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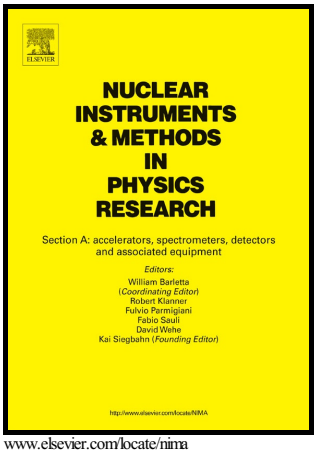

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Assessing and Minimizing Contamination in Time of Flight Based Validation Data

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Abstract

Time of flight experiments are the gold standard method for generating labeled training and testing data for the neutron/gamma pulse shape discrimination problem. As the popularity of supervised classification methods increases in this field, there will also be increasing reliance on time of flight data for algorithm development and evaluation. However, time of flight experiments are subject to various sources of contamination that lead to neutron and gamma pulses being mislabeled. Such labeling errors have a detrimental effect on classification algorithm training and testing, and should therefore be minimized. This paper presents a method for identifying minimally contaminated data sets from time of flight experiments and estimating the residual contamination rate. This method leverages statistical models describing neutron and gamma travel time distributions and is easily implemented using existing statistical software. The method produces a set of optimal intervals that balance the trade-off between interval size and nuisance particle contamination, and its use is demonstrated on a time of flight data set for Cf-252. The particular properties of the optimal intervals for the demonstration data are explored in detail.

Keywords: time of flight, pulse shape discrimination, Poisson regression,

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