

Towards the next generation of fast neutron detectors for high-energy neutron metrology.

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Organic liquid scintillator detectors such as those based on BC-501A are widely used by metrology laboratories as the reference for measurements of fast and high-energy neutron fields, however these scintillators are composed of highly toxic, flammable, and volatile aromatics. These detectors are coupled with a high-voltage photomultiplier tube, NIM standard pulse processing modules and an analogue ADC-based multi-parameter analyser (MPA), which are not suitable for use outside of a laboratory environment and will not be sustainable for decades to come. For these reasons, a modern detector system is under development based on new organic scintillator materials capable of pulse shape discrimination, such as the high-flash point and low-toxicity liquid EJ-309, and solid plastic EJ-276. The traditional photomultiplier tube and analogue pulse processing will be replaced with silicon photomultipliers, and digital pulse processing, improving portability and flexibility. This new system forms part of the redevelopment of the fast neutron facility at iThemba LABS into an ISO accredited reference facility for neutrons up to 200 MeV. Here we present preliminary characterisations of the EJ-309 and EJ-276 scintillators and digital data acquisition system in comparison to currently adopted technologies for high-energy neutron metrology.

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