This experiment is well-defined and, as a result, is easily simulated. One can conclude that EGS4 will predict photon conversion efficiencies rather well, at least in the energy range 30-200 MeV, and for geometries similar to the one described here.

To further aid in our understanding of the physical events taking place, we can use the SHOWGRAF package to draw particle trajectories. Figure 6 shows the electron-positron tracks created by five photons incident on a 10-mm lead converter. The photon tracks have been suppressed in order to avoid cluttering up the figure. The charged particle tracks passing through the second (scintillator) slab are consistent with the multiple-peak structure in Fig. 5.

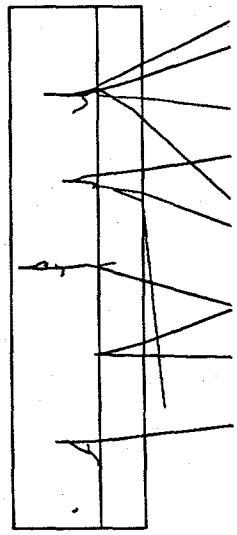

Figure 6. Electron (±) tracks produced by five 177 MeV photons (not shown) in a lead-scintillator detector.

7.2 Electron Emission in RF Cavities

The next example relates to a series of spectral measurements recently performed at SLAC after an RF cavity was tested and found to emit high levels of radiation[7]. Because the cavity was subjected to very high power levels, surface electrons were believed to be produced from two locations within the structure and accelerated to kinetic energies of 8.5 and 3.5 MeV, respectively, depending on their point of origin.

Upon exiting the cavity, they passed through a 0.015 inch copper window, where they lost energy primarily by ionization and were multiple scattered. The experimentalists attempted to measure the spectrum of the electrons using a magnet, a lead slit, and a Faraday cup. A strong peak corresponding to the 8.5-MeV group was observed, but the 3.5-MeV peak was not observed.

The object of the EGS4 simulation was to try to understand these observations, particularly with the help of graphics showing particle trajectories. Figure 7 shows the EGS4 geometry designed for this problem.