# DEVELOPMENT OF RESISTIVE PLATE COUNTER FOR THE EXTENDED MINI-ARRAY EXPERIMENT AT GAUHATI UNIVERSITY

Subhash Chandra Rajbongshi [1], Pradip Kr.Baruah1, Jyoti.P. Phukan[2] , Kalyani Baruah [2]
[1]*Department of University Science Instrumentation Centre, Gauhati University Guwahati - 781 014, Assam, India.*
[2] *Department of Physics, Gauhati University, Guwahati - 781 014, Assam, India.*

## Abstract

Resistive Plate Counters (RPC) of size $15 \times 15$ square centimeter are constructed with copper clad phenolic laminate of thickness 1.5 mm forming a gas gape of dimension 2 and 3 mm [1]. The gas gap is filled with P-10 gas ( 90% Argon and 10% methane ) flowing through it at a pressure difference of 2-3 mbar. The counter is operated in spark mode with a electric potential (+3 kV) applied to the anode. Five (5) numbers of signal strips are arranged in an insulated plane above the anode for picking up the pulse signal. The pulse produced has an averaged amplitude of$\sim$ 150 mV and rise time $\sim$ 2 nanosecond. These counters are proposed to be used in the extended mini-array experiment of the Physics Department , Gauhati University. The construction and testing of these counters are discussed in this paper.

## 1. Introduction

Resistive Plate counter is a low cost particle detector which can substitute scintillation counters in a conventional array of ground based detector. It consist of two parallel resistive plate, made of a material with high bulk resistive ($\sim 10^{10} - 10^{11}$ ohm cm). An uniform electric field is produced between this plates in presence of a gas mixtures called P-10 gas( 90% Ar and 10% $CH_4$). Passage of charged particles induce a highly localized discharge inside the enclosed gas leading to the formation of a spark made which can be pickup as a signal.

## 2. Construction

The RPC is constructed using two resistive plates i.e., bakelite coated with copper. one plate acts as the anode which is connected to a high positive potential. The other plate which acts as the cathode is grounded. A glass frame in between the two electrode plates make a chamber of 3mm width. The gap

pp. 777–780 

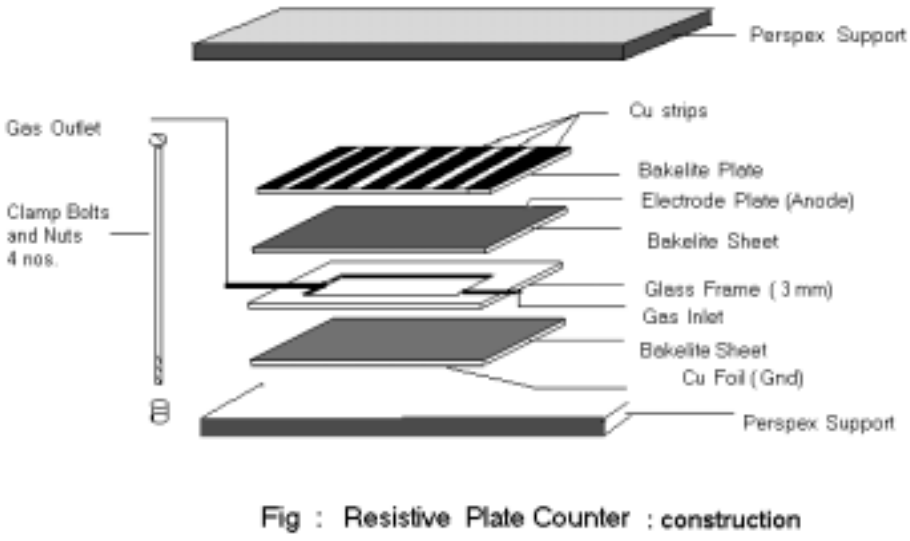


**Fig. 1.** Resistive plate chamber.

between the electrodes is filled with a gas mixture which is supplied from the gas cylinder with the help of a rubber tubing and connected to the inlet of the gas chamber. Copper strips for picking up the signal are placed over the anode plane insulated from it by a 3mm thick glass plate. These strips are 3 cm wide and 15 cm long and separated by 2 mm [2] gap. The gas flow through the detector is maintained at a pressure difference of 2-3 mbar. The sensitive area of the counter is $100cm^2$.

