L3 Note 1799

Search for Monojets in Z^0 Decays with the L3 Detector

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Abstract

We report preliminary results of a search for monojet events using 4.6 million Z decays collected by the L3 detector at LEP. Seven candidate were found in agreement with known sources of background. The kinematic characteristics of those events are not very different from background expectations.

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1 Introduction

The standard electroweak theory has proven very successful in the description of present high-energy experiments. On the other hand, the collider experiments have found some classes of events [1, 2] which may not fit in the standard model and which have stimulated considerable theoretical speculation. Monojet events are one such class of events. It has been considered, for example, as providing a clear signature for the production of a light Higgs boson [3],or of an isosinglet neutral heavy lepton [4],or of a light neutralinos [5].

In this letter, we report preliminary results of a search for monojet events using 4.6 million Z decays collected by the L3 detector from 1990 to 1994. A detailed description of the L3 detector can be found in [6].

2 Monte-Carlo background simulation

Main background arises from two types of processes:

- (1) Those with a large-angle jet together with other particles produced at angles outside the detector acceptance
- (2) The process $e^+e^- \rightarrow \tau^+\tau^-(\gamma)$

The two-photon reactions with unobserved beam particles escaping in the beam pipe can produce the first type of background. The second type of background coming from τ pair production where the visible energy of one τ is below the threshold of the jet reconstruction algorithm due to the large fraction of energy carried away by the neutrino.

The DIAG36 [7] and FERMISV [8] event generators were used to simulate two-photon and four-fermion processes. For the reaction $e^+e^- \rightarrow \tau^+\tau^-(\gamma)$ the KORALZ [9] was used. The Monte-Carlo events have been fully simulated in the L3 detector and then reconstructed in the same way as data.

3 Search for monojet events

In searching for monojet events we used the following criteria:

- Selected events have exactly one reconstructed jet and at least two 'good' tracks[1] in the TEC.

[1]A 'good' track is defined as having an impact parameter to the vertex smaller than 10 mm, at least 20 hits and a distance between the innermost and outermost used hit (in units of wire spacing) greater than 30 out of a maximum of 64. Its transverse momentum must satisfy $P_t > 100$ MeV.

- The monojet energy should be greater than 15 GeV and its polar angle should be in the range $25^\circ < \theta < 155^\circ$. This removes two-photon process events, which are produced dominantly at low polar angles and have small energy deposition in the detector.

- No charged tracks and no energy should be detected in the hemishere opposite to the direction of the monojet candidate. This suppress $\tau^+\tau^-(\gamma)$ background.

- The monojet candidate should not consist of a single e^+e^- pair compatible with originating from a photon conversion. In particular, the pair invariant mass must exceed 250 MeV/c^2.

4 Results

After applying all selection cuts, we are left with 7 monojet candidates from data, while we expect 6.2 events from background Monte Carlo (4.0 events from $e^+e^- \rightarrow \tau^+\tau^-(\gamma)$ process and 2.2 events from two-photon process). The charactiristics of the data candidates are shown in Table 1. All monojet candidates with large transverse momentum and large polar angle have low multiplicity (number of TEC tracks less than 4) and can be associated with $\tau^+\tau^-(\gamma)$ background discussed above. The monojet candidate with 6 charged tracks has moderate transverse momentum and small polar angle and can be associated with two-photon background.

Year	Transverse momentum, GeV/c	Number of 'good' tracks	Polar angle, degrees
1991	28.1	3	74.6
1991	28.3	2	57.9
1993	20.8	2	143.9
1993	7.9	6	28.6
1994	12.5	2	32.7
1994	35.9	3	84.8
1994	17.9	3	68.0

Table 1: Monojet candidates

5 Conclusion

We report preliminary results of a search for monojet events using 4.6 million Z decays collected by the L3 detector at LEP. Seven candidate were found in agreement with known sources of background. The kinematic characteristics of those events are not very different from background expectations.

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