

## Multi wire proportional counter at HIRA focal plane

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Ionization detectors [1] are widely used at Inter University Accelerator Centre (IUAC), New Delhi for charged particle detection in fusion-fission studies [2, 3]. Multi wire proportional counters (MWPC) are often used for extracting the position information of the reaction products. An MWPC with an active area  $150 \times 50 \text{ mm}^2$  is developed and fabricated for the same.

### Fabrication of the MWPC

The MWPC fabricated, is of four electrode geometry, Cathode, X position electrode, anode and Y position electrode. The inter electrode gap is kept 3.2 mm. Electrodes are wire frames, made from  $20 \mu\text{m}$  diameter gold plated tungsten wires with an inter wire spacing of 50 mill (1.27 mm). Thus X position frame has 120 wires and Y position frame has 40 wires. Every two adjacent wires are shorted together. A fixed delay of 2 ns is provided between these sets of shorted wires using delay line chips. Each chip has 10 taps and a delay of 2 ns per tap. Position information is derived

from these wire frames by taking the timing signals through both the ends. Isobutane is used as the detector medium. A  $0.5 \mu\text{m}$  thick mylar foil is used as detector window foil.

### Testing of the MWPC

During initial testing of the fabricated detector, it was operated at isobutane pressure  $\sim 5 \text{ mbar}$  (at the inlet) with Anode and Cathode bias  $+460 \text{ V}$  and  $-200 \text{ V}$ , respectively. The detector was tested with an  $^{241}\text{Am}$  alpha source placed in front of it at a distance of around 265 mm. The MWPC has total of six output signals, Anode, Cathode, two X position signals X-left (XL) and X-right (XR) from both ends of the X position electrode, similarly two Y position signals Y-up (YU) and Y-down (YD) from the two ends of Y position electrode. The detector signals at preamplifier level were quite strong and clean. With alpha source and the above said operating parameters, the Anode signal was  $\sim 300 - 400 \text{ mV}$ , Cathode  $\sim 200 \text{ mV}$  and position signals were  $\sim 30-40 \text{ mV}$ . Fig. 2 shows the detector signals at preamplifier level.

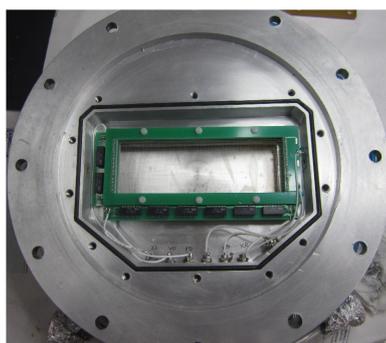


FIG. 1: Photograph of the developed MWPC.

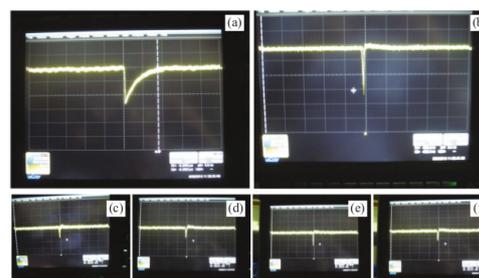


FIG. 2: Multi wire proportional counter signals (a) Cathode, (b) Anode, (c) X-left, (d) X-right, (e) Y-up, and (f) Y-down, at preamplifier level.

Fig. 3 shows the two-dimensional position spectrum with X and Y positions on either axis, with an alpha source placed in front of

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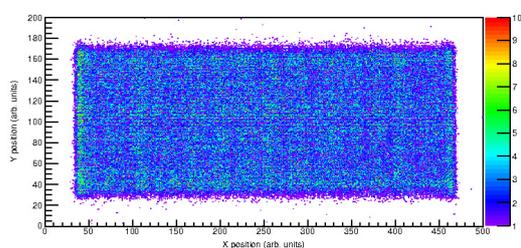


FIG. 3: Two-dimensional position spectrum with an alpha source placed in front of the multi wire proportional counter.

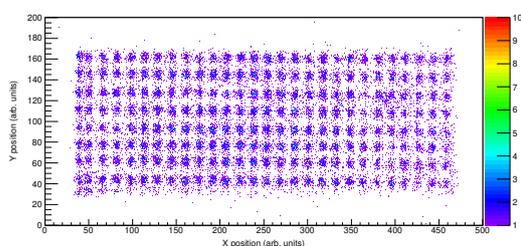


FIG. 4: Two-dimensional position spectrum with a mask placed in between alpha source and the multi wire proportional counter.

the MWPC. It can be seen that the detector is uniformly illuminated.

The detector was tested for position resolution using  $^{241}\text{Am}$  alpha source. A mask having 1 mm diameter holes with 5 mm separation in X and Y direction was placed before the detector, approximately 5 mm from the detector electrodes.  $^{241}\text{Am}$  alpha source was placed approximately 265 mm from the mask. Fig. 4 show the two-dimensional position spectrum (with X and Y positions on either axis) with an alpha source placed in front of the MWPC, and the mask placed in between the source and the detector respectively.

From the two-dimensional spectrum with mask, it is evident that the particles passing through holes are reproducing the mask image. Fig. 5 shows X and Y individual position spectra collected with mask. A position resolution in X and Y direction was estimated using these individual position spectra. Posi-

tion resolution in X was estimated to be  $\sim 1.6$  mm and in Y  $\sim 1.7$  mm.

The developed detector is presently installed at the focal plane of Heavy Ion Reaction Analyzer (HIRA) [4], and has been successfully used in several in-beam experiments [5–9] for measuring evaporation residue cross-sections and for transfer measurements.

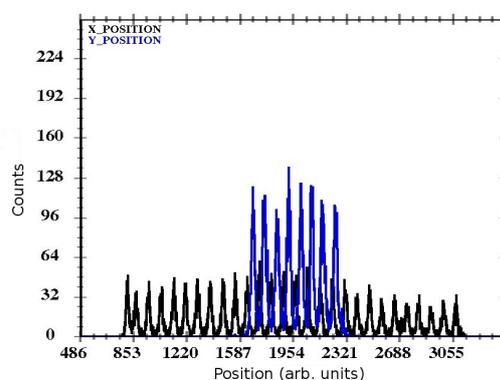


FIG. 5: X and Y position spectra using a mask before multi wire proportional counter.

## References

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