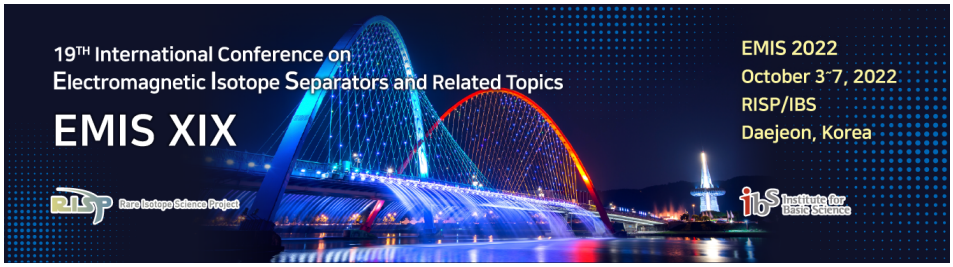

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Development of ultra-fast plastic scintillation counter with reaching time resolution around 5 ps

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The measurement of the time of flight(TOF) of charged particles can give important information for particle identification through the determination of particle velocity. In order to improve the resolution of particle identification, it is effective to improve the time resolution of the scintillation counters for TOF measurements. In the present study, we developed a plastic scintillation counter with an extremely good time resolution by combining a fast plastic scintillator and new high-speed photomultiplier tubes.
Recently, HAMAMATSU PHOTONICS K.K. developed a new type series of ultra high-speed photomultiplier tube that places the anode potential near the first dynode. On the other hand, ELIJEN TECHNOLOGY also developed ultra-fast scintillators by adding trace amounts of benzophenone as a quenching agent. We assembled the detector by mounting two PMTs of this series on either side of the ultra-fast scintillator of rectangular shape.
In order to test the performance of these detectors, we measured the time resolution using primary beams such as ^{132}Xe at 420 AMeV at the HIMAC synchrotron accelerator facility at National Institutes for Quantum Science and Technology. We investigated the dependence of time resolution on scintillator size and thickness, the high voltage applied to the PMT, the type of PMT, and the threshold level of the discriminator, and searched for the conditions with the best time resolution. As a result, a time resolution of around 5 ps was obtained as a preliminary value. In this presentation, we will present the final results of the study.

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