External electron beam comparison of Monte Carlo codes in homogeneous phantom and interfaces (C4MCNP ,BEAMnrc) :Title 8339 :AbstractID

Purpose: Understanding the limitation of the Monte Carlo codes is essential in order to avoid systematic errors in simulations, and to suggest further improvement of the codes. The purpose of this study was to simulate the treatment head of Elekta (Synergy^{TM}) linear accelerator with two different Monte Carlo codes called MCNP4C and BEAMnrc and compare the calculated data of both codes with each other and with experimental measurements. **Method and Materials:** MCNP4C and BEAMnrc Monte Carlo codes commonly used in medical physics, were compared and evaluated against electron depth dose, beam profile and experimental total scatter factor results obtained using clinical radiotherapy beams. Different physical models and algorithms used in the codes give different depth dose curves, beam profile and total scattering factors. **Results:** The maximum difference for percentage depths dose curves in the Build-up region was about 1.1% and it was less than 1mm in the d_{max}. These differences for the dose profile curves in the flat area was at last 0.9% and for the penumbra was about 1.5mm and in the out field regions which only the scatter radiation reach that area, the maximum difference was about 0.2%. **Conclusion:** In conclusion, the differences in cross sections used for bremsstralung effect, different multiple scattering theory and different electron transport algorithms used by MCNP4C and BEAMnrc will lead to discrepancy in depth dose and beam profile curves, which is negligible for both codes if the simulations were well tuned. The timing study is also shows that BEAMnrc is generally faster than MCNP4C and use of large number of scoring voxels dramatically slows down the MCNP calculation. However, use of a large number of geometry voxels in MCNP only slightly affects the speed of the calculation.