Purpose: To quantify the calibration accuracy of the Calypso System to radiation isocenter on systems at multiple sites. This data is being gathered under clinical conditions and will be used to refine margins used for treatment planning.
Method: The electromagnetic tracking system is calibrated to isocenter with the manufacturers recommended technique, using laser-based alignment. A test patient is created with a transponder at isocenter whose position is measured electromagnetically. Four portal images of the transponder are taken with collimator rotations of 45°, 135°, 225°, and 315°, at each of four gantry angles (0°,90°,180°,270°) with a 3x6 cm^2 radiation field. In each image, the center of the copper-wrapped iron core of the transponder is identified. All measurements are made relative to this transponder position to remove gantry and imager sag effects. For each of the 16 images, the 50% collimation edges are identified and used to find a ray representing the rotational axis of each collimation edge. The 16 rays pass through and bound the radiation isocenter volume. The center of the bounded region, relative to the transponder, is calculated and then transformed to tracking system coordinates using the transponder position coordinates, allowing the tracking systems calibration offset from radiation isocenter to be found. All image analysis and calculations are automated with in-house software for user-independent accuracy. Three different Calypso Systems at two different sites are being used for this study.
Results: Two sets of data have been collected and analyzed to date. The positions of RF isocenter were found to be (LR,AP,SI)=(0.51,0.22,1.02)mm and (0.97,0.12,-0.77)mm, relative to radiation isocenter. The distances between radiation and RF isocenter were 1.16 and 1.24 mm.
Conclusions: This method allows the calibration accuracy of the Calypso System to radiation isocenter to be determined. Preliminary results indicate an accuracy of about 1.2 mm.

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