Purpose: To evaluate the dose calculation in a commercial treatment planning system (TPS) for a breast cancer brachytherapy technology using Monte Carlo simulation for 21 patients.

Methods: Plans for 21 patients who received SAVI treatments were modeled using data from the TPS including CT images, structures and source information. The MC code PENELOPE was used, inputting images in voxel format, where density and material (tissue, air, bone and Nitinol) for each voxel were assigned based on its calibrated Hounsfield units and contoured structure sets, respectively. For the source model only gamma-rays and fluorescence X-rays of the NuDat database 192Ir spectrum were used, leaving out photons with emission intensity less than 0.1% and X-rays with energies below 10 keV. Source positions were entered into the plan and run individually. Dose was totaled by individually weighting the dose for each source position using the original TPS plan dwell times and then summing the weighted dose for all positions.

Results: Dose from the Monte Carlo plan was compared with dose from the original plan using isodose lines at 50, 100, 150 and 200% of the prescription dose of 34Gy. Dosimetric coverage of the target was compared by evaluating the V100, V150 and V200 (volume of the target covered by 100%, 150 and 200% of the dose respectively). The V200 and V150 had an average increase (and standard deviation) of 9.1% (3.2%) and 3.8% (1.4%) respectively, while the average change in V100 was 1.2% (1.0%). Where variance for the entire simulation was 0.9%.

Conclusion: We have compared dose distributions of a commercial TPS using Monte Carlo simulation for SAVI breast cancer brachytherapy and found that a dose increase near the air-tissue interface.