

Purpose: To analyze the consistency and accuracy of the respiratory signal tracking from the GateCT™ for 4DCT scanning.

Methods: This experiment involved the use of the GateCT™ system, RPM™ system, GE CT scanner, QUASAR respiratory motion platform (Chest Wall Platform), and MATLAB. Both GateCT and RPM systems were used to collect data on the CT scanner, using 20 various-range breathing patterns (12 simulated & 8 patients). Once data was acquired with both systems, MATLAB was used to analyze the possible frequency and amplitude discrepancies between input and recorded signals.

Results: All recorded breathing patterns of both GateCT and RPM had a frequency percent error less than 4% from the ideal frequency despite some breathing patterns being irregular. Also, the correlation coefficients of GateCT and RPM, with respect to the input breathing pattern, had an average percent difference of 1.26% within the range of 0.24%-3.22%. GateCT accurately recorded the frequency of the input breathing pattern, but sometimes displayed an amplitude drift within its data. The amplitude drift within the recorded breathing pattern of GateCT has shown to be significant when the chest wall platform has amplitudes less than 0.42cm. When the chest wall platform has amplitude greater than 0.50cm, the amplitude drift has a change of less than 5%, rendering the amplitude drift insignificant.

Conclusions: GateCT has shown its accuracy and consistency in recording the frequency of any breathing pattern, be it typical or irregular. Due to its accurate tracking, GateCT is trustworthy of tracking the breathing pattern of any patient, in result, producing high quality 4DCT images that will improve the patient's treatment plans. When a patient has breathing amplitude less than 0.42cm, RPM should be used due to GateCT displaying a significant amplitude drift. In conclusion, GateCT provides accurate data necessary for high quality 4DCT images.