ABSTRAK

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Program Studi : Fisika

Judul : Optimasi komposisi material target TiVCu untuk mengurangi produksi neutron pada Linac menggunakan metode Monte Carlo

Paparan neutron memiliki dampak biologis yang lebih tinggi dibandingkan sinar-X dan gamma, karena dapat menyebabkan kerusakan lokal seperti lesi DNA kompleks. Pada Linac (Linear Accelerator) energi 10 MV, neutron dihasilkan melalui reaksi fotonuklir (γ,n) antara foton dan target tungsten. Penelitian ini mengusulkan material target alternatif berupa campuran TiVCu, untuk menurunkan produksi neutron. Pendekatan One Factor at A Time (OFAT) digunakan untuk mengevaluasi kontribusi unsur Titanium (Ti), Vanadium (V), dan Tembaga (Cu). Hasil menunjukkan bahwa Titanium memiliki pengaruh paling dominan (87,13%) dalam menurunkan produksi neutron, diikuti Vanadium, sementara peningkatan kadar tembaga justru meningkatkan produksi neutron. Komposisi optimal target TiVCu adalah Ti 2,2%, V 0,077%, dan Cu 97,723%, yang mampu menurunkan produksi neutron hingga 96,52% dibandingkan dengan target tungsten. Efektivitas ini didukung oleh ambang energi reaksi fotonuklir yang tinggi dari ketiga unsur. Meskipun peningkatan kadar Titanium (Ti) dan Vanadium (V) dapat menurunkan produksi neutron, hal ini tidak bersifat linear karena adanya kompleksitas interaksi partikel pada sistem energi tinggi.

Kata Kunci: Neutron, Footneutron, Target, Linac, TiVCu

ABSTRACT

Name : Sabila Hasanah

Study program: *Physics*

Title : *Optimization of TiVCu target material composition to reduce neutron production in Linac using the Monte Carlo method*

Neutron exposure poses greater biological risks compared to X-rays and gamma rays, as it can induce localized damage such as complex DNA lesions. In a 10 MV Linear Accelerator (Linac), neutrons are generated through photoneutron reactions (γ,n) between photons and a tungsten target. This study proposes an alternative target material in the form of a TiVCu alloy to reduce neutron production. The One Factor at A Time (OFAT) approach was used to evaluate the contribution of Titanium (Ti), Vanadium (V), and Copper (Cu). Results show that Titanium has the most dominant influence (87.13%) in reducing neutron yield, followed by Vanadium, while an increase in Copper content leads to higher neutron production. The optimal TiVCu composition was determined to be 2.2% Ti, 0.077% V, and 97.723% Cu, which can reduce neutron generation by up to 96.52% compared to the tungsten target. This effectiveness is attributed to the high photonuclear reaction thresholds of the three elements. Although increasing the concentration of Ti and V generally reduces neutron production, the relationship is not linear due to the complex nature of particle interactions at high energies.

Keywords: *Neutron, Photoneutron, Target, Linac, TiVCu.*