On the development of the full TexNeut array

A. Alafa,[1] J. Sanders,[1] G.V. Rogachev,[1] H. Webb,[2] L. Sobotka,[2] J. Elson,[2] K. Haverson,[3] and R. Smith[3]
[1]*cyclotron Institute, Texas A&M University, College Station, Texas 77843*
[2]*Washington University in St. Louis, Missouri 63110*
[3]*Sheffield Hallam University, Howard Street, Sheffield S11WB, United Kingdom*

TexNeut is a modular array of 2x2x2cm n/γ PSD-capable *p*-Terphenyl crystal scintillators. The crystals are arranged in sets of 6, side-by-side in a 'pseudo-bar'. A single bar consists of the 6 crystals separated by thin silicon pads, all wrapped up in 3M specular film (and teflon tape for structural integrity) to direct scintillation to either end, where thin plastic trim applies pressure to the bar and holds mumetal PMT housing. In Dec 2021, a prototype array of 48 bars was constructed and commissioned on the MARS beamline. As the data from that run is analyzed, the full 128-bar array has been constructed and is now ready for commissioning. A picture of the setup and the relative electronics is shown in Figure 1.

With 2 PMTs per bar, the prototype had 96 channels of data to handle while the full array has 256. During the commissioning run, a few channels died, indicating an issue in the array that has only recently been identified and resolved. The array was prepared for an experiment in February 2025 alongside TexAT for directional neutron detection. During the experimental setup, the long-standing issue was finally identified: the Hamamatsu PMTs used in the array come from a decommissioned PETT machine, and a residue has been left near the pins that causes sparking when a PMT is socketed into a base. Although the array was ready, the experiment was postponed, and PMT cleaning/repair has begun.

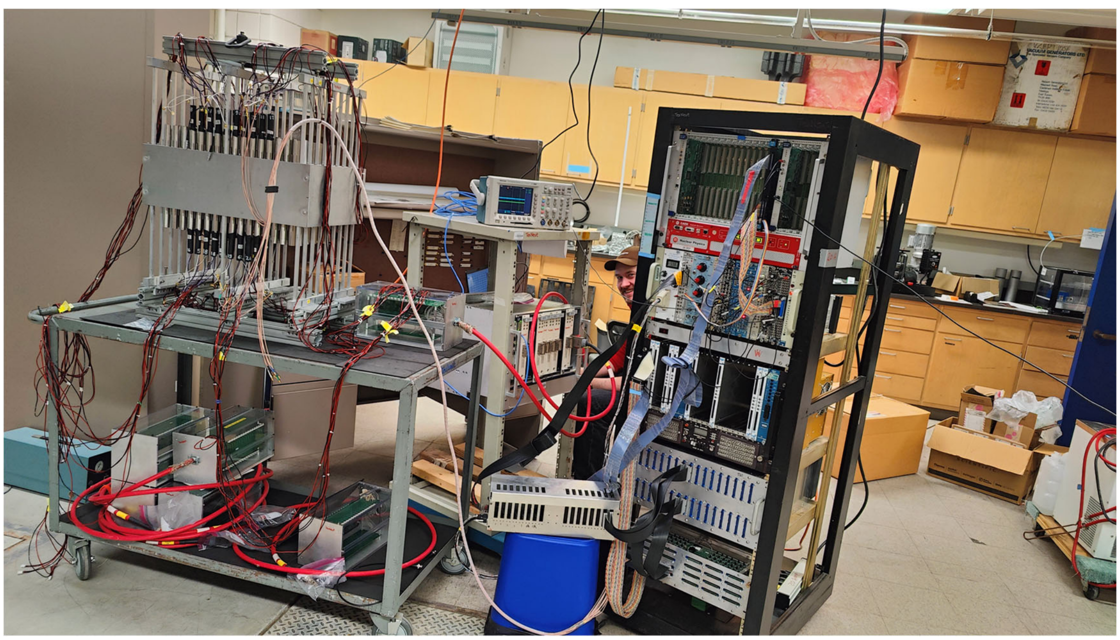

Fig. 1. UK collaborator Kristian Haverson operating TexNeut MPOD Crates during the February 2025 experiment setup.

The full TexNeut array requires updated electronics and data acquisition software as well as proper documentation. The establishment of a lab space in the JCAIN mechanical engineering building dedicated to TexNeut development has allowed for careful, uninterrupted progress toward a time-resilient array capable of rapid deployment and calibration. Here, necessary upgrades and replacements have been made to dated hardware and software used for the protype array.

An experiment is planned before the end of 2025 to place TexNeut behind the Gobbi array (WashU St. Louis) on the MDM line to measure *p*+*n* correlation in $^{12}C(^{7}Li,^{6}Li)^{13}C$. This will come after full-array efficiency testing at the end of July.