

AbstractID: 8728 Title: Effect of Fluence Smoothing on Plan Quality and  
Delivery Accuracy in Intensity Modulated Radiotherapy

**Purpose:** This study investigates the effect of fluence smoothing on plan quality using a commercial inverse planning system and how associated changes in complexity affect delivery accuracy. More complex plans may provide better plan quality but have larger delivery uncertainties, expose the patient to higher out-of-field doses, and result in longer delivery times.

**Method and Materials:** IMRT plans were created using the Varian Eclipse treatment planning system for prostate and head/neck test cases established for AAPM TG-119 "IMRT Quality Assurance." Treatment plans were generated using varying smoothing parameters from XSmooth=YSmooth=0 (no smoothing) to XSmooth=YSmooth=100 (heavy smoothing). The number of monitor units required for delivery was recorded as a measure of complexity. Homogeneity Index (HI) and Conformity Index (CI) were used to evaluate plan quality as a function of smoothing. Delivery accuracy was investigated for default (XSmooth=40, YSmooth=30), heavy (XSmooth=YSmooth=100), and no smoothing (XSmooth=YSmooth=0), using ion chamber, film and MapCheck. Ion chamber measurements were compared to Eclipse calculated values. Percentage of points passing gamma analysis (3%/3mm) was used to evaluate film and MapCheck results.

**Results:** The increase in MUs from simplest to most complex plan was 38% for prostate and 138% for head/neck test cases. HI increased 75% for prostate and 40% for head/neck from the simplest to most complex plan with CI staying relatively constant. Ion chamber measurements in OARs trended toward higher accuracy with lower plan complexity. Gamma pass rate decreased consistently with increasing plan complexity. This decrease for both film and MapCheck was <1% for prostate, but approximately 5% for head/neck plans.

**Conclusion:** Reductions in plan quality and delivery complexity were quantified with increasing fluence smoothing. A measurable decrease in the accuracy of IMRT delivery was observed with increasing complexity, and the most complex head/neck plan actually failed departmental standards.

**Conflict of Interest:** Partially supported by Varian Medical Systems.