Calculations of this type can be very useful in radiation protection where estimates must be made of the expected dose rate from devices (*e.g.*, targets, collimators, dumps) struck by electrons beams.

7.5 Positron Target Design

The basic scheme behind the newly commissioned SLC project at SLAC is to produce and collide a beam of 50-GeV positrons with a beam of 50-GeV electrons, the purpose of which is to observe and measure intermediate vector bosons (Z^0, W^+, W^-) near the center-of-mass energy of 100 GeV.

This requires producing low-energy (2 to 20 MeV) positrons by directing a 33-GeV electron beam onto a 2.4-cm tantalum alloy target. These positrons are then "collected", re-injected into the machine, and accelerated to the required energy of 50 GeV.

EGS4 was used in order to determine the size and nature of the target necessary to accomplish the task. Fig. 13 shows an EGS4 shower generated by a single 33-GeV electron striking the target.

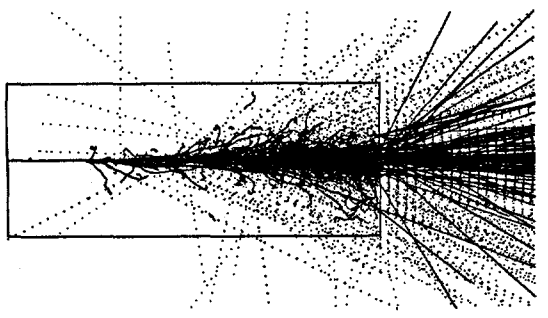

Figure 13. Shower produced in 2.4 cm-tantalum alloy target struck by one 33-GeV electron: solid ($e^{\pm}$), dots (γ).

Clearly, not only are a lot of positrons and electrons created by a single electron, but there is a central core of energy deposition that can lead to serious engineering problems, particularly target heating, melting, and stress (this core is primarily due to the small angles associated with bremsstrahlung and pair production, convoluted with multiple scattering).

EGS has been useful in determining not only the optimum positron yield, but also to point out some of the difficulties involved in running small beam spots into thick targets, generally leading to premature target failure[10].

7.6 Electron-Beam Irradiation of Wire and Tubing

EGS4 has recently been used to predict the absorbed dose distribution in wire and tubing[11]. Figure 14 is an example showing the irradiation of a thin (1-mm diameter) copper wire by 3-MeV electrons. One is interested in the absorbed dose pattern in the surrounding insulation (2-mm O.D.).