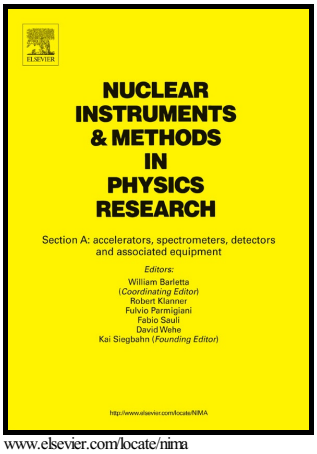

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Proton Therapy treatment monitoring with in-beam PET: investigating space and time activity distributions

L. Brombal[a,*], D. Barbosa[b], N. Belcari[b], M.G. Bisogni[b], N. Camarlinghi[b], L. Cristoforetti[c], A. Del Guerra[b], F. Fracchiolla[c], M. Morrocchi[b], G. Sportelli[b], R. Righetto[c], M. Schwarz[d], A. Topi[e], V. Rosso[b]

[a] *Department of Physics, University of Trieste and INFN, Trieste, Italy*
[b] *Department of Physics, University of Pisa and INFN, Pisa, Italy*
[c] *Proton Therapy department, Trento Hospital, Trento, Italy*
[d] *Proton Therapy department, Trento Hospital and TIFPA INFN, Trento, Italy*
[e] *Department of Physical Sciences, Earth and Environment, University of Siena and INFN, Pisa, Italy*

Abstract

In this study the possibility of retrieving composition information in proton therapy with a planar in-beam PET scanner is investigated. The analysis focuses both on spatial activity distributions and time dependence of the recorded signal. The experimental data taking was performed at the Trento Proton Therapy Center (IT) by irradiating three different phantoms. We show that different phantom compositions reflect into different activity profile shapes. We demonstrate that the analysis of the event rate can provide significant information on the phantom elemental composition, suggesting that elemental analysis could be used along with activity profile analysis to achieve a more accurate treatment monitoring.

Keywords: Particle Therapy, In-beam monitoring, PET

1. Introduction

Radiotherapy is one of the key players in modern cancer treatment and roughly 45% to 55% of cancer patients require radiotherapy at some point [1]. The goal of the treatment is to deliver a high conformal dose to the tumor region, minimizing the dose to the surrounding tissues.

Proton therapy is a leading edge radiotherapy technique which allows the delivery of high-dose in well-defined volumes (Bragg-peak) significantly reducing the absorbed dose in the sorroundings. However, due to the steep dose profile of protons, this technique is much more sensitive to spatial uncertainties than conventional photon treatments. In fact, uncertainties in particle range, unexpected anatomical changes and patient or accelerator

*Corresponding author, University of Trieste, building F - Via Valerio, 2 - 34127 Trieste, Italy. Tel.: +39 040 558 3395.

Email address: luca.brombal@ts.infn.it (L. Brombal)