MS 8: Accelerator Mass Spectrometry 3

Time: Thursday 14:30–15:30 Location: R 1.020

MS 8.1 Thu 14:30 R 1.020

Recent applications and developments of actinide detection at VERA — •Karin Hain[1], Peter Steier[1], Robin Golser[1], Jixin Qiao[2], Gabrielle Wallner[3], Stephan Winkler[4], and Philipp Zima[3] — [1]Faculty of Physics, University of Vienna, Austria — [2]Technical University of Denmark, Denmark — [3]Faculty of Chemistry, University of Vienna, Austria — [4]iThemba LABS, Johannesburg, South Africa

Long-lived actinides like ^{239,240}Pu, ^{241}Am and in particular ^{236}U are routinely analyzed in environmental samples at the Vienna Environmental Research Accelerator (VERA). The aim is to understand the migration of these elements by studying their distribution in the environment and also biosphere, and their emission sources. In this context, for example, depth profiles of these nuclides and ^{237}Np in the Pacific Ocean and the ^{236}U concentration in human lungs ashes were studied. Most recently our portfolio was extended by anthropogenic ^{233}U which can be found in global fallout at around 1 % of ^{236}U on the Northern Hemisphere where it seems to offer the opportunity to discriminate between U releases from thermonuclear weapons and civil nuclear industry. First measurements on corals and snow from Antarctica, however, indicate a considerably lower ^{233}U/^{236}U ratio on the Southern Hemisphere. Current developments mainly focus on the increase of the negative ion yield of actinides from the sputter ion source by using fluoride based targets and to simplify sample preparation by detecting ^{236}U directly from the soil matrix. The results of the mentioned applications and developments will be discussed in this talk.

MS 8.2 Thu 14:45 R 1.020

Developments towards AMS of ^{182}Hf with ILIAMS — •Martin Martschini[1], Xiaohe Zhang[1], Dag Hanstorp[2], Johannes Lachner[1], Alfred Priller[1], Peter Steier[1], Paul Wasserburger[1], and Robin Golser[1] — [1]VERA Laboratory, University of Vienna - Faculty of Physics, Austria — [2]Department of Physics, University of Gothenburg, Sweden

The Ion Laser InterAction Mass Spectrometry (ILIAMS) technique is currently developed at the Vienna Environmental Research Accelerator (VERA). It provides suppression of isobar contaminants in negative ion beams for AMS via selective laser photodetachment in a gas-filled radio frequency quadrupole (RFQ). Measurement of the longlived trace isotope ^{182}Hf ($T_{1/2} = 8.9$ Ma) is one of the main objectives of this project. ^{182}Hf is of high astrophysical interest, however, despite substantial efforts, could not be measured at its natural abundance level with conventional AMS so far due to strong isobaric interference from stable ^{182}W.

With He-O mixtures as buffer gas in the RFQ, suppression of $^{182}WF_5^-$ vs $^{180}HfF_5^-$ by up to 10^6 has recently been achieved with W-spiked targets. Mass analysis of the ejected anion beam identified the formation of oxyfluorides as an important reaction channel. Furthermore, first tests with ^{182}Hf reference materials have been conducted. In this contribution, we will give details on these measurements including the overall detection efficiency and the present sensitivity limit. In addition, we will report on a survey of several sputter materials for highest negative ion yields of HfF_5^-.

MS 8.3 Thu 15:00 R 1.020

Progress in detection of Cs isotopes with ILIAMS at VERA — •Johannes Lachner, Martin Martschini, Alfred Priller, Peter Steier, Xiaohe Zhang, and Robin Golser — VERA Laboratory, University of Vienna, Faculty of Physics, Austria

The development of Ion Laser InterAction Mass Spectrometry (ILIAMS) establishes new prospects for sensitive Accelerator Mass Spectrometry analyses of isotopic systems. The reliability of the new method was proven with measurements of ^{36}Cl and ^{26}Al. Inside a radiofrequency quadrupole filled with ≈0.2 mbar He buffer gas the isobars ^{36}S and ^{26}Mg could be suppressed by up to 10 orders of magnitude via laser photodetachment using 532 nm photons from a 18 W cw laser.

Further application of the technique is expected by studying isotopic systems that are new to AMS: Here, one focus is on the detection of the trace isotopes ^{135,137}Cs as the measurement of these two Cs isotopes has widespread applications in the environmental sciences for dating or source apportionment. In this case a suppression of the isobars ^{135}Ba and ^{137}Ba is required.

I will present the benefits of the use of either Cs^- or CsF_2^- as primary extracted negative ion and their performance in the ion source and transmission through the ion cooler. By generating the di-fluoride anions CsF_2^- and BaF_2^- a suppression of the ^{135,137}Ba isobars can be accomplished using 532 nm photons in the photodetachment process. The suppression furthermore profits from an additional chemical effect inside the ion cooler, which is enhanced by an admixture of O_2 to the He buffer gas.

MS 8.4 Thu 15:15 R 1.020

AMS measurement of Cl-36 with Gas-Filled Magnet at 6 MV — •Christof Vockenhuber — Laboratory of Ion Beam Physics, ETH Zurich, Otto-Stern-Weg 5, 8093 Zürich

Cl-36 is one of the AMS nuclides that still requires high ion energy to suppress the interfering isobar S-36 and is often used to justify a (relatively) large tandem accelerator with a terminal voltage of 5-6 MV. Over the past decades several methods have been developed by the different AMS laboratories to solve the S-36 problem, each with its own advantages and disadvantages. At ETH we recently switched to the method of the gas-filled magent (GFM) for routine Cl-36 measurements. Traditionally the GFM method has been only employed by even larger accelerators at higher ion energies. In this talk I will discuss the setup of the GFM at the 6 MV tandem accelerator at ETH Zurich and the performance of Cl-36 under routine measurement conditions. Additionally the question of how low in energy one can go with the GFM will be addressed.