^a Institut Jules Bordet – Université Libre de Bruxelles, Radiotherapy Department, Brussels, Belgium

^b Université Libre de Bruxelles, Nuclear Metrology, Brussels, Belgium

* Corresponding author.

Purpose. During last decades many radiotherapy machines, treatment planning systems (TPS) and complicated treatment techniques (VMAT, IMRT, SBRT) have been developed. Fast dose calculation algorithms are used for radiotherapy, applying many approximations during dose calculation to minimize calculation time. The main objective of this presentation is to present how to implement Monte Carlo in clinical daily quality control of TPS and machine performance.

Methods. EGSnrc \ BEAMnrc were used to create a model of the Agility (Elekta) by using the data provided by the manufacturer. Validation of the MC model was done using the methodology of Pena[1]. Comparison of standard treatment plans between MC treatment planning system and measurements was necessary to verify moving parts of the machine. Converting RTplan DICOM files to MC input files and converting MC dose matrix file to a DICOM file were done using the Moderato platform [2]. Impacts of variance reduction techniques, voxel size and simulating volume were well investigated to minimize calculation time. Homemade MATLAB code was used to extract the data from machine log files which was used as input for MC simulation.

Results. Validation of MC model was within 2% when comparing to measurement for all PDDs, profiles and output factors of different fields sizes. Good agreement was obtained between TPS algorithm and MC for most of the cases, but small differences were found for small lung lesions, as MC and TPS do not use same cut off energy of secondary electrons. TPS and MC plans using machine log files have a good agreement for all patients. 30 min as max of calculation time and 1% uncertainty for all planning treatment volumes (PTVs) are respected for all patients. The system is currently being extended to use it with other external radiotherapy machines like Clinac® (Varian) and Gamma Knife (Elekta) for double calculation and delivered dose verification.

Conclusions. Monte Carlo has been used to validate TPS plans as well as performance of the external radiotherapy machine (Agility (Elekta)). Beside to measurements, MC as independent quality control tool is important for complicated treatment techniques.

<https://doi.org/10.1016/j.ejmp.2018.06.311>

[OA240] Comparison between four routine control devices detecting photon beam energy changes

Miguel Jiménez Melguizo^{a,*}, Joaquín Montes^b, Jose Manuel de la Vega^a, Cristina Forastero Rodríguez^c, Rafael Guerrero Alcalde^a, Francisco Moreno^d, Damián Guirado Llorente^e, Antonio M. Lallena^f

^a Hospital Universitario San Cecilio, Unidad de Radiofísica, Granada, Spain

^b Fibao, Hospital Universitario Clínico San Cecilio, Radiofísica, Granada, Spain

^c Hospital Clínico Universitario San Cecilio, Servicio de Radiofísica Y Protección Radiológica, Granada, Spain

^d Siemens Healthineers, Radiology, Granada, Spain

^e Fibao, Hospital Universitario San Cecilio de Granada, Radiofísica, Granada, Spain

^f Universidad de Granada, Dpto. de Física Atómica, Molecular Y Nuclear, Granada, Spain

* Corresponding author.

Purpose. The quality assurance (QA) program of a LINAC includes the control of the stability of the photon beam energy, through a

control variable, the beam quality *BQ*. Our department owns four devices for this task. In this work a method to compare the performance of these QA devices is designed and applied.

Methods. Two photon beams with energies 6 and 15 MV, produced by a Siemens Artiste LINAC, were used to analyse the response of the following QA devices: StarTrack (Iba Dosimetry), QuickCheck and StarCheck (PTW) and IC Profiler (Sun Nuclear). They determine the *BQ* indirectly through their own control variable, BQ_{dev} which shall be related to the *BQ* measured in reference conditions. To determine this relationship, the photon energy was modified by varying the bending magnet intensity I_{BM} . For each value of I_{BM} , three PDD curves in water and three measurements for each device were taken.

Through the measurements taken before and assuming that they follow a normal distribution, pairs of values of *BQ* and BQ_{dev} were generated using Monte Carlo simulation methods. The pairs of simulated values are related between them by the relationship obtained previously. By comparing if the pair of values are inside or outside the tolerance interval, each simulation is classified as true positive *TP*, false positive *FP*, true negative *TN* or false negative *FN*. The tolerance interval chosen was 0.5%. Summing all the *TP*, *FP*, *TN* and *FN*, two parameters can be calculated: sensitivity and specificity. These parameters will allow to compare the performance between devices.

Results. For all devices, the relationship between BQ_{dev} and *BQ* is linear, with a determination coefficient $r^2 \geq 0.9$.

The QuickCheck and IC Profiler devices showed the best performance, with a sensitivity and a specificity higher than 95%. The StarTrack device had a good sensitivity, but a specificity of around 85%, for both energies. The StarCheck device showed a decent sensitivity, but a specificity of 67.7% and 78.7% for each energy, respectively.

Conclusions. The QuickCheck and IC Profiler devices showed the best performance, followed by StarTrack. The StarCheck device had a specificity much lower than the other three devices.

<https://doi.org/10.1016/j.ejmp.2018.06.312>

[I241]

Abstract not available

[OA242] Digital breast tomosynthesis: Flat panel and photon counting detectors comparison

Alessandro Loria^{a,*}, Patrizia Signorotto^a, Mauro Campoleoni^b, Nicoletta Paruccini^c, Raffaele Villa^c, Elena Venturini^d, Pietro Panizza^d, Antonella del Vecchio^a

^a Irccs San Raffaele Scientific Institute, Medical Physics Department, Milan, Italy

^b Fondazione Irccs Ca' Granda Ospedale Maggiore Policlinico, Medical Physics Department, Milan, Italy

^c Asst Ospedale San Gerardo, Medical Physics Department, Monza, Italy

^d Irccs San Raffaele Scientific Institute, Breast Radiology Department, Milan, Italy

* Corresponding author.

Purpose. In this study three digital breast tomosynthesis (DBT) devices equipped with different flat panel detectors (FPD) and a prototype equipped with a scan-spectral photon counting detector (PCD) are compared. The aim is to evaluate if a PCD device can guarantee a comparable or even better image quality delivering lower radiation doses than FPD devices.

Methods. Image quality performances were evaluated exposing two image quality DBT phantoms, Tomophan and Agatha and a