AbstractID: 5861 Title: Surface dose measurements for Intensity Modulated Radiation Therapy

Purpose: To measure the surface and near-surface doses for a variety of IMRT delivery and planning techniques, and to determine the optimal PTV size and planning scenerio for skin dose maximization or minimization.

Methods and Materials: A primary PTV was defined on an anthropomorphic head phantom for a typical parotid-sparing head &neck treatment. Treatment plans were created with 0, 1, 2, 3, 4, and 5-mm separation between the skin surface and PTV boundary. IMRT treatments were planned using the Pinnacle treatment planning system and delivered on a Varian 21EX with a 120-leaf multileaf collimator. Inverse planning was performed using Direct Machine Parameter Optimization (DMPO) for step and shoot IMRT and gradient decent optimization for sliding window leaf sequencing IMRT. Helical tomotherapy cases were planned using the TomoTherapy HI-ART treatment planning system and delivered using a Tomotherpy HI-ART treatment delivery system. Surface doses were measured for each of the treatment deliveries using film placed in an anthropomorphic head phantom and thermoluminescent dosimeters (TLD) chips placed on the phantom's surface. A chip-specific TLD surface calibration factor was determined and applied to the raw TLD readings to account for measurement efficiency at the surface. Relative dose measurements were made using calibrated film placed in the phantom. Surface and near-surface doses were measured from digitized film images for a 1.5-cm range inside the phantom to in-air outside the phantom.

Results: Surface dose values measured with film were consistently lower, while TLD measurements were higher than planned for the cases studied.

Conclusions: The helical tomotherapy treatment plans were found to have better parotid sparing and PTV dose uniformity than both the step-and-shoot DMPO and sliding window plans. The tomotherapy planning system was observed to overestimate the surface dose from 9 to 18 percent.