AbstractID: 12894 Title: Self-sorted Four-Dimensional CT using Body Volume as Respiratory Surrogate

Purpose: To develop a self-sorting four-dimensional CT (4D-CT) technique that uses body volume as the respiratory surrogate.

Method and Materials: Respiratory signals are determined by the changes in body volume at each slice location as a function of image acquisition time. Respiratory phases were then calculated for each image and used in 4D-CT retrospective sorting. The technique was validated on an in-house built motion phantom and tested on a lung cancer patient and a liver cancer patient. Self-sorted 4D-CT images were compared to the 4D-CT images generated using Varian's RPM system.

Results: Both phantom and patient study revealed excellent agreement in image quality between the self-sorted 4D-CT and the Vairan's RPM-sorted 4D-CT. Mean difference in amplitude in phantom study is 0.1±0.1mm. Breathing cycles can be clearly seen in all image sets by observing the position changes of tumors and organs (liver, stomach, and kidneys). The fact that the self-sorted 4D-CT technique worked well for the tumor in the upper lung region (which typically moves much less than the abdomen regions during the breathing) suggested that the body volume is a sensitive marker of respiration. Small discrepancies do exist between the two sorting methods on the phase-by-phase basis. It is difficult, however, to conclude which method has the better image quality.

Conclusions: Self-sorted 4D-CT using body volume alone as the respiratory surrogate is feasible. Its image quality is comparable to that using Varian's RPM system. This new technique has the potential in reducing 4D-CT simulation time and increasing patients' comfort while maintaining the same image quality.