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Moderation of the avalanche gas discharge through a quasi-uniform electric field device: the Resistive Cylindrical Chamber

The saturated avalanche discharge regime led to an increase in term of detection rate capability, allowing RPC to be used in experiments on particle accelerators. Future experiments require even more extreme performance from particle detectors, in term of rate capability and time resolution, so that the saturated avalanche discharge is a limiting factor for the RPCs application.

In this presentation we introduce a new device, which allows the moderation of the avalanche discharge growth thanks to a quasi-uniform geometry of the electric field. This device, which we refer to as the Resistive Cylindrical Chamber(RCC), consists of two concentric cylindrical electrodes, of which at least one is made of resistive material. It is possible to design the device passing from radial to quasi-uniform electric field by modifying the radii of the cylinders, reproducing in the extreme case the same features as an RPC. We show the characterization of the first RCC detector performed with 165 GeV/c muons. The device has been designed to have a non-negligible variation of the electric field within the gas-gap in order to emphasize and study the asymmetrical response of the detector when polarized with positive or negative bias voltage. We analyze the device time response and charge distributions, highlighting how the moderation of the avalanche discharge and the cylindrical geometry may lead to innovative applications, allowing the detector pressurization with eco-friendly gas mixtures.

Primary experiment

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Track Classification: Gaseous Detectors