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A position-sensitive large-area microchannel plate detector with digital data acquisition system for studies of exotic nuclei

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We have developed and commissioned a position-sensitive large-area microchannel plate (MCP) detector with a new digital data acquisition system. The MCP detectors coupled to delay-line anodes are powerful tools for single particle/photon counting, by providing information on position and impact time of each particle/photon [1]. Therefore, MCP detectors are widely utilized in experimental setups for nuclear physics studies at low and medium energies.

Our new detector system consists of two large-area MCPs with 120 mm active diameter, mounted in chevron configuration, with delay-line (DL) anodes [2]. The digital-readout-based data acquisition system (DDAQ), which is coupled to the delay-lines of the detector, is based on a fast-timing amplifier unit and a CAEN v1751 FADC waveform digitizer (10-bit resolution, and 1 GS/s or 2 GS/s sampling rate) [3]. Our digiTES-based self-developed software manages the digital pulse processing, the intelligent triggering, and provides ADC, TDC, event timestamp and waveform data.

The DL-MCP detector system will be exploited in the Rare-RI Ring setup at RIKEN for high-precision mass measurements [4,5], and in different future experimental setups at RAON for beam analytics and tracking of reaction residues [6].

In this talk, the details of our DL-MCP setup, properties of the detector and the programmed triggering method will be described, as well as the results of our commissioning with light charged particles. Additionally, the preliminary results of the measured position and time resolution will be discussed. The presentation will end with an outlook for experimental plans with our DL-MCP detector at RIKEN and RAON.

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