

# MONTE CARLO SIMULATION OF LIVER DOSIMETRY WITH YTTRIUM-90 RADIONUCLIDE USING GATE: 3D PHANTOM

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*This study is aimed to validate  $^{90}\text{Y}$  dosimetry with MC simulation by comparing the TLD measurements results obtained in 3D liquid phantom (LP) and its monte carlo (MC) simulation. In the first step, tumor imitation was filled with 1900  $\mu\text{Ci}$  (70.3 MBq) amount of  $^{99\text{m}}\text{Tc}$  activity in LP. In addition, 24 thermoluminescence dosimetry chips (TLD-100) were placed in 8 different locations in the LP. The same measurement system was created in GEANT4 Tomography Emission Application (GATE version 8.1). DoseActor library was defined for 24 points instead of TLDs and doses were taken. In the second step,  $^{90}\text{Y}$  with the amount of 2 mCi (74 MBq) activity and 27 DoseActor libraries were placed in tumor mimic and different locations in LP to calculate the dose distribution with GATE...*

**Keywords:** monte carlo method, gate, dosimetry, yttrium, technetium, phantom.

*Introduction.* Yttrium-90 ( $^{90}\text{Y}$ ) microsphere therapy is a nuclear medicine treatment for inoperable liver tumors [1]. The  $^{90}\text{Y}$  radionuclide used in the treatment emits 934 keV average energized beta particles (99.9%) and bremsstrahlung radiation (0.02%) and its half-life is 64 hours [2]. The primary goal is to maximize tumor damage while minimizing harm to healthy liver tissue [3]. Hence, it's crucial to calculate the ideal radionuclide activity and perform patient-specific dosimetry.

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