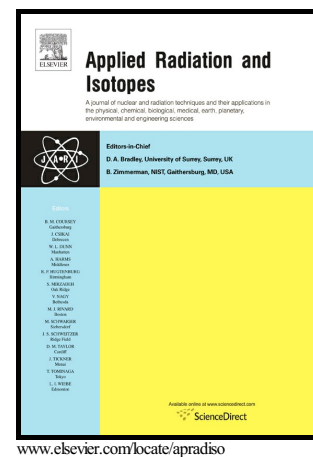


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# Characterisation of the secondary neutron field generated by a compact PET cyclotron with MCNP6 and experimental measurements

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## Abstract

The production of the most common used PET radioisotope Fluorine-18 with commercial cyclotrons is obtained from the  $^{18}\text{O}(\text{p},\text{n})^{18}\text{F}$  nuclear reaction when  $^{18}\text{O}$ -enriched water is bombarded with a proton beam. We present the characterization of the secondary neutron field spectra produced by this reaction in different locations around the cyclotron, through a comparison between MCNP6 Monte Carlo simulation results and experimental data obtained with Neutron Activation Analysis (NAA) of thin target foils of different materials.

## Keywords

Cyclotron, gamma spectrometry, Monte Carlo simulations, neutron activation analysis, neutron spectrum, Positron Emission Tomography

## 1. Introduction

During the last fifteen years, PET (Positron Emission Tomography) has become a widely used functional imaging technique for determining biochemical and physiological processes in vivo by using radiopharmaceuticals labeled with positron-emitting radio-nuclides such as  $^{11}\text{C}$ ,  $^{13}\text{N}$ ,  $^{15}\text{O}$  and  $^{18}\text{F}$  and by measuring the annihilation radiation using a coincidence technique. The radioactive substances administered to the patients are mostly produced by commercial cyclotrons. These PET isotopes have short half-lives directly produced at health centers or at least nearby. During isotopes

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