Purpose/Objective(s): Breath hold treatments can be used to reduce the cardiac dose for patients with left-sided breast cancer and unfavorable cardiac anatomy. A surface imaging technique was developed to ensure accurate patient setup and reproducible real-time breath hold positioning.

Materials/Methods: Thirteen patients were included in the study. Three dimensional surface images were obtained using the AlignRT system (VisionRT, London, UK). For each treatment, to ensure a consistent position prior to breath hold, the initial position of the patient was determined by registering the patient’s free breathing position with a reference surface determined on the first day of treatment. For each treatment field, the patient was instructed to perform a deep inspiration breath hold, and, using real-time surface imaging, the therapists observed the difference between the patient’s breath hold position and a breath hold reference from the first day of treatment. If the difference between the two surfaces was within tolerance (5 mm), the beam was turned on. If out of tolerance, the beam was not turned on and another breath hold was requested. The real-time position of the patient was recorded during the treatment. The number of breath holds was also noted for each treatment. Reference surfaces were generated on the first treatment based on matching breath hold MV EPID images with planning DRRs.

Results: Real-time surface data were obtained for a total of 1400 breath holds and 220 treatment fractions for 13 patients. The average shifts for daily initial patient setup were 2.1 mm, 1.6 mm, and 1.2 mm in the anterior-posterior (AP), superior-inferior (SI), and left-right (LR) directions, respectively. The average three dimensional vector shift was 8.2 mm. The systematic errors were 1.8 mm (AP), 3.3 mm (SI), 2.8 mm (LR), and 2.0 mm (3D), and the random errors were 3.5 mm (AP), 3.4 mm (SI), 4.1 mm (LR), and 3.0 mm (3D). Real-time surface monitoring data indicated that 22% of the breath holds were outside of the 5 mm tolerance (range, 7% to 41%). The average difference between the treated breath hold position and the reference position was 2 mm in each direction. For out-of-tolerance breath holds, the average difference in the breath hold position was 6.2 mm, and the average maximum difference was 8.1 mm.

Conclusions: Daily real-time surface imaging provides a method for accurate and reproducible positioning for breath-hold treatment of left-sided breast cancer patients with unfavorable cardiac anatomy.