Optimization of Beryllium-10 Detection using a 1MV AMS System

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Introduction: Accelerator Mass Spectrometry (AMS)
The Spanish Accelerator for Radionuclide Analysis (SARA) implements AMS, an accelerator technique, used to detect radioactive isotopes at extremely low levels by accelerating ions to extraordinary high kinetic energies before mass analysis. The special strength of AMS among the mass spectrometric methods is its power to separate a rare isotope from an abundant neighboring mass (e.g. Be from B).

Strategy & Analysis
1. Speculation
- Optimal 10Be Detection is achievable with effective & maximum Suppression of 10B
- Multiple parameters contributing to total sensitivity for 10Be Detection.

Sample | Magnet | Detector
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10Be | 10B |

2. Suppression Methods
- Passive Absorber: 10Be is injected as BeO
- 10B is suppressed with the aid of a passive absorber.
- A passive absorber is placed at the High Energy side.
- Be and B lose different energies due to their respective stopping powers. Hence, they are partially separated by the Electrostatic Analyzer.
- Sample Preparation: F-Be Compound
- 10B is suppressed during the sample preparation process at a factor of 10^4.
- No need to use a passive absorber: higher transmissions. However, extracted currents at the ion source are very low.
- Analyzing Magnet

The Analyzing Magnet at the Spanish Accelerator for Radionuclide Analysis (SARA) reduces the amount of scattering from particles that contribute to noise at the detector site.

3. Proposed Comparative Study
- New Detector vs. Old Detector
- We intend to repeat the previous experiments at CNA with the aid of a new detector designed and built by ETH. We also hope to use the settings and system at ETH as a model for improved measurements of 10Be.

Results from ETH 0.6 MV AMS system using the New Detector Design 10Be detection.

Summary
To summarize, we intend to use the most recent experiment at ETH as a model to continue the measurements on the optimization of 10Be detection. We hope to improve the previous measurements at CNA with the addition of a new detector built by ETH, sample preparation and possibly an additional magnet. Furthermore, we expect more sensitive results with the setup at the CNA laboratory because it is equipped with a 1MV AMS system compared to that of the 0.6 MV system at ETH.

Future Direction
Use the existing AMS system to detect other long lived radioisotopes (Al, C, I, Pu).

Spectrum of a BeO Sample after passage through 490 nm Si3N4 absorber in front of the gas ionization detector.

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