

The calculation of the replacement correction factor P_{repl} of plane-parallel electron chambers using Monte Carlo simulation requires an accuracy of better than 1 %. The following factors need therefore to be considered:

- The average stopping power ratio material/air derived from the real electron spectrum.
- The structural details of the chamber.
- A Monte Carlo code capable of handling small geometry structures, i.e. small step sizes.
- The full spectrum of a real beam (In a separate contribution we studied the influence of using a real spectrum versus an approximate or a monoenergetic spectrum).

We demonstrate the improvements in the calculation of P_{repl} originating from the consideration of the above factors for electron energies between 1 MeV and 20 MeV and in different phantom depths. We used EGS4 with the improved boundary crossing algorithm provided by PRESTA II. We developed a program to handle the complex geometry coding, containing graphical input for cylindrical scoring region selection. We modified the user code DOSRZ II in order to generate the energy spectrum of the electrons in the air cavity and created an algorithm to calculate the corresponding effective stopping power ratio. Thus we determined the replacement correction factor of the Markus chamber and compared it with measured values. The results show good agreement for mean energies in depth of 3 MeV. Below this energy the calculated values differ from the measured ones. We explored this observation in more detail and show that the calculated results are more reliable.