Problem 1

Monte Carlo electron-trajectory simulation provides a way to visualize the volume of the sample in which the beam electrons interact. In this simulation, equations for elastic and inelastic scattering are used to determine scattering angles, mean free-paths, and the rate of energy-loss of the electrons. From these parameters and equations of analytical geometry, an electron trajectory is simulated in a stepwise fashion from the location at which the electron enters the specimen to its final state when it either leaves the specimen or loses all of its energy to be absorbed by the specimen.

Use the programs PLOT2Z and FSE_MC (written by David Joy, NIST; updated versions are available from ftp://ftp.nist.gov/pub/cstl/wight/MonteCarlo/) to simulate the paths of the beam electrons in C, Fe, Ag and U, and the primary x-ray generation sites for CKα, FeKα, AgLα and UMα at 10, 15 and 20 keV beam energies and perpendicular incidence of the beam. Parameters such as the atomic weight and density may be obtained by using the program EIS. Answer the following:

- Are the x-rays mentioned above emitted with all beam energies? If not, why?
- How does the electron range change with (a) atomic number, (b) beam energy?
- Are the electron interaction volume and the volume for primary x-ray generation the same under the same set of conditions? If not, why?