

Use of digitizers in nuclear spectroscopy experiments

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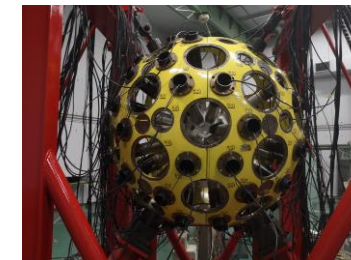
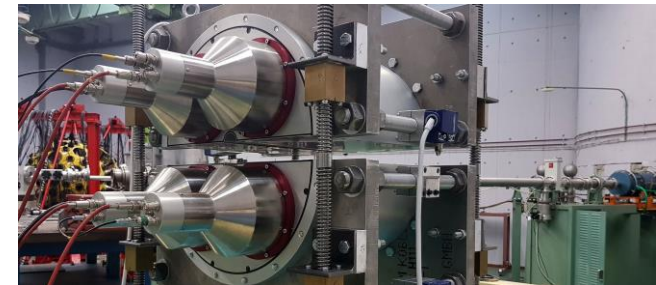


Motivation

The purpose of this work is to study the properties of digitizers as an alternative to analog electronics for data acquisition of nuclear physics experiments. The comparison is made by means of resolution and dead time/counting rate comparison for several types of detectors, namely HPGe, NaI, BGO and Si. The sources used were ^{60}Co and ^{137}Cs for gamma radiation and a triple alpha source (^{239}Pu , ^{241}Am , ^{244}Cm) for particles.

