Accepted Manuscript

A fully automated and scalable timing probe-based method for time alignment of the LabPET II scanners

Arnaud Samson, Christian Thibaudeau, Jonathan Bouchard, Émilie Gaudin, Caroline Paulin, Roger Lecomte, Réjean Fontaine

NUCLEAR
INSTRUMENTS
& METHODS
IN
PHYSICS
RESEARCH
Setton A Accelerator, spectrometer,
detectors and associate conjument
Father
Construint prices
Construint
PII: S0168-9002(18)30065-2

DOI: https://doi.org/10.1016/j.nima.2018.01.049

Reference: NIMA 60475

To appear in: Nuclear Inst. and Methods in Physics Research, A

Received date: 21 September 2017 Revised date: 10 January 2018 Accepted date: 15 January 2018

Please cite this article as: A. Samson, C. Thibaudeau, J. Bouchard, Ġaudin Bouchard, C. Paulin, R. Lecomte, R. Fontaine, A fully automated and scalable timing probe-based method for time alignment of the LabPET II scanners, *Nuclear Inst. and Methods in Physics Research*, A (2018), https://doi.org/10.1016/j.nima.2018.01.049

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

*Manuscript

Click here to view linked References

- A Fully Automated and Scalable Timing Probe-Based
- ² Method for Time Alignment of the LabPET II Scanners
- Arnaud Samson^a, Christian Thibaudeau^b, Jonathan Bouchard^a, Émilie Gaudin^b, Caroline Paulin^a, Roger Lecomte^b, Réjean Fontaine^a
- ^aDepartment of Electrical and Computer Engineering, Institut interdisciplinaire d'innovation technologique, Université de Sherbrooke, QC, Canada J1K 2R1
- b Sherbrooke Molecular Imaging Center and Department of Nuclear Medicine and Radiobiology, Université de Sherbrooke, Sherbrooke, QC, Canada J1H 5N4

9 Abstract

A fully automated time alignment method based on a positron timing probe was developed to correct the channel-to-channel coincidence time dispersion of the LabPET II avalanche photodiode-based positron emission tomography (PET) scanners. The timing probe was designed to directly detect positrons and generate an absolute time reference. The probe-to-channel coincidences are recorded and processed using firmware embedded in the scanner hardware to compute the time differences between detector channels. The time corrections are then applied in real-time to each event in every channel during PET data acquisition to align all coincidence time spectra, thus enhancing the scanner time resolution. When applied to the mouse version of the LabPET II scanner, the calibration of 6 144 channels was performed in less than 15 min and showed a 47% improvement on the overall time resolution of the scanner, decreasing from 7 ns to 3.7 ns full width at half maximum (FWHM).

- 10 Keywords: Positron Emission Tomography (PET), Timing Probe, Time
- 11 Alignment

2 1. Introduction

- Time of arrival of 511 keV photons in detectors is a key measurement in PET
- scanners. This information is mandatory to detect true coincidences. Inherent
- 15 statistical fluctuations in photon generation, electronic noise, time walk due to

Download English Version:

https://daneshyari.com/en/article/8166467

Download Persian Version:

https://daneshyari.com/article/8166467

Daneshyari.com