AbstractID: 5895 Title: Capabilities of a CT-suitable, Patient-Adaptive HDR/PDR Intracavitary Brachytherapy Applicator for the Treatment of Cervical Cancer

Purpose: To demonstrate the capability of a prototype, high-dose-rate/pulsed-dose-rate (HDR/PDR) intracavitary brachytherapy cervical applicator to be (a) imaged using computed tomography (CT) with minimal artifacts as compared to current, clinically-utilized applicators and (b) deliver dose to a simulated disease plane that is at least equivalent to that delivered by the FW applicator while delivering less dose to multiple, simulated rectal planes for equivalent loadings. Capability (b) demonstrates the prototype applicator's ability to adapt to varying patient anatomies utilizing a remotely adjustable shield contained within the colpostat.

Method and Materials: CT image sets were acquired of the Fletcher-Suite-Delclos (FSD), Fletcher-Williamson (FW), and prototype applicators (utilizing a step-and-shoot technique) and artifacts generated by each were compared qualitatively. Images were acquired of the applicators positioned parallel to the table and in positions that simulated applicator placement during treatment. Using film validated MCNPX Monte Carlo (MC) models of the prototype and FW applicators, dose comparisons (min, max, average, and dose-surface histograms) were made in simulated disease (1cm medial to colpostat) and multiple rectal (1cm distal and 0, 0.5, and 1cm medial to the colpostat) planes.

Results: Preliminary results indicate that the prototype applicator is CT-friendly; qualitatively minimizing anatomy-obscuring artifacts compared to equivalent FW and FSD image sets. Additionally, the prototype applicator is able to deliver comparable dose levels (within +/- 5%) to a simulated disease plane while reducing dose (32% average) to varying simulated rectal planes when compared to equivalent FW treatments.

Conclusion: The prototype applicator is able to be CT imaged with minimal artifacts and substantially reduce dose delivered to the rectum while maintaining dose delivered to disease when compared to current ICBT technologies. Currently, the model is being extended to include two prototype applicators and a 15^{o} tandem so that dose-volume histograms can be generated using specific-patient cases of varying anatomical geometries.