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Development of 18F Radiochemistry for Positron Emission Particle Tracking (PEPT)

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Positron Emission Particle Tracking (PEPT) is a radioactive tracer technique used to determine the trajectory of a positron emitting macroscopic particle used as a flow follower. The nearly collinear 511 keV gamma ray pairs resulting from positron annihilation are detected in dedicated arrays. The tracking efficiency and performance is dependent on the physical properties of the tracer, particularly the achievable positron activity. The primary application of PEPT is to study dynamic flow systems under varying conditions; including a wide range of particle size distributions, physical, and chemical properties (e.g. densities, shapes, surface chemistry, friction coefficients, etc.), with applications across the science disciplines.

We are developing tracer particles for PEPT applications based on the radioisotope 18F. Radiochemical and physical methods are being explored to produce tracer particles representative of the system under study with respect to size, density and shape. In radiochemical tracer particle production, we extract 18F from commercially available 18-fluorodeoxyglucose (18FDG) and implement ion-exchange techniques to label small phase-representative resin particles (diameter < 1mm). For physical activation we utilise the novel reaction 16O(alpha,pn)18F using 100 MeV alpha particles produced by the iThemba LABS separated sector cyclotron (SSC) to produce 18F in-situ for larger particles (>5mm diameter).

This work will develop iThemba LABS specific tracer particle production mechanisms using 18F for the first time. The effects of tracer particle properties in PEPT applications, including optimisation of the PEPT technique and enhanced tracer production mechanisms, will be discussed.

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

Yes

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

MSc

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