SAINTS@tlabs Course Framework

[**S**]outhern [**A**]frican [**I**]nstitute for [**N**]uclear [**T**]echnology and [**S**]ciences

Empowerment through education, training and practice

1 - 4 July 2024

Short Course: *An introduction to Accelerator Mass Spectrometry*

Facilitators:
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An **online** Accelerator mass spectrometry (AMS) course aimed at demonstrating, at least theoretically, that the mass-spectrometric technique which incorporates an accelerator, aptly called the AMS can achieve much higher sensitivities than are attainable with conventional mass spectrometers. Usually, the atoms to be counted are radioactive with a long half-life, and are rare. The archetypal example is ^{14}C, which has a half-life of 5730 years and an abundance in living organisms of 10^{-12} relative to stable ^{12}C. So, this is a needle in the haystack conundrum really come to life. **The course will be in offered in four sessions from the 1st to the 4th of July, 2024.**

• **Session 1 (1,0h)** This session will use radiocarbon dating to introduce new students to the general theory of AMS and the hardware that has made this a routine technique. To stimulate interest this introduction will cover applications out of the archives of AMS research at iThemba LABS. This includes climate change applications, groundwater dating, and heritage studies.

• **Session 2 (1,0h)** Production of Cosmogenic Nuclides in the Lithosphere including scaling factors. This session will emphasise the dependence cosmogenic nuclides on the earth's magnetic shielding, hoping to highlight that activity is higher at the poles than in the equator.

• **Session 3 (1,0h)** This session will demonstrate the sample preparation methods.
In this session it is shown that essentially similar protocols are followed requiring some chemistry. In this case and as an example, quartz mineral is purified from the sample and from this mineral, we extract the radionuclides, Al and Be. The methods are similar even for the other radionuclides. In this section there will be a brief introduction of online calculators.

• **Session 4 (1,0h)** Applications and archives of cosmogenic radionuclides that the group is already engaged in and the those the group is looking to extend to in the near future. In this session, the suite of applications of the cosmogenic radionuclides will be discussed to highlight that long-lived radionuclides in the environment provide important information on natural and

anthropogenic processes. It can be imagined that they are whispers from the past, we just have to listen intently. The presence and concentration reflect the balance of production and decay. Geological archives store such information and the nuclides can be chemically extracted from the bulk sample. The three different terrestrial archives will also be discussed as examples for radionuclide extraction using various chemical separation methods for subsequent AMS measurements, highlighting the cosmogenic radionuclides ^{10}Be and ^{26}Al, various anthropogenic actinide isotopes such as U, Pu, and Am as well as the astrophysical interesting nuclides ^{41}Ca, ^{53}Mn, and ^{60}Fe, and what information is can be deciphered from each of these archives.

Target audience: postgraduate students that are curious about other offerings with the organisation.
No. of lectures/contact sessions: 4 sessions of 1 hours each

Presentation venue: virtual (Zoom platform)
Course dates/times: 1– 4 July 2024, 11h30 to 12h30
Course registration deadline: 28 June 2024
Course registration link: **https://indico.tlabs.ac.za/event/135/**
Contact for queries on course: Rivoningo Khosa: **rkhosa@tlabs.ac.za**
Contact for general queries: saintsadmin@tlabs.ac.za