CT-Dose: a graphical user interface for dose calculation using MC-GPU Monte Carlo code

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Although the benefits of computed tomography (CT) scans are well known, there are concerns about the imaging dose received by patients due to the increased usage of CT scanners in recent years. Children are of particular concern because of their longer life expectancy and the increased sensitivity of their developing tissues to radiation. Recent epidemiological research has demonstrated a dose-response relationship for subsequent risk of leukemia and brain tumors from pediatric CT scans. For this reason, tools for establishing a patient dose registry would be helpful for supporting future epidemiological research on late health following CT scans.

This study describes a new methodology for evaluating patient CT organ dose. A software was developed to automatically convert the patient image data in *DICOM* format into a voxelized input for a Monte Carlo radiation transport simulation using the *MC-GPU* code. The simulation results consist of the dose in each image voxel and a table of dose values and associated statistical error classified by material or organ. The data dose in each voxel can be converted to ".vtk" format for visualization in *Paraview*. This approach could be used to automatically report patient CT organ dose when combined with methods to automatically segment organs on CT images.

To validate our method, we compared our Monte Carlo calculated dose results with experimental measurements performed using an anthropomorphic *RANDO* phantom. Metal Oxide Semiconductor Field Effect Transistor (MOSFET) dosimeters were placed in several locations within the physical phantom and the cumulated dose was recorded while performing a typical CT scan. The CT scanning was performed using a *Siemens Somatom Emotion* scanner located at the *Consorci Hospitalari Provincial De Castello, Spain* and the same scan parameters were modeled in the Monte Carlo simulation for comparison purposes. Finally, twenty punctual doses were registered and compared. Although absolute dose could not be compared, the relative dose shows similar trend when comparing simulated results and experimental values.