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P2.18: Investigation of fast neutron interactions in semiconductor sensors with Timepix3

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Neutron radiation effects on semiconductor detectors have long been investigated, as it offers a more complete understanding of the amount of damage to which such sensors can be subjected while operating them under extreme experimental conditions. The competition between ionizing (IEL) and non-ionizing energy losses (NIEL) was described theoretically through partition functions, which are in a fair degree of agreement with silicon sensor experimental observations and prompt the need for extending the studies to other materials which are used for radiation detection, like gallium arsenide(GaAs) and cadmium telluride(CdTe).The pixelation of Timepix3 detectors together with the energy deposition measurement and pattern discrimination algorithms which are exploited for separating the different neutron interactions (elastic and inelastic). In order to measure the competition of IEL and NIEL in different semiconductors with unprecedented accuracy, an experiment was performed at the Weapon Neutron Research facility in the Los Alamos Neutron Science Centre, where several Timepix3 sensors were placed in a neutron radiation field of an energy spectrum ranging from hundreds of keV to hundreds of MeV. The presentation aims to deliver a comprehensive look at the analysis process leading to new results on the competition between IELs and NIELs of recoil nuclei in several semiconductor lattices following fast neutron interactions with Timepix3 sensors.

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