Contribution ID: **1092**

Type: **Oral (Non-Student) / orale (non-étudiant)**

CaF3-/KF3- on-line separation methods and the present 41Ca/Ca sensitivity at AEL-AMS

Wednesday 15 June 2016 09:15 (15 minutes)

The use of 41Ca as a sensitive long-period tracer for osteoporosis diagnoses is made possible by accelerator mass spectrometry (AMS), with which CaF3- ions are produced and the resulting MeV positive 41Ca ions are counted. When the ion energy is sufficiently high, 41Ca and its interfering isobar 41K can be well separated by their dE/dx differences in the final ionization detector. Such applications to the populace at large, however, still await the creation of efficient small (<1MV) AMS systems that can still have a sufficiently high abundance sensitivity (41Ca/Ca~1e-13 or better). At present, small AMS systems do not have effective means to separate 41Ca from 41K on-line. Two potential methods have been explored in Canada, one exploits the molecular binding differences in CaF3- and KF3-, and the other exploits the yield differences when CaF3- and KF3- are partially fragmented into CaF+ and KF+. While these are being further developed at Lalonde AMS of uOttawa, its existing capability for 41Ca analysis using the AMS system as is, has also been determined. The 41Ca/Ca abundance sensitivity using the straightforward fast sequential injection technique between 41CaF3- and 40CaF3-, is found to be ≤5e-13 with the 3MV tandem accelerator running at its designed upper voltage limit. This is already adequate for supporting 41Ca medical research at the new and presently the only AMS facility in Canada.

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Session Classification: W1-6 Instrumentation for the Detection of Low-Level Radioactivity (DIMP) / Appareillage de détection de radioactivité de faible intensité (DPIM)

Track Classification: Instrumentation and Measurement Physics / Physique des instruments et mesures (DIMP-DPIM)