Abstract

Gaseous sampling hadron calorimeters can be finely segmented and used to record
showers with high spatial resolution.
This imaging power can be exploited at a future linear collider
experiment where the measurement of jet energy by a Particle Flow method
requires optimal use of tracking and calorimeter information.
Gaseous detectors can achieve high granularity; in this paper a hadron sampling
calorimeter using gas as sensitive material
and simple threshold electronics is considered.
Large Micromegas chambers offer some advantages over traditional gaseous
detectors using wires or resistive plates.
To test the validity of this concept, a Micromegas prototype of 1#1m2 size
equipped with 9216 readout pads of
1#1 cm2 has been built. Its technical and basic operational characteristics are
reported.

1.1 Particle Flow calorimetry

The detailed study of electroweak symmetry breaking and of the properties of the Higgs boson within
and beyond the Standard Model (SM) are some of the physics goals motivating the construction of a linear
electron positron collider (ILC [1] or CLIC [2]).
This physics case is now enhanced with the discovery at LHC of a Higgs-like new particle [3, 4].

Many of the interesting physics channels at a linear collider will appear in multi-jet
final states, often accompanied by charged leptons or missing transverse energy associated with neutrinos or
possibly the lightest super-symmetric particles.

The reconstruction of the invariant masses of two or
more jets will be important for event reconstruction and event identification.
The dijet mass resolution should be good enough to identify Z and W bosons in their hadronic final states
with an accuracy comparable to their natural decay width. This requires an excellent jet energy
resolution of 3–4% over an energy range which extends up to 1.5 Tev for a 3 TeV collider.

Two techniques are studied by the DREAM [5] and CALICE [6] collaborations to meet this

goal. The first one, called Dual Readout, is a compensation technique that uses cherenkov and scintillation
light produced in hadron showers to correct for fluctuations of the electromagnetic fraction
which otherwise dominate the jet energy resolution [7].
The Particle Flow technique uses highly segmented calorimeters and a precise tracker to identify
the jet charged and neutrals components[8].
The use of tracking information reduces the dependence on hadronic calorimetry and results
in the required excellent jet energy and di-jet mass resolution [9].