NEXT: Detector

Cole Howell, TTU Physics

In recent years, neutron detection has become more important in studying nuclear structure and processes. In beta delayed neutron emission, neutron energies provide important information about the parent nucleus and the decay process. Neutron energies are calculated by measuring neutron time of flight (ToF) between two detectors. The energy resolution is therefore dependent upon the ToF resolution and the position resolution within the detector. The Neutron dEtector with Tracking (NEXT) is a segmented neutron detector based on pulse shape discriminating (PSD) plastic coupled to segmented photomultipliers. The NEXT design will improve energy resolution by increasing particle localization and ToF resolution. Current research focuses on determining PSD and timing capabilities of different detector designs. Results of timing and PSD dependence on scintillator type and geometry will be shown.

NEXT Detector Signal Amplification

Joseph Owens, TTU Electrical Engineering

The Neutron dEtector with Tracking (NEXT) is an experimental detector designed to provide high neutron energy resolution with neutron-gamma discrimination filtering. The detector works with a Time of Flight (ToF) energy measurement system, and Pulse Shape Discrimination (PSD) algorithms to remove gamma ray data. To maintain affordability, modularity, and volume reduction, the detector uses Silicon Photo Multipliers (SiPM) as a light readout system. The signals produced by the SiPMs must be amplified and filtered, while maintaining accurate pulse shape for PSD, so acquisition equipment can accurately collect the details of the pulses. The amplification circuits used prior to this study worked to the desired specification. However, the goal of this study is to find possible modifications to the circuitry to achieve greater than desired performance from the detector. In this contribution, advances toward this goal will be presented.