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Determining Linac Beam Energy from C-11/O-15 Activity Ratios in Polymers[1] RYAN CARDMAN, Allegheny College , MATTHEW SHEPHERD, Indiana University, Bloomington — A method for precisely measuring the beam energy of 20-25 MeV electron linear accelerator was developed. Polyoxymethylene (Delrin) and poly(methyl methacrylate) (acrylic) samples were irradiated with an electron linac at several energy settings of the accelerator simultaneously producing C-11 and O-15 via photonuclear reactions within each of the polymers. Using gamma-ray spectroscopy the activity ratios of C-11/O-15 were measured by analyzing the decay of activity vs. time. The C-11/O-15 ratio exhibits an energy dependence due to differences in the production cross section vs. energy. The observed dependence can be matched to predictions of the activity ratio vs. energy, developed from GEANT4 Monte Carlo models of an electromagnetic shower and knowledge of the cross sections, in order to determine the energy of the beam at a sub-MeV level of precision.

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