

# Development of a Pulse Shape Discrimination Algorithm

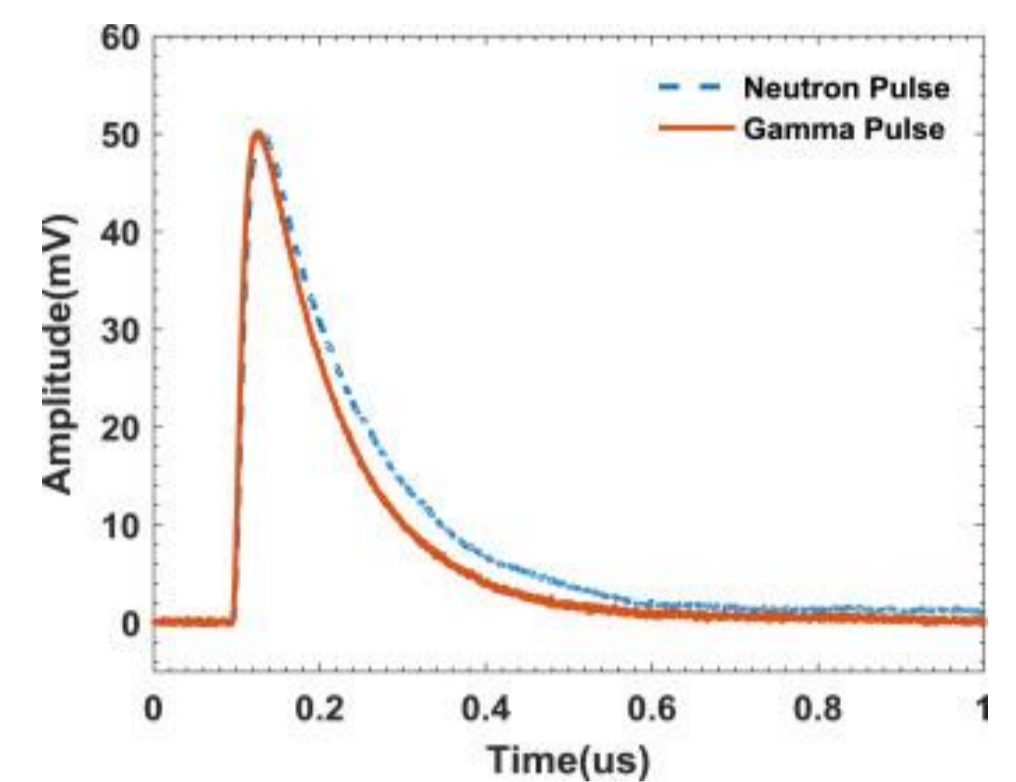
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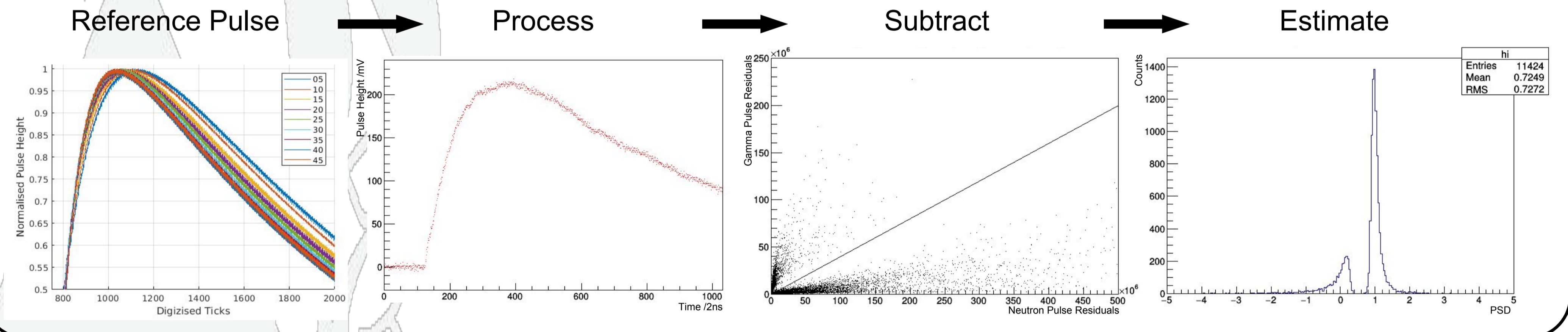
## Pulse Shape Discrimination

Pulse Shape Discrimination (PSD) is the process of distinguishing between radiation types such as neutrons or gamma-rays. Dual detector scintillators can be used as they fluoresce from both neutron and gamma-ray interactions. Once the light has been collected on the photo sensor and its electric signal gets digitised, discrimination algorithms can be applied to identify the radiation type on an event-by-event basis. Several types of algorithms exist, each with benefits and disadvantages. As the requirements of detector systems change, so do the PSD algorithms.



## Reference Algorithm on Neutron/Gamma-Ray Data

The Reference Algorithm uses a database of reference pulses to determine whether an interaction was due to a neutron or gamma-ray. The Reference Algorithm builds a reference pulse from experimental data, normalising each pulse's energy before calculating the mean pulse. Pulse data is then normalised, time-aligned, and filtered before being subtracted from the neutron and gamma reference pulse. The residuals from the two subtractions are then used to discriminate.



## Comparison to Existing Algorithms

There are many other algorithms used for PSD which vary in their computational complexity and accuracy. The ability to distinguish between neutron and gamma events is determined by calculating Figure-of-Merit (FoM). Compared to the Zero-Crossing and Two-Window Charge Comparison algorithms, the Reference Algorithm outperforms both existing algorithms by a significant margin.

