AbstractID: 8783 Title: A patient set-up protocol based on partially blocked cone-beam CT

Purpose: Three-dimensional x-ray cone-beam CT (CBCT) is being increasely used in radiation therapy. Since the whole treatment course typically lasts several weeks, the repetitive x-ray imaging results in large radiation dose delivered on the patient. In the current radiation therapy treatment, CBCT is mainly used for patient set-up, and a rigid transformation of the CBCT data from the planning CT data is also assumed. For an accurate rigid registration, it is not necessary to acquire a full 3D image. In this paper, we propose a patient set-up protocol based on partially blocked CBCT.

Methods and Materials: A sheet of lead strips is inserted between the x-ray source and the scanned patient. From the incomplete projection data, only several axial slices are reconstructed and used in the image registration for patient set-up. Since the radiation is partially blocked, the dose delivered onto the patient is significantly reduced, with an additional benefit of reduced scatter signals.

Results: The proposed approach is validated using experiments on two anthropomorphic phantoms. As compared to registration using the regular CBCT, the registration difference using the partially blocked CBCT is less than $1mm$ in translation and less than 0.2 degrees in rotation. In our implementations, the proposed protocol using partially blocked CBCT reduces radiation dose by a factor of more than 6. The comparison of the reconstructed images also shows that the image quality of the illuminated slices in the partially blocked CBCT is much improved over that in the regular CBCT.

Conclusions: A practical patient set-up protocol based on partially blocked CBCT has been developed for radiation therapy. The proposed approach greatly reduces radiation dose, as well as the adverse effect of scatter photons. It should be useful to improve the clinical practice.

Conflicts of Interest: There are no actual or potential conflicts of interest.