

**Purpose:** To evaluate differences observed between two different external surrogate acquisition systems: Varian's Real-Time Position Management (RPM) and Philips Medical Systems pneumatic bellows, in the context of 4DCT sorting and tumor delineation.

**Methods:** Eight patient displacement curves from RPM data were inputted into the motion platform with a variety of amplitudes (0.5 to 3 cm). Simultaneous 4DCT acquisition was performed with both bellows and RPM block placed on the platform. The bellows signal was used for on-line retrospective phase-based sorting, while raw 4DCT data was reconstructed off-line using RPM signal on a research version of the Extended Brilliance Workspace (Philips Healthcare). Curves were resampled, normalized, and analyzed to determine the association between different external surrogates, amplitude differences, and latency between systems. 4DCT data was imported into Eclipse, and a lung window/level was used for all contouring. The volumes and centroids were compared among techniques.

**Results:** Pearson r correlations between the RPM and bellows-acquired breathing traces were 0.987- 0.999. Slight discrepancies were observed with low amplitude displacement, where bellows were not as sensitive as RPM to slight variations in motion platform position. Target volumes were 200.27 +/- 12 cc and 199.96 +/- 13.3 cc for RPM and bellows targets, respectively, which was not significantly different ( $t(7) = 0.33$ ,  $p = 0.75$ ). Small centroid variations were observed between bellows and RPM contoured MIP targets: 0.025 +/- 0.05 mm, 0.013 +/- 0.04 mm, and 0.25 +/- 0.32 mm in lateral, anterior-posterior, and superior-inferior directions, respectively. Largest volume difference was observed for an RPM target 2.5 cc (1%) less than bellows target, which showed the largest difference in centroid displacement (0.9 mm). Overall, RPM data lagged behind the bellows data ~126 ms.

**Conclusions:** We have demonstrated comparable results between Philips bellows and Varian's RPM system, particularly in the management of 4D treatment planning.

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**Conflict of interest:** Henry Ford Health Systems holds a research agreement with Philips Healthcare.