Modelling scattering contributions in X-ray micro-CT scanners with variable geometry

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Poster Outline

It is commonly known that scattered X-rays (both Compton- and Rayleigh scattering) produce a disturbing contribution to the projection images taken during a CT-scan. In medical CT a scatter-grid and collimators are used to decrease the contribution of scatter. In high resolution micro-CT scanners such as those at UGCT, the "Centre for X-ray Tomography" of the Ghent University, this approach is not possible because of the inherent structure of the used detector systems (e.g. flatpanels) and the highly variable geometry of the scanners. At UGCT a wide variety of samples is scanned, requiring different geometries. Very small samples are positioned close to the X-ray source, while larger samples have to be positioned close to the detector. The samples also have a wide range of densities, from organic material, such as apples, to geological stones and metals.

For several reasons it is important to determine the specific amount of scattered X-rays that reach the detector in micro-CT. This amount is dependent on the distance between the object and the detector, the composition and size of the sample… . Also the geometry of the scanner and the kind of X-ray source (pencil beam, parallel beam or cone-beam) can have a relevant effect. As such, every different sample in its optimal geometry will cause a different amount of scattered photons reaching the detector plane.

To study the characteristics of scattered radiation, the Monte Carlo based simulation program BEAMnrc is used[2]. BEAMnrc is based on the EGS-code developed for coupled transport of photons and electrons[3]. In BEAMnrc each photon can be 'followed' during the complete simulation. For each photon tallied at the detector plane one can determine whether this photon has scattered in the sample or not, which yields the number of scattered photons, next to the number of unscattered photons.
The final goals of this research are to add a scatter-tool in our set-up optimizer and to be able to correct projection images for the scattering contribution. The used methodology and obtained results of this work will be presented.

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[2] http://www.nrc-cnrc.gc.ca/eng/solutions/advisory/beam_index.html
[3] http://www.nrc-cnrc.gc.ca/eng/solutions/advisory/egsnrc_index.html