**Purpose:** To assess the effect of patient positioning errors on treatment delivery and evaluate target coverage and margin values.

**Methods and Materials:** A cohort of patients was studied retrospectively. All patients underwent a volumetric modulated arc therapy (VMAT) breast boost treatment in which daily CBCT scans were acquired for positioning. The images were registered against the planning CT and appropriate shifts were applied as needed before treatment delivery. The daily CBCT images were first registered and merged with the planning CT to create a complete image set using MIM software. The merged image was imported into Varian’s Eclipse treatment planning software and used to calculate the daily dose based on the anatomy of the day. Each daily plan was calculated using two treatment isocenters, one in the initial set-up position and the other with the applied shifts. All calculations were done without heterogeneity corrections turned on to be consistent with the original plan. The daily dose distributions were deformed and accumulated on the original CT using MIM Software’s deformable dose accumulation algorithm. The accumulated distributions were compared with the original plan distribution to evaluate tumor bed and PTV coverage. Contours were drawn on each CBCT image and deformed to the planning CT using MIM Software’s deformable adaptive re-contour algorithm. The deformed contours were compared with the contours of the planning CT’s structure set to test the accuracy of the deformation. The change in centroid location and the Dice coefficient were calculated.

**Results:** While tumor bed coverage is always achieved, were the patient to be treated in the initial setup position, PTV coverage is lost. The $D_{98}$ for the tumor bed is within 2% of the original plan, however for the PTV can be under dosed by almost 27%. The mean change in centroid location for the left and right lungs is 0.43 mm and 1.53 mm respectively. The Dice coefficient showed agreement with the original lung contours as well, 0.94 and 0.95 for the left and right lung respectively.

![Dose volume histogram (DVH) for one patient comparing the original plan coverage with the accumulated distribution based on initial set-up and shifted isocenter calculations](image)

**Discussion:** Evaluation of target coverage based on accumulated daily dose calculations with CBCT images shows adequate margins are used when defining the PTV. We see that the tumor bed receives a clinically acceptable dose when evaluated in both the initial and shifted treatment positions. Issues encountered included: determination of an adequate relative electron density table for the CBCT images, reconstruction artifacts affecting the deformable registration, and difficulty in image registration when one data set is incomplete. Future work includes expanding the patient cohort as well as investigating reducing the PTV margin while maintaining the coverage of the tumor bed.