Time-of-Flight detection system at MALT and its performance

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Currently, accelerator mass spectrometry (AMS) is the most sensitive technique to measure ^{236}U with its absolute elimination of molecular interference. Due to small energy difference among ^{235}U, ^{236}U and ^{238}U, it is difficult to completely identify ^{236}U from ^{235}U and ^{238}U with the characteristic of energy deposition difference in a gas detector or semiconductor detector. With the distinct velocity difference of ^{235}U, ^{236}U and ^{238}U in a nearly identified energy, it is visible to use time-of-flight (TOF) technique to separate them. A TOF detection system for the measurement of ^{236}U AMS has been set up at Micro Analysis Laboratory, Tandem accelerator (MALT), The University of Tokyo. As a first test of the system, 3 standards with 10^{-5}, 10^{-8} and 10^{-11} of $^{236}U/^{238}U$ have been measured by TOF detection system. The measured results have shown an unambiguous separation for ^{236}U from the interference of ^{235}U and ^{238}U, which improve the sensitivity of $^{236}U/^{238}U$ from 3×10^{-10} to 6×10^{-12}. The time resolution of 1 ns has been achieved by TOF detection system, which makes a high resolution to separate ^{236}U from ^{235}U and ^{238}U. The experimental results are highly consistent with Geant4 Monte Carlo simulation results, which demonstrate that this simulation can provide a prediction for experiment. The results of Geant4 Monte Carlo simulation demonstrate that the thinner carbon foil, the better efficiency and time resolution.