7.1 Conversion Efficiency of Lead for 30-200 MeV Photons

An experiment to measure the conversion efficiency for 44, 94, and 177 MeV photons incident on lead was performed at CERN by Darriulat *et al*[6] using a photon *tagging* scheme. A beam of charged leptons and hadrons was momentum selected and allowed to impinge on a target so that electrons would radiate bremsstrahlung. By measuring the energy of the electron, and knowing the angles of the particles, the mean photon energy was determined to an accuracy of ±4 MeV.

The tagged photon beam was then allowed to strike a lead plate having a thickness ranging from 1 to 20 mm. A 5-mm thick scintillator was positioned immediately downbeam to detect electrons (±) produced by photon interactions in the lead converter.

To calculate the conversion efficiency with EGS4, the geometry layout shown in Fig. 3 was used, consisting of four regions separated by three semi-infinite planes.

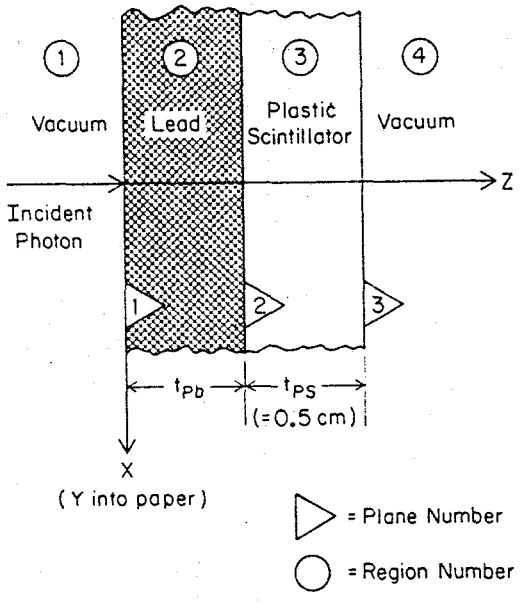

Figure 3. Geometry layout used for simulation of the photon conversion efficiency experiment.

Polystyrene (ρ = 1.03 g/cm^3) consisting of hydrogen and carbon (H/C=1.1) was used as the medium for plastic scintillator in region 3. The density of lead was taken to be 11.3 g/cm^3. PEGS4 was used to create the necessary material data with cutoff energies of 0.1 MeV and 1.5 MeV (total energy) for photons and electrons, respectively.

The scoring subroutine AUSGAB was set up to sum the energy deposition in the plastic (region 3) for each photon. An event was counted as a *conversion* if more than 60 keV, corresponding to the discrimination level established in the experiment, was deposited in the scintillator for each incoming photon.