AbstractID: 12893 Title: Organ doses in the reference adult male and female exposed to computed tomography examinations: Monte Carlo simulations and experimental validation

Purpose: To establish an organ dose database for adult male and female reference individuals undergoing computed tomography (CT) examinations by using the Monte Carlo (MC) method.

Methods and Materials: We are using the MC method to estimate organ doses from CT examinations to support epidemiologic studies of the risk of second cancers associated with radiation exposure from CT examination. The fan-shaped x-ray beam of a SOMATOM Sensation 16 CT scanner was simulated by using a general purpose MC code, MCNPX v2.6. The bowtie filter was approximated based on beam profile measurements under service mode tube settings. To simulate the anatomy of patients, the University of Florida family of hybrid computational phantoms representing the adult male and female at their 50^{th} percentile body weight and standing height were coupled with the CT scanner model. The reliability of the MC simulation system has been validated by comparing results with measurements from Computed Tomography Dose Index (CTDI) head and body phantoms. Organ absorbed doses were calculated for Head, Chest, Abdomen, and Pelvis examinations and compared with those from two commercial CT dose calculation programs (CT-expo and CT-Dosimetry).

Results: Central and peripheral doses from the measurements using head and body CTDI phantoms were compared with those from MC simulation. The simulated doses showed good agreement with measured values with the largest percent difference of 8%. Normalized values of organ absorbed dose (mGy/100 mAs) were calculated for 25 organs in the adult male and female phantoms undergoing CT examinations. The dose results were compared with those from the commercial programs, and significant differences up to 200% were shown in major organs.

Conclusion: The organ dose database developed in this study significantly improves the accuracy of organ dose assessments in CT examinations which have not been implemented in existing commercial CT dose evaluation programs.