AbstractID: 4661 Title: Use of the gamma index to evaluate the dosimetric characteristics of x-rays beams in radiotherapy: implementation to a LINAC Monte Carlo simulation

Purpose: From IEC 976 and 977, the dose distributions quality for x-rays beams from LINAC gets through the fulfilment of four parameters. This work is aimed at replacing these dosimetric tests by one parameter (gamma index) and using this concept to validate Monte Carlo simulated beams.

Method and Materials: From measurements of a 12 MV beam of a medical LINAC, analytical functions have been set to fit reference depth-dose and profile distributions. Then, those 1D distributions have been altered to reach the admissible limits of the IEC standard criteria. The peculiar tolerance criteria of the gamma index have been determined by comparing altered and reference distributions. This 12 MV beam have been simulated with the Monte Carlo code PENELOPE for different incident electron configurations at the target. The simulations have been fitted with polynomial functions to get better resolution before being compared to measurements using the gamma index to avoid false positives or false negatives due to a lack of spatial resolution in these simulations.

Results: The tolerance criteria for the gamma index have been determined experimentally by comparison with the IEC standard requirements. They are more restrictive by nature than the IEC criteria. This unified concept of dosimetric tests by the systematic use of the gamma index enabled us to select effectively the parameters for the beam simulation.

Conclusion: This work shows the possibility of using only one test for all the measurements required for x-rays beam QA and its Monte Carlo simulations. In the future, this work will lead to the implementation of a set of simulations in order to replace measurements required for the quality control of the Treatment Planning System. Evaluation tests should be based on the calculation of the 3D gamma index to simplify test processes.