A new UK fast-timing array

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A new fast timing array is currently under development for use at the future Facility for Antiproton and Ion Research (FAIR). The array will be used to measure the half–lives of excited states in exotic nuclei implanted in the Advanced Implantation Detector Array (AIDA [1]) at the focal plane of the the FRS/SuperFRS at GSI/FAIR [2]. It is planned that the array will consist of $LaBr_3$(Ce) detectors which have become increasingly popular in the field of nuclear physics due to their exceptional timing properties, and reasonable energy resolution.

One of the major decisions in the design of the array is whether to use small 1” detectors which have a good intrinsic timing resolution (150 ps FWHM at 1.1 MeV [3]), but a lower efficiency than larger 2” or 3” detectors, which have worse timing properties (300 ps FWHM at 1.1 MeV for 2” detectors [3]). Therefore a series of simulations has been carried out using the GEANT4 Monte–Carlo code to determine the efficiency of various geometrical configurations of detectors around AIDA. These efficiencies have been used to derive precisions of various array configurations, where precision is defined as the intrinsic timing resolutions of the detector divided by the standard deviation of the number of counts. New tapered Hybrid crystals have also been simulated in an attempt to maximise solid angle coverage and efficiency, while maintaining an intrinsic sub–nanosecond timing resolution.

The results of these simulations will be considered along with results from preliminary measurements at Bucharest in order to make a final decision about the size of detectors and their arrangement for the array.

[1] T. Davinson *et al.*, `http://www2.ph.ed.ac.uk/~td/DSSD/`
[2] `http://www.gsi.de/portrait/fair.html`
[3] N. Marginean *et al.*, Eur. Phys. J. **A** 46, 329 (2010).