

## Performance of RPC operated at the mini-array laboratory

Subhash Chandra Rajbongshi<sup>a</sup>, P.K. Boruah<sup>a</sup> and K. Boruah<sup>b</sup>

(a)Department of Instrumentation & USIC, Gauhati University, Guwahati-14

(b)Department of Physics, Gauhati University, Guwahati-14

Presenter: Subhash Chandra Rajbongshi (scr73@rediffmail.com), ind-rajbongshi-SC-abs1-he15-oral

The mini-array laboratory is detecting Ultra High energy cosmic ray particles having primary energy greater than  $10^{17}$  eV. The array consists of eight plastic scintillation detectors (50X50X5 cm<sup>3</sup> area). Recently the mini-array has been extended by adding RPC detector with the existing eight scintillation detectors. The RPC is a low cost particle detector giving average pulse amplitude of ~150mV and rise time ~3.2 nanosecond. Such an RPC is developed in the mini-array laboratory. It is proposed to add more such detectors in the extended mini-array. Performance the RPC in the extended mini-array presented in this paper.

### 1. Introduction

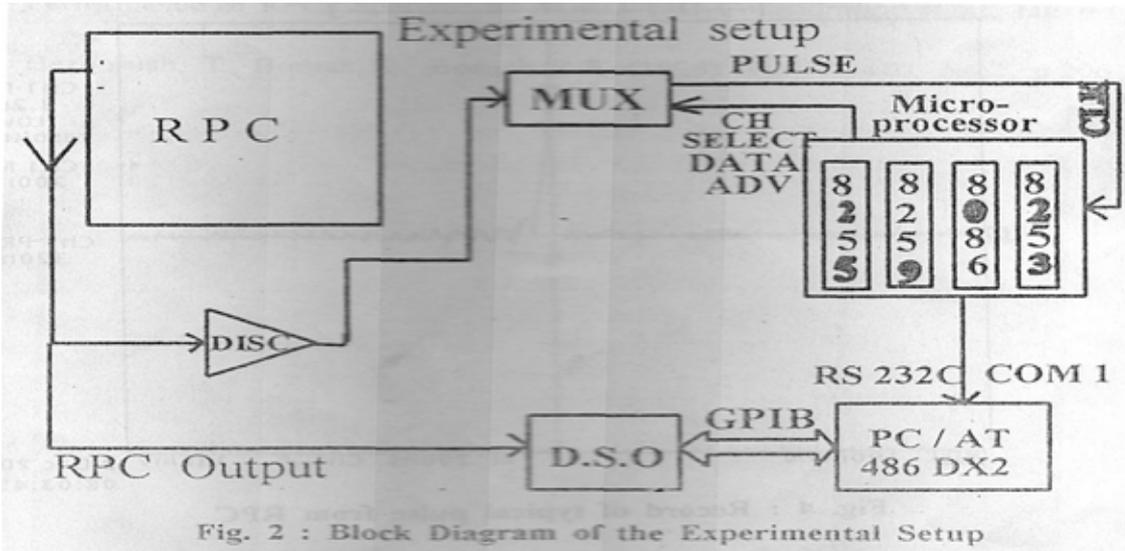
Three RPC's have been put in operation inside the existing mini array in the roof of the Physics Building at Gauhati University, in order to check their performance. It is made up of resistive plate bakelite with 2mm & 3mm gas gap [1, 2, 3], operating in a streamer mode in a high uniform electric fields (15 KV).

#### 1.a RPC Detector

The RPC is constructed using two resistive plates i.e., bakelite coated with copper(PCB material). One plate acts as the anode which is connected to high positive potential. The other plate acts as the cathode. A glass frame in between the two electrode plates make a chamber of 2 mm (type2) & 3mm (type1) width. The gap between the electrodes is filled with a gas mixture (p-10) flowing at a pressure differential slightly lower than atmosphere which is supplied from the gas cylinder. The RPC's are installed on the top of the Physics building data collected at mini-array laboratory. Altogether three RPC's have been installed. The RPC signals are picked up by means of copper strips 3cm wide and 15 cm long separated by 2 mm gap. The detector strips are connected to the front end electronics and terminated with high pass first order filter (to reduce pick-up from nearby radio station).

