Research and development of a new PET detector module

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Research and Development of a New PET Detector Module

A thesis submitted in fulfilment of the requirements for the award of the degree

Master of Science - Research

from the

UNIVERSITY OF WOLLONGONG

by

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2007
Research and Development of a New PET Detector Module

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Abstract - A proposed new positron emission detector module was developed and researched with the aim to produce accurate depth of interaction information utilising high yield scintillators optically coupled to Si photodiode arrays with high end low noise readout electronics. The design of the detector module has been simulated using Monte Carlo techniques to model the interaction of scintillation photons within the silicon photodiode arrays. The optimal scintillation crystal was also investigated using code developed at the University of Wollongong.

The design of n-Si pixel photodiode allows for the attachment of a 25x25 mm² scintillator crystal on the p⁺ side of the photodiode. A special boron ion implantation technique will be used to produce a p⁻ layer that is optically coupled to the scintillator crystal. The aim is to enhance the time properties of the detector module in coincidence mode, due to the fast hole collection near the surface of the p⁺ region.

The light collection properties of the proposed detector module was characterised using empirical and monte carlo methods.
Declaration
I declare that the work of this thesis is my own original work and does not exceed 30,000 words.

Michael Bailey

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Thanks most of all to my wonderful wife, Kerrilyn and beautiful daughter, Eleanor. Your love, inspiration, encouragement and most of all understanding have been the only reason I have been able to complete this project - at last!

“Anything lost can be found again – except for time - TIME WASTED”
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