



Contribution ID: 204

Type: Oral

Flow measurement and characterisation from positron annihilation

Monday, 20 September 2021 14:50 (20 minutes)

Flow following tracer particles containing short lived positron emitting species are placed inside physical and engineering devices. The pairs of photons produced by positron annihilation are detected in coincidence by large arrays of high speed position sensitive detectors, and used to determine the near-instantaneous position of the tracer. Hence the resulting bulk dynamics occurring inside the device are inferred in a technique known as Positron Emission Particle Tracking (PEPT).

At the largest multidisciplinary national research facility in South Africa, the iThemba Laboratory for Accelerator Based Sciences (iThemba LABS), PEPT is used by the University of Cape Town group to study dynamic physical processes, turbulent, and multiphase flow phenomena. Such studies are of interest to industry, particularly in the South African context of mining and minerals processing. Further applications address global challenge topics including problems of water scarce environments, reducing industrial wastes, and towards sustainable economies through improved process efficiencies and design led approaches.

The applications of PEPT, and alternative complimentary measurement techniques, have enabled the development of flow metrology systems applicable to real world problems. Recent research produced by the PEPT Cape Town laboratory will be discussed, including aspects of our four key themes: instrumentation & detector development, radioisotope tracer techniques (physical and chemical), data acquisition & processing, and applications.

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Session Classification: Session 3

Track Classification: Applied Nuclear Physics