#### 1.b Laboratory Test

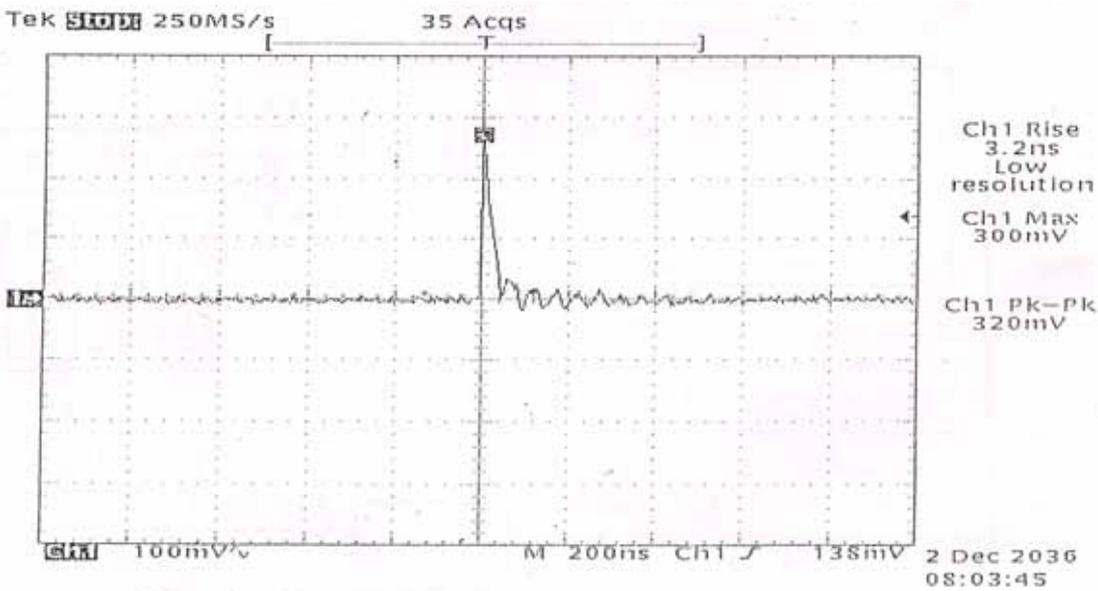
A high voltage power supply has been designed for applying a potential 15kV at the anode of RPC. The output pulses from RPC are recorded by Digital storage Oscilloscope (Tektronix, TDs-520A) with a GPIB (IEEE 488) interface (Fig 1). For counting the pulses the signal is fed to a fast discriminator with a bias of 66mv and counting is done by microprocessor (8086) with suitable programming.



**Fig 1. Experimental setup.**

**2. Discussion**

A record of typical pulse from RPC is shown in the Fig.2. Both the RPC's produce characteristic pulse having rise time 3.2 ns and width 30 ns. A histogram of using RPC type 1 (gas gap ~3mm) is shown in figure 3a. The corresponding histogram using RPC type 2 (gas gap ~2mm) and for the same observation period is shown in figure 3b. The peak position (5 counts/sec) of the type 2 RPC is much higher than the corresponding peak position (2 counts/sec) of the type 1 RPC .



