ABSTRACT

Name : Arrum Nitasari

Study Program: *Physics*

Title : *Simulation of Volumetric Modulated Arc Therapy (VMAT) Radiation Technique Based on Dynamic Log File (Dynalog) Using Monte Carlo-EGSnrc Method*

In modern radiotherapy, especially External Beam Radiation Therapy (EBRT) using Linear Accelerator (linac), the dose calculation of Analytical Anisotropic Algoritm (AAA) is done first before the treatment. In addition to achieving the principle of radiotherapy radiation techniques have been developed. One of many methods that can achieve the principle of radiation is the radiation technique of Volumetric Modulated Arc Therapy (VMAT). There have been many studies that carry out clinical linac modeling simulations using the Monte Carlo EGSnrc method. The EGSnrc software consists of BEAMnrc and DOSXYZnrc. In this study Clinac iX varian linac's head simulation was conducted using BEAMnrc and VMAT simulation using DOSXYZnrc. The input file on this simulation based on Dynamic Log file (Dynalog) which is recorded by the linac during the treatment. The results of the simulation of the linac's head are characteristic of particle files (photons, electrons, and positrons) under jaws and MLC. The characteristics of particle are influenced by the interaction of photons with the constituent material of linac. The VMAT simulation results are 1D dose distribution or dose profile compared to the AAA dose profile. The mean deviation between dose profiles between alogritma Monte Carlo and AAA obtained is 5.95%.

Keywords: VMAT, Dynalog, Monte Carlo, AAA

ABSTRAK

Nama   : Arrum Nitasari

Program Studi : Fisika

Judul   : Simulasi Teknik Radiasi *Volumetric Modulated Arc Therapy* (VMAT) Berdasarkan Data *Dynamic Log* (*Dynalog*) Menggunakan Metode Monte Carlo-EGSnrc

Pada radioterapi modern khususnya *External Beam Radiation Therapy* (EBRT) menggunakan *Linear Accelerator* (linac) sebelum dilakukan treatment, perhitungan dosis Analytical Anisotropic Algoritm (AAA) terlebih dahulu dilakukan. Selain itu untuk mencapai prinsip radioterapi telah dikembanagkan teknik-teknik radiasi. Salah satu metode yang dapat mencapai prinsip radiasi adalah teknik radiasi *Volumetric Modulated Arc Therapy* (VMAT). Telah ada banyak penelitian yang melakukan simulasi pemodelan linac klinis menggunakan metode Monte Carlo EGSnrc. *Software* EGSnrc terdiri BEAMnrc dan DOSXYZnrc. Pada penelitian ini dilakukan simulasi *head* linac jenis Varian Clinac iX menggunakan BEAMnrc dan simulasi VMAT menggunakan DOSXYZnrc. Simulasi yang dilakukan menggunakan *input data* dari pembacaan data *Dynamic Log* (*Dynalog*) yang merupakan data yang direkam linac selama *treatment* berlangsung. Hasil simulasi *head* linac berupa karakteristik berkas partikel (foton, elektron, dan positron) di bawah *jaws* dan MLC. Karakteristik berkas partikel dipengaruhi oleh interaksi foton dengan materi penyusun linac. Adapun hasil simulasi VMAT yaitu distribusi dosis 1D atau berupa profil dosis dibandingkan dengan profil dosis AAA. Deviasi rata-rata antara profil dosis antara alogritma Monte Carlo dan AAA yang diperoleh adalah 5,95 %.

Kata Kunci: VMAT, Dynalog, Monte Carlo, AAA