AbstractID: 4324 Title: Phase and Amplitude Binning for 4D-CT Imaging

We compare the consistency and accuracy of two image binning approaches used in 4D-CT imaging. In 4D-CT the images and respiratory motion are correlated via RPM Respiratory Gating system (Varian, Palo Alto, CA). In phase binning (PB), RPM assigns each breathing cycle 2π radians, within which the images are grouped. Alternately, the images are assigned bins according to the signal's amplitude (AB). To quantitate both approaches, we used NEMA NU2-2001 IEC phantom oscillating at random frequencies and amplitudes, simulating patients breathing. 4D-CT images were obtained using 4-slice GE Lightspeed CT operating in cine mode. We define consistency error as ability to correctly bin over breathing cycles in the same FOV. Average consistency error in PB ranged from 18%±20% to 30%±35%, while in AB the error ranged from 11%±14% to 20%±24%. For 28mm sphere, PB images were hardly consistent, with error of 43%±47%, while AB images for the same sphere resulted in error of only 18%±22%. In PB, while not all breathing cycles covered all phases, nearly all bins contained sphere slices. AB was more accurate, revealing empty bins where no sphere slices existed. As a proof of principle, we present examples of two NSCLC patients' 4D-CT lung images binned by both approaches. While AB can lead to gaps in the images, depending on patients' breathing pattern, PB exhibits no gaps but suffers visible artifacts due to misbinning, yielding images that covered a relatively large amplitude range. AB was more consistent, though often resulting in gaps corresponding to CT slices where no data existed due to patients' breathing. We conclude AB is more accurate than PB, which should be factored into treatment planning and diagnosis.

Work supported by GE Healthcare Technologies and Varian Medical Systems.