AbstractID: 10448 Title: Monte Carlo Based Multidetector CT Modeling and Dose Calculations for Pregnant Patients

Purpose: To model and validate the multidector CT (MDCT) scanner and to assess radiation dose to the fetus and pregnant patient in three different gestational periods. **Method and Materials:** Monte Carlo code, MCNPX, was used to simulate the x-ray source including the energy spectrum, filter, and scan trajectory. Detailed CT scanner components were specified using an iterative trial-and-error procedure for a GE LightSpeed CT scanner. The scanner model was validated by comparing simulated results against measured CTDI values and dose profiles reported in the literature. The source movement along the helical trajectory was simulated using the pitch of 0.9375 and 1.375, respectively. The validated scanner model was then integrated with phantoms of a pregnant patient in three different gestational periods to calculate organ doses and fetal doses. **Results:** Comparison between simulated results and reported results in literature shows good agreement in terms of CTDI values as well as dose profiles. It was found that the dose to the fetus of the 3-month pregnant patient phantom was 0.13 mGy/100mAs and 0.57 mGy/100mAs from the chest and kidney scan, respectively. For the chest scan of the 6-month patient phantom and the 9-month patient phantom, the fetal doses were 0.21 mGy/100mAs and 0.26 mGy/100mAs, respectively. All these scans were performed with protocols that did not contain the fetus directly in the x-ray beam. The paper also discusses how these fetal dose values can be used to evaluate imaging procedures and to assess risk using recommendations of the report from AAPM Task Group 36. **Conclusion:** This work demonstrates the ability of modeling and validating MDCT scanner by Monte Carlo method, as well as rapidly and accurately assessing fetal dose and organ doses by combining the MDCT scanner model and pregnant patient phantom.