ABSTRAK

Penelitian ini difokuskan pada pemodelan dan optimasi parameter pesawat CT-*Scan* untuk pemeriksaan kanker nasofaring stadium I menggunakan pendekatan teknik *Multiple Scan Average Dose* (MSAD) berbasis metode Monte Carlo. Pemodelan dilakukan dengan perangkat lunak PHITS versi 3.30, yang berhasil merepresentasikan sistem CT-Scan berbasis model *Siemens* serta phantom kepala-leher berdasarkan model MIRD. Variasi parameter yang dioptimalkan meliputi tegangan tabung sebesar 125, 130, dan 135 kV, dengan arus tetap 215 mA dan tanpa memperhitungkan waktu penyinaran. Arah penyinaran dilakukan secara menyeluruh dari 0° hingga 360° dengan interval 15°, serta lebar pemindaian (*scan length*) sebesar 2 cm. Pemodelan berhasil memvisualisasikan komponen penting seperti gantry, sumber sinar-X, dan detektor, serta menghasilkan spektrum sinar-X yang terdiri dari komponen diskrit dan kontinyu. Optimasi dengan metode MSAD menunjukkan bahwa tegangan tabung 125 kV dan sudut penyinaran 0°, 180°, dan 360° memberikan hasil paling optimal, dengan paparan radiasi yang mencapai target kanker namun tetap dalam ambang batas aman sesuai standar BAPETEN. Penelitian ini tidak mempertimbangkan kualitas citra, namun memberikan kontribusi penting dalam pengembangan protokol CT-Scan yang aman dan efektif untuk deteksi dini kanker nasofaring.

***Kata kunci**: CT-Scan, Kanker Nasofaring, PHITS, MSAD, Monte Carlo*

ABSTRACT

This research focuses on the modeling and optimization of CT-Scan parameters for stage I nasopharyngeal cancer detection using the Multiple Scan Average Dose (MSAD) approach based on the Monte Carlo method. The goal of this study is to optimize the CT-Scan parameters to ensure safe and effective radiation exposure for the early detection of nasopharyngeal cancer. Modeling was performed using PHITS software version 3.30, successfully representing a Siemens-based CT-Scan system and a head-neck phantom based on the MIRD model. The parameters optimized include tube voltages of 125, 130, and 135 kV, with a constant current of 215 mA and no consideration of exposure time. Irradiation was conducted at angles from 0° to 360° in 15° intervals, with a scan length set to 2 cm. The modeling successfully visualized key components such as the gantry, X-ray source, and detector, and generated an X-ray spectrum consisting of both discrete and continuous components. MSAD optimization showed that a tube voltage of 125 kV and an irradiation angle of 0°, 180°, and 360° provided the most optimal results, delivering radiation exposure that reached the cancer target while remaining within the safe limits set by BAPETEN standards. Although this study did not evaluate image quality, it makes a significant contribution to the development of safe and effective CT-Scan protocols for the early detection of nasopharyngeal cancer.

***Keywords**: CT-Scan, Nasopharyngeal Cancer, PHITS, MSAD, Monte Carlo*