THE ACTINIDE BEAMLINE - A NEW AMS FACILITY AT ANTARES

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At the ANTARES accelerator a new beamline has been commissioned, incorporating new magnetic and electrostatic analysers, to optimise the efficiency for Actinides detection by Accelerator Mass Spectrometry. The detection of Actinides, particularly the isotopic ratios of uranium and plutonium, provide unique signatures for nuclear safeguards purposes. We are currently engaged in a project to evaluate the application of AMS to the measurement of Actinides in environmental samples for nuclear safeguards. Measurement of ^{236}U is of particular interest as a means of tracing the anthropogenic component of uranium. ^{236}U is expected to be present in natural samples at an extremely low level (^{236}U:^{238}U ratio ~10^{-10}). It has recently been demonstrated[1] that AMS has sufficient sensitivity to detect ^{236}U at this level. Other applications of ultra-sensitive detection of Actinides are also under consideration.

The principal components of the new beamline are:

1. electrostatic quadrupole in the accelerator tank to focus high-mass beams;
2. 12° electrostatic deflector (radius 5m, gap 25mm, E/q = 16MeV);
3. 90° electrostatic analyser (radius 2.5m, gap 25mm, E/q = 8MeV);
4. 90° magnet (radius 2m, gap 50mm, ME product = 250);
5. multi-isotope detection system including ion counters and Faraday cups.

The design considerations which have led to the above choices of specification include (1) sufficient bending power to allow selection of charge states close to the peak charge state with argon gas stripping in the accelerator terminal; (2) energy resolution sufficient to separate molecular interferences such as ^{235}UH from ^{236}U; (3) matched magnetic deflection, capable of clean resolution of neighbouring masses at mass ≈ 240.

The beamline was completed in September 1998 and tests are currently underway. Initial tests have been performed with iodine samples, which we have previously measured and have ^{129}I:^{127}I isotopic ratios in the range 10^{-10} to 10^{-12}. Figure 1 shows a scan of the 90° magnet for ^{129}I at 36 MeV, with a 4mm slit width, illustrating the high resolving power of the system.

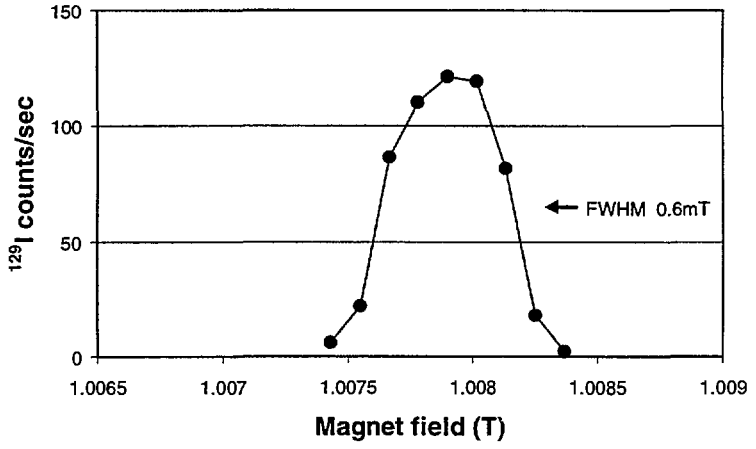

Figure 1.

[1] X.-L. Zhao, M.-J. Nadeau, L.R. Kilius and A.E. Litherland, Nucl. Instr. & Meth. B92 (1994) 249.