AbstractID: 8887 Title: A high resolution fluence-convolution model for prediction of amorphous silicon EPID IMRT images

In this work an amorphous silicon electronic portal imaging device (a-Si EPID) dose prediction model based on the fluence model of the Pinnacle treatment planning system Version 7 (Philips Medical Systems, Madison, WI, USA) is developed. A fluence matrix at very high resolution (0.5 mm) is used to incorporate multileaf collimator (MLC) leaf transmission effects in the predicted EPID images. The primary dose deposited in the EPID is calculated from the fluence using experimentally derived radially dependent EPID interaction coefficients for the open and MLC transmitted fluence components. A spatially invariant EPID dose deposition kernel that describes both radiative dose deposition and optical scatter is convolved with the primary dose. The kernel is further optimised to give accurate EPID scatter factor with changing MLC field size. Model predictions were compared to a-Si EPID images corrected for pixel sensitivity variation, support-arm backscatter and calibrated to dose for various static jaw defined and MLC defined fields and a step and shoot intensity modulated radiotherapy (IMRT) field. For the static fields the model predicts EPID off-axis ratio, penumbral shape as well as inter-leaf leakage. For the IMRT field with a Gamma criteria of 2% and 2 mm, 97.2% of points had a Gamma index less than 1. We found that incorporating the difference in EPID response to open and MLC transmission did not improve the accuracy of the prediction for the IMRT field. The developed model incorporates the effects of MLC design on the dose and therefore should improve the verification of IMRT treatments with EPIDs.