AbstractID: 3147 Title: Registration of volumetric kV or MV cone beam CT with fan beam CT

Purpose: Kilovoltage (kV) cone beam CT (CBCT) provides the patient's volumetric information and is valuable for patient positioning verification. An important step in this application is the registration of CBCT acquired at simulation or before treatment with the planning CT (PCT). The purpose of this work is to investigate several specific issues involved in CBCT-TPCT registration and develop an effective algorithm to effectively utilize the volumetric imaging system for IGRT.

Method and Materials: The PCT data were acquired using Picker PQ5000 scanner, and the CBCT images were obtained using Varian Trilogy OBI system. The image quality of CBCT is generally poor as compared with conventional CT: Low soft tissue contrast, artifacts/distortions, and limited width/length present practical problems for its clinical application. A BSpline based non-rigid image fusion software was implemented to provide voxel-to-voxel matching between PCT and CBCT.

Results: For the phantom study, the quality of CBCT has little effect on the registration and the CBCT-PCT mapping was relatively straightforward because of the absence of motion artifacts. Examination of "bony" landmarks indicated that an accuracy less than 2mm was achievable. The patient registrations were complicated by artifacts and, in the cervix case, the limited field size of CBCT. While the bony landmarks can be registered to within 2mm, the motion artifacts complicated registration and caused a large uncertainty in the PCT-CBCT mapping.

Conclusion: Low soft tissue contrast and artifacts of CBCT posed a challenge for CBCT-PCT registration. While continuous effect is needed to improve the CBCT, a robust registration tool that can cope with specific issues of CBCT is highly desirable to fully exploit the volumetric CBCT technology.