Development of New-Generation Gaseous Detectors for Nuclear Physics

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One of the major and frontiers of today's current nuclear physics research programs is the investigation of heavy ion induced fission reactions. Apart from fundamental interest to study the dynamics of heavy ion nuclear reactions, these studies will be helpful to find out the proper target and projectile combination for the synthesis of super heavy elements (SHE). To have an insight into the dynamics, one requires the study of fission fragment mass and angular distribution at near barrier energies for heavy-ion induced fission reactions. The detection of fission fragments is particularly suitable with gaseous detectors [1]. Conventionally, Multi wire proportional counter (MWPC) [2], are more favourable in such are preferred in experiments to detect fission fragments because of the flexibility it offers. However, the central anode plane of MWPC detectors, which is the main charge multiplication region, is made of 10 μm thin wires and, therefore, makes the detectors highly fragile, and prone to tear. The present work is motivated towards overcoming fragility of this kind of detector, maintaining all the advantages of the older design as much as possible. In particular, time of arrival, position and energy loss information should be of a similar quality, as obtained from the older detector. In particular, the proposed design should provide time of arrival, position and energy loss information of a quality similar to the earlier design. During recent times, Micro-Pattern Gaseous Detector (MPGD) [3] design and applications have made significant progress towards achieving excellent time, position and energy resolution. Semiconductor fabrication technologies used in the production of many of these detectors lead to very robust designs, as well. The present activities encompass a detailed evaluation of the operational conditions of different MPGDs operated in low-pressure isobutane gas with a view to optimizing their use in the detection of charged particles and fission fragments [4]. In the presentation, numerical demonstration of such hybrid detector technologies as possible candidates for new generation low energy fission studies and their evaluation as a function of different possible geometric and electric configurations will be discussed.

References:

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