## 3. Experimental Technique

The experimental setup is described in the fig 2. The two prototype RPCs are first individually tested with Cosmic Ray background. These are then stacked together vertically and coincidence output is tested. The fast pulses from the individual strips are discriminated by fast discriminator circuit [3]. Counting is done for the pulses from individual strips. For checking coincidence the RPC's are arranged one above other with a separation of 15 cm. TTL outputs, one each from the top and bottom RPC are input to the fast coincidence circuit. The stretched output is used for counting using a counter timer (ECIL EC 5104).

## 4. Results and discussions

A record of typical pulse from the RPC is shown in fig.3. Although individually both RPCs produce characteristic pulses of rise time $\sim$ 2 ns and width $\sim$ 40 ns, coincidence rate falls far below what is expected from a genuine events.

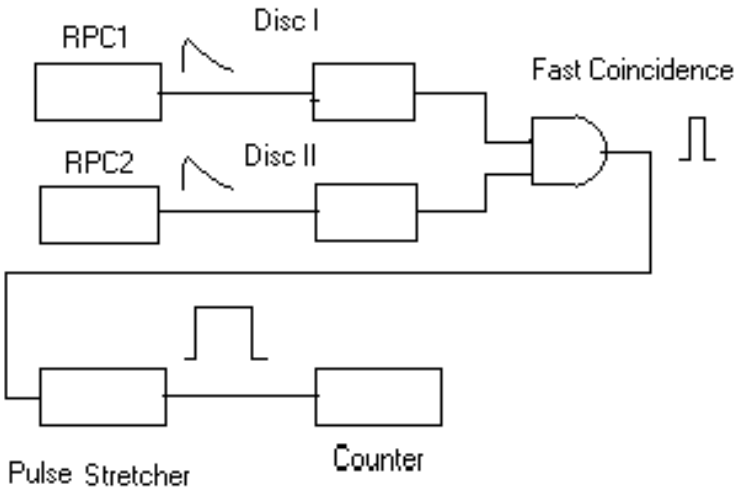


**Fig. 2.** Block diagram of the experimental setup.

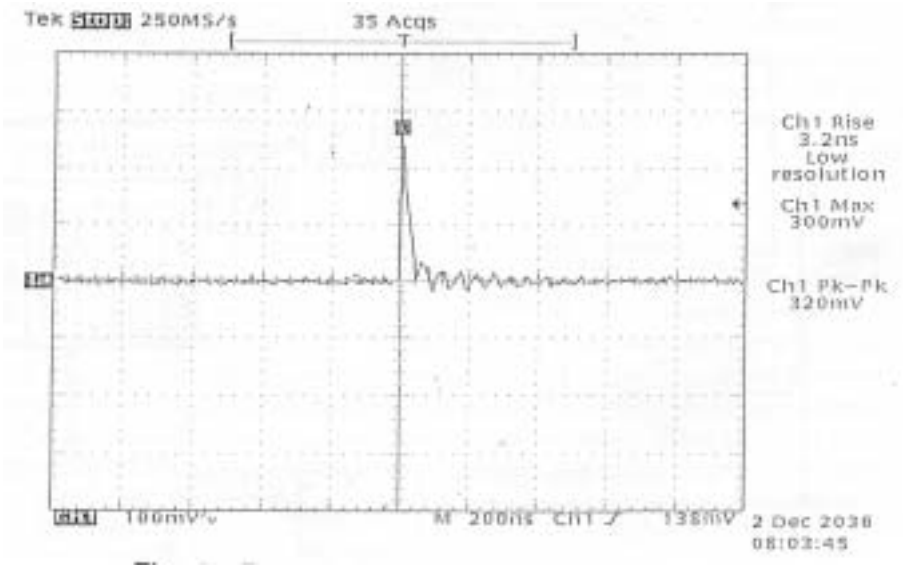


**Fig. 3.** Recorded typical pulse from the RPC.

As such the RPCs are to be further studied for possible modification in design and construction, in order to fulfill the objectives of our research topic.

## 5. Achnowledgement

The authors thanks the department of Indian Space Research organisation (ISRO), Govt of India for financial support.

## References

1. Development of resistive plate counters - R. Santanico and R.Cardarelli NIM vol. 187 (1981) 377-380.

2. Performance of the E771 RPC muon detector at Fermilab. - G.Cataldi et al NIM in Phy Rev. A337(1994) 350-354

3. Bezboruah ,T. , Boruah K., Boruah P.K (1998) NIM A. 410,No.2. p.206