Study of the Optimisation of the CT Transmission Parameters

for the Attenuation Correction of PET Data

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Aims and Objectives. Time-of-flight (TOF) PET improves localization of events along coincidence lines-of response by employing very fast detectors. In this work, we aimed to investigate the clinical benefit of TOF in terms of minimising CT attenuation artefacts caused by presence of metallic implants in patients. Additionally, we aimed to study the lowest CT dose that can provide adequate attenuation correction of the TOF-PET data and comparison with non-TOF-PET data.

Method. An anthropomorphic torso phantom incorporating multiple lesions was scanned on a PET/CT scanner with TOF capabilities. To simulate a clinical situation the phantom was scanned with and without a pacemaker attached to the exterior of the phantom. This was followed by acquiring multiple CT acquisitions with varying parameters and therefore varying dose. The data was then reconstructed using different reconstruction methods and a comparison of the different methods were made in terms of contrast recovery coefficient of the lesions (CRC), coefficient of variation (COV) and signal-to-noise-ratio (SNR**).**

Results.

The results show that image artefacts are significantly reduced by incorporation of TOF information. In addition, it was found that increasing the mA of the CT tube from 30 to 150 mA did not make a significant difference in the quality of the PET images. This was evident from visual analysis of the images as well as quantitative

evaluation of CRC of the lesions and COV in the background. However, an increase of the kVp of the tube from 80 to 100 kVp showed a reduction in COV of approximately 6%. Overall, it was proven that TOF reconstructions outperformed non-TOF reconstructions, providing a significant improvement in image quality.

Conclusions. Incorporation of TOF information into clinical data can reduce image artefacts caused by metal implants and ultimately improving the clinical management of patients. Additionally, TOF can also lead to a significant reduction in patient dose without compromising the PET image quality.