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Development of a new Multigrid-type MicroStrip Gas Chamber

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Introduction

We are developing two-dimensional position-sensitive microstrip gas chambers (MSGCs) for high intensity neutron sources. To realize a low cost system, the charge division method is utilized for decreasing the number of feed-through connectors of a pressure vessel, which connect the microstrip plate and the preamplifiers.

The design of the new MSGC and experiment

The new MSGC plate

The MicroStrip Gas Chamber[1] is a kind of gas proportional counters, which is composed of patterned electrodes on a insulator substrate. Applying high voltage bias between anode and cathode, radiation is observed as a charge pulse. In a new MSGC, anodes are connected to a resistive line and the both sides of cathode strip are connected to readout line. By using cathode strips as resistive lines, two-dimensional position can be determined by using the charge division method for each resistive line. Conceptual schematic of the new test MSGC plate is shown in Fig. 1. However, connecting readout lines onto one side of the cathode strips is difficult because anode strips and the resistive line surround them. Therefore we try to route the readout lines under the anode resistive line by via holes at the end of cathode strips. The via hole size must be smaller than anode pitch, therefore we used a laser blasting method to make a few hundred micron size hole. This process is used for MSGC fabrication for the first time and we tried to evaluate the detailed performance of this plate by using SR X-rays. The photograph of the plate and close-up view around the hole is shown in Fig. 2. The test plate with an effective area of 6.6cm x 6.0cm was fabricated and tested with X-rays.

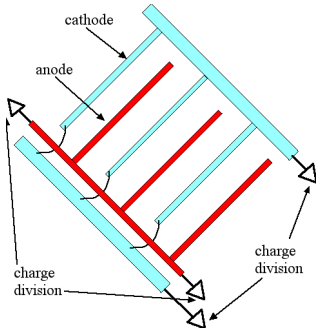

Fig. 1. Conceptual diagram of the new MSGC

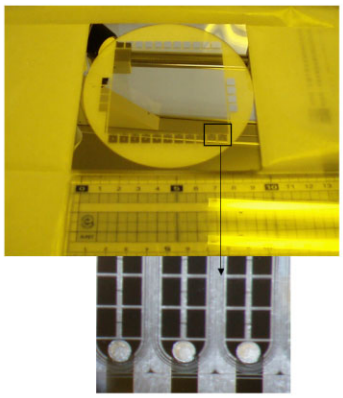

Fig. 2. The photograph of the MSGC and the holes.

Experimental

Four coincident signals from the ends of the anode resistive line and the cathode resistive lines were used to determine the position with the charge division method. In this experiment, we used about a half number of cathode strips and position sensitive area was about half size of the plate. The test experiment was performed with 1atm of Ar + CH4(30%) gas mixture at the gas flow condition. The position resolution at the gas gain of 3000 was estimated to be 2mm for anode signals and 2.1mm for cathode signals ath the X-ray energy of 14keV at BL-14A, photon factory in KEK. This is a preliminary test and the experimental setup still needs to be optimized. Thus we expect a better position resolution in the coming experiment.

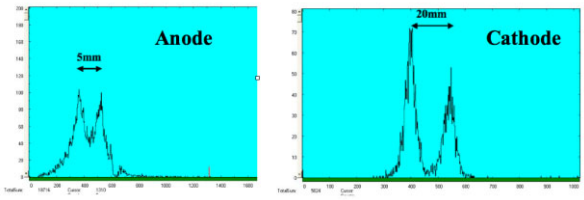

Fig. 3. Evaluation of the position resolution

Conclusion

A new MSGC with the laser blasting technique was fabricated and tested for the first time. Preliminary test was performed at the Photon Factory and the position resolution was evaluated to be better than 2mm.

References

[1] A. Oed Nucl. Instr. and Meth. A 263 (1988), p. 351.

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