AbstractID: 9189 Title: The verification of respiratory-gated radiation treatments using 3D dosimetry techniques

Purpose: This work investigates the feasibility of verifying respiratory gated treatments using a new 3D dosimetry system consisting of a radiochromic plastic (PRESAGE™) with optical-CT readout.

Materials and Methods: Three identical PRESAGE™ dosimeters (5cm radius x 5cm length) were manufactured for insertion into a CIRS' Dynamic Thorax Phantom. CT scans of the phantom were acquired corresponding to 3 motion scenarios; (1) static CT (no motion), (2) moving non-gated CT (free-breathing), and (3) moving gated CT. In the moving scans, the PRESAGE™ insert sinusoidally oscillated in the sup-inf direction with a 3cm amplitude and 4.5sec period. A simple plan with AP/PA parallel opposed beams was created in the Eclipse planning system to treat a simulated small lung nodule (1.5cm), central to the insert, for all 3 scenarios. The simple plan enabled accurate independent measurement using EBT films. Each plan was then delivered to the phantom twice, first containing the PRESAGE™ insert and second the EBT insert. The gated treatments were delivered using the Varian RPM gating system. The dose recorded in the PRESAGE™ dosimeters was determined by optical-CT using a novel, fast, in-house CCD based scanner, which acquired all data in ~10min. The doses among PRESAGE™, EBT, and Eclipse were compared.

Results: In the cases of static and moving gated treatments, excellent agreement (<1mm distance-to-agreement) was observed between the PRESAGE™ and EBT measurements. For the moving non-gated treatment, good agreement was again observed between PRESAGE™ and EBT. Significant differences are seen between the PRESAGE™/EBT films and the Eclipse distribution due to the modeling effects of penumbral broadening at small fields.

Conclusion: The combination of small field sizes and sophisticated gating techniques represents a challenging scenario for dosimetry verification. The PRESAGE™ /optical-CT 3D dosimetry system is demonstrated to achieve high quality, fast, relative dosimetry verification of gating treatments.