**Fig 2. A recorded typical pulse from RPC.**

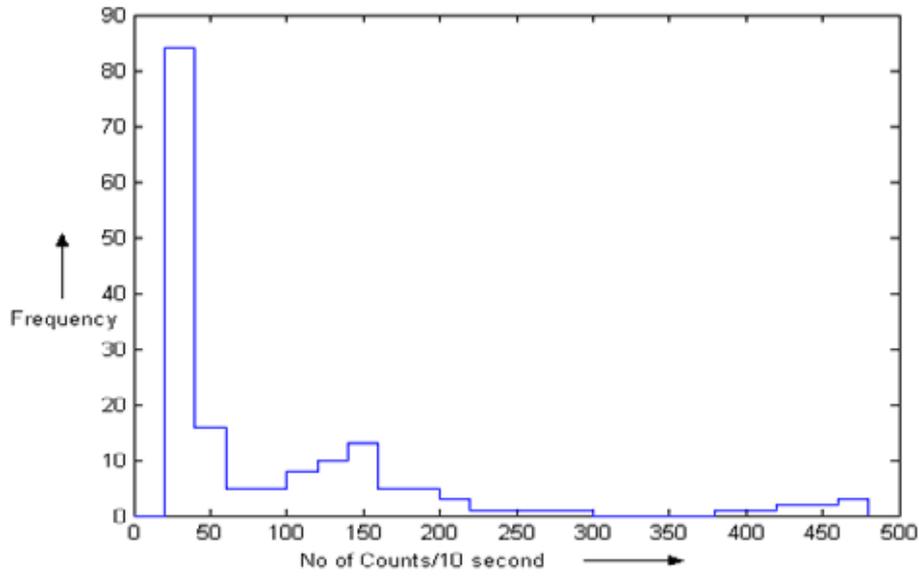


Fig.3a. No of Count /10 sec Vs Frequency for RPC type 1

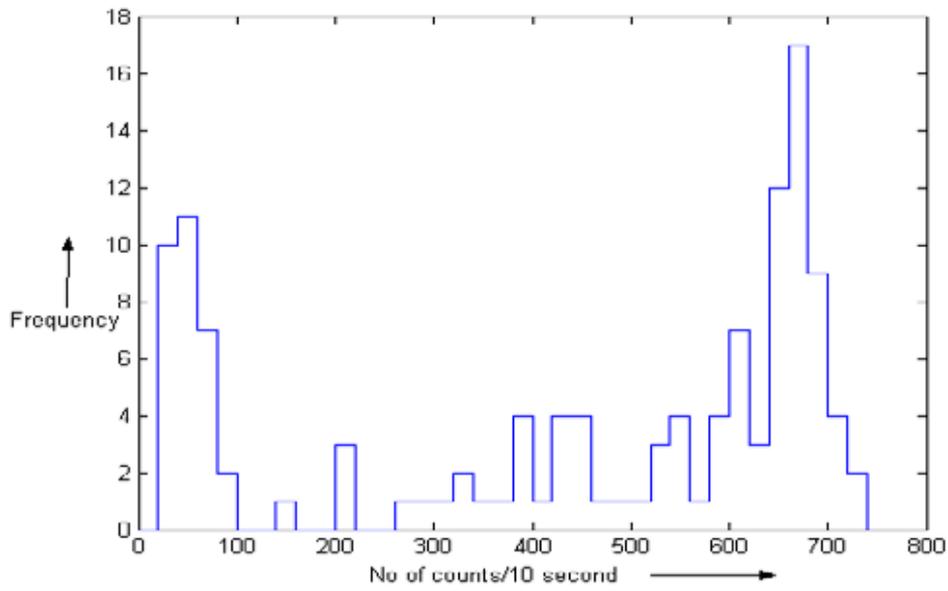


Fig.3b. No of Count/10sec Vs Frequency for RPC type 2

### 3. Conclusion

Count rate spectrum of the two RPC's are shown in fig 3a & 3b . From the study of two histograms we find two peaks. The peaks at lower count rate have smaller width & correspond to an average of 2 counts / sec for 3mm gas gap RPC(RPC type 1) and about 5 counts/sec for 2mm gas gap RPC(RPC type 2). Comparing with the average secondary cosmic ray flux at sea level( about 1 count/RPC) 3mm gap RPC shows better performance.

The higher count rate peak of the 2mm gas gap RPC may be attributed to multiple pulsing due to composition of gas mixture which is low in quenching gas content.

### 4. Acknowledgement

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