



Contribution ID: 369

Type: **Oral Presentation**

Search for Higgs to 4 leptons through new gauge bosons

Tuesday, 10 July 2012 15:10 (20 minutes)

Abstract content
 (Max 300 words)

The $H \rightarrow ZZ \rightarrow 4l$ channel has long been known to be the dominant discovery channel for the Higgs with the ATLAS detector, due to its clean signature of 4 isolated leptons.

However, there are also scenarios where the Higgs could decay into a pair of new gauge bosons of very low mass which are not of the SM (Standard Model) but rather through a hidden sector.

Theoretical models, which predict hidden sector Higgs and gauge bosons, would be observable through mixing with SM Higgs, are well known and are applied in this investigation.

In this study, prospects for a Higgs discovery in the decay channel $H \rightarrow Z'Z' \rightarrow 4l$ (where l can either be an electron or a muon) is being investigated.

The decay channel, $H \rightarrow Z'Z' \rightarrow 4l$, has both clean signature and a potentially large branching ratio for a low mass Higgs boson ($m_H < 200 \text{ GeV}/c^2$).

The decay of the mass eigenstate of the SM Higgs into two Z' bosons of which mass can be as low as 5 GeV, is possible. Because of its low mass and the low coupling to fermions, the Z' must decay into SM fermions (leptons or light quarks) with a very narrow width. Our interest is on the four-lepton state.

The decay of the Z' bosons to lepton pairs with a large branching ratio can be explored in the same way as the standard $H \rightarrow ZZ^* \rightarrow 4l$ channel, by relaxing the constraints on the di-lepton invariant mass.

Here, I shall talk about the fixed mass cuts as well as the backgrounds we investigate in this search.

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Session Classification: NPRP

Track Classification: Track B - Nuclear, Particle and Radiation Physics