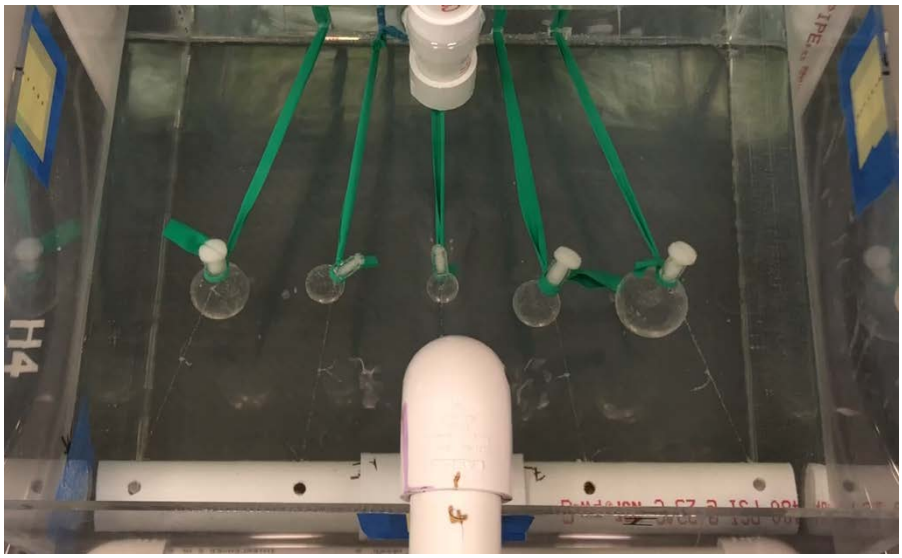
Supplemental Material

The phantom was designed to move 5 spheres in three planes to simulate the elastic motions of the thorax and abdomen. To achieve this 3D motion, the CIRS dynamic thorax phantom (Norfolk, Virginia) motor moved the shaft of the phantom in the superior inferior direction as shown in the figure below [Also figure 2 in the manuscript]).



To simulate the anterior posterior motion of lung tumors, the stationary, superior attachment point of the spheres was placed at a depth of 11 cm, and the inferior mobile connection point of the spheres was placed at 6 cm, so that the depth of the spheres changed as the phantom moved. Furthermore, the attachment points of the spheres were spaced with less distance on the superior, stationary attachment point, in comparison to the inferior attachment point, such that the spheres paths diverged with inhalation, and converged with exhalation. The connection to the spheres from the superior location was made with elastic bands, while the connection to the mobile inferior shaft was non-elastic. Please refer to the movie below to see the sphere motion trajectory.

IMG_1614.mp4

The spheres had inner diameters of 10, 13, 17, 22, and 28 mm. The spheres were placed in an acrylic tank containing 16 liters of water. The spheres to background ratio was set to 5:1. . A motor drove the spheres using a repeated patient respiratory cycle that had a duration of 6 s. Four acquisitions were performed in which the spheres were driven with 0, 1, 2, and 3 cm amplitudes. The phantom motion was programmed such that the spheres always returned to the same location for all acquisitions. During PET acquisition, the respiratory waveform was acquired with the AZ-733V respiratory gating system (Anzai Medical Co., Ltd.; Tokyo, Japan), by wrapping the belt around the surrogate motor platform as shown by the red arrow in the figure below [Also figure 2 in the manuscript].