MS 7: Accelerator Mass Spectrometry and Applications I

Time: Thursday 11:00–12:45 Location: f128

Invited Talk MS 7.1 Thu 11:00 f128

The ILIAS project - Isobar suppression in AMS by laser photodetachment — •Martin Martschini[1], Pontus Andersson[2], Oliver Forstner[3], Dag Hanstorp[4], Johannes Lachner[1], Yuan Liu[5], Tobias Moreau[1], Johanna Pitters[1,6], Alfred Priller[1], Peter Steier[1], and Robin Golser[1] — [1]VERA Laboratory, University of Vienna, Faculty of Physics, Austria — [2]Earth and Space Sciences Department, Chalmers Technical University, Gothenburg, Sweden — [3]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität, Jena, Germany — [4]Department of Physics, University of Gothenburg, Sweden — [5]Oak Ridge National Laboratroy, Oak Ridge, USA — [6]Beams Department, CERN

The ILIAS-project at the University of Vienna was initiated in 2010 to explore isobar suppression by selective laser photodetachment for future AMS purpose. A gas-filled radio frequency quadrupole is used to decelerate negative atomic and molecular ion beams from a cesium sputter source and thereby extend the ion laser interaction time. Following successful development and characterization of the RFQ cooler at a purpose-built test bench, the ILIAS cooler is currently moved to a new injector beamline at VERA. This will allow first applications of this novel technique at a state-of-the-art AMS facility.

Besides an overview of the project, the talk will highlight experimental results on the performance of the RFQ ion cooler. This includes the suppression of a $^{63}Cu^-$ test beam by more than 99.999% with a 532nm laser, optical filtering of MgO^- and AlO^- and comprehensive measurements of the ion residence time inside the RFQ ion cooler.

MS 7.2 Thu 11:30 f128

Status of the 300 kV multi isotope AMS project — •Sascha Maxeiner, Hans-Arno Synal, Marcus Christl, Martin Suter, Arnold Müller, and Christof Vockenhuber — Laboratory for Ion Beam Physics (LIP), ETH Zurich, Switzerland

The goal of the presented 300 kV multi isotope project is the development of a compact AMS system capable of measuring a wide range of isotopes including ^{10}Be, ^{14}C, ^{26}Al, ^{41}Ca, ^{129}I and the actinides. The high voltage platform for tandem acceleration is housed in a vacuum insulated chamber and fed by a commercial power supply. Helium stripper gas feeding from ground, compactness, good vacuum but sufficient areal stripper gas density are key features of the accelerator. Some of the latest technical improvements to achieve stable operation conditions will be discussed and results of AMS measurements with a prototype setup are presented.

MS 7.3 Thu 11:45 f128

Carrier free $^{10}Be/^9Be$ measurement with AMS — •Johannes Lachner[1], Marco Ploner[1], Aya Sakaguchi[2], Peter Steier[1], and Robin Golser[1] — [1]Faculty of Physics, University of Vienna, Austria — [2]Faculty of Pure and Applied Sciences, University of Tsukuba, Japan

Measuring $^{10}Be/^9Be$ ratios is a powerful tool to date marine deposits in the range of million years if it succeeds to determine minute amounts of the long-lived ^{10}Be and the stable ^9Be. The low abundance of Be in natural samples poses challenges to the preparation of samples and to very sensitive measurements of both ^{10}Be and ^9Be. The high efficiency of BeO^- extraction from the Fe_2O_3 target matrix in combination with a good transmission from the low energy side into the detector enables us to measure 0.1% of the total material during the first hour of sputtering a target. Ion source cross-contamination from intense standards and traces of Be taken up during the preparation of the targets currently limit the background to levels of 0.06 counts per second (^{10}Be) and 15 pA ($^9Be^{2+}$). We present the establishment of the carrier-free Be method at the VERA laboratory and show results of Fe-Mn crusts from the Pacific Ocean dated back to 17 Myr.

MS 7.4 Thu 12:00 f128

Improved ^{26}Al measurements with absorber setup at low energies — •Klaus-Ulrich Miltenberger, Marcus Christl, Arnold Milenko Müller, Hans-Arno Synal, and Christof Vockenhuber — Laboratory of Ion Beam Physics, ETH Zurich, Otto-Stern-Weg 5, 8093 Zurich, Switzerland

At the ETH 500 kV AMS facility (Tandy) transmission of more than 50% is achieved for aluminium ions in charge state 2+, enabled by the use of helium as a stripper gas in the accelerator. However, to utilize the high transmission for sensitive AMS measurements of ^{26}Al, the intense interference caused by $^{13}C^{1+}$ entering the detector has to be suppressed. To achieve this, a new absorber setup for low energy $^{26}Al^{2+}$ measurements was developed and tested.

Using the new absorber-detector configuration, several standards, blanks, and real samples were measured. Compared to earlier measurements conducted at the ETH 6 MV accelerator, the statistical measurement errors could be reduced significantly due to better counting statistics and more stable measurement conditions. The $^{26}Al/^{27}Al$ ratios measured for different standards (ZAL94N, Nishiizumi) correspond very well with their nominal ratios ranging from $5 \cdot 10^{-13}$ to $5 \cdot 10^{-10}$. Blank ratios are currently in the range of $1 - 3 \cdot 10^{-14}$ and limited by ^{26}Al cross-contamination in the SNICS ion source caused by the high ratio ($(480 \pm 18) \cdot 10^{-12}$) of the ZAL94N standard. To minimize cross-contamination the new ETH Zurich standard ZAL02 with a nominal $^{26}Al/^{27}Al$ ratio of $(46.5 \pm 0.1) \cdot 10^{-12}$ was introduced.

MS 7.5 Thu 12:15 f128

Online coupling of thermal-optical and 14C AMS analysis in atmospheric aerosols source apportionment — •Sönke Szidat, Konstantinos Agrios, and Gary Salazar — Universität Bern, Departement für Chemie und Biochemie & Oeschger-Zentrum für Klima- und Klimafolgenforschung, Bern, Schweiz

Radiocarbon (14C) is a powerful tool that allows the distinction of fossil and non-fossil sources of atmospheric carbonaceous aerosols. The total carbon fraction and its sub-fractions organic carbon (OC) and elemental carbon (EC) comprise a significant portion of the atmospheric fine air particulate matter, influencing the global climate and human health. The separation of OC and EC for 14C measurement is performed with a commercial thermo-optical aerosol analyzer that transforms thermal degradation products into gaseous carbon dioxide. Currently, these gas fractions are then analyzed for 14C with the accelerator mass spectrometry (AMS) system MICADAS either offline (i.e. by sealing of ampules) or by trapping with a zeolite molecular sieve and direct transfer. Although these techniques have been frequently applied with success, they suffer from a loss of information by mixing, as both fractions, OC and EC, comprise many individual chemical compounds. Therefore, we present here the development of a continuous-flow AMS analytical hyphenation. This approach allows for real-time 14C AMS analysis of carbonaceous aerosol samples, as they evolve sequentially from the thermo-optical aerosol analyzer according to their volatility and refractivity.

MS 7.6 Thu 12:30 f128

Speed Dating: A Rapid Way to Determine the Radiocarbon Age of Wood by EA-AMS — •Adam Sookdeo[1], Lukas Wacker[1], Simon Fahrni[1], Cameron P. McIntyre[1], Micheal Fredrich[2,3], Frederick Reinig[4], Bernd Kromer[2], and Ulf Büntgen[4] — [1]Laboratory of Ion beam physics, ETH-Zürich, Zürich Switzerland — [2]Institute of environmental physics, Heidelberg University, Heidelberg, Germany — [3]Institute of Botany, Hohenheim University, Stuttgart, Germany — [4]Swiss Federal Research Institute, WSL, Birmensdorf, Switzerland

Trees ranging from modern to 14000BP and older are discovered in construction sites, rivers and lake sediments, these trees contain information about past atmospheric 14C concentration that is used to create 14C calibration curve. When new trees are found the scientific value remains unclear until they are dated, this can be expensive and time consuming using conventional techniques. At the Laboratory of Ion beam Physics (LIP), we developed a new application called Speed Dating to quickly establish 14C dates for wood samples using an Elemental Analyzer (EA) coupled to an Accelerator Mass Spectrometer (AMS). For Speed Dating we do not chemical treat the wood samples but rather directly combust wood using an EA and the CO2(g) is measured by an AMS. This results in measurements times that are five times quicker than conventional 14C dating and are cheaper.