PO-RT-24 Evaluation de la précision de simulations Monte Carlo pour des traitements VMAT sur un accélérateur Noavlis TrueBeam STx avec PRIMO

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Résumé

Introduction: In the general framework of performing Monte Carlo simulations with a Varian TrueBeam STx Linac, we used PRIMO. We tested the feasibility of using PRIMO to calculate dose distributions of a VMAT plan for TrueBeam, and to compare this calculation with AcurosXB algorithm in Eclipse.

Methods: PRIMO [1] is a computer software that simulates radiotherapy linacs and estimates absorbed dose distributions in water/slab phantoms and CT. It combines a graphical user interface, the geometry of some linacs and their MLC, and the PENELOPE Monte Carlo code.

As no publication of the exact geometry of TrueBeam head can be found, we used phase space files published by Varian. We performed calculations based on these files to check if they fit our measurements.

Calculations were performed with Eclipse and PRIMO, for 6MV beams.

We developed a script to export VMAT DICOM RTPlan to PRIMO as 178 single static beams.

We merged individual beam phase spaces calculated by PRIMO before dose calculation in phantom/CT into 1 single phase space in order to improve PRIMO usage for plans containing large number of fields. This method allows taking into account the relative weight of control points.

For dose comparison, OmniPro IMRT (IBA) was used. An in-house script converts the dose from PRIMO to OmniPro. Dose from Eclipse is directly imported in OmniPro, and thus 2D plane sets can be compared.

Results: Comparison between simulation based on Varian phase space files for TrueBeam and measurements shows good agreement: g 1%/1mm passing rate > = 99% for depth dose (10x10cm2, 5x5cm2 and 2x2cm2 beams), g 2%/2mm passing rate > = 99% for profiles at

*Intervenant

5cm depth (10x10cm2 and 5x5cm2 beams). A profile with some parts of the field under MLC (partially closing the field) and opened parts shows g 2%/2mm passing rate > = 99%.

Relative dose distribution in homogeneous phantom comparison gives good results. Set of 2D planar dose comparison between Eclipse and PRIMO can be analyzed. A few pairs do 2D distributions were compared, for a 3 static beams plan, and for a VMAT arc (from head and neck case).

For 3 beams plan, g 3%/3mm passing rate is > =97% for a representative set of plans. For 1 arc VMAT plan, g 3%/3mm passing rate is > =95% for a representative set of plans (and even > =98% for most of the analyzed plans).

Moreover, dose distributions for static beam or VMAT plan can be calculated in a CT dataset in PRIMO.

Conclusions: PRIMO is a valid tool to perform Monte Carlo dose distribution calculations in a phantom, for TrueBeam, based on Varian Phase space. PRIMO is still under development, and VMAT plan calculation is not yet integrated. With some external developments, VMAT plan calculation will be made possible.

References:

https://www.primoproject.net

Mots-Clés: Monte Carlo, VMAT, PRIMO TrueBeam