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Multiple interactions in a Neutron Monitor

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The flux of low-energy (GeV-range) Galactic cosmic rays at Earth is modulated by the long term magnetic variations of the Sun (11-year sunspot cycle and 22-year magnetic solar cycle). This process known as Solar modulation is most pronounced at 1 GeV and below. However, it also operates at much higher energy, still exhibiting solar magnetic polarity dependence. For the last decades, ground-based neutron monitors provided valuable observations of the solar modulation up to a rigidity cutoff of about 17 GV. To extend the energy range of the neutron monitor observations, we recently upgraded the electronics of the Princess Sirindhorn Neutron Monitor in Thailand (PSNM, the operating neutron monitor at the highest geomagnetic rigidity cutoff) to record complex combinations of hits in multiple proportional counters. We present here the detection of multiple-hit events recorded at the PSNM. We discuss these observations with the help of a detailed Monte-Carlo simulation of energetic neutrons interacting in the detector. Finally, we estimate the nucleonic spectrum of the atmospheric secondary particles at the altitude of the detector.