AbstractID: 10553 Title: Toward a more accurate dose calculation technique using a semiautomatic organ contouring in Monte Carlo post-implant assessment of breast LDR brachytherapy

Purpose: We assess the impact of the uncertainty of glandular/adipose tissue proportion on dose distribution inside the breast for LDR brachytherapy. Furthermore, we propose a semiautomatic tissue segmentation method to be used in Monte Carlo (MC) calculations for breast LDR patients. **Methods & materials:** Post-implant CT exams of five breast brachytherapy patients are imported into our Geant4 MC platform. The CTV and the PTV were contoured by the oncologist; the external contours of the breast, skin, lungs and the ribs were made manually by a physicist. In a first step, the breast is assigned with different proportions of glandular/adipose tissue (ρ = 100/0, 75/25, 50/50, 25/75, 0/100) in order to study the impact of this variation on clinical dosimetries. In a second step, a density-based semiautomatic segmentation of breast tissue is used to identify glandular from adipose regions inside the breast and to create a more representative breast anatomy with appropriate chemical compositions. A TG43-like simulation (SMC: Superposition MC) is also performed for each patient. Does-Volume-Histograms are used to visualize the effect of dose reduction. **Results:** In all patients, the glandular/adipose proportion, affects the dose distribution across the breast. The higher the adipose proportion in the breast tissue, the larger is the dose reduction across the organ. The D90 clinical parameter is reduced by up to 22% when the breast is entirely made of adipose. The semiautomatic contouring enabled a patient-dependent segmentation of the glandular and adipose regions leading to more accurate dose calculations for each patient. **Conclusion:** Using realistic chemical compositions in MC simulations is achievable for MC calculations. Unlike external-beam radiotherapy, the low-energy emission of ^{103}Pd is strongly affected by the heterogeneities adipose proportion in breast. A patient-dependant glandular/adipose segmentation in breast is important for accurate dose determinations in MC, especially for breast LDR brachytherapy.