AbstractID: 8930 Title: An Anthropomorphic Adult Physical Phantom and Fiber Optic Coupled Point Dosimetry System for the Measurement of Effective and Average Organ Doses of CT Patients

Purpose: Advances in computed tomography (CT) acquisition techniques, primarily multi-detector CT (MDCT) and cone beam CT (CBCT), make it highly desirable to develop measurement techniques that provide a more physically meaningful measurement of patient dose than the traditional CT dose index (CTDI). The goal of this work was to accurately quantify the organ doses delivered to adult patients during CT exams as a fundamental tool for developing patient dose histories.

Method and Materials: A tissue-equivalent anthropomorphic adult phantom based on a tomographic data set was developed and fabricated at the University of Florida. The adult phantom's physical and radiological parameters are designed to mimic ICRP reference man, and include tissue-equivalent materials for soft tissue, bone, and lung. Fiber optic-coupled (FOC) dosimeters, which have been calibrated and characterized across the CT energy range, provide point dose measurements for multiple organ locations. The combination of phantom and FOC dosimeters establishes a dosimetry system to characterize both internal organ doses and effective dos

Results: The calibrated point detector system provides remote, real-time dose measurements and in conjunction with the adult physical phantom allows for the quantification of absorbed organ dose measurements for a wide range of MDCT acquisition protocols. Average organ doses were quantified for the prostate, kidneys, liver, and lungs. The point dosimeter measurement illustrates the significant dose contributions that originate from scattering outside of tissue regions represented by the 15 cm length of CTDI phantoms. FOC dosimeters permit the dose to be displayed as a function of longitudinal position for a variety of scan parameters, aiding in the interpretation of dose comparisons.

Conclusion: FOC dosimeters demonstrate high sensitivity, reproducibility, excellent dose linearity, and combined with their small physical size permit accurate point-dose measurements. The organ doses vary significantly from interpretations of the CTDI, depending strongly on position and scan volume.