AbstractID: 1102 Title: A real-virtual phantom system of verifying and correcting dosimetric errors in modern radiotherapy

IMRT and other modern radiotherapy modalities have become disparate in dose distributions to the point where it is difficult to design clinical trials that will accrue sufficient patients to have statistical power. To facilitate the development of standardized clinical trials and practices, a system of virtual anthropomorphic phantoms and real embodiments was created to verify the dosimetric accuracy of contemporary radiation therapy systems (RTS). Virtual anthropomorphic phantoms described by analytic equations, similar to the MIRD phantom, and real embodiments of the virtual phantoms with cavities for detectors, similar to the Rando phantom, were integrated into a real-virtual phantom (RVP) system. RTS applications include a) acceptance and commissioning, b) periodic QA as in AAPM TG-40; and c) patient-specific dosimetric verification as in IMRT practice. Analytic descriptions of H&N and prostate anatomy were applied to exemplify the system. Diverse target shapes were described analytically to simulate realistic clinical targets. Tomotherapy and DMLC IMRT dosimetric features were exemplified in H&N and prostate treatment plans. These features were then examined for suitability in clinical trials of IMRT. The RVP system may be integrated into treatment planning and delivery systems so as to detect, analyze, and correct for errors in dose calculation and delivery. In conclusion, the RVP system of benchmarking and dosimetric verification may provide a basis for solving the problems of standardizing disparate practice, and agreeing on dosimetric criteria for clinical trials and standards of care.