RPC Investigation Using Finely Spaced 2-D Strip Readout

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Abstract -- **RPCs are in use for many high energy physics applications where there is no need for fine spatial resolution. However, there are applications such as digital calorimetry where the dimension of the induced charge at pick-up pads is of interest. Such calorimetry is proposed for eg, Particle flow calorimetrey at the ILC. While there are both experiments and calculations which address this to some extent, we have been able to read out a single gap RPC using fine pitch laser etched two-dimensional strip readout as used in GEM tracking. This measurement is made in in the Fermilab test beam in conjunction with the GEM tracking test for the STAR upgrade. We discuss tracking with a single gap glass RPC, effective signal dimension , and distortion of signal by adjacent conductive pickup strips.**

Introduction

The laser etched x and y strips for simultaneous 2D readout, as used in COMPASS, are a good investigative tool for looking at RPC signal width. This setup is not ideal for tracking, both because of the variation in signal amplitude for an RPC in avalanche mode, and because of the width of the induced signals from the RPC.

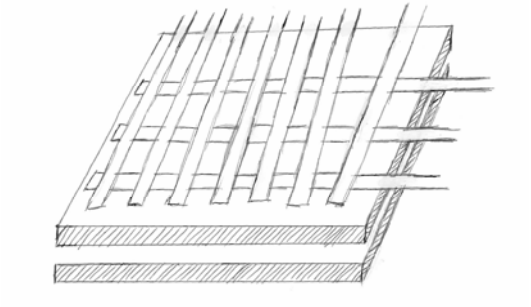

Fig. 1 A GEM detector readout uses crossed strips, and electrons get to both the X and Y strips after amplification.

The RPC exudes an electric field from an amplified dipole in the gas gap. In this case the strips are on 630 micron centers.
The RPC is run in avalanche mode. The gas used is 95% R134, 4.5% Isobutane, 0.5% SF6.
The electronic readout readout chain is as follows: The APV25 chip is used at the front end The MIT GEM controller is used for ADC and sequencing. Interfaces to data and STAR trigger-token and APV setup were done by Argonne National Lab on hardware from Blue-Sky electronics. The transfer to the DAQ computer is done with the CERNTech SIU and RORC developed for the ALICE experiment at CERN.

For the case of RPCs read with 1 cm sq pads, there are published measurements of the "crosstalk" in adjacent 1 cm sq pads vs resistivity of the conductive paint. There is less crosstalk with increased resistivity, indicating a smaller dimension of the signal at the pads. Pickup pads or strips are of low resistivity, and are in close proximity to the Conductive paint, separated by a thin insulator. Given the high resistivity of the glass and the paint, these pads or strips can be expected to have an influence on the electric field distribution and charge distribution. In the case of the 2-Dstrips, the strips closer to the RPC would be expected to spread the charge and electric field in a direction along their length, thus making the apparent charge dimension larger for the pickup strips at right angles behind them.

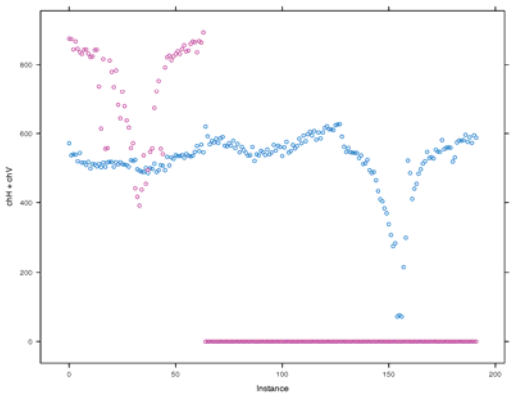

Fig.2 Signals from RPC Y(red) and X (blue) coordinates in one event. RPC 5% Isobutane, 95% R134a, no SF6, 6.6KV, 1.1 mm gap, 635 u strip spacing.

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References

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