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Agility multileaf collimator parameters optimization in the independent dose calculation system

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The MIM SureCalc® is MonteCarlo Plan verification system (MIM Software Inc. Clevland, OH, USA) used to provide an independent dose calculation calculation check of radiotherapy treatment plans. These module include a voxel based Monte Carlo engine to calculate the dose in the patient. The input data are DICOM RT Image, RT Structure and RT dose derived from treatment planning system. The algorithm uses virtual source models, which are analytically expressed phase space models generated from BEAMnrs [1]. The model of the linac is created by the software manufacturer based on the data provided by the users (depth dose distributions, beam profiles, and radiation output factors)
The aim of this study was to assess the MIM SureCalc® MonteCarlo Plan verification module and optimize the calculation parameters according the measured data obtained using Elekta linear accelerator equipped with Agility™ multileaf collimator (MLC).
The modeling accuracy of MLC was assessed by comparing the calculated and measured dose distributions in L-shaped test radiation fields (four bordering segments in the form of the letter "L"). The measurements were performed with the massive of ionization chambers MatriXX (IBA Dosimetry). The modeling of the MLC offsets (the difference between the given leaf position and its actual value), as well as the leaf groove values (characteristic of the field edge formed by the side surfaces of the MLC leaf) was evaluated using Gamma analysis [2].
The optimization began with all parameters set to their default value. Comparison of the calculated test fields with the measurements showed that correction of the leaf groove leakage and offset values are required. The offset value of 0.1 mm was selected that best replicated measurements with the Agility™ MLC. Correction of leakage values was possible only by changing the virtual source model and required additional actions from the manufacturer.
The adjustment of the above parameters resulted in improved 2D Gamma of 2% 1 mm analysis passing rates up to 98.0% when applying the global and 95.2% when applying the local normalization.
The appropriate optimization of MLC parameters responsible for the properties of a particular device makes it possible to achieve high accuracy in MIM SureCalc® MonteCarlo Plan calculation.

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2. Daniel A. Low, William B. Harms, Sasa Mutic, James A. Purdy A technique for the quantitative evaluation of dose distributions // Med. Phys.—1998.—V.25.— P.656-661

The speaker is a student or young scientist

No

Section

1. Nuclear technology and methods in medicine, radioecology

Primary author: Mrs LOGINOVA, Anna (Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, Moscow, Russia)

Co-authors: Ms TOVMASYAN, Diana (1 Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, Moscow, Russia 2Lomonosov Moscow State University, Moscow, Russia;); Mr NECHESNYUK, Alexey (Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, Moscow, Russia); Prof. CHERNYAEV, Alexandr (Lomonosov Moscow State University, Moscow, Russia;)

Presenter: Mrs LOGINOVA, Anna (Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, Moscow, Russia)

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