AbstractID: 1385 Title: Investigation of the optimal number of projections for head and neck megavoltage cone-beam CT

In megavoltage (MV) cone-beam CT (CBCT), under the constraint of fixed total dose, different imaging strategies are possible in terms of the overall number of projections employed for the 3D reconstruction. A large number of projections improves the CBCT spatial resolution. However, because of decreased photon flux, system noise can deteriorate image quality. On the other hand, increasing the projection SNR ratio by distributing the acquisition dose over a smaller number of projections results in characteristic streak patterns in the reconstructed CBCT and lower spatial resolution.

Aiming at low-dose MV CBCT volumetric targeting prior to a treatment fraction, we have investigated the influence of the number of projections on the precision of mutual information registration. Five MV CBCT test datasets and a target, low-dose 3D MV CBCT image were acquired. The registration of a high-dose dataset (44 MU, 192 degree arc) to the target image provided a "gold standard" transformation. The other test datasets were reconstructed with a varying number of projections ranging from 48 to 192 over an arc of 192 degrees. The total acquisition dose was fixed to 11 MU. The proximity of the registration transformation for each test dataset to the "gold standard" transformation was evaluated via the average distance between the predicted locations of spatial points mapped by both transformations.

The experiments indicate that, with a registration precision of about 2 mm, a strategy that employs a near compete set of very low dose projections compares favorably to the other acquisition approaches.