22.55 Spring 2004
Professor Coderre
March 3, 2004
Due: March 10, 2004

Problem Set 4

Use SRIM to set up the following problem:
4.6 MeV alpha particles into a layered target consisting of

2 mm air
1.4 µm mylar
cells 7 µm thick

1. Calculate the initial LET, the LET at the mylar surface and the LET at the cell surface.

2. Calculate the residual range in water of the initial particles, the residual range in water after 2 mm of air, and the residual range in water after the air plus mylar.

3. A CR-39 track-etch detector placed directly on the mylar at the cell position recorded 0.006 tracks/μm^2 in 60 seconds. Calculate the dose rate to the cells (the surface dose) in cGy/min.

4. Use the Chatterjee (1976) formulas for core radius and penumbra radius to estimate the relative areas of the core and the penumbra for the alpha particles at the LET calculated for the cell surface in 1) above. Calculate the energy density in the core and the penumbra. Assume the cell is a 10 µm diameter circle. What percentage of that cross sectional area is core and what percentage is penumbra? From that perspective, what is the weighted average dose to the cell from the passage of a single alpha particle? Assume the cell is a right cylinder, 10 µm in diameter and 5 µm thick.