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Modeling of the energy resolution of a 1 meter and a 3 meter time of flight positron annihilation induced Auger electron spectrometers.[1]
A FAIRCHILD, V CHIRAYATH, R GLADEN, A MCDONALD, Z LIM, M CHRYSLER, A KOYMEN, A WEISS, Univ of Texas, Arlington — Simion 8.1®simulations were used to determine the energy resolution of a 1 meter long Time of Flight Positron annihilation induced Auger Electron Spectrometer (TOF-PAES). The spectrometer consists of: 1. a magnetic gradient section used to parallelize the electrons leaving the sample along the beam axis, 2. an electric field free time of flight tube and 3. a detection section with a set of ExB plates that deflect electrons exiting the TOF tube into a Micro-Channel Plate (MCP). Simulations of the time of flight distribution of electrons emitted according to a known secondary electron emission distribution, for various sample biases, were compared to experimental energy calibration peaks and found to be in excellent agreement. The TOF spectra at the highest sample bias was used to determine the timing resolution function describing the timing spread due to the electronics. Simulations were then performed to calculate the energy resolution at various electron energies in order to deconvolute the combined influence of the magnetic field parallelizer, the timing resolution, and the voltage gradient at the ExB plates. The energy resolution of the 1m TOF-PAES was compared to a newly constructed 3 meter long system. The results were used to optimize the geometry and the potentials of the ExB plates for obtaining the best energy resolution.

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