AbstractID: 9389 Title: Validation Tests for CyberKnife® Monte Carlo Dose Calculations Using Heterogeneous Phantoms

Purpose: To validate the Monte Carlo dose calculation algorithm for the CyberKnife® Robotic Radiosurgery System (Accuray Inc.) in the MultiPlan® Treatment Planning System. **Method and Materials:** Dose was measured in heterogeneous phantoms for clinically relevant dosimetry situations and compared with Monte Carlo dose calculations. The validation tests involve dose measurements in slab phantoms for single beams as well as multiple beams delivered on phantoms such as a modified Accuray ball cube and the RPC thorax-lung phantom. Depth doses as well as dose distributions at the inhomogeneity boundaries were measured. Single beam tests were performed for four collimator sizes (5, 10, 30, and 60 mm). Measurements were performed primarily with EBT films and complemented with MOSFETs at inhomogeneity interfaces. **Results:** 1) EBT film and MOSFET measurements at the tissue inhomogeneities show excellent agreements in all phantoms and for all collimators in both orthogonal and oblique incidences. 2) The Monte Carlo depth dose calculations in heterogeneous phantoms show excellent agreements with measurements. For example, the depth doses in water-lung-water phantom show a drop in the lung region that was predicted very well by the Monte Carlo calculation. 3) The treatment plans delivered to the heterogeneous ball cube and RPC thorax-lung phantom show excellent agreements between radiochromic film measurements and Monte Carlo calculations. **Conclusion:** The tests and phantoms collectively cover a wide range of tissue types (including air and lung, water, and bone-equivalent materials), angles of incidence of beams to tissue interfaces, collimator sizes, and single and multiple beam situations. A total of 91 tests were performed and in 83 (91%) of these tests, 90% or more pixels pass γ(2% dose difference, 2 mm distance-to-agreement) condition.