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Statistics of energy losses of fast electrons HANS BICHSEL — Electrons deflected by the field of a nucleus will emit photons ("Bremsstrahlung, BMS"), resulting in energy losses E. The differential cross section for this effect is of the form $\sigma_b(E) = \chi/E$. For Si, $\chi \sim 2 \cdot 10^{-24}$ cm^2/nucleus. For collisions with atomic electrons the differential cross section is $\sigma_R(E,\beta) = \xi/E^2$, $\xi = 1.3 \cdot 10^{-19}$ eV/cm^2 for fast electrons ($\beta = v/c \sim 1$). We use the *moments* $M_0(T) \equiv N \int_{E_l}^{T} \sigma_{\rm rad}(E;T)dE$ to get the mean number of collisions per cm and $M_1(T) \equiv N \int E\ \sigma_{\rm rad}(E;T)dE$ to get the mean energy loss per cm for electrons with energy T, giving ${}_bM_0(T) = \chi\ \ln(T/E_l)$ and ${}_RM_0(T) = \xi\ (1/T - 1/E_l)$. Also ${}_bM_1(T) = \chi \cdot T$, ${}_RM_1(T) = \xi\ \ln(T/E_l)$. Assuming $E_l = 20$ eV, M_0 depends little on T, and the *average energy loss per collision* $< E >= M_1/M_0$ depends little on T for electron collisions, but is almost proportional to T for BMS collisions. The ratio ${}_RM_0(T)/{}_bM_0(T)$ is of the order of 10,000, while ${}_bM_0(T) \sim 1.6$ col/cm for Si. In a thick absorber this causes great variances in the distributions of the number of BMS collisions, the practical range of the primary electrons and its electronic energy loss. These effects have been simulated with Monte Carlo calculations and will be described.

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