

MCP with Delay-line Anode Used for Position Sensitive Detector at Rare RI Ring

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The Rare RI Ring (R3) aims at measuring masses of exotic nuclei with precision of 10^{-6} . In order to achieve this goal, the beam diagnostics is needed at the beam line to improve the transport efficiency and measure the velocity of nuclei of interest. For this purpose, we are developing position sensitive detectors with lower energy loss than conventional beam line detectors. We report the development of the foil position sensitive detector based on micro-channel plates (MCPs) with a delay-line anode.

KEYWORDS: Storage ring, mass measurement, position sensitive detector, delay-line anode

1. Introduction

For atomic nuclei, mass is one of the most important fundamental properties since it reflects all interactions, including strong, weak and electromagnetic interactions among nucleons in the nucleus. Nuclear mass also plays an essential role in understanding nuclear structure and the origin of elements in the cosmos. However, precision mass measurements of exotic nuclei far away from the β -stability line are strongly restricted by their low production rates and short half-lives [1]. A new mass spectrometer, Rare RI Ring (R3), has been recently commissioned at Radioactive Isotope Beam Factory (RIBF) in RIKEN to measure masses of these exotic nuclei [2]. A mass precision of about 10^{-6} is expected to be achieved.

To deduce the mass, we need to know the revolution time and the velocities of the reference nucleus and target nuclei in R3. The reference nucleus whose mass is well known circulate in the R3 under the isochronous condition. Because it is difficult to measure the velocities of the nuclei in the R3, we measure the velocities in the beam line with the precision of 10^{-4} instead. We need to measure the time of flight and reconstruct the trajectory of the nuclei. For this reason, a foil position sensitive detectors used for trajectory reconstruction with low energy loss, high position resolution and high efficiency has been developed.