AbstractID: 10373 Title: Accuracy and computing time of a ray-driven projector/back-projector for simulation and reconstruction in tomosynthesis and cone beam CT imaging

Accurate and fast projector/back-projector (PBP) is the key to successful simulation and iterative reconstruction of tomosynthesis and cone beam CT. In this study, the accuracy and computation speed of a ray-driven PBP operator were investigated.

To simulate x-ray tomography imaging, a ray-driven projector was developed and implemented on a 64 computing node PC Cluster. Each x-ray path is represented by sampling points in the object. Their μ values are summed up to compute the integral attenuation along the path. To evaluate the accuracy of the reprojection algorithm as the function of sampling ratio (Sampling length / voxel length), reprojections obtained with a significantly smaller sampling ratio were used as reference. To minimize the additional loss of accuracy from pixelization, the pixel size of the projection images was selected to be one third of the voxel size projected back to the image plane. Error images were formed by subtracting the re-projection from the reference re-projection and used to compute the percentage errors.
SART were implemented for image reconstruction in tomosynthesis and CBCT imaging. To evaluate its accuracy, CBCT images reconstructed with 300 projection views over 360 degree were compared to the original CBCT images. Errors were computed from the subtraction images and plotted together the computing time as the function of the sampling ratio.

With reduced sampling ratio, the accuracies of both the re-projection and SART algorithms were improved at the expense of longer computing time. The improvement was accelerated with smaller sampling ratios. Aliasing artifacts were visible when the sampling ratios were greater than 0.5.

We have demonstrated that the accuracy of the re-projection and SART reconstructions improved with reduced the sampling ratio at the expense of longer computing time for a ray-driven PBP. The tradeoff between accuracy and computing time should be determined by the imaging requirement.