AbstractID: 12662 Title: GPU-Accelerated Digitally Reconstructed Radiograph Generation for Radiation Therapy

Purpose: To evaluate the speed up and image quality for digitally reconstructed radiograph (DRR) calculations using a graphic processing unit (GPU) comparing with a central processing unit (CPU). **Method and Materials:** We developed an application for DRR image calculations using a faster incremental Siddon ray tracing algorithm. The implementation of the core integration loop was the same for the CPU and the GPU except that single-precision operations were used on the GPU with CUDA 1.2. The GPU runs on NVIDIA GeForce GTX 280M with 1 GB video memory. To validate the correctness of the algorithm, we employed a clinical three-field plan as an example. The CT volume image and the RT plan were exported from a commercial treatment planning system and read by our application to generate the DRR images. **Results:** By comparing visually with the bony structures from our DRR images and the commercial software generated DRR images, we have confidence in the correctness of our fast ray tracing implementation on both CPU and GPU. The accuracy of the GPU calculations comparing with the CPU calculation is well acceptable as only about 3% of the total pixels have less than 0.1% pixel values difference from the CPU calculations for the test fields. **Conclusions:** The DRR calculations using GPU is more than an order of magnitude faster than using a general purpose CPU. The image quality by the two methods is very similar where the difference comes from the float point operation type. This accelerated DRR computation has potential to reduce the patient-positioning time during the 2D/3D registration where inline DRR calculations are required in the iteration.