Digital Pulse Shape Acquisition from CHIMERA AZ−4π detector: Results and Perspectives.

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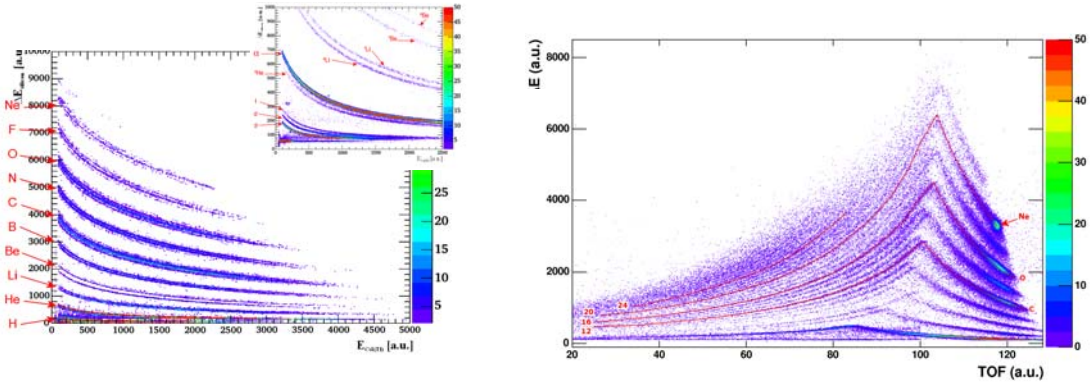
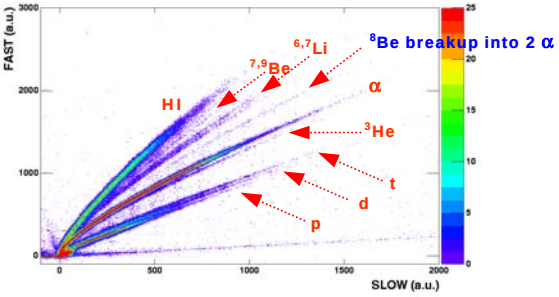
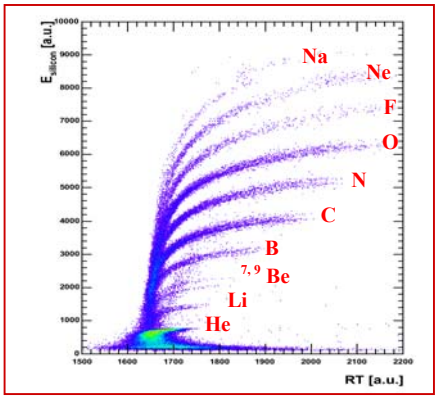
In view of new AZ-4π detectors for a RIB facility, we have studied the possibility to improve mass and charge identification of the reaction products by applying pulse-shape analysis to the pre-amplifier outputs to exploit fully the information carried by the detector signals. We thus have used digital signal sampling as general approach to data acquisition from CHIMERA [1]. The followed approach results in a substantial reduction of the analogue electronics, obviating the need for linear amplifiers, fast amplifiers, CFDs and TDCs. In this contribution we present the results obtained in realistic experimental conditions, by applying digital pulse shape acquisition techniques to the signals coming from CHIMERA telescopes (Silicon -300 μm, 25 cm^2- and CsI(Tl)). We process data directly collected from the preamplifier. Charge identification of the ejectiles has been obtained by using the (ΔE,E) technique. The charge comparison method [2] allows to obtain Light Charged Product isotopic identification for CsI(Tl). Moreover for products stopping in silicon, charge identification is performed by using signal pulse-height vs. rise-time technique [3]. For the same products, Time of Flight measurements allow mass identification up to A=26 at least, with a timing resolution of 800 ps. Several kinds of sampling analog-to-digital converters have been employed and compared, with different sampling frequencies and resolutions: 105 MS/s, 14-bit and 2 GS/s, 12-bit and 105 MS/s, 14-bit equipped with TigerSHARC DSPs. This last allows the on-board and online computation of the event parameters at an acquisition rate of ~ 2kHz.

The quality of the obtained results (see figures) clearly indicates that digital signal pulse shape acquisition directly from the preamplifiers is an advantageous approach to pursue in the development of new generation detectors.



Figures: ^{20}Ne at 21 AMeV on ^{12}C; top left: (ΔE_{Si},E_{CsI}) scatter plot; top right: (E_{Si},ToF) scatter plot; bottom left: (Fast,Slow) scatter plot; bottom right: (E_{Si},RT_{Si}) scatter plot.





References

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[2] D. Guinet *et al.*, Nucl. Instrum. Methods **A278**, 614 (1989)
[3] G. Pausch *et al.*, Nucl. Instrum. Methods **A349**, 281(1994)