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R&D programme on active-target TPCs at the University of Warsaw

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An R&D program on gaseous active-target time-projection chambers (TPCs) with strip readout for studying nuclear reactions of astrophysical interest is carried out by the University of Warsaw in collaboration with University of Connecticut and ELI-NP/IFIN-HH since 2013. The long-term goal of this project is to measure cross-sections of time-reverse processes using TPC detection technique by measuring energies and angular distributions of the charged products of photo-disintegration reactions induced by intense monochromatic gamma-ray beams. In particular several (p, γ) and (α, γ) reactions can be studied by tuning composition and density of the gaseous target for particular energy of the gamma beam.

The full scale ELITPC prototype with a low-pressure gaseous target volume of about $33 \times 20 \times 20 \text{ cm}^3$ has been recently build and tested. The three-dimensional kinematics of the reaction events is reconstructed from about 1000 signal strips read out by the Generic Electronics for TPCs (GET).

The ELITPC detector can utilize gamma-ray beams available at the High Intensity Gamma-Ray Source facility at Duke University, Durham, NC, USA and at the new Extreme Light Infrastructure –Nuclear Physics facility in Magurele, Romania. In addition, the same TPC detector and data reconstruction algorithms can be used to study astrophysically-relevant neutron-induced reactions or decays of radioactive-ion beams.

The talk will cover several aspects of the TPC design, readout structure, DAQ electronics and gas system, as well as demonstration of the capabilities of the proposed detection technique using scaled down and full-size prototypes.

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