

Purpose: To evaluate leakage radiation through treatment head of Elekta Synergy-S linear accelerator, which has a new “beam modulator” MLC design.

Method and Materials: As part of the acceptance test of a newly installed Elekta Synergy-S, Kodak XV films were used to encompass the entire treatment head to locate potential radiation hot spots. After evaluating film results, an ion chamber (with appropriate buildup caps) was used to measure the leakage radiation for 6MV and 15MV x-ray beams with MLC leaves fully closed. The chamber was placed in a plane perpendicular to the beam axis and which contained the machine isocenter, at distances ranging from 13-100 cm away from the machine isocenter in three directions (inline, crossline and diagonal). A 4.5 cm lead block placed on the blocking tray was used to evaluate the scattered radiation contribution from closed MLC leaves to ion chamber measurements at selected locations near the secondary collimator edges.

Results: Leakage radiation was greater than 0.1% of the dose at isocenter for the original beam modulator treatment head design. A Beam Modulator Head Shielding Kit was installed and measurements repeated. Leakage radiation was only slightly reduced. A second version of Beam Modulator Head Shielding Kit was installed, and subsequent measurements showed that head leakage radiation was finally reduced below 0.1%. Contributions to ion chamber readings from scattered radiation generated from closed MLC leaves can be as high as 60% at close proximity to the secondary collimator edge.

Conclusions: Thorough measurement of head leakage is necessary during acceptance testing of a LINAC machine, especially for new type machines such as the Synergy-S, to ensure patient and staff safety. It is recommended leakage radiation measurements be made by blocking the scattered radiation contribution from the closed MLC leaves.