Solenogam – A novel spectrometer for characterising isomeric states*

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A new recoil spectrometer has been designed and constructed at the Heavy-Ion Accelerator Laboratory of the Australian National University. The device will be used to fully characterise the structure of nuclear excitations in neutron-deficient nuclei, with an initial focus on the mercury-lead region, where many of the features of these isotopes are attributed to shape-coexistence [1]. The understanding of the underlying physical processes is an extremely important component in defining the key ingredients of a successful mean-field theory of nuclear matter. Some initial results regarding an isomer in ^{189}Pb, now interpreted as the head of a magnetic rotational band, have already been published [2].

The original recoil spectrometer combines a compact 6.5T superconducting solenoidal separator for fusion studies, SOLITAIRE [3] with a highly sensitive array of photon and conversion electron spectrometers. A new 8T solenoid is currently being installed, improving the capability of the system for more asymmetric reactions. Fusion-evaporation residues produced by heavy ions from the ANU 14UD Tandem accelerator are transported by the magnetic field to the focal plane, located 1.8 m from the production target. Typical flight times of ~300 ns will allow the full exploration of short lived nuclear states that are usually not accessible with competing devices [3,4] that are significantly larger in size.

We have recently been preparing the system for installation on the new solenoid, and have been making preliminary measurements of the effects of recoil implantation depth on the electron resolution of the system, with a view to designing energy degraders to control the implantation depth and optimise the electron resolution. Details of the system, as well as the results for ^{189}Pb and the electron straggling measurements, will be presented.

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[1] K. Heyde and J.L. Wood, *Rev. Mod. Phys.* **83**, 1467 (2011).
[2] G.D. Dracoulis, G.J. Lane, T. Kibédi, and P. Nieminen, *Phys. Rev. C* **79**, 031302(R) (2009).
[3] M.D. Rodríguez *et al.*, *Nucl. Instr. and Meth. A* **614**, 119 (2010).
[4] M. Leino, et al., *Nucl. Instr. and Meth. B* **99**, 653 (1995).
[5] C.N. Davids, et al., *Nucl. Instr. and Meth. B* **70**, 358 (1992).