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A dE/dx-E position sensitive charged particle spectrometer

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Hybrid pixel detectors- Timepix are very promising detectors considering their advantages getting simultaneously information about the position, energy, and time of arrival of a particle hitting the detector. These types of multi-parameter detectors can be effectively used to study and/or reinvestigate some fission processes such as the rare fission modes (ternary, quaternary, quinary), which are planned. In studying nuclear reactions, it is necessary to consider the following features: the energy resolution of the detecting system, angular distribution information, coincident timing, discrimination of different particles, background problem etc. Silicon solid-state detectors are commonly used for measuring the specific ionization (dE/dx), in instruments designed for identifying energetic nuclei using the dE/dx versus total energy technique. Using Timepix detector as E detector in this method gives the possibility to get simultaneous measurement of energy, coordinate, interaction time and the type of charged particles. This work is devoted to application of multi-parameter detectors-Timepix in dE/dx-E particle identification measurements. In constructing tailor-made dE/dx-E spectrometers, our requirement is the measurement of angular distributions, energy spectra, coincident time, yield of rare fission mode products. In order to test the spectrometers, a spontaneous fission source 252Cf was used as a light particle source, since LCPs (mainly alpha particles) are formed along with the heavy fragments in ternary fission. The tailor-made dE/dx-E spectrometers consist of transmission type ΔE detectors and the Timepix detector. The particles (1H, 2H, 3H, 4He, 7Li, and 8Be et.c) have been identified by the method dE/dx-E, since the dE/dx-E value is unique to the type of particle. The specific energy loss (dE/dx) is measured using the transmission type ΔE detector (16 or 150 um thicknesses) ordered from the company Micron Semiconductors, while the residual energy (E) is measured by a Timepix detector with thicknesses of 300 and 600 um.

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