AbstractID: 2010 Title: Demonstrated Accuracy Performance Stability in Prototype AC Magnetic 4D Localization System in Radiation Therapy Environment

A 4D localization system (Calypso Medical Technologies, Seattle, WA), comprising implanted magnetic transponders and an external AC magnetic array, has been developed to objectively localize target isocenter within 2 mm and continuously monitor target isocenter during beam delivery. This study demonstrates system accuracy and precision in the radiation treatment room. Materials for testing included a tissue-equivalent radiographic phantom embedded with three electromagnetic transponders, a prototype AC magnetic localization system and a standard Varian Clinac 23EX linear accelerator for registration. Accuracy of the target positions was computed from the distance between the expected and treatment isocenter locations reported by the system. System accuracy, stability of accuracy over time and accuracy with deviations to the transponder plan baseline were evaluated. System accuracy includes factors beyond the AC magnetic system, such as, transponder CT localization accuracy and phantom fixture accuracy. In all cases, the range of reported target offset varied no more than +/-1.0 mm in radial distance from known target positions. In an 8-minute acquisition cycle, 30 second average target position varied < 0.1 mm from the Confirmed Location on x, y and z-axes. Simulated target volume changes of 5% larger and smaller volumes, in each linear dimension, approximating a 15% volume change were measured accurately < 1mm. Simulated asymmetric deformations in targets were measured accurately (<1mm) with one of three transponders shifted from baseline orientation: (1) 2 mm toward centroid (2) 2 mm away from centroid and (3) 2mm orthogonal to the plane.

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