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Development of a digital data acquisition system for neutron metrology

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Development of a digital data acquisition system for fast neutron metrology

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Fast neutron fields are found in a wide variety of contexts, for example at accelerator and medical radiation facilities, around nuclear power plants, in aviation and space flight. The essence of neutron metrology is to quantify both the fluence and energy distribution of these fields, which is complicated by the large range of energies, intensities and directional characteristics in each unique scenario [1]. Neutron metrology and spectrometry communities are beginning to adopt modern digital pulse processing systems to complement, and eventually replace, the existing analogue data acquisition systems [1,2].

Digital pulse processing electronics offer several distinct advantages over the existing analogue systems, with a need to rigorously benchmark against the current metrology standards prior to deployment [3]. Measurements were made using a BC-501A scintillator detector for neutron fields with energies between 1.2 MeV and 20.0 MeV over the full range of available beam currents at the AMANDE fast neutron metrology facility [4] at the IRSN. Comparisons were made between the AMANDE standard analogue data acquisition system, and a new digital system comprised of a CAEN DT5730 digitizer and the open source QtDAQ software [5]. An overview of the comparison will be presented, with a focus on the definition of the digital light output parameter, and dead time effects. Based on these measurements, recommendations will be made for implementing a fully digital data acquisition system for fast neutron metrology.

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- [2] V. Fedorov et al. (2018) EPJ Web of Conferences. 170 02005.
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