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Hardware Performance of the NIFFTE fissionTPC for High Precision Measurements

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Nuclear physics and engineering communities call for new, high precision measurements to improve existing models for understanding fission and designing next generation reactors. The Neutron Induced Fission Fragment Tracking experiment (NIFFTE) has developed the fission Time Projection Chamber (fissionTPC) to measure neutron induced fission cross-sections with unrivaled precision. The fissionTPC is annually deployed at the Weapons Neutron Research facility at Los Alamos Neutron Science Center where it operates with a neutron beam passing through the drift volume, irradiating heavy actinide targets to induce fission. At the Lawrence Livermore National Laboratory, the fissionTPC measures spontaneous fission sources to characterize the detector, develop performance, and improve upon earlier measurements. The fissionTPC uses a MICROMEGAS amplification stage and has a two-chamber, compact cylindrical drift volume (15 cm diameter, 12 cm length) resulting in 4π acceptance of fission fragments. Nearly 6000 channels are readout at 50MHz using custom electronics, built from off-the-shelf components resulting in a cost of $55 per channel. The fissionTPC is designed to handle ~MBq activity with a dynamic range that allows identification of particles from proton recoils to fission fragments, with energies from 10 keV to hundreds of MeV. This talk will further explore the fissionTPC system performance and developments to include: gain regimes, data acquisition, track reconstruction, particle identification and more.

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