

Medical Isotope Production Utilizing Photonuclear Interactions

by

Benjamin Christopher Lawrence

A Thesis Submitted to the Graduate
Faculty of Rensselaer Polytechnic Institute
in Partial Fulfillment of the
Requirements for the degree of
MASTER OF SCIENCE
Major Subject: NUCLEAR ENGINEERING

Approved:

Dr. Yaron Danon, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York
December, 2011

ABSTRACT

Interest in producing medical isotope supplies in the United States has increased with the temporary closing of key isotope reactors in Canada. Current production methods utilize nuclear reactors, which are based on neutron interactions. However, some isotopes do not lend themselves to be produced easily through this pathway, and research into more efficient production methods is necessary. One possibility is the use of linear accelerators, utilizing a variety of target arrangements.

The focus of this research is on linear accelerators that employ a tantalum target to produce Bremsstrahlung photons. Design of this target and the experimental foils was considered, as well as the parameters at which to operate the linear accelerator. The goals of this research are to explore isotope production methods that utilize photonuclear interactions using simulations and to verify these results through experiments. The MCNP code was used to simulate the production yield of specific isotopes. These results were then compared to experimental production yields making use of the RPI Linear Accelerator to validate the simulations.