Purpose: The validation of a treatment plan is based on the analysis of dose distributions. The dose distributions are calculated by algorithms implanted in TPS. So, the changing of an algorithm must be preceded by a complete dosimetric analysis in order to provide a method for controlling the clinical impact of this change. We present in this study the methodology used for implementing a new TPS in our clinic.

Methods: We used five algorithms for dose calculation: Clarkson, PBC, Batho Power Law, modified Batho and EqTAR. We compared six treatment plans with identical configurations: 2 plans without heterogeneity correction and 4 with density correction. We have compared nine tumours locations: 4 lungs, 1 oesophagus, 1 breast, 1 head and neck, 1 brain and 1 prostate. We used a phantom to compare calculated and measured doses. We compared the following parameters: monitors units, HDV, isodoses, covering index, index of homogeