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## Increasing the location rate of Positron Emission Particle Tracking (PEPT) measurements at PEPT Cape Town

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Positron Emission Particle Tracking (PEPT) is a non-invasive particle tracking technique used to study particle and fluid transport in a range of applications, including medicine and chemical engineering. PEPT produces time-series 3D location data, however the output rate of locations is limited by the timing resolution of the equipment used. At PEPT Cape Town at the University of Cape Town, the in-house positron emission tomography (PET) scanner is a Siemens "EXACT3D" HR++ which records coincidence data to the nearest "timestamp" of 1 ms. Therefore a maximum location rate of 1 kHz is used for PEPT measurements to avoid introducing additional uncertainty to the time of each location measurement. For some applications, this is insufficient to track the highest frequency components of the motion of the tracer particle. To investigate the uncertainty in the time of each location, we developed a simulation of the HR++ and moving tracer particles in GEANT4 (GEometry ANd Tracking 4) Application for Tomographic Emission (GATE). Our results suggest a value for the uncertainty in the time measurement of each location and ways in which the precision of the time of each coincidence event can be increased. The implementation of PEPT measurements with higher locations rates will improve the accuracy of measurements of the average velocity of the tracer particle, which is especially important for tracking the fluctuating velocity components characteristic of turbulent flows.

### Apply to be considered for a student ; award (Yes / No)?

Yes

### Level for award;(Hons, MSc, PhD, N/A)?

PhD

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