# MS 6: Accelerator Mass Spectrometry 2

Time: Thursday 10:30–12:00 Location: R 1.020

**Invited Talk** MS 6.1 Thu 10:30 R 1.020

**High precision radiocarbon analysis of annual tree-ring samples** — •Lukas Wacker, Stephanie Arnold, Silvia Bollhalder Lück, Marcus Christl, and Hans-Arno Synal — LIP, Otto-Stern-Weg 5, CH-8093 Zürich

Trees catalogued by dendrochronology are the most valuable source for radiocarbon calibration throughout the Holocene, as trees rings preserve atmospheric radiocarbon concentrations from the time they were formed. The longest continuous European tree ring chronology reaches back to 12 300 BP. However, the majority of the tree-ring based international radiocarbon calibration curve (IntCal13) is presently based on measurements with decadal resolution. We will show that highest precision radiocarbon analysis on annual tree-ring samples are now possible on a routine basis with compact AMS systems, which require less material than for previous measurements performed with decay counting. The newly acquired data will not only improve the next iteration of IntCal, but also carries new, high fidelity information about past solar activity and therefore will allow for synchronization with other not-so-well dated environmental archives.

MS 6.2 Thu 11:00 R 1.020

**Design of a new Gas Interface for biomedical $^{14}$C analyses** — •Daniele De Maria[1], Simon Fahrni[2], Lukas Wacker[1], and Hans-Arno Synal[1] — [1]Laboratory of Ion Beam Physics, ETH Zurich, Switzerland — [2]Ionplus AG, Dietikon, Switzerland

Radiocarbon analyses by accelerator mass spectrometry (AMS) have a great potential for biomedical applications, in particular in pharmacokinetic studies using $^{14}$C as a microtracer. Thus, the AMS approach for this research field was investigated in a validation study conducted in collaboration with Novartis (Basel, Switzerland) to evaluate the performance of the MICADAS. Since these studies require the measurement of a large number of samples in a short period of time, a key problem of AMS technology is its low sample throughput. Therefore, our aim is to develop a new gas handling system to achieve a faster measurement process for applications where low precision but higher throughput is required. The design of the new interface will be presented, focusing in particular on the strategies to overcome the time consuming cleaning procedure required after each sample to avoid cross-contamination.

MS 6.3 Thu 11:15 R 1.020

**Optimierung von $^{14}CO_2$-Gasmessungen am CologneAMS** — •A. Stolz[1], A. Dewald[1], S. Heinze[1], G. Zitzer[1], R. Altenkirch[1], M. Schiffer[1], S. Herb[1], C. Müller-Gatermann[1], A. Wotte[2], J. Rethemeyer[2] und T. Dunai[2] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut für Geologie und Mineralogie, Universität zu Köln

Zur Messung von $^{14}CO_2$-Gasproben wurde eine zweite HVEE SO-110B Sputterquelle mit einem Gasführungssystem von Ionplus AG am Kölner 6 MV Tandetron Beschleuniger installiert und weitere Optimierungen in Hinblick auf die Steigerung der Sputtereffizienz, Reproduzierbarkeit, und Betriebssicherheit durchgeführt. Darüber hinaus wurde ein EuroVektor EA3000 an das Gassystem angeschlossen und das Magazin des Gassystems von 8 auf 16 Proben erweitert. Zur Einbindung neuer Hardware und der Erweiterung des Funktionsumfangs wurde eine eigene Steuersoftware entwickelt. Unbeaufsichtigte Übernachtmessungen mit dieser Software wurden mit EA-Proben und Ampullen erfolgreich durchgeführt. Der Blankwert von Proben aus Glasampullen liegt bei $2...3{\cdot}10^{-15}$. Die Reproduzierbarkeit von typischerweise 0.5...1.5 % liegt im Rahmen der Zählstatistik. Zur Erhöhung der Betriebsstabilität wurde die Temperatur des Cs-Reservoirs von 130 °C auf 116 °C verringert. Die Sputtereffizienz beträgt mit den neuen Einstellungen 4...5 %. Ergebnisse zu Reproduzierbarkeit und Blankwerten für verschiedene Probengrößen und zu ersten Tests mit dem EA werden vorgestellt.

Das Projekt wurde teilweise aus Mitteln des ULDETIS Projekts der Universität zu Köln im Rahmen der DFG Exzellenzinitiative finanziert.

**Invited Talk** MS 6.4 Thu 11:30 R 1.020

**A Gas Ion Source and its extension by Laser Ablation for Online Radiocarbon Analyses** — •Christiane Yeman[1], Lukas Wacker[1], Bodo Hattendorf[2], Marcus Christl[1], Caroline Welte[1], and Hans-Arno Synal[1] — [1]Laboratory of Ion Beam Physics, ETH Zurich, Switzerland — [2]Laboratory of Inorganic Chemistry, ETH Zurich

In 2017, 5000 gaseous samples were analysed for radiocarbon with a versatile gas interface at the gas ion source of the MICADAS (MIniCArbonDAtingSystem) at ETH Zurich. It is a fast way for radiocarbon analysis, for many applications favored over graphitization due to higher sample throughput and the smaller sample sizes that are required.

Even faster radiocarbon analyses can be achieved by using the novel laser ablation (LA) interface coupled to the AMS. A full radiocarbon record can be collected in a single measurement. The sample surface is scanned with a focused pulsed laser beam of UV light producing a gas mixture of CO, $CO_2$ and $O_2$, which is directly and continuously introduced into the gas ion source of the MICADAS.

The pros and cons of the continuous online measurements of laser ablation are compared in detail with the routine sequential gas measurements using the versatile gas interface.