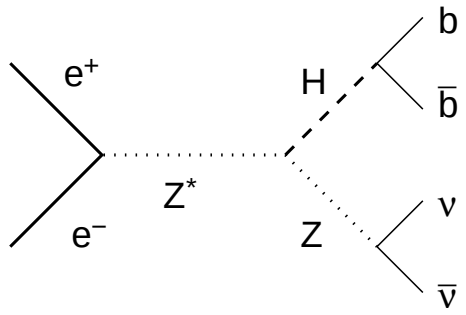
Higgs boson search in the ALEPH experiment at LEP

Supervision: Dr. Pedro Teixeira-Dias

This project is based on the analysis of simulated data from the ALEPH experiment at LEP. At LEP Higgs boson production would occur via "Higgsstrahlung": $e^+e^- \to HZ$. The search for the Standard Model (SM) Higgs boson, H, was carried out in several channels, depending on the H/Z decay modes. This project will concentrate on the search in the so-called "missing energy channel", characterized by the missing mass and energy due to the $Z \to \nu\bar{\nu}$ decay:



$e^+e^- \to HZ \to H\nu\bar{\nu}$

The main backgrounds in this channel are $e^+e^- \to ZZ, W^+W^-$ and $q\bar{q}(\gamma)$. The project is broken down in several parts:

- Familiarization with the ALEPH search for the SM Higgs boson, the signal and the main background processes.
- Study of the standard cut-based event selection for missing energy events [1]. Implementation of the cut-based event selection, on ntuples of simulated signal and background events at $\sqrt{s} = 206\,\text{GeV}$.

- Development of an improved event selection, using a multi-variate method such as a likelihood ratio, or a linear discriminant[2]. Comparison with the standard cut-based event selection in terms of, *e.g.*, efficiency and signal-to-background ratio.

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References

[1] "Search for the neutral Higgs bosons of the Standard Model and the MSSM in e^+e^- collisions at $\sqrt{s} = 189$ GeV"
Barate, R et al., ALEPH Coll., Eur. Phys. J., **C17** (2000) 223-240; CERN-EP-2000-019.

[2] *e.g.* "Statistical data analysis", G. Cowan, Oxford University Press, 1998.