



Contribution ID: 173

Type: Poster

Proposal of a simplified procedure for the commissioning of AAA and Acuros photons calculations algorithms for Varian accelerators.

Thursday, June 22, 2017 10:45 AM (5 minutes)

Introduction :

Two important steps are dedicated to the modeling of calculation algorithms like AAA and Acuros:

- Measurement of the different data (pdd's, profiles, output factors...) required by the algorithm then modeling from these data.
- Commissioning of the algorithm in accordance with different protocols like TRS-430, NCS-15, IPEM Report 94....

The purpose of this work is to propose a simplified methodology for the commissioning and this specially in the case of limited duration missions in emerging countries. Only the aspects related to the calculations are involved in this proposal (scales, data transfer...)

For some algorithms, the measured data are send to the manufacturer who will perform the modeling and send back the data ready to be used for the calculations on the TPS. In this case a more complete commissioning has to be realized. For Varian algorithms it is not the same situation and the user will have a full local control on the different steps between the data measurements and the modeling. AAA and Acuros algorithms are both based on Monte Carlo based pre modeling of the head of the accelerator and the different measurements are used to adjust a few parameters related to the local machine.

If the different measurements are performed with the correct detector (spatial resolution, energy dependence...) and in a correct way, the results between measured and calculated data will be very good.

In case of differences, there is no way or no parameters (except maybe the second source size) to modify the algorithm and generally the problems are linked to the quality of the measurements.

The results of the modeling for AAA for 13 clinacs and 3 TrueBeam machines have showed that the dosimetric data of all these different machines are the same for each photon energy.

From this ascertainment, we have developed a methodology to simplify the commissioning of the algorithm after the modeling for a specific energy.

This procedure is based on the following points :

1. Comparison of the measured data (Pdd's, profiles and ouput factors with the reference ones. If they are identical, continue with the procedure.
2. After the modelisation, use of the "Beam data analysis" Varian module to verify the adequation of the measured and calculated Pdd's and Profiles. Verification of the output factors.
3. Use of a home created set of plans based on recommendations from IAEA TRS 430 and NCS-15 protocol. These different plans are covering the following points : • Complex fields • Rectangular fields • MLC and collimator • Half fields and Asymmetric fields • Off axis measurements • Missing tissues • Modified SSD • Obliquities • Fields with wedges All these plans have been calculated on our system with AAA and Acuros algorithms. The results of the calculations have been compared with measurements performed in water or PMMA phantoms. For the wedges comparisons are based on measurements with the PTW 2DARRAY 729 detector. All these data have been validated for each energy. For the new equivalent machine (Clinac or TrueBeam) commissioning, the set of plans and phantoms are imported in Eclipse and the results of the calculations obtained with the new algorithm are compared with the reference ones
4. Measurement in the water phantom of a limited number of calculated data to validate the procedure.

5. Use of 5 different plans calculated for different localisations (prostate, breast, lung, Head&Neck and brain). Plans and CT's are imported and after recalculation, the results are compared via the 3D doses matrix comparisons module of PTW Verisoft.

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Session Classification: Thursday morning - Poster Presentations - Screen1

Track Classification: QA/QC