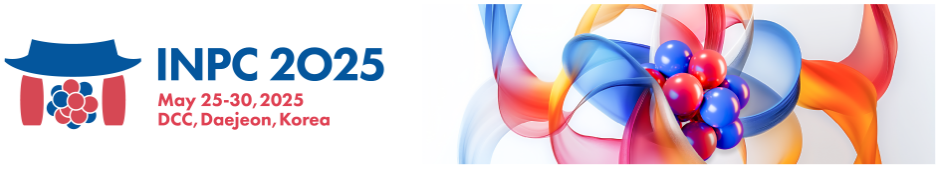

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A large-area position-sensitive MCP detector system for studies of exotic nuclei

Microchannel plate (MCP) detectors are widely utilized in experimental setups for nuclear physics studies at low and medium energies. These detectors offer excellent timing resolution and precise position information via delay-line anode readouts [1, 2]. As a result, MCP detectors have found significant applications in nuclear physics experiments requiring high precision and resolution in both timing and position. Applications include mass measurements of short-lived nuclei [3], β-decay studies [4], and tracking reaction residues [5].

We have developed a position-sensitive, large-area MCP detector system [6] designed for high-precision mass measurements of exotic nuclei and reaction residue tracking at radioactive ion (RI) beam facilities. Our setup employs a thin conversion foil to emit secondary electrons as particles pass through, which are then guided to the MCP detector by an electrostatic grid. The system integrates accelerating grids, electrostatic lenses, and a digital readout circuit to ensure minimal energy loss and high accuracy. This optimized design enables precise measurement capabilities, making it a versatile tool for RI beam experiments.

The system employs a pair of MCPs with an active diameter of 120 mm, configured in a chevron configuration and coupled with a delay-line anode. Detector signals are processed using a fast-timing amplifier unit and a CAEN v1751 FADC waveform digitizer, offering sampling rates of 1 GS/s or 2 GS/s. A self-developed digital data acquisition system handles pulse processing, implements intelligent triggering, and provides charge and timing information.

This presentation will highlight the properties of the detector setup, with a focus on digital pulse processing. Preliminary results on position resolution will be presented, followed by an outlook on future experimental plans for utilizing the MCP detector system at RI beam facilities.

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