

# Commissioning of the NEXT mass separator and spectrometer

Friday, 3 November 2023 16:05 (20 minutes)

Soon to be located in the North hall of PARTREC, Groningen, the NEXT experiment intends to produce Neutron-rich EXotic heavy nuclei in multi-nucleon Transfer reactions. By measuring the masses of these exotic nuclei to high precision, their internal nuclear structure can be probed. These masses can also be used as input data for nucleosynthesis models.

Once produced, the transfer products will be pre-separated by magnetic rigidity in a solenoid separator before being slowed to thermal energies in a gas catcher and extracted via an RF carpet [1]. The extracted ions are bunched using a novel ion guide consisting of a stack of ring electrodes [2]. The bunched ions can then be accelerated to a few keV and transferred to a Multi-Reflection Time-of-Flight Mass Spectrometer (MR-TOF MS) which separates the prepared ions from their isobaric contaminants and measures their masses to a precision of  $10^{-7}$  after 10 ms [3].

Currently, each component is being commissioned in offline experiments. The extraction performance of the gas catcher has been determined, while an offline set-up has been constructed to commission both the ion-guide and the MR-ToF MS. Early testing with the MR-ToF MS has demonstrated isotopic separation with a mass precision of  $10^{-4}$  after less than 1 ms of flight time and poor ion bunching. The NEXT ion guide is now being commissioned, it will provide ion bunches  $<100$  ns in width and with an energy spread of 3 eV.

In this contribution, the current status of the NEXT experiment will be discussed, with a focus on NEXT's gas catcher, ion guide, and MR-ToF MS.

[1] J. Even, X. Chen, A. Soyly, P. Fischer, A. Karpov, V. Saiko, J. Saren, M. Schlaich, T. Schlathölter, L. Schweikhard, J. Uusitalo, and F. Wienholtz, "The NEXT project: Towards production and investigation of neutron-rich heavy nuclides," *Atoms*, vol. 10, no. 2, p. 59, 2022.

[2] X. Chen, J. Even, P. Fischer, M. Schlaich, T. Schlathölter, L. Schweikhard, and A. Soyly, "Stacked-Ring Ion Guide for Cooling and Bunching Rare Isotopes", *International Journal of Mass Spectrometry*, vol. 477, 116856, 2022.

[3] M. Schlaich, "Development and Characterization of a Multi-Reflection Time-of-Flight Mass Spectrometer for the Offline Ion Source of PUMA", Master's Thesis, Technische Universität Darmstadt, Darmstadt, Germany, 2021.

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