

AbstractID: 6964 Title: Analysis of Film Registration Techniques in Intensity Modulated Radiation Therapy Quality Assurance

Purpose: The purpose of this study was to evaluate manual and fiducial-based plan-to-film registration techniques, identify advantages and disadvantages of manual and fiducial-based plan-to-film registration techniques, develop a new automatic plan-to-film registration technique using a genetic algorithm, and compare the performance of the automatic registration to the manual and fiducial-based techniques.

Method and Materials: Ten patient plans (*4 Head & Neck and 6 Prostate*) were selected for the IMRT plan-to-film registration study. For each patient, the IMRT dose measurements were obtained in both axial and coronal planes using radiographic film, resulting in 20 test films. Dose calibration films were irradiated at the same time as the test cases, and the test cases were processed at the same time. The calculated and measured dose distributions were registered with one another using RIT113 dosimetry software. Manual registration was performed by visual selection of four points in common on the dose and film images. Fiducial-based registration was performed using the "Template" tool in RIT113 and marks placed on the films prior to irradiation. An automatic plan-to-film registration genetic algorithm was created that performs image registration by optimizing the best longitudinal and rotational shifts.

Results: Of the techniques, the manual registration technique was inferior because it was highly susceptible to inter- and intra-user variations. The fiducial-based technique often resulted in incorrect registrations due to incorrect fiducial placement. Of the three techniques evaluated in this study, the genetic algorithm-based registration provided the best agreement between calculated and measured dose distributions.

Conclusion: Fiducials should be used for an initial registration, and the automatic technique should be used to calculate the spatial offset between the plan and the film. Using these techniques in combination should improve the time required to perform IMRT QA and decrease the incidence of false positives.

Conflict of Interest: Research consultant for RIT.