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Research on TPC physics experiments and simulation methods at Back-n white neutron source

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In response to the needs of cross-section measurement at the CSNS Back-n white neutron source, Multi-purpose Time Projection Chamber (MTPC) is constructed. As a gas detector, MTPC has the characteristics of large solid angle and high detection efficiency. Compared with traditional ionization chambers, MTPC uses a resistive micromegas readout at the anode. This design enables MTPC to have the advantages of high electron gain and multi-channel readout, which can realize three-dimensional reconstruction of particle tracks and better identification of charged particles. From the design of the detector system to the conduct of the experiment, our team has completed a complete preliminary study. It is worth mentioning that during this process, we completed the design and processing of the detector structure, the development of the dedicated electronics system, and the development of the simulation and data analysis program. Currently, MTPC is widely used in neutron nuclear reaction cross-section measurements. The experiments that have been successfully carried out include $6\text{Li}(n, t)4\text{He}$, $^{232}\text{Th}(n, f)$ and n-p scattering experiments.

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