Development of multireflection time-of-flight for PALIS

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The development of multi-reflection time-of-flight (MRTOF) for PALIS is in progress. This device will be used for identifying particles in extracted RI-beams in the PALIS experiment. We reuse an old MRTOF, that was used for the first performance test at RIBF.[1] According to the past data, the achieved mass resolving power in this MRTOF exceeded $m/\delta m = 65\,000$ in 2005.[1] The geometry of the MRTOF consists of two coaxially arranged electrostatic ion mirrors with a field-free region (drift tube) in between. Besides two lens electrodes, there are nine and four mirror electrodes in the injection and ejection sides, respectively. The total length is about 400 mm, which is smaller than the conventional one.[2] Figure 1 shows the typical potential parameters in the MRTOF used in the past experiment. As the energy isochronous is necessary to achieve a high time resolving power, sophisticated electrical supplies must be tuned. In the preliminary test at 2024, we connected the MRTOF to the laser ionization chamber used to examine for the resonant laser ionization in vacuum, as shown in Fig. 2. As the laser pulse is as short as 10 ns, the photo-ionized ions can be created as a bunched ion beam within the time duration convoluted with the spatial distribution for the photo-ionized atoms. We used a Knudsen cell for producing evaporated atoms, which were sent to the space where atoms overlapped laser photons for the ionization. The photo-ionized ions were extracted to the MRTOF via two rf-ion transport devices and electric static acceleration electrodes. Figure 3 shows one example of the TOF for the single flight path for laser ionized Bi ions when the start signal was used by the trigger pulse for the laser and the stop signal was used as the output signal of the channeltron. The TOF was recorded by a multi-time scaler (p7887 FAST ComTec). The time resolution was approximately 800 ns when the potential parameters in MRTOF were set as shown in Fig. 1. In the next, multi reflection will be tested using two pulsed power supplies.

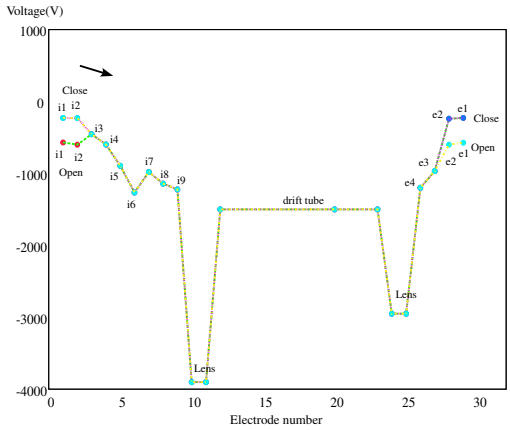

Fig. 1. Typical potential parameters in the MRTOF according to the past experiment.

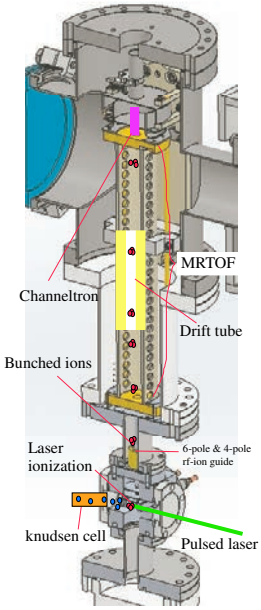

Fig. 2. Setup of the preliminary MRTOF test.

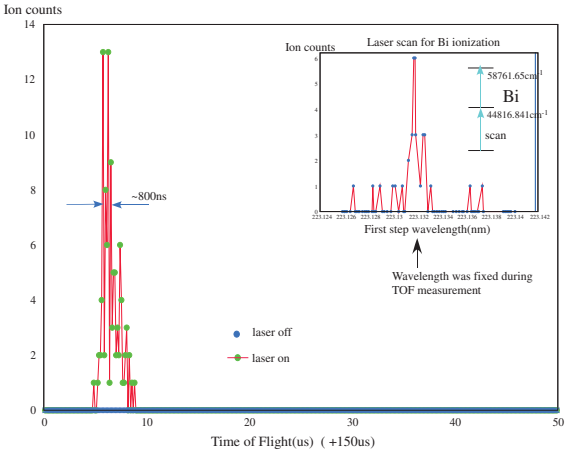

Fig. 3. Time-of-flight for the single flight path of laser ionized Bi ions (laser on) and background (laser off). The laser wavelength was fixed on resonance obtained from the result of wavelength scan shown in the small graph.

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References

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