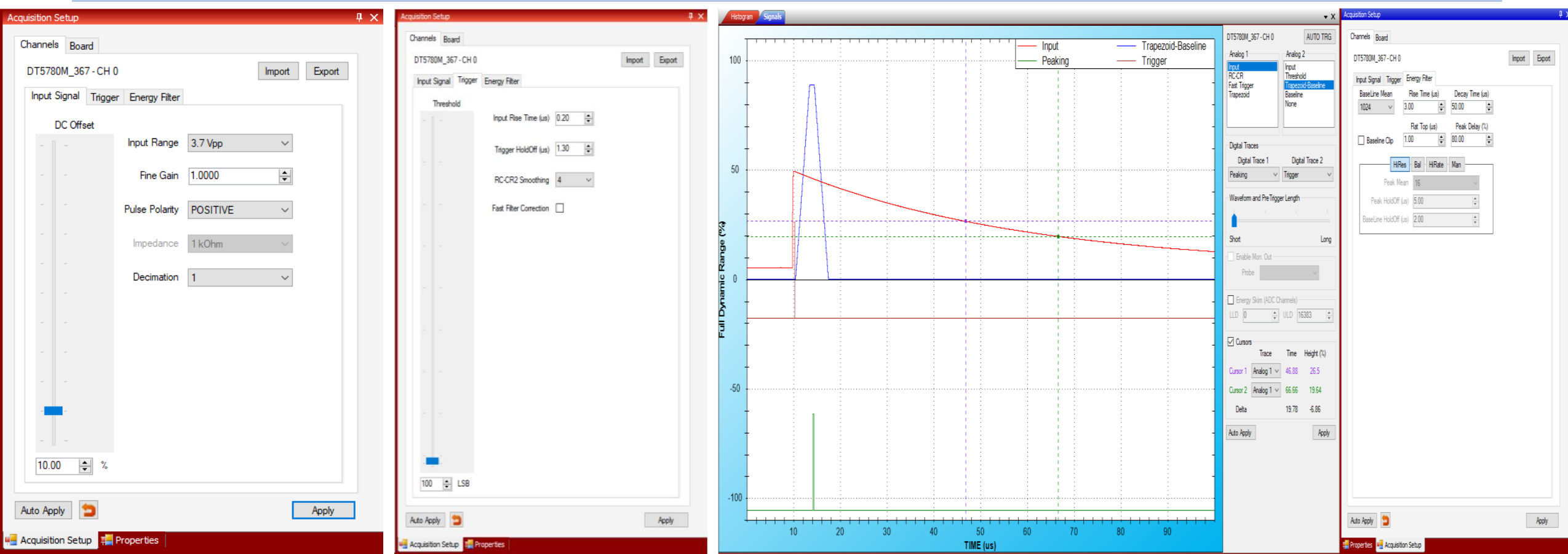
Experimental Setup

- 725S CAEN Digitizer (14-bit , 8 channels , 0.5V / 2V range).
- Desktop PC or Laptop connected to the digitizer through a USB cable.
- MC2A and CoMPASS software.
- A HPGe detector with a ^{60}Co source.
- A NaI detector with a ^{60}Co source.
- A BGO detector with a ^{137}Cs source.
- A Si detector with a triple alpha particle source.



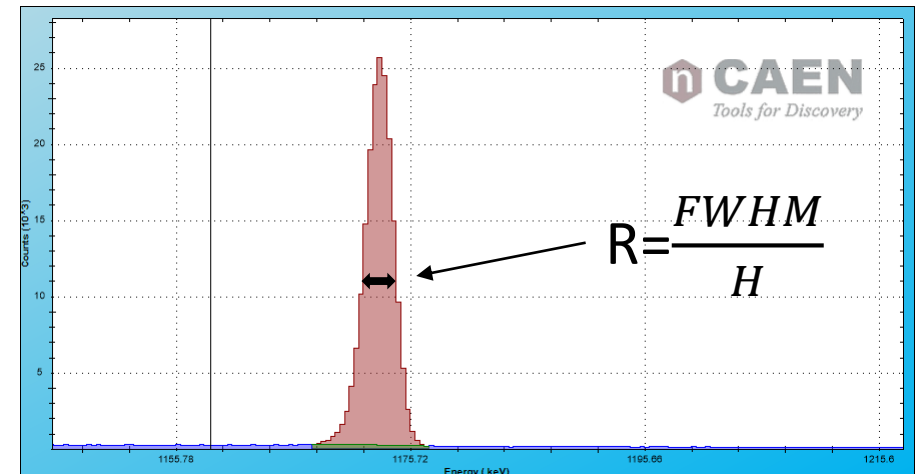
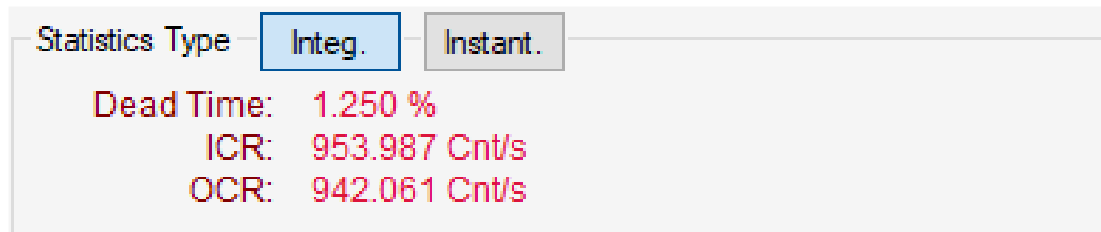
Parameter Setup

- Every digitizer parameter was tuned via software (MC2A / CoMPASS).
- Individual parametrization for each detector type .
- Parameters adjusted in order to optimize resolution and/or sustained counting rate.



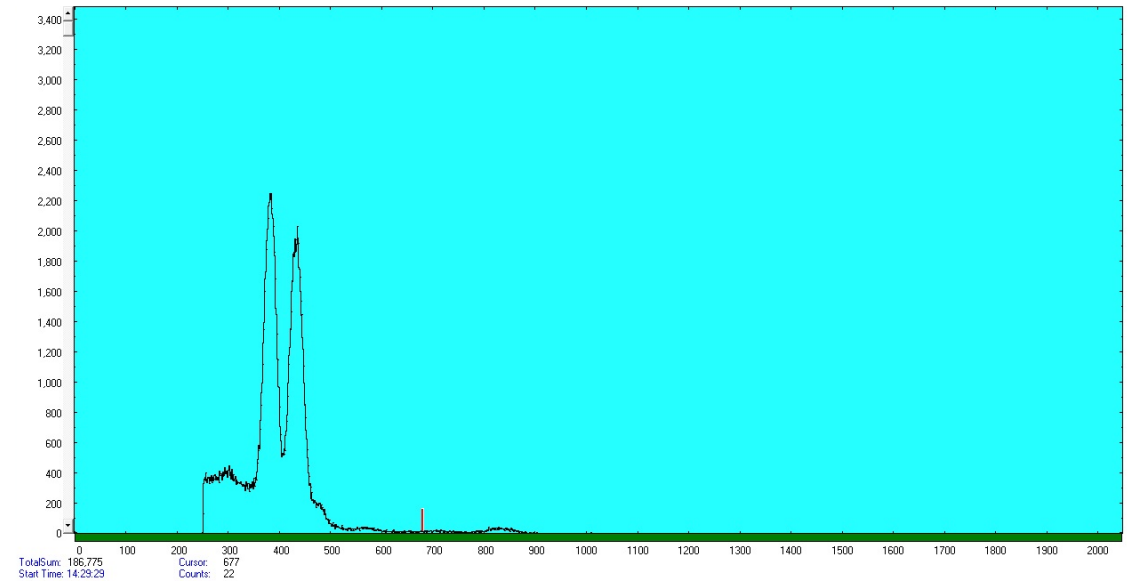
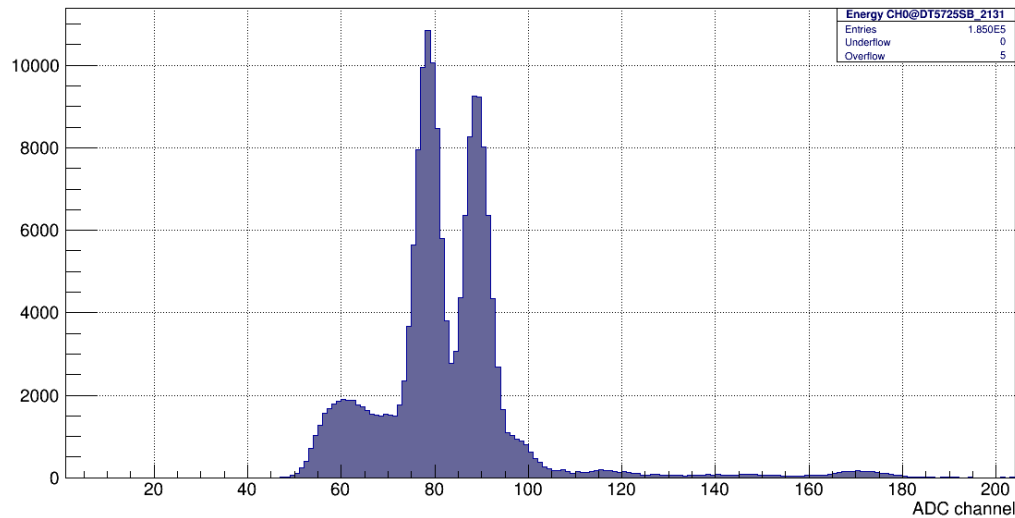
Data Analysis

- Resolution was measured using the digitizer software (MC2A / CoMPASS)
- Dead Time was measured automatically by digitizer software.



Results / Discussion

- For all the detector types the achieved resolution is similar to the one of analog electronics (no degrade noticed).
- Digitizer could sustain higher counting rates without dead time rising .
- Digitizer provide easier means for event by event acquisition (list mode) and post process of data without the need of CAMAC.



Future Perspectives

- Create a database with the optimal parameters for all the types of detectors used in Institute of Nuclear and Particle Physics of NCSR Demokritos.
- Study the use of multiple digitizers concurrently - correct synchronization of data.
- Create off line program to post process list mode data according to experiment's needs (summation, coincidences, ...).
- Use them in experiments to test them in real measurement conditions.