

Multi-Functional Positron Beam for the Coincident Measurement of the Energy Spectra of Doppler-Shifted Annihilation Gamma Quanta and Positron Annihilation-Induced Electrons

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Preliminary results are presented which were collected using a new positron beam system at the University of Texas at Arlington (Figure 1). The beam allows for the coincident measurement of the energy of Doppler-shifted annihilation quanta and time-coincident positron-induced electrons. Previous apparatus have allowed for the coincident measurement of the energies of annihilation gamma rays and annihilation-induced Auger electrons, but only for electrons emitted into a narrow range of energies [1]. The system reported here allows for the parallel collection of a 2-dimensional array of coincident pairs of gamma and electron energies over the full energy range of relevance. The array is constructed from a digital analysis of the pulses resulting from the detection of electrons by a micro-channel plate in coincidence with the pulses resulting from the detection of associated annihilation gamma rays. The system can be used with a NaI (Tl), BaF₂, or HPGc gamma detectors depending on the experiment. Additionally, in-house developed software permits the system to acquire multi-electron spectra, allowing for the observance of multi-electron processes.

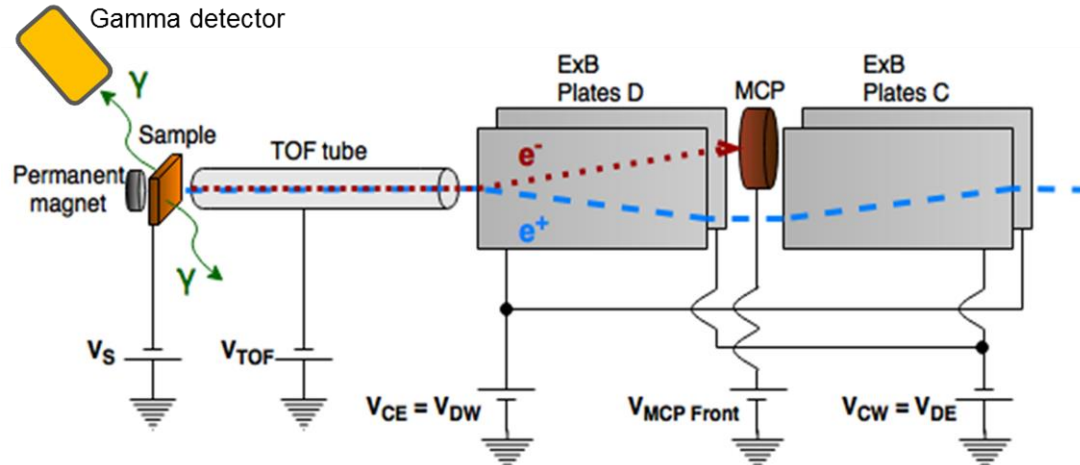


Figure 1 Schematic of the inner ion optics of the positron beam apparatus displaying the paths of the positron beam and resulting positron-induced electrons from the sample surface. The type of gamma detector can be interchanged depending on the type of experiment.

References

[1] S. Kim, A. Eshed, S. Goktepli, P.A. Sterne, A. R. Koymen, W. C. Chen and A. H. Weiss, *Phys. Rev. B.* **73**, 014114 (2006).

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