AbstractID: 11366 Title: A Comprehensive MLC Dose Model: Use in Dynamic IMRT Verification using an EPID

Purpose: To report on our development of a comprehensive MLC model that incorporates interleaf leakage, transmission, and tongue-and-groove effects, which can be used to accurately predict the a-Si electronic portal imaging device's (EPID's) dose image for use in pretreatment IMRT verification. This would remedy the fact that our current clinical TPS (Eclipse v 8.1) only models a portion of the MLC's dose effects which can lead to large verification errors.

Method and Materials: EPID images were acquired using Varian's *Varis Portal* (aS500) *Vision's* service monitor (IAS3) using a 6 MV beam at 400 MU/min and 'integrated image' mode. Images from sweeping-window and closed-MLC fields were used to determine MLC interleaf leakage and transmission. Sweeping-checker fields were used to characterize the shape of the MLC penumbra perpendicular to the travel direction, which was used to model the MLC's tongue-and-groove effects. In-house software (*MATLAB*) was used to generate a 2D correction map which, when multiplied by the original predicted TPS images produces a corrected predicted image, which was then used for IMRT verification.

Results: Dynamic IMRT EPID verifications with and without correction maps applied were performed. Verification of a worst-case test field yielded a gamma-map for the uncorrected case where 42.8% of the pixels had gamma-values of > 1 (3mm and 3%). After correcting for MLC effects, only 4.2% of the pixels have gamma-values > 1. After applying the correction to a clinical head-and neck IMRT field, the percentage of pixels failing the gamma analysis was reduced from 3.6% to 0.25%.

Conclusion: By implementing a correction map for the predicted EPID image, an accurate prediction of the measured EPID image can be generated. Therefore, this technique may significantly help the interpretation of verifications yielding marginal or unacceptable gamma-map results by isolating the source of the discrepancies between predicted and measured images.