# A new robust statistical method for treatment planning systems validation using experimental designs



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Résumé en anglais

Introduction
Dose computation verification is an important part of acceptance testing. The IAEA Tecdoc 1540 and 1583 suggest comparing computed dose to measurements for several beam configurations. However, this process is time-consuming and results out of tolerance are often left unexplained.
Purpose
To validate a treatment planning system using experimental designs which allow evaluating several parameters in a few tests selected by a robust statistical method.
Materials and methods
The Taguchi table L36 (211 × 312) was used to determine the 72 beams needed to test the 7 parameters chosen: energy, MLC, depth, jaw field size in X, Y1 and Y2 directions and wedge. Measurements were conducted in water using a CC04 (IBA) on a TrueBeam STx, a TrueBeam Tx, a Trilogy and a C-serie clinac (Varian). Dose was computed using the AAA algorithm (Eclipse, version 11). The same raw data was used for all accelerators during the algorithm configuration.
Results
The mean difference between computed and measured doses was 0.1 ±± 0.5% for all tested beams and all linacs with a maximum difference of 2.4% (under the 3% tolerance level). For all beams, the measured doses were within 0.6% for all linacs. No studied parameter led to statistically significant deviation between computed and measured doses.
Conclusion
Experimental design is a robust statistical method to validate an algorithm. Only 2 h of measurements were needed to evaluate 7 parameters. Furthermore, the commissioned accelerators were found dosimetrically equivalent even though the linac characteristics differ.

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