (low Higgs mass region). The searches use the complete Tevatron data sample of $p\bar{p}$ collisions at a center of mass energy of 1.96 TeV collected by the CDF and D0 detectors at the Fermilab Tevatron, with an integrated luminosity of 9.45 fb^{-1} – 9.7 fb^{-1} . The CDF and D0 detectors are multipurpose solenoidal spectrometers surrounded by hermetic calorimeters and muon detectors and are designed to study the products of 1.96 TeV proton-antiproton collisions [3, 4]. In the Tevatron combination we consider all the complimentary to $H \rightarrow b\bar{b}$ Higgs decay modes to maximize the search sensitivity. The complete list of channels considered in combination is given in Ref. [5].

RESULTS

We combine all available CDF and D0 results on SM Higgs boson searches. A broad excess is observed in data (Fig. 1) with respect to the background estimation, corresponding to a 2.5 standard deviations [5]. Considering only the $H \rightarrow b\bar{b}$ final state searches yields an excess, corresponding to a 3.1 standard deviations [6]. We interpret this result as evidence for the presence of a particle that is produced in association with a W or Z boson and decays to a bottom-antibottom quark pair. The excess seen in the data is most significant in the mass range between 120 and 135 GeV/c^2 , and is consistent with production

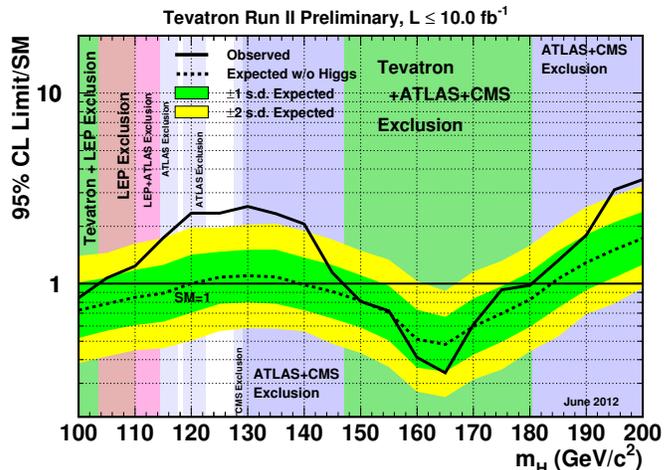


FIG. 1: The solid line is observed 95% credibility level upper limits on SM Higgs boson production as a function of Higgs boson mass. The dashed line indicates the median expected value in the absence of a signals. The associated dark and light-shaded bands indicate the 1 s.d. and 2 s.d. fluctuations of possible experimental outcomes.

of the SM Higgs boson.

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