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Validation of BEAMnrc Monte Carlo model for a 12MV photon beam

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ABSTRACT

Accurate dose calculation in the treatment planning system (TPS) process is the most important step to succeed the radiation therapy. For this purpose, Monte Carlo method is a powerful tool for dose calculation. This study aims to validate Monte Carlo BEAMnrc model of Saturne43 Linac head to simulate 12 MV photon beam. To validate MC model, the dose distributions was calculated by BEAMnrc simulation and then the results obtained were compared against measurements. This requires to adjust the parameters of the initial electron beam incident on the target, such as mean energy, beam radius and mean angular spread. Our approach has been suggested to determine the initial electrons beam parameters. The dose distribution (percent depth dose and lateral profile) have been calculated for 10×10 cm² field size in a homogeneous water phantom of 40 ×40×40 cm^3. The results obtained are compared with measured data using gamma index criteria which were fixed within 1.5% -1 mm accuracy. Using phase space technique as a sub-source allows us to reduce the simulation time by a factor of 6. Good agreement between calculated and measured dose has been achieved when the mean energy, beam width and mean angular spread were 11.8 MeV, 1.5mm and 0.5°, respectively. So, Monte Carlo based- BEAMnrc code is suitable to be used in the process of treatment planning system for calculating the dose distribution.

Keywords: Monte Carlo; BEAMnrc; dose distribution; Linac; phase space

INTRODUCTION

A good compatibility between the calculated doses and that delivered to the patient is most important to succeed the radiation therapy (Verhaegen and Seuntjens, 2003). The dose distribution can be estimated by Monte Carlo simulations with a high accuracy. A precision of dose calculation by Monte Carlo codes requires accurate identification of the head geometry and the incident electron parameters (Verhaegen and Seuntjens, 2003). Errors in determining