AbstractID: 7036 Title: A method to calculate electron beam angular distributions in multislab media

The angular distribution of electrons in a broad beam which is penetrating a multilayered medium can be expressed as a gaussian function. When one uses the Fermi-Eyges theory, the electron scattering power is defined so that its path integral over depth (the zero order moment) is the angular variance. This model is adequate where the scattering power integral is small. However when the accumulated scattering is high, the Fermi-Eyges variance becomes meaninglessly large, even though the angular distribution can still be accurately expressed as a gaussian. In this work, we used Monte Carlo calculations to determine electron angular variance as a function of depth for different materials and beam energies. We then showed that while the zero moment of scattering power (the Fermi-Eyges variance) was not equal to the Monte Carlo variance except very near the surface, the true (Monte Carlo) variance is a unique function of the Fermi-Eyges zero moment. The true variance shows an asymptotic cutoff at depth, and a particular Boltzmann distribution was used to fit the data. We then performed Monte Carlo simulations for a series of three layered media and determined the angular variances. We then calculated the Fermi-Eyges values by integrating the scattering power. Those Fermi-Eyges values were input into the Boltzmann distribution to determine our analytic angular variance. Our results show excellent agreement with the Monte Carlo values, even when the Fermi-Eyges variances become very large.