**Development of extracorporeal radiation detector to non-invasively measure arterial $^{18}$F-FDG concentration**

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Positron emission tomography (PET) using a radioactive glucose analogue ($^{18}$F-FDG) is an important oncologic imaging modality. Currently, oncologic $^{18}$F-FDG-PET images are primarily reported based on visual interpretation by highly-trained medical experts. As the aggressiveness of tumours typically correlates to tumour glucose consumption, quantitative analysis of $^{18}$F-FDG-PET images has been shown to improve the interpretation and clinical value of oncologic PET images.
In clinical routine, typically a single whole-body PET scan is performed at 60-90 minutes after $^{18}$F-FDG administration. However, this approach does not allow tumour $^{18}$F-FDG uptake kinetics to be recorded and only semi-quantitative metrics, such as the standardized uptake value (SUV), can be obtained.
By correcting the SUV for the total amount of $^{18}$F-FDG that was available to the tumour between administration and PET scanning, more reliable information on tumour glucose consumption can be obtained. This is achieved by assessing the tumour fractional uptake rate (FUR) which can be derived from the clinically used SUV and the time-integrated arterial $^{18}$F-FDG concentration. However, current techniques to accurately measure the arterial $^{18}$F-FDG concentration consist of invasive arterial blood sampling or expensive and time consuming dynamic PET acquisitions. Consequently, these techniques are not compatible with the current clinical workflow.

**AIM:** The aim of this project is to design an extracorporeal radiation detector system to non-invasively measure the arterial $^{18}$F-FDG concentration over time outside the PET scanner.

This is achieved by investigating the concept of measuring the small periodic fluctuations in radiation levels outside the patient caused by cardio-ventricular contractions or arterial vessel pulsations using realistic Monte Carlo simulations. Ultimately, this measuring concept will result in the development of new type of medical device system to non-invasively assess arterial radiotracer concentrations. Successful development of such a medical device may improve the clinical value of oncologic PET imaging and nuclear imaging in general.