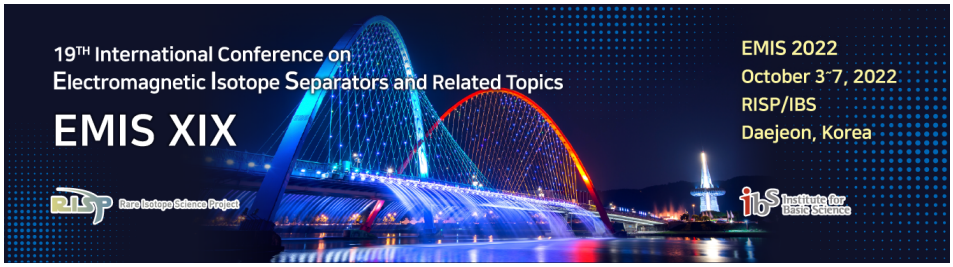

Contribution ID: **62** Type: **Poster Session**

Performance comparison of various electronics systems for fast-timing measurements using the KHALA LaBr3(Ce) detector array

Tuesday, 4 October 2022 19:12 (8 minutes)

Precise lifetimes of excited nuclear states are essential information to understand the nuclear structure. For example, the nuclear quadrupole deformation can be reduced from the E2 transition probabilities of the nuclei. In these days LaBr3(Ce) crystals are commonly adopted to measure the lifetimes of excited states down to tens of picoseconds because of their prompt timing response and good energy resolution.
To facilitate the precise lifetime measurement in studying the nuclear structure the Center for Extreme Nuclear Matters (CENuM) has developed the Korea High-resolution Array with LaBr3(Ce) (KHALA) for the three years. KHALA that consists of total 36 LaBr3(Ce) crystals read out by photomultipliers were assembled and tested with the radiation sources. Recently, as the joint effort between KHALA and FATIMA in Europe, the IDATEN (International Detector Assembly for fast-timing measurement of Exotic Nuclei) Collaboration was formed for the biggest ever LaBr3(Ce) system for nuclear physics. The campaign experiment using IDATEN system is being planned at RIBF, RIKEN, using total 84 LaBr3(Ce) crystals, in near future.
At present the data acquisition system for KHALA and IDATEN is being investigated. Currently, three options for the electronics systems, employing different working principles, are available: the digitizers with Constant-Fraction Discriminator (CFD), the traditional analog electronics, and the Time-to-Digital Converter (TDC) based system. The benchmark tests using the radioactive sources have been performed for all three systems with (1) the commercially available CAEN digitizers, (2) the analog electronics composed of ORTEC CFD and the TAC module and (3) the Twin-peak TAMEX which is the newly developed electronics system by GSI. In this presentation, we summarize the results of the benchmark tests with three options for energy resolution, time resolution, prompt response curve, and the electronics effect caused by jittering and the clock dependent biases. This effort enables us to compare the advantages and disadvantages of the three electronics systems, reaching the final selection for KHALA and IDATEN.

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Session Classification: Poster Session