

FAZIA: prototyping a next generation 4π detection array for nuclear reaction-dynamics studies

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for the FAZIA collaboration

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The future availability of radioactive nuclear beam facilities will permit the investigation of the role of the isospin degree of freedom in nuclear matter excited by means of heavy ions reactions, over a wide portion of the chart of nuclides. At present, the properties of heavy-ion reactions are mainly studied with stable beams by using 4π detector arrays (INDRA [1], CHIMERA [2]). These arrays are based on various detection methods (ΔE -E, time of flight, ...) and employ standard analog electronics for the whole detector signal-processing.

The international FAZIA collaboration (**F**our π **A** and **Z** Identification Array, presently involving researchers and institutions from France, Italy, Poland, Romania, and Spain) is currently investigating the use of new detector types/configurations (NTD Si detectors, single chip telescope [3]) and new electronics (digital sampling and signal processing) in view of a possible next generation detection array. The present main goal of this collaboration is to develop a prototype detection-module able to fulfill the needs for low energy (SPIRAL2 / LNL) and higher energy (GANIL / LNS / FAIR-NUSTAR / EURISOL) studies with exotic and stable beams. Fast digital sampling/signal processing methods are being developed in order to extend the performances of the currently available 4π detectors – low thresholds for particle-detection/identification, isotopic identification over a wide particle- and energy-range. Special attention is also paid to design a detecting system well suited for transportability and exploitation at various RNB facilities.

In Fig. 1, a solution for the envisaged detection module is shown – this system allows for a detailed digital pulse shape analysis on the silicon current and/or charge signals, thus also including the fluorescence of the CsI(Tl) [3]. The performances of the proposed approach are currently under active investigation, by means of experimental tests, simulations, and development of dedicated electronics.

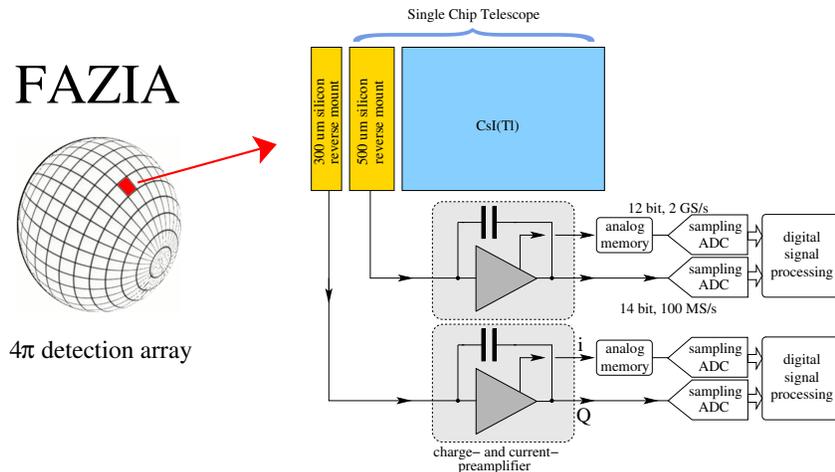


Figure 1: Representation of the basic detection module of the FAZIA prototype.

References

- [1] J.Pouthas *et al.*, Nucl. Instr. Meth., **A 357** (1995) 418.
- [2] S.Aiello *et al.*, Nucl.Phys. **A 583** (1995) 331c.
- [3] L.Bardelli *et al.*, Proc. of RNB6 Conf., 2003, Nucl.Phys. **A 746** (2004) 272.