

## The effect of multileaf collimator and compensator on the contaminated neutron production in medical linear accelerator

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**Background:** Today, intensity modulated radiotherapy (IMRT) is a useful tool for treating various cancers. In order to achieve a field of variable intensity and the better definition of the target volume in IMRT, multileaf collimators (MLC) and compensators are employed with a medical linear accelerator producing bremsstrahlung photon fields with energy greater than 10 MeV. The contaminated neutrons are generated by photonuclear reactions when the energy of the incident photon is higher than 10 MeV. These unwanted particles deliver an undesirable dose to the patients and staffs. Therefore, these particles are a significant problem for radiation protection.

**Aim:** The aim of this study is the determination of the multileaf collimator and the compensator contribution in photoneutron production.

**Materials and methods:** The actual geometry of Elekta SL75/25 Linac was simulated by using MCNPX MC Code version 2.6.0. Then, the contribution of brass, cerrobend compensators with 1 cm thickness and MLC in photoneutrons production is separately calculated in  $10 \times 10 \text{ cm}^2$  field size by MPN card.

**Results:** our results showed that the contributions of MLC, brass and cerrobend compensator in photoneutrons production are 15.5%, 21% and 31% respectively.

**Conclusions:** based on cerrobend composition, it has a high capability in photoneutrons production for same conditions (an equal absorbed dose in isocenter) in comparison with MLC and brass compensator. Compensators have some advantages such as robustness, excellent intensity modulation resolution, high treatment delivery efficiency, simple fabrication and quality assurance procedures and flexibility versus MLC. Our results showed that compensators have a big disadvantage. For delivering equal absorbed dose in isocenter, compensators produce more photoneutrons than MLC in  $10 \times 10 \text{ cm}^2$  field size and have a large contribution in photoneutrons production.

**Keywords:** multileaf collimator, compensator, neutron, MCNP