Contribution ID: **320** Type: **Poster**

Resistive Micromegas for sampling calorimetry

Wednesday, May 27, 2015 9:34 AM (0 minutes)

Micromegas, as a proportional and compact gaseous detector, can be used as an active medium in a sampling calorimeter.
Moreover, its readout plane can be finely segmented to perform Particle Flow reconstruction of jets at a future linear collider or high luminosity LHC experiment.
For this application, sparks that would result from the potentially very large ionisation released in the gas during a shower can be avoided by means of resistive eletrodes.
By slowing down the charge evacuation to ground through an RC-network, they allow a field reduction when the avalanche grows too large.
While this mechanism efficiently quenches sparks, it might compromise the Micromegas intrinsic proportionality and the overall calorimeter response linearity.

A study was conducted to determine the resistive configuration that best suppresses sparks and preserves proportionality.
Several configurations were implemented on small prototypes, with a resistivity varying over five orders of magnitude.
Charging of the resistive electrodes depends on the detector current, therefore the gain dependence on the rate and the dependence on the charge density (or dE/dx) were examined separately.
Then, the spark quenching efficiency was assessed in a high intensity hadron beam used to generate showers that propagate through the prototypes.
Our findings indicate that the resistivity necessary for quenching is surprisingly low, corresponding to an RC constant of the order of the avalanche time scale.

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Session Classification: Gas Detectors - Poster Session

Track Classification: S7 - Gas detectors