Thomson 1.8

Todd Hirtler

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Tungsten has a radiation length of $X_0 = 0.35$ ***cm and a critical energy of*** $E_c = 7.97$ ***MeV. Roughly, what thickness of tungsten is required to fully contain a*** 500 ***GeV electromagnetic shower from an electron?***

After each radiation length, the energy is divided up between twice as many particles, so the average energy is halved after every radiation length.

$$\langle E \rangle = \frac{E}{2^n}$$

The electromagnetic shower continues to cascade until the average energy of the particles reaches the critical energy, in which case bremsstrahlung is no longer the primary mode of energy loss. At this time, the primary mode of energy loss would be ionisation. We can then find our minimum thickness of tungsten to contain the shower as

$$n = \frac{\ln\left(E/E_c\right)}{\ln 2} \approx 16$$

With a maximum amount of decays of about 16, we get a minimum thickness necessary to contain the shower to be about 5.6 cm.