Purpose:
The hybridisation of SPECT with X-ray CT is expanding the utility of SPECT. In addition to image fusion, CT enables improved attenuation maps (AM) for SPECT. Two CT designs are used in SPECT/CT: slow-rotation and fast-rotation. The "slow-rotation" CT completes a full-rotation in 15 seconds to provide an AM that is acquired over several frames of the respiratory cycle; hence includes motion related physiologic artifacts. The "fast-rotation" CT completes a full-rotation in 0.6 seconds to provide an AM that is comparatively free of breathing artifacts. Neither is similar to SPECT, which is acquired in a step-and-shoot manner, where each projection is acquired over all frames of the respiratory cycle.

Methods:
We compared cardiac SPECT/CT acquisitions with the General Electric Infinia/Hawkeye-4 which incorporates a slow-rotating CT and the Siemens Symbia/T6 which incorporates a fast-rotating CT. Three canine experiments were performed comparing SPECT reconstructions that were corrected for attenuation with no respiratory motion between SPECT and CT (gold standard). These were compared with SPECT reconstructions that incorporated respiratory motion and corrected for attenuation using either the slow or fast-CT AMs. The SPECT reconstructions were compared using a Root-Mean-Squared (RMS) metric and scatter plots, calculated pixel-by-pixel in a region-of-interest through a central slice of the heart.

Results:
The canine experiments showed improvements in both the RMS error and correlation coefficients for all canines when using the fast-CT AM. The average RMS error improved from 28% to 17%, while the average correlation coefficient improved from 0.85 to 0.96. Canine studies confirmed respiratory motion has the potential to corrupt CT data and can effect attenuation correction in SPECT.

Conclusions:
Artifacts in the attenuation map due to physiologic motion propagate into the SPECT image reconstructions causing erroneous results. Therefore, for SPECT to become more quantitative an attenuation map with fewer artifacts is desirable.