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SU-E-T-05

The Effect of Leaf Corner Details in Sliding Windows Distributions, Implementation of Corrections in a Commercial Planning System

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Purpose: The dosimetric effect of leaf tip corner details in sliding window dose distributions has been studied, a solution to account for this corner leakage has been designed and implemented. **Methods:** The dosimetric effect of leaf tip corner deviations from perfect 90 degree borders between the front face and leaf side, was analyzed for sliding window IMRT beams. The study was carried out using film, EPID and diode arrays on Elekta Linacs fitted with MLCi and MLCi2 MLC models. Although the effect is general and does not depend on a particular MLC model, the magnitude and distribution is dependent on MLC model. The study consisted of simple fields designed to de-couple the combined effects of the leaf properties (transmission, interleaf leakage, tongue and grove, corner leakage), such that corner leakage could be quantified. An enhancement to the transmission filter of a commercial Monte Carlo treatment planning system (Monaco, Elekta AB) was implemented to account for this effect, allowing the user to model the corner leakage for individual leaf tip corners. **Results:** The analysis of test beams indicates that corner leakage will introduce additional fluence in sliding window IMRT distributions. Of the two mlc models studied, this effect is more important for MLCi, but is also present for MLCi2. Generally, corner leakage will be present in every mlc in which the corner is not perfectly cut at 90 degrees. In this light, small manufacturing differences give rise to small but visible effects on the dose distribution. Correct modeling of these small effects is increasingly important as users seek improved patient specific QA results, in particular using local gamma. **Conclusion:** In this work we study the effect of mlc leaf corner leakage in sliding window distributions, presenting a software implementation to model this effect in a Monte Carlo-based Treatment Planning system.

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SU-E-T-06

Comparison of Different Commercial MU Verification Software in Terms of Accuracy and Performance

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Purpose: All radiation therapy departments have a need for a quick and accurate verification of their treatment plans ranging from conventional, brachytherapy, to IMRT. The aim of this study is to perform an inter-comparison of different commercially available Monitor Unit (MU) secondary/independent software. **Methods:** In this study, four independent MU verification software were examined (IMSure, DIAMOND, MuCheck, and Radcalc) as quality assurance tools for RTP systems. An inter-comparison of the treatment plans of 13 patients was performed using those MU verification software. All the plans were generated using the Pinnacle v9.2 treatment planning system. The treatment techniques include VMAT, MLC-based step-and-shoot IMRT and Conventional Conformal plans for different treatment sites (breast, head and neck, chest, pelvis, abdomen, and brain). The parameters that had to be adjusted after importing the treatment plans into the different software were the average SSD and effective depth. **Results:** The average percent differences between the MUs provided by the Pinnacle and the RadCalc, ImSure and DIAMOND software were found to be -1.7%, -1.9% and 3.4%, respectively. The variation of the percent differences among the individual patients were 2.9% (-7.2 - 2.5), 3.7% (-7.2 - 3.7) and 7.0% (-9.9 - 16.2) for RadCalc, ImSure and DIAMOND, respectively. **Conclusion:** Importing the files from the Pinnacle RTP system was equally easy for all the software. It was found that Radcalc was the software that required the minimum changes/interventions when inserting the average SSD and effective depth. However, the Radcalc was the slower among the examined software in computing the MUs of the different beams for the VMAT technique. Overall, the variation of the MU calculations between the examined software was found to be very similar indicating that their ability to be used as quality assurance tools of the calculations provided by the RTP systems is equivalent.

SU-E-T-07

Estimation of Effective Field Size with Leaf-Based Algorithm

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Purpose: Demonstrate a geometric algorithm for calculating equivalent squares of multileaf collimator defined fields. **Methods:** Equivalent square (Q) can be modeled as the product of a field's size (square root of area) and a function of its shape, f(E), where f(E)=1 for squares and f(E)<1 for elongated or eccentric shapes. It follows from Sterling's approximation that f(E) = (2*S^0.5)/(S+1) for rectangles with aspect ratio S. By Day's approximation, f(E)=1.8/pi^0.5 for circles. For MLC-defined fields, effective width can be modeled as the average separation between opposing leaf-tips, where leaf position is weighted both by leaf thickness and by inverse-square distance of the leaf tip from central axis. Inverse-square weighting is heuristic, based on the observation that scatter-air-ratio is concave with radius. A ratio by area yields effective length and Sterling's approximation yields equivalent square. This algorithm was benchmarked against both Sterling and Day using square, circular, and rectangular fields. Ratios of phantom dose in blocked versus open fields were also used to determine Q through iterative comparison to clinical Sp and TMR tables. **Results:** The leaf-based algorithm produced f(E) values of approximately one, greater than one, and less than one where these were expected. It also produced good agreement with benchmarks, with a maximum difference of 3%. In heavily blocked fields, the agreement between the leaf-based algorithm and the benchmark was superior to the agreement between the benchmark and the measurement. **Conclusion:** The separation of size from shape is a useful construct in evaluating the equivalent squares of MLC defined fields. The leaf-based algorithm is a promising technique for calculating equivalent square that produces results consistent with classic benchmarks and accuracies consistent with the limitations of the underlying equivalent square model.

SU-E-T-08

How Much Dose to the Eyelid Is Reduced by the Backscatter Cap of the Eye Shield From Electron Beam Radiation Therapy?

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Purpose: The eye shield set (tungsten (W) shells of 2 and 3 mm thick and various diameters) that is manufactured by RPD, Albertville, MN is supplied with aluminum backscatter caps of 0.5 and 1 mm thickness. However, existing backscatter reduction data (Weaver et al 1998, IJROBP, 41.1. pg.233) are not sufficient. This study attempts to quantify eyelid dose vs backscatter cap thickness using MCNP5. **Methods:** The electron source in MCNP is simplified to be monoenergetic. The simulated PDD is first validated to measured PDD. The eyelid, Al backscatter cap, tungsten shield, and eyeball are stacked along the electron beam direction. Additional cap thickness of 1.5 mm and 2 mm are simulated to increase the thickness range. For comparison, 3 mm thick lead (Pb) shield is simulated. All dose values are normalized to the dose at dmax without the eye shield. **Results:** Without any Al cap, the eyelid dose is 123%, 123%, 126% for 2 mm W, 3 mm W, and 3 mm Pb shields. With a 1 mm Al cap, the eyelid dose is 112%, 112%, and 114% respectively. With a 2 mm Al cap, the eyelid dose falls to 105% for all three shields. The backscattered photon dose component is <1% for all simulation scenarios so the backscatter dose is dominated by electrons. The transmission through the shield is <0.8%, suggesting the shield thickness can be reduced for 6 MeV electrons. Further study is needed for higher electron energy beams. **Conclusion:** Of practical guidance value: If 110% or less hot spot is desired for eyelid, the 0.5 mm Al cap is not sufficient for 6 MeV. The 1 mm cap or 1.5 mm (0.5+1 mm) should be considered (while factoring in patient discomfort in using a thick cap).

SU-E-T-09

Evaluation of Depth Dose Distribution with Limit Scatter Condition and Comparing with Treatment Planning System

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Purpose: Beam commissioning data are acquired in full scatter condition but some body parts such as fingers, hands and legs are treated with limited scatter. An evaluation of depth dose distribution in carried out to study limited scatter situation and compared with treatment planning system.Material and **Methods:** Radiation scatter is considered as an important contribution of dose in patients. This experiment evaluated the