Monte Carlo Simulation of Electron Beams from Varian TrueBeam® Linear Accelerator used in Radiotherapy: Estimation of Initial Beam Parameters

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**Abstract**.

**Background**: In Radiotherapy, electron beams are widely used to treat superficial tumours. They deliver a uniform dose in the therapeutic range and have steep dose falloff at the underlying normal tissue region. Compared to other methods, the dose delivered to the patients was precisely estimated by Monte Carlo (MC) methods since it’s considered the gold standard in Radiotherapy. Monte Carlo codes need initial beam parameter values (Mean energy, energy spectrum and spot size) and structural details of the machines as input to predict the dose distribution. This information was hard to get from manufacturers due to proprietary reasons.

**Aim:** This study is performed to determine the Initial Beam Parameters of Varian TrueBeam® Linear Accelerator using PRIMO Software and validate it using depth dose curves and profiles.

**Methods & Materials:** This study was performed on a TrueBeam® Clinical High Energy Linear accelerator (Varian Medical Systems, Palo Alto, CA). The MC Code GEANT 4 (VirtuaLinac) and PENELOPE(PRIMO) were used in this study. The energies used in this study were 6,9,12 & 18 MeV electrons, the applicator used was 10x10 cm2 and 25x25 cm2, and the source to surface distance (SSD) value was set as 100cm.

**Results:** The MC model available in PRIMO for Varian TrueBeam® was correctly validated. Initial mean energies were obtained of 6.81, 9.77, 13.15 and 19.79 MeV for 6, 9, 12 and 18 MeV nominal energies, respectively. Sigma of Gaussian distribution (dE) was estimated as 0.59, 0.62, 0.71 and 0.82, respectively. The average values of percentage dose difference between the measured and MC simulated PDD and profiles were within 5%. It was determined that PRIMO is a convenient and easy-to-operate software application with the competent potential to estimate dose distribution in water phantoms or CT Images precisely.

**Keywords:** TrueBeam®, Monte Carlo methods, Geant4, VirtuaLinac, PENELOPE, PRIMO, Electron Beams

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