Developments of time-of-flight detectors for Rare-RI Ring

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Construction of the Rare-RI Ring to measure masses of short-lived rare-RI with a relative precision of $10^{-6}$ is in progress at RIKEN [1, 2]. The mass is determined by measuring a time-of-flight (TOF). For determination of nuclear masses with high precision, TOF detectors should be as thin as possible with a good timing resolution ($\sigma < 100$ ps). We are developing two types of TOF detectors for the Rare-RI Ring, one is to be used for timing measurements before injection to the ring, to provide a start signal for TOF inside the ring, and the other is to be used for direct circulation measurements inside the ring. For the former type of detector, we develop specially configured “T-shaped” scintillation counters with a thin plastic scintillator (100 $\mu$m) to be accommodated by the narrow housing space before the ring. For the latter type of detector, we adopt a large, thin carbon foil (100 mm× 50 mm and 60 $\mu$g/cm$^2$) and a large micro channel plate (MCP) (95 mm× 42 mm), which can cover the large beam profile in the Rare-RI Ring. To impinge secondary electrons produced in the carbon foil onto the MCP, we utilize two methods. One method uses crossed magnetic and electric fields [3], while the other uses only a mirror electric field. Measurements of timing resolution and detection efficiency have been performed using an alpha source and heavy-ion beams (~200 A MeV). In this contribution, we will present the design and performance of these TOF detectors.

References

[2] T. Yamaguchi et al., contribution to this symposium.