## AbstractID: 12770 Title: IGRT via machine learning from limited angle projection images

**Purpose:** To yield accurate patient treatment setup correction from few numbers of projection images in tomosynthesis-based IGRT approaches using cone-beam CT (CBCT) and the novel carbon nanotube stationary tomosynthesis (NST) devices.

**Method and Materials:** Our method uses a machine learning strategy that has a two-stage process: training and IGRT. In the training stage we perform a patient-specific training that samples from a range of potential patient movements, and for each such movement we generate 2D projections by transforming and re-projecting the patient's planning CT. We compute a linear regression between the patient movements and the differences between the projections of the moved CT and those of the CT in the planning position. In the IGRT stage, the learned regression model is applied iteratively to the successive residues between the real-time projections and those of the moving CT transformed by the previously predicted parameters. This iteration yields the predicted transformation with sub-voxel accuracy. The re-projection process is implemented on GPUs to speed up the real-time image guidance that will be enabled by the carbon nanotube based stationary tomosynthesis IGRT system NST.

**Results:** We tested our method using three patients' head-and-neck CTs. A total of 180 test movements were simulated with combination of both translations and rotations that were randomly picked within -2 to 2 cm and -5 to 5 degrees, respectively. The NST and the 44-degree CBCT IGRT devices are simulated in our tests. The mean of the vector error distance are 0.1270 cm with 12 NST image projections and 0.1116 cm with 5 image projections from the 44-degree CBCT.

**Conclusion:** Our method can yield accurate patient's position and orientation correction with limited projection images, which is important for image-guidance during treatment delivery and the reduction of imaging radiation dose.

Conflict of Interest: Research sponsored by Siemens Medical Solutions.