Purpose: We applied 2D reference dosimetry protocol for dose measurements using XR-QA radiochromic film model during diagnostic computed tomography (CT) examinations carried out on patients and humanoid Rando phantom.
Methods: Response of XR-QA model GAFCHROMIC™ film reference dosimetry system was calibrated in terms of Air-Kerma in air. Four most commonly used CT protocols were selected on our scanner (GE Lightspeed VCT 64), covering 3 anatomical sites (Head, Chest, and Abdomen). For each protocol, 25 patients ongoing planned diagnostic CT examination were recruited. Surface dose was measured using 4 or 8 strips taped on patients' skin and on Rando phantom. Film pieces were scanned prior to and after irradiation using Epson Expression™ 10000XL document scanner. Optical reflectance of the unexposed film piece was subtracted from exposed one to obtain final net reflectance change, which is subsequently converted to dose using previously established calibration curves.
Results: Our measurements show that skin dose variation has a sinusoidal pattern along the scanning axis due to the helical movement of the X-ray tube around body, and axial movement with pitch around head. Preliminary results show that the average skin dose for patients can be up to 6.8 cGy, 7.6 cGy, 6.0 cGy and 7.0 cGy for Head, Chest, Abdomen and Angio Abdomen protocol. The obtained experimental Dose-Length Products (DLP) show higher values than CT based DLP taken from the scanner console.
Conclusions: In this work, we applied an Air-Kerma in air based radiochromic film reference dosimetry protocol for in vivo skin dose measurements. We found that green channel extracted from the scanned RGB image is the best suited for dose measurements in the range from 0 to 20 cGy. Measured skin doses and corresponding DLPs are larger than provided by the manufacturers since they are measured on the skin of the patients.