BACKGROUND SUPPRESSION USING SEGMENTED HPGe DETECTORS*

M. Cromaz, R.M. Clark, M.A. Deleplanque, M. Descovich, R.M. Diamond, P. Fallon, I.Y Lee, A.O. Macchiavelli, F.S. Stephens, D. Ward
Lawrence Berkeley National Laboratory, Berkeley, CA, 94720, USA

Key experiments on nucleosynthesis in stellar evolution involve laboratory measurements of several low energy, very low cross-section capture reactions. Such measurements are background limited when performed in normal kinematics as the detection of a single gamma ray is the only indication that the reaction took place. The sources of background include cosmic-ray induced gammas and neutrons as well as beam-induced backgrounds due to light target impurities. Currently, the dominant cosmic-ray induced backgrounds are addressed through the use of passive shielding, with several recent experiments being performed in deep underground sites, and by the use of active scintillation shields.

With the advent of gamma-ray tracking detectors using segmented HPGe detectors, background suppression through the rejection of gamma rays that do not originate from the target is now feasible. This can be accomplished through Compton tracking and by taking advantage of the self-shielding properties of the detector itself. Simulations carried out for single, segmented Ge crystals show that, in background limited cases, factors of two reduction in running time can be easily achieved as compared to conventional (non-segmented) Ge detectors. I will discuss the techniques which can be employed to distinguish target-like from backgound-like gamma rays and discuss the practical gains and limitations of using segmented detectors in this application.

* This work has been supported by the U.S D.o.E. under Contract No. DE-AC03-76SF00098