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Interaction of slow ions with laser light –the ILTIS injector beamline at the 1-MV AMS facility HAMSTER in Dresden

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Suppression of isobars for AMS profits from studying element selective interactions of slow ions with photons or in collisions with other atoms. Negative ions extracted from an ion source can be slowed down to near-thermal energies in an ion cooler consisting of a buffer gas filled radio-frequency quadrupole. The slow ions collide with the buffer gas and can be overlapped with a laser beam. These processes are utilized to suppress isobaric interferences in element selective neutralizations or transformations of the injected anions. Such a device expands the repertoire of measured isotopes to nuclides previously restricted to large AMS facilities as documented in experiments at the ion-laser-interaction mass spectrometer ILIAMS at the VERA (Vienna Environmental Research Accelerator) facility, among them ^{36}Cl or ^{26}Al from extraction of AlO^- [1,2] and non-classical AMS radionuclides such as ^{135}Cs and ^{137}Cs [3].
The new AMS system called HAMSTER (Helmholtz Accelerator Mass Spectrometer Tracing Environmental Radionuclides) will expand the capabilities of radionuclide measurements at HZDR. A second injection line to the 1-MV Pelletron tandem accelerator holds such a novel ion cooler developed in a collaboration between VERA and the HZDR, the so-called Ion Linear Trap for Isobar Suppression ILTIS.
The injector around ILTIS is delivered by NEC and is equipped with a MC-SNICS ion source, followed by an electrostatic analyzer, options for beam attenuation and a magnet before and after the ion cooler, each allowing for fast beam switching. Low-current Faraday Cups and sensitive beam profile monitors enable mass analysis of the beam before and after the ion cooler at the pA level.
In addition to the combination with the 1-MV accelerator, the new injector can be operated independently for testing purposes in parallel to conventional AMS measurements running from another ion source. The control of the different beamline components will be conducted by an EPICS based control system.
I will present the potential of interaction for studying new long-lived radioisotopes based on measurements of ^{135}Cs and ^{137}Cs at VERA as well as our design of the ILTIS injector and first impressions and results from the setup of this system at HZDR.

Refs:
[1] Lachner et al., 2019, ^{36}Cl in a new light: AMS measurements assisted by ion-laser interaction, 10.1016/j.nimb.2019.05.061
[2] Lachner et al., 2021, Highly sensitive ^{26}Al measurements by Ion-Laser-InterAction Mass Spectrometry, 10.1016/j.ijms.2021.116576
[3] Wieser et al., 2023, Detection of ^{135}Cs & ^{137}Cs in environmental samples by AMS, 10.1016/j.nimb.2023.02.013

Student Submission

No

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