MS 8: Accelerator Mass Spectrometry I

Time: Thursday 15:45–17:15 Location: HS 2 Chemie

Invited Talk MS 8.1 Thu 15:45 HS 2 Chemie

LABEC, the INFN-university of florence laboratory of nuclear techniques (IBA and AMS) for environment and cultural heritage — •Franco Lucarelli — Department of Physics and Astronomy and INFN, Firenze, Italy

The LABEC laboratory, located in the Scientific and Technological Campus of the University of Florence, is the joint INFN-University of Florence laboratory of nuclear techniques (mainly Ion Beam Analysis (IBA) and Accelerator Mass Spectrometry (AMS)) for environment and cultural heritage. Although those techniques are well-established, a strong effort is put on their upgrade, making them suitable for more and more applications. The laboratory is based on a 3 MV Tandetron accelerator. There are many beam lines; in particular one is devoted to IBA application to Cultural Heritage, one to IBA applications for the study of atmospheric aerosol composition, one to AMS applications, mainly 14C dating with the graphite sample masses down to a few tens of μg of carbon (also for modern art objects). Switching between IBA and AMS operation is very easy and fast, which gives high flexibility in programming the activities. The facilities presently available at the LABEC laboratory, their technical features and some success stories of recent applications will be presented.

MS 8.2 Thu 16:15 HS 2 Chemie

Sample size series for CO_2 measurements with an EA-IRMS-GIS-AMS system at CologeAMS — •Martina Gwozdz[1], Stefan Heinze[1], Janet Rethemeyer[2], Markus Schiffer[1], and Dennis Mücher[1] — [1]University of Cologne, Institute for Nuclear Physics, Cologne, Germany — [2]University of Cologne, Institute for Geology and Mineralogy, Cologne, Germany

CO_2 sample materials such as soil samples or wood samples measured with AMS can be very versatile and often only little material is available. At CologneAMS we want to measure precise ^{14}C data in the ranges of approximately 5-100 μg of carbon. Most importantly, ultra-small samples containing approximately 2-20μg of carbon, need to be measured reliably and with a constantly low background. At CologneAMS we established a connection between an elemental analyser (EA), an isotope ratio mass spectrometer (IRMS) and the 6MV AMS system of CologneAMS as well as an existing gas interface (GIS) to measure these small CO2 samples. This setup provides a fully automated, online-analysis of $^{14}C/^{12}C$, and it delivers precise values for $\delta^{13}C$. We will present the first CO_2 sample size series of Ox-II standard measured with this system. Additionally, with the collaboration of the Dendrochronology laboratory in Cologne we want to use this system to establish a routine process for radiocarbon dating of pine trees, with the goal to improve dendrochronological archives in the ages of 13.000 years.

MS 8.3 Thu 16:30 HS 2 Chemie

Exposure dating using AMS of ^{36}Cl isotopes in $CaSO_4$ -containing sediments and evaporites — •Natasha Goaba Kalanke[1], Markus Schiffer[2], Erik Strub[3], Gregory Campbell Hillhouse[1], Michael Staubwasser[4], Steven Binnie[4], and Dennis Muecher[2] — [1]Department of Physics and Astronomy, Botswana International University of Science and Technology — [2]Institute of Nuclear Physics, University of Cologne — [3]Institute of Nuclear Chemistry, University of Cologne — [4]Institute of Geology and Mineralogy, University of Cologne

The cosmogenic nuclide ^{36}Cl is valuable for exposure dating due to its long half-life of 3.013E5 years, enabling accurate geochronological timelines. This study measures isotopic ratios of ^{36}Cl, ^{35}Cl and ^{37}Cl focusing on under-utilized gypsum ($CaSO_4$.2H2O) due to overlapping isotopic mass interference from ^{36}S. We are developing a novel chemical preparation method to suppress isobaric ^{36}S and enhance chlorine yield as AgCl(∼80-90%), validated by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES). The Anion Laser Isobar Separator (ALIS), employs laser photo-detachment principles for isobar suppression and ^{36}Cl transmission. Furthermore, ions are cooled within an advanced radiofrequency quadrupole (RFQ) system with a high-power 532 nm continuous-wave laser (>10 W). Initial ALIS transmission measurements with chemically optimized samples will be presented, along with the chemical protocol, and integration of ALIS to a 6 MV Tandem accelerator for improved ion beam emittance and superior isobar suppression.

MS 8.4 Thu 16:45 HS 2 Chemie

Advanced chemical sample preparation of soil and concrete for AMS measurements of ^{90}Sr — •Oscar Marchhart[1,2,3], Markus Schiffer[3], Martin Martschini[1], Silke Merchel[1], Melisa Maslo[3], Erik Strub[3], Laura Frost[4], Tibor Dunai[3], Dennis Mücher[3], and Robin Golser[1] — [1]University of Vienna, Faculty of Physics, Austria — [2]University of Vienna, Vienna Doctoral School in Physics, Austria — [3]University of Cologne, Faculty of Mathematics and Natural Sciences, Germany — [4]JEN Jülicher Entsorgungsgesellschaft für Nuklearanlagen mbH, Germany

An advanced sample preparation method for measuring ^{90}Sr ($T_{1/2}$ = 28.91 a) by Accelerator Mass Spectrometry (AMS) in soil and concrete samples has been developed. Based in general on published recipes, it increases the AMS measurement efficiency of ^{90}Sr for soil samples by 50% within the first hour of sputtering time. As earlier and newly prepared SrF_2 have the same chemical yield, we interpret the higher ion source output as less CaF_2 and other contaminations in SrF_2. For the first time concrete samples have been processed with chemical yields of SrF_2 >90% for AMS measurements. These were performed using the unique Ion-Laser InterAction Mass Spectrometry (ILIAMS) setup at the Vienna Environmental Research Accelerator (VERA), which achieves an isobar suppression of $>10^{12}$ for ^{90}Zr. The sample preparation and AMS measurements were validated using IAEA reference materials for soil, and with known LSC results for concrete. Within 1-sigma the AMS results are in good agreement and yield results for samples below the LSC limit due to the low detection limit of <0.1 mBq.

MS 8.5 Thu 17:00 HS 2 Chemie

Actinide work at MILEA during 2024 — •Habacuc Pérez-Tribouillier[1], Marcus Christl[1], Nuria Casacuberta[2,1], and Chrisrof Vockenhuber[1] — [1]Laboratory of Ion Beam Physics, ETH Zürich, Switzerland — [2]Department of Environmenta Systems Sciences, ETH Zürich, Switzerland

Among the main applications of the Multi-Isotope Low-Energy AMS (MILEA) system is the precise measurement of various elements within the actinide group. This work provides a comprehensive overview of studies conducted in 2024 that utilized actinide measurements performed at MILEA, with a particular emphasis on their contributions to Environmental Sciences. These studies address a broad spectrum of topics, ranging from the analysis of oceanographic processes to the assessment of direct and long-term environmental impacts of nuclear incidents. The versatility, extremely low background, and excellent sensitivity of MILEA enable ultra-low-level determinations, providing valuable insights into the transfer of actinides among different environmental compartments.