Gamma ray spectroscopy using radioactive beams at Notre Dame

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Gamma ray spectroscopy has been performed from fusion evaporation reactions produced by a radioactive beam of ^{6}He on a Copper target. Only one other radioactive beam spectroscopy experiment has been published to date [1] making this a state of the art apparatus. There are consequently many experimental difficulties to overcome in the design of any such facility, and these will be discussed.

The radioactive beam facility at the University of Notre Dame nuclear structure laboratory [2-4] was used to produce a beam of ^{6}He at an energy of 28 MeV and with an intensity of 5×10^5 pps. This radioactive beam was produced by 1 proton transfer from a ^{7}Li primary beam on a gas cooled ^{9}Be target. The secondary beam was separated from non-reacting primary beam using the 'Twinsol' dual superconducting magnet apparatus, and was then incident on a target of natural (63% ^{63}Cu) copper. Two large volume HPGe detectors were used to detect gamma rays from excited states in the secondary fusion evaporation reaction fragments, and coincidence spectra will be presented.

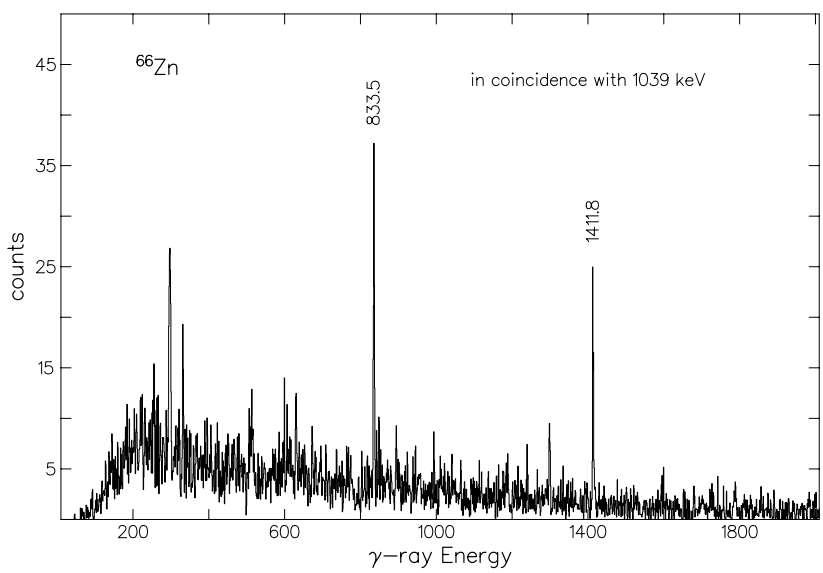

FIG. 1. Coincidence spectrum from reaction of radioactive ^{6}He on ^{63}Cu, gated by $2^+ \rightarrow 0^+$ in ^{66}Zn.

[1] W. Catford *et al.*, Nucl. Instr. Meth **A371** (1996) 449

[2] J.J. Kolata, A. Morsad, X.J. Kong, R.E. Warner, F.D. Becchetti, W.Z. Liu, D.A. Roberts, J.W. Jänecke, *Nucl. Instr. Meth. Phys. Rev. Sect.* **B40/41**, 503 (1989).

[3] F.D. Becchetti and J.J. Kolata, *Application of Accelerators in Research and Industry*, edited by J.L. Duggan and I.L. Morgan, AIP Conf. Proc. No. 392 (AIP Press, New York, 1997), 369-375.