Study the Influence of Heterogeneity on the Brachytherapy Dose Distribution in Spherical Phantom Using GEANT4 Toolkit

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STUDY THE INFLUENCE OF HETEROGENEITY
ON THE BRACHYTHERAPY DOSE
DISTRIBUTION IN SPHERICAL PHANTOM
USING GEANT4 TOOLKIT

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DEDICATION

TO
MY PARENTS
BROTHERS AND BEST FRIENDS
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First of all, I am grateful to GOD, most mighty, most merciful.

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# Contents

1 Introduction ............................................. 1  
    1.1 Previous Studies .................................. 3  
    1.2 Thesis Organization ............................... 6  

2 Theoretical Background ................................. 7  
    2.1 Brachytherapy .................................... 7  
        2.1.1 Brachytherapy sources .................. 9  
    2.2 Interaction Coefficients ........................ 11  
    2.3 Interaction of Photons with Matter .......... 13  
    2.4 Absorbed Dose .................................. 16  
    2.5 Charged Particle Equilibrium ................. 18  
    2.6 Dose Distribution For Line Sources ........ 19  
        2.6.1 Sievert Integral ........................ 19  
        2.6.2 Dosimetric quantities ................. 20  
    2.7 The Primary and Scatter Dose Components ... 22  

3 Simulation Technique .................................. 24  
    3.1 Geant4 Simulation Toolkit ...................... 24  
    3.2 Brachytherapy code Description ................ 25  
        3.2.1 Geometry Construction .................. 25  
        3.2.2 Primary Generator ..................... 31  
        3.2.3 Physical Processes ...................... 32  
        3.2.4 Action Classes .......................... 33  
    3.3 Data Analysis and Tools ....................... 34  
    3.4 The Visualization Drivers ..................... 34  

4 Code Validation ....................................... 35  
    4.1 Material Validation ............................ 35  
    4.2 Validation of Dosimetric Quantities .......... 38
5 Method of Calculation
5.1 Simulation Setup ........................................... 45
5.2 Data Selection .............................................. 48
  5.2.1 Track and Step information ......................... 48
  5.2.2 Deposited Energy ........................................ 51
  5.2.3 Dose Components ....................................... 52

6 Results and Discussion ...................................... 60
6.1 Introduction ................................................. 60
6.2 Influence of Heterogeneity on Dose Components .......... 60
  6.2.1 Dose Components Versus $z_{cp}$ ...................... 61
  6.2.2 Isodose Maps ........................................... 68
6.3 Heterogeneous Medium Effects on Dose Distribution ..... 73
  6.3.1 Anisotropy Function .................................... 73
  6.3.2 Isodose Maps ........................................... 75
6.4 Heterogeneity Correction Factor .......................... 84

7 Conclusions and Recommendations .......................... 90
7.1 Conclusions ................................................ 90
7.2 Recommendations .......................................... 91
List of Figures

1.1 A geometry definition used to score the absorbed dose. ........................................... 3

2.1 The decay scheme of $^{192}Ir$ [18]. ........................................................................ 10

2.2 Schematic representations of the narrow-beam geometry used to measure attenuation coefficient. ............................................................... 11

2.3 Schematic diagram illustrating the photoelectric interaction accompanied by the emission of Auger electron or characteristic x-ray [19]. 14

2.4 Schematic diagram illustrating the Compton scattering [19]. ............................... 14

2.5 Atomic cross sections for photoelectric, Compton and pair production interactions [20]. ............................................................. 15

2.6 Illustration of the production of bremsstrahlung radiation [19]. .......................... 16

2.7 The relation between the dose and collision part of kerma as a function of depth [19]. ................................................................. 18

2.8 Schematic diagram showing the line source and point of calculation [19]. ................. 19

2.9 Schematic diagram illustrating the various components of dose [27]. ................. 23

3.1 The diagram showing the Geant4 class categories [http://www.ge.infn.it/geant4]. 26

3.2 Three main components for geometry construction. ............................................. 27

3.3 A two-dimensional schematic diagram of the heterogeneous medium geometry [3]. ................................................................. 28

3.4 A two-dimensional schematic diagram of the heterogeneous medium geometry in spherical water phantom simulated by Geant4. 29

3.5 Schematic view of the BEBIG HDR source. Distances are given in mm. The origin of coordinates is the geometric centre of the active core. .......................................................... 29

3.6 HepRep visualization of $^{192}Ir$ BEBIG GI192M11 model source simulated with Geant4. ................................................................. 30

3.7 A step is bounded by its pre-step and post step points. One factor that defines the post-step is the crossing of a boundary in the geometry. 34
4.1 Attenuation coefficient vs. energy for water and Whitlockite materials. 37
4.2 Geometry definition simulated via Geant4. .......................... 38
4.3 Location of energy deposition as a test of the shape of the detector with ROOT. .................................................. 39
4.4 Geometric system used to calculate radial dose function $g(r)$ and anisotropy function $f(r, \theta)$ [46]. ............................... 40
4.5 Comparison of radial Dose function $g(r)$ of the BEBIG source data with the simulated data in the present study. ...................... 41
4.6 Anisotropy function for $^{192}Ir$ BEBIG GI192M11 model as a function of angle (BEBIG web site) [49]. (a) The radius of ring is 0.5 cm, (b) the radius of the ring is 2.0 cm. ........................................ 42
4.7 Anisotropy function for $^{192}Ir$ BEBIG GI192M11 model as a function of angle. (BEBIG web site) [49]. (a) The radius of ring is 5 cm, (b) the radius of the ring is 7.5 cm .................................................. 43
5.1 A schematic diagram of a heterogeneous material positioned at transverse axis [3]. ........................................................ 46
5.2 Association of tracking and readout geometry [35]. ..................... 47
5.3 The calculation voxel as a box and disk-shaped heterogeneous material simulated with Geant4. ........................................... 47
5.4 The cylindrical Detector for the calculation of dose deposited at different positions and angles simulated with Geant4. .................... 48
5.5 Association between $G4Trak$, $G4Step$ and $G4StepPoint$. .............. 49
5.6 Primary dose and varying orders of scatter photons and dose components tagged with identification numbers. ............................... 50
6.1 The primary dose for a 380 keV $^{192}Ir$ line source in homogeneous water and in water with a disk-shaped heterogeneity of whitlockite as a function of calculation position. The disc is located on z-axis 1.0 cm from Iridium source and has different thickness $t_h$: (a) $t_h = 0.1$ cm, (b) $t_h = 0.5$ cm and (c) $t_h = 1.0$ cm with diameter $d_h = 3.0$ cm. ............................. 62
6.2 The once-scatter dose for a 380 keV $^{192}Ir$ line source in homogeneous water and in water with a disk-shaped heterogeneity of whitlockite as a function of calculation position. The heterogeneity is located on z-axis 1.0 cm from Iridium source and has different thickness $t_h$: (a) $t_h = 0.1$ cm, (b) $t_h = 0.5$ cm and (c) $t_h = 1.0$ cm with diameter $d_h = 3.0$ cm. ................................. 63
6.3 The multiple-scatter dose for a 380 keV $^{192}$Ir line source in homogeneous water and in water with a disk-shaped heterogeneity of whitlockite as a function of calculation position. The heterogeneity is located on z-axis 1.0 cm from Iridium source and has different thickness $t_h$: (a) $t_h = 0.1$ cm, (b) $t_h = 0.5$ cm and (c) $t_h = 1.0$ cm with diameter $d_h = 3.0$ cm. 

6.4 Comparison between the primary dose, the once-scatter and multiple-scatter dose as well as total dose for a 380 keV $^{192}$Ir line source in homogeneous water phantom. The water disk is located on z-axis 1.0 cm from Iridium source and has different thickness $t_h$: (a) $t_h = 0.1$ cm, (b) $t_h = 0.5$ cm and (c) $t_h = 1.0$ cm with diameter $d_h = 3.0$ cm.

6.5 Comparison between the primary dose, the once-scatter and multiple-scatter dose as well as total dose for a 380 keV $^{192}$Ir line source in homogeneous water and in water with a disk-shaped heterogeneity of whitlockite. The heterogeneity is located on z-axis 1.0 cm from Iridium source and has different thickness $t_h$: (a) $t_h = 0.1$ cm, (b) $t_h = 0.5$ cm and (c) $t_h = 1.0$ cm with diameter $d_h = 3.0$ cm.

6.6 Isodose maps for dose components in homogeneous water phantom. 

6.7 Isodose maps for dose components in homogeneous water phantom included disk-shaped heterogeneity of whitlockite has $t_h = 0.1$ cm and $d_h = 3$ cm. 

6.8 Isodose maps for dose components in homogeneous water phantom included disk-shaped heterogeneity of whitlockite has $t_h = 0.5$ cm and $d_h = 3$ cm. 

6.9 Isodose maps for dose components in homogeneous water phantom included disk-shaped heterogeneity of whitlockite has $t_h = 1$ cm and $d_h = 3$ cm. 

6.10 Illustrate the values of anisotropy function versus polar angle for different heterogeneous disk materials as well as homogeneous water phantom at different calculation ring radius $r$: (a) $d_h = 3.0$ cm, $t_h = 0.1$ cm, $r = 5.5$ cm, (b) $d_h = 3.0$ cm, $t_h = 0.1$ cm, $r = 3.0$ cm and (c) $d_h = 3.0$ cm, $t_h = 0.1$ cm, $r = 0.6$ cm.

6.11 Isodose maps of total dose and dose components in water with $t_h = 1$ cm of a disc-shaped heterogeneity of Whitlockite.

6.12 Isodose maps of total dose and dose components in water with $t_h = 1$ cm of a disc-shaped heterogeneity of Stainless steel (SS304).
6.13 Isodose maps of total dose and dose components in water with $t_h = 1\ cm$ of a disc-shaped heterogeneity of lead. ........................................ 79
6.14 Isodose maps of multiple dose and multiple dose components in homogeneous water phantom. ........................................ 80
6.15 Isodose maps of multiple dose and multiple dose components in water with $t_h = 1\ cm$ of a disc-shaped heterogeneity of whitlockite. ........ 81
6.16 Isodose maps of multiple dose and multiple dose components in water with $t_h = 0.5\ cm$ of a disc-shaped heterogeneity of whitlockite. .... 82
6.17 Isodose maps of multiple dose and multiple dose components in water with $t_h = 0.5\ cm$ of a disc-shaped heterogeneity of whitlockite. .... 83
6.18 Heterogeneity correction factor for once-scatter versus heterogeneity diameter as calculated by Geant4 MC simulation for 380 keV $^{192}$Ir source in water containing a disc-shaped heterogeneity of whitlockite. The disc is located at different distance $z_{hl}$ on $z$-axis from $^{192}$Ir source: (a) $z_{hl} = 0.5\ cm$, (b) $z_{hl} = 1.0\ cm$, (c) $z_{hl} = 3.0\ cm$ .... 85
6.19 Heterogeneity correction factor for multiple-scatter dose versus heterogeneity diameter as calculated by Geant4 MC simulation for 380 keV $^{192}$Ir source in water containing a disc-shaped heterogeneity of whitlockite. The disc is located at different distance $z_{hl}$ on $z$-axis from $^{192}$Ir source: (a) $z_{hl} = 0.5\ cm$, (b) $z_{hl} = 1.0\ cm$, (c) $z_{hl} = 3.0\ cm$. .... 86
6.20 Heterogeneity correction factor for once-scatter dose versus heterogeneity disc thickness as calculated by Geant4 MC simulation for 380 keV $^{192}$Ir source in water containing a disc-shaped heterogeneity of whitlockite. The disc is located at different distance $z_{hl}$ on $z$-axis from $^{192}$Ir source $z_{hl} = 3.0\ cm$ and $z_{hl} = 7.0\ cm$, and the diameters and calculation position: (a) $z_{cp} = 5.0\ cm$ and $d_h = 8.0\ cm$, (b) $z_{cp} = 3.0\ cm$ and $d_h = 6.0\ cm$. .... 88
6.21 Heterogeneity correction factor for multiple-scatter dose versus heterogeneity disc thickness as calculated by Geant4 MC simulation for 380 keV $^{192}$Ir source in water containing a disc-shaped heterogeneity of whitlockite. The disc is located at different distance $z_{hl}$ on $z$-axis from $^{192}$Ir source $z_{hl} = 3.0\ cm$ and $z_{hl} = 7.0\ cm$, and the diameters and calculation position: (a) $z_{cp} = 5.0\ cm$ and $d_h = 8.0\ cm$, (b) $z_{cp} = 3.0\ cm$ and $d_h = 6.0\ cm$. .... 89

7.1 Monte Carlo method applied to approximating the value of $\pi$ ........ 93
# List of Tables

3.1 Density and composition of heterogeneity material. ........................................ 30

4.1 Simulated as well as XCOM mass attenuation coefficients for 1 MeV photons. ........................................................................................................ 36

4.2 Values of radial and longitudinal distances used in the simulation. .......... 38

5.1 A portion of track information for a photon which has parent ID = 0 and Track ID = 1. ................................................................. 55

5.2 A portion of track information for an electron which has parent ID = 1 and Track ID = 2. ................................................................. 56

5.3 Part of primary.dat file containing the minimum electron track in Table 5.1 with parent ID = 1 and track ID = 2. This electron thus deposits a primary doses. .......................................................... 57

5.4 Part of scatter.dat file containing the scatter electron track in Table 5.1 with parent ID = 1 and track ID = 3. This electron thus deposits a once-scatter doses. .......................................................... 58

5.5 Part of multiple.dat file containing the scatter electron track in Table 5.1 with parent ID = 1 and track ID = 4, 5, 6 and 7. This electron thus deposits a multiple-scatter doses. ........................................ 59

6.1 The contribution percentage of Dose components. .................................... 76

6.2 The contribution percentage of Multiple scatter components. ................. 76
Abstract

AlSharairi, Ehab Nezar. Study the Influence of Heterogeneity on the Brachytherapy Dose Distribution in Spherical Phantom Using GEANT4 Toolkit. Master of Science Thesis, Department of Physics, Yarmouk University, 2012 (Supervisor: Dr. Zaid Q. Ababneh, Co-Supervisor Dr. Anas M. Ababneh)

The benefits of therapeutic procedures depend strongly on maximizing the dose to the planning target volume while minimizing the dose to normal tissues. Since the presence of heterogeneous media produce perturbation of dose distribution in brachytherapy, therefore, major studies propose a framework for calculating brachytherapy dose distributions in heterogeneous media. The Geant4 is a powerful simulation toolkit based on Monte Carlo techniques which is adopted in the present study as a new framework for studying brachytherapy dose distribution in heterogeneous media. In the present study, a code was developed using Geant4 toolkit and combined with ROOT data analysis framework in order to compute dose components around 380 keV $^{192}$Ir source in water phantom containing disk-shaped heterogeneity. The GATE which is a Geant4 extension toolkit, was adopted for investigating the angular dependency of brachytherapy dose distribution. Several tests have been taken to validate the developed code. The present study is meant to furnish a new methodology to study dose components separately with the presence of heterogeneity.

Keywords: Geant4; ROOT; GATE; Dose components; Heterogeneity; Brachytherapy.