

Purpose: The purpose of this study is to assess the temporal and reconstruction accuracy of two different optical systems for respiratory motion detection for 4DCT.

Materials and methods: A clinical CT scanner, run in cine mode, was used with two optical devices, the Gate CT[®], (Vision RT, London, UK) and the RPM[®] (Varian, Palo Alto, CA), to detect respiratory motion. A radiation detector, GM-10 (Blackcat, Westminster, MD), triggers the Xray on/off to Gate CT system, while the RPM is directly synchronized with the CT scanner through an electronic connection. Two phantoms were imaged: the first phantom translated a rigid plate along the antero-posterior direction, and was used to assess the temporal synchronization of each optical system with the CT scanner. The second phantom consisted of 4 spheres that translated 3cm peak-to-peak in the superior inferior direction, used to assess the rebinned images created by Gate CT and RPM.

Results: Calibration assessment showed a nearly perfect synchronization with the scanner for both the RPM and Gate CT systems, thus demonstrating the good performance of the radiation detector. Results for the volume rebinding test showed a variations in volumes for the 3D reconstruction of up to 15% for Gate CT and up to 12% for RPM. The mean of the standard deviations errors were 11% and 9% respectively. Errors are mainly due to phase detection inaccuracies and to the large motion of the phantom.

Conclusions: This feasibility study assessed the consistency of our two optical systems in synchronizing the respiratory signal with the image acquisition. A new patient protocol based on both RPM and GateCT will be soon started.