AbstractID: 2835 Title: Portal Imaging Capability of Motion Detection

Purpose: Quantitative determination and validation of tumor motion is required for Image-Guided Radiotherapy (IGRT) of mobile tumors. One method for validating motion is portal imaging using electronic portal imaging devices (EPIDs). Ability to detect and delineate moving tumors depends on EPID specifications and image acquisition protocol. Requirements include accurate object definition and the capability to localize objects throughout the breathing cycle, at different locations within the body. We devised a straightforward test to assess EPID performance.
Method and Materials: Water-filled spheres of different diameters were attached to a computer-controlled linear stage programmed to move spheres at constant velocities over a range of distances (up to 60mm) and speeds (from 5-40mm/s), within a stationary phantom. Images were captured during motion cycles using Varian PortalVision and Elekta iView amorphous silicon EPIDs. Accuracy of the projected target position was evaluated for images consisting of 1-3 averaged frames. We tested the image quality across the EPID while maintaining fixed source-to-object (isocenter) distances.
Results: Both imaging systems accurately reproduced projected target shapes. The accuracy of range and speed measurements were 0.5mm and 0.1mm/s, respectively. The iView system detected the 60mm range of motion to within 2.5mm, for all tested speeds. The PortalVision system detected 60mm range of motion to within 3.5mm, up to 20mm/s, but performance degraded at greater speeds, with images missing in parts of motion cycles. At 30mm/s, only 45mm was detected. For both systems, range measurement errors were proportionally smaller for shorter ranges. Both imagers performed consistently throughout their imaging surface and both were comparable for image quality.
Conclusion: We've devised a process that can simultaneously assess motion detection capability and test EPID systems. Both imagers performed well in static conditions, implying accelerator feedback system led to missing images. We'll investigate methods to improve the dynamic imaging characteristics of these EPID systems.