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LOOKING FOR A FERMIOPHOBIC HIGGS BOSON AT LEP2 IN THE WW CHANNEL USING THE ALEPH DETECTOR

C. DELAERE
on behalf of the ALEPH collaboration.
Institut de physique nucléaire
Université catholique de Louvain
2, chemin du cyclotron, 1348 Louvain-la-Neuve, Belgium
E-mail: christophe.delaere@cern.ch

A feasibility study concerning the search for WW decay of a Higgs boson produced in association with a fermion pair via the Higgs-strahlung or boson-fusion diagrams is presented. An expected upper limit is derived, as a function of the Higgs boson mass, on the product of the $e^+e^- \to Hf\bar{f}$ cross section and the $H \to WW$ branching ratio.

1 Introduction

A Higgs model incorporating two doublets of complex scalar fields [1] generates five scalar Higgs bosons, three of which are neutral. For certain choices of the model parameters, one of these neutral scalars provides mass only to the fermions and the other couples exclusively to the bosons, i.e. is a "fermiophobic" Higgs boson.

In the ALEPH experiment at LEP, the search for a fermiophobic Higgs boson has been primarily carried out in the $H \to \gamma\gamma$ channel, in which the Higgs boson couples to photons via a W loop [2]. For fermiophobic Higgs bosons heavier than 90 GeV, the predicted $H \to \gamma\gamma$ branching ratio becomes small relative to the predicted $H \to WW$ branching ratio (Fig. 1) motivating a search in this new channel[3].

The study is normalized to a luminosity of 453.3 pb^{-1} corresponding to the data taken in the years 1999 and 2000 at center-of-mass energies ranging from 191 to 209 GeV.

2 The ALEPH detector

The ALEPH detector is described in detail in Ref. [4]. An account of its performance and a description of the standard analysis algorithms can be found in Ref. [5].

In ALEPH, the trajectories of charged particles are measured with a silicon vertex detector, a cylindrical wire chamber, and a large time projection chamber (TPC). These detector components are immersed in a 1.5 T axial magnetic field provided by a superconducting solenoidal coil. The electromagnetic calorimeter, placed between the TPC and the coil, is a highly-segmented, 22-radiation-length-thick sandwich of lead planes and proportional wire chambers. It is used to identify electrons and photons. The hadron calorimeter consists of a iron return yoke of the magnet instrumented with streamer tubes. It provides a measurement of