EP-0078
Validation of the GAMOS Monte-Carlo Toolkit for Nuclear Medicine Dosimetry

P. Ritt1, K. Reuss1, J. C. Sanders1,2, N. Lanconelli1, M. Pacilio1, T. Kuwert1; 1University Hospital Erlangen, Erlangen, GERMANY, 2Pattern Recognition Lab, Friedrich-Alexander-University Erlangen-Nürnberg, Erlangen, GERMANY. 3Department of Physics and Astronomy, Alma Mater Studiorum, University of Bologna, Bologna, ITALY, 4Department of Medical Physics, Azienda Ospedaliera S. Camillo Forlanini, Rome, ITALY.

Purpose: Monte-Carlo simulations (MCS) are frequently used in tasks of Nuclear Medicine dosimetry, e.g. for calculating dose-kernels for voxel based dosimetry of Y-90 and Lu-177 therapies. A large variety of MCS are available. The GAMOS MCS framework is based on GEANT4 routines and aims at simplified usability. Consequently, the different physics modules known from GEANT4 are also available in GAMOS. So far, the accuracy of GAMOS has only been shown for external beam radiation and brachytherapy settings. The aims of this study were 1) to evaluate the accuracy of GAMOS for application in voxel based dosimetry of Nuclear Medicine therapies using Lu-177 and Y-90 and 2) to compare the dose values obtained from standard electromagnetic (EM) and Penelope physics modules. Methods: Using GAMOS, the voxel-wise deposited energy dose from radiation sources was simulated. Sources were mono-energetic electrons (range 10-2100 keV) and mono-energetic photons (set of energies for most common Lu-177 and Y-90 gamma transitions). Additionally, the decays of radionuclides Lu-177 and Y-90 were directly simulated. Absorbing tissue types included soft tissue and compact bone. The obtained data were compared to reference values from literature, obtained by other MC-codes. Additionally, the dose values obtained from EM and Penelope physics modules were compared. Results: Differences between GAMOS and reference data were: 1a) Photons: <5% for central voxel and energies below 1 MeV. For high photon energies and non-central voxels, larger differences of up to 20% were found. 1b) Electrons: <1% for central voxel and energies up to 2.1 MeV. For non-central voxels, larger differences of up to 5% were found. 1c) Lu-177: ~3.2% for central voxel for soft and bone tissue. For non-central voxels slightly higher, with on average 4.0% and 3.7% for soft and bone tissue, respectively. 1d) Y-90: ~0.4% for central voxel for soft and bone tissues. For non-central voxels higher, with on average 3.5% and 2.2% differences for soft and bone tissue, respectively. 2) Physics modules: Only minor differences (<1%) were found for central voxels and Lu-177 and Y-90. Larger differences (up to 10%) occurred for Y-90 for distances which correspond to the bremsstrahlung region. Conclusion: Energy dose values obtained from GAMOS show good agreement with those available from literature. For this, GAMOS is suitable for application in Nuclear Medicine therapies with Lu-177 and Y-90. Between standard EM and Penelope physics modules, only minor differences were found.

EP-0079
Partial volume correction changes intra-tumoral heterogeneity in 18F-FDG PET

I. Shiri1, A. Rahimm2, G. Hajianfar3, H. Abdollahi1, P. Geramifar4, P. Ghafricani14, A. Bitarafan-Rajabi12; 1Department of Medical Physics, School of Medicine, Iran University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 2Department of Radiology, Johns Hopkins University, Baltimore, MD, UNITED STATES OF AMERICA, 3Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, UNITED STATES OF AMERICA, 4Research Center for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 5Chronic Respiratory Diseases Research Center, National Research Institute of Tuberculosis and Lung Diseases (NRITLD), Shahid Beheshti University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 6PET/CT and Cyclotron Center, Masih Daneshvari Hospital, Shahid Beheshti University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 7Cardiovascular Intervention Research Center, Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF.

Aim: PET images suffers from the partial volume effect (PVE), a consequence of the limited spatial resolution and the tissue fraction effect. Several partial volume correction (PVC) methods have been developed to enable appropriate quantification for PET images. In the present study, we investigated impact on intra-tumoral heterogeneity by PVC methods as applied to 18F-FDG PET. Material and Methods: Thirty-seven lesions from twenty patients were included in the current study. 3D tumor segmentation was performed on CT images, and following tumor delineation, three methods of PVC including Richardson-Lucy (RL), Reblurred Van Cittert (RVC) and Single Target Correction (STC) were used to compensate for PVE. Intra-tumoral heterogeneity was assessed by 31 textural features including gray level co-occurrence matrices (GLCM), gray level run length matrices (GLRLM), gray level zone length matrix (GLZLM) and neighboring gray-level dependence matrix (NGLDM). Subsequently, we determined the Relative Change (RC %) with respect to uncorrected PET image. Result: 46, 75 and 39% of textural features had RC more than 10% for RL, STC and RVC respectively. Homogeneity (RC: 11-43%), Contrast (RC: 12-53%) and Correlation from GLCM (RC: 12-43%), LGRE (RC: 56-84%), LRLGE (RC: 46-86%) from GLRLM, Busyness (RC: 85-211%) from GLZLM, gray-level zone length matrix (GLZLM) and neighboring gray-level dependence matrix (NGLDM). Consequently, the differences between GAMOS and reference data

EP-0080
Relationship between intra-tumoral heterogeneity indices and metabolic parameters in 18F-FDG PET

I. Shiri1, H. Abdollahi1, P. Geramifar2, A. Bitarafan-Rajabi3; 1Department of Medical Physics, School of Medicine, Iran University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 2Research Center for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, IRAN, ISLAMIC REPUBLIC OF, 3Cardiovascular Intervention Research Center, Rajaie Cardiovascular