AbstractID: 4834 Title: Concurrent Tracking and Fluoroscopic Imaging of Implantable Wireless Electromagnetic Transponders

Purpose: Multiple technologies are being utilized to improve real-time tumor tracking. To date, there have not been methods to prospectively compare different technologies with realistic tumor trajectories. We evaluated the capabilities of the Calypso® Medical 4D Localization System (Calypso Medical, Seattle, WA) and Varian Trilogy System (Varian Medical Systems, Palo Alto, CA) fluoroscopy in tracking dynamic objects.

Method and Materials: Initially, a quality assurance fixture containing three implantable transponders was moved by an in-house developed 4D phantom through an ellipse and a non-uniform human lung tumor path modeled with CT imaging and spirometry. Subsequently, three transponders that had been implanted in a canine lung were tracked. In both experiments, the transponders were fluoroscopically imaged on a Trilogy system while simultaneously being tracked by the Calypso® 4D localization system. The fluoroscopic images were recorded and later analyzed using a custom-written (MATLAB) image processing program to determine the transponder projection positions with respect to time. The trajectories derived from the fluoroscopic images were synchronized with and compared to the Calypso System position data.

Results: The root mean square (RMS) position differences were less than 0.03 mm for all tested measurement system combinations. While both were small, the Calypso System RMS error was slightly lower than that of the fluoroscopy when compared against the 4D phantom positions. Of the three trajectories, the RMS error between imaging modalities was largest for the patient trajectory and smallest for the ellipses.

Conclusion: This work indicates that both tracking methods provide excellent positioning accuracy. Although the accuracy discrepancy between the two systems is negligible, the Calypso® System also offers the ability to localize in three dimensions and has the advantage of being able to track a target continuously without the use of ionizing radiation.

Conflict of Interest: Supported in part by Calypso Medical Technologies, Inc.