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P2.067 A clustering algorithm for scintillator signals applied to neutron and gamma patterns identification.

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In many nuclear applications, sensors are widely used in order to detect high energy particles; one of the available technologies is the scintillator, which is generally coupled with a photomultiplier and pulse amplifier. The different particles incident on the scintillator produce electrical pulses having different shape; moreover the amplitude of these signals is related to the particle energy. The electrical pulses of the scintillator are recorded by digital acquisition/processing systems that, generally, performs a triggered acquisition consisting of a stream of pulse windows.
The aim of this study is the development of a clustering algorithm able to produce reference patterns compliant with the pattern recognition algorithm based on the matched filter technique.
The algorithm processes the data digitally acquired which contain the stream of pulse windows generated by particles having different energy and type. This paper contains a general explanation of the clustering algorithm and of the main customizations made for the scintillator signals. Many parameters can be set in the algorithm, such as the amplitude level for the negligible pulse windows or the maximum number of desired elements in the final cluster, and so on; moreover the very low probability patterns, such as the overlapping of simultaneous pulses or artefact due to noise, are removed from the final analysis.
In order to test the efficiency of the algorithm in real case, it has been applied on the data acquired during a radiation test performed at Frascati Neutron Generator for stilbene scintillator. The results show that, with this algorithm it is possible to obtain the cluster containing the neutron and the gamma shapes; furthermore, during the digital processing, for each window, the energy of the received particles and the occurrences of each different type of pulses present in the cluster are calculated.

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