# AbstractID: 4375 Title: A Monte Carlo post-implant prostate dosimetry study : interseed attenuation, tissue composition, and calcification.

**Purpose:** To use an automated Monte Carlo (MC) code to perform a clinical dosimetry study that includes 18 post-implant prostate brachytherapy cases. The interseed attenuation and the impact of tissue compositions are specifically investigated.

**Method and Materials:** A MC technique is used to simulate the post-implant dosimetry for voxelized patients. For a typical patient, 200,000 voxels are stacked to generate the realistic anatomy. For each voxel, the density is set by the Hounsfield Units (HU) from the computed tomography data and the elemental composition is set according to the radiation oncologist's contours. Between 180 and 320 different materials (prostate tissue, muscle, rectum tissue, bladder tissue, calcification, adipose tissue, and various mixtures) are utilized for each patient. Data (HU, seed positions, and contours) is input into the MC program through the DICOM-RT protocol. Several MC simulations are performed in order to study different elements: interseed attenuation, impact of inter-organ tissue composition, prostate composition, and specifically calcifications inside the prostate.

**Results:** The interseed attenuation level is 3.9±1.5% for the $D_{90}$ CTV parameter. The effect on organs at risk is an average decrease of 0.2 $cm^3$ for the $V_{100}$ parameter in both rectum and bladder. For the 18 clinical cases, the comparison between the TG-43 based dosimetry and the complete MC simulation leads to average differences of 12±3 Gy for the $D_{90}$ CTV parameter. If localized and/or diffuse calcifications are incorporated into the prostate tissue, differences of up to 14 Gy are added.

**Conclusion:** The overall difference between the clinically approved TG-43 based calculations and MC simulations can reach non-negligible levels. Including the calcifications in the prostate can lead to important dosimetry differences. However, the presence of calcification is difficult to establish with traditional CT data.