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# Extracting signal's shape parameters using real-time interpolation: a possible way to enhance the performances of the GARFIELD+RCo apparatus at LNL

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In the last few decades, Pulse Shape Analysis techniques (PSA) has proven to be a very powerful tool to identify nuclear fragments that are stopped inside the active layer of a single detector. These techniques, as the name suggests, are based on the extraction of informations from the shape of the signal produced by the impinging fragment.

The NUCL_EX group of INFN has focused its recent work towards the development of highly performing detectors for studying nuclear collisions at energies around or below the Fermi Energy. In this field the capability to detect and identify nuclear fragments (both in Z and A) plays a crucial role, hence the group made great efforts in obtaining very good isotopic resolution. As of today, the FAZIA array, composed of several three-stage telescopes (Silicon-Silicon-Cesium) is the result of these efforts, granting the possibility to identify in mass the fragments up to Z=20 and even more, using both DeltaE-E techniques and PSA.

During the FAZIA R&D two main PSA techniques for Silicon detectors were considered, one techniques uses the correlation of the charge-signal rise time with the energy (amplitude) and the other uses the correlation of the current signal maximum value with the energy. Since the latter has shown better performances, the FAZIA apparatus has been designed in order to acquire also the current signal coming from the silicon detector, thus achieving better results concerning isotopic resolution.

However, the slightly older GARFIELD+RCo detector, which is also managed by the NUCL_EX group, does not have the possibility to acquire the current signal and uses the rise-time PSA to identify fragments.
To overcome this limit, hoping for better performances, we have implemented on the new FEE electronics of the apparatus a real-time algorithm that performs real-time Cubic Spline interpolation of the charge signal and then differentiates the interpolated signal to obtain the current signal, thus allowing for the current PSA to be exploited.

The algorithm has been tested in December 2015 at LNS during a campaign of the FAZIA apparatus and recently al LNL during the commissioning of the new electronic with the GARFIELD+RCo apparatus, showing encouraging results.

## Selected session

Accelerators and Instrumentation

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