



Iranian Journal of Radiation Safety and Measurement
Vol. 12, No. 1, Spring 2023

Determining the received dose of the organs in mammography energy spectra with GATE code and images quality evaluation

F. Nezarat* and M. R. Shojaei

Physics Department, Shahrood University of Technology, Semnan, Iran.

*Physics Department, Shahrood University of Technology, Semnan, Iran.

P.O. Box: 3619995161

Email: fatima.nt1996@gmail.com

Abstract

One of the best methods for detecting breast cancer, especially in its early stages, is X-ray mammography. However, few studies have examined the risk of developing cancer in tissues other than the breast. The aim of the current study is to determine the absorbed dose in sensitive body organs during mammography. Simulation was performed using the GATE code. In the first step, an X-ray tube was created to produce suitable energy spectra for mammography. Then, a quality control phantom was designed to assess image quality, including spatial resolution and contrast-to-noise ratio (CNR). An adult ORNL phantom with different organs was designed, and the geometry of a digital mammography device was simulated in two main mammography views (CC and MLO) to calculate the dose in the organs. Finally, it was found that the radiation dose to body tissues such as the uterus, which is outside the primary X-ray field, is low (on average $0.022 \mu\text{Gy}$). However, the highest dose is received by the contralateral breast, about $2735.5 \mu\text{Gy}$, in the lungs about $48.9 \mu\text{Gy}$, in the heart about $7.6 \mu\text{Gy}$ and in the stomach about $5.8 \mu\text{Gy}$ after the examined breast and tumor. Based on the results, in our study, the energy of 25 keV is introduced as the optimal energy.

Keywords : Mammography, breast cancer, GATE code, dosimetry, image quality.

For full article, refer to the Persian section.