Contribution ID: **359** Type: **Oral**

Micromegas for sampling calorimetry

Monday 2 June 2014 17:50 (20 minutes)

Micromegas is an attractive option for a gaseous sampling calorimeter. It delivers proportional and fast signals, achieves high efficiency to minimum ionising particles with a compact design and shows well-uniform performance over meter-square areas. The current R&D focuses on large-size spark-protected Micromegas with integrated front-end electronics. It targets an application at future linear colliders (LC) and possible upgrades of LHC experiments for the running at high luminosity. Prototyping work and characterisation results will be reported with a special emphasis on the impact of the resistive layer on the calorimeter signals.

Summary

A few technologically-advanced prototypes of 1x1 m2 were constructed. Optimised for Particle-Flow hadron calorimetry at a LC, they are segmented into pads of 1x1 cm2, each read out by simple threshold electronics. Their standalone performance were studied in great details in testbeams. In addition, expected performance of a Micromegas calorimeter were deduced from the measured three-dimensional shape of high-energy pion showers inside the CALICE semi-digital hadron calorimeter (SDHCAL).

Absorption in the gas of highly ionising particles produced in hadron showers occasionally triggers a discharge. This can be a serious show-stopper for high-rate applications such as forward calorimetry at a high-luminosity LHC experiment. Discharge protections based on resistive films were successfully implemented on small-size prototypes. Several resistive configurations were actually studied to minimise the time necessary for charge evacuation and the resulting efficiency and linearity losses.

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Session Classification: I.c Gaseous

Track Classification: Sensors: 1c) Gaseous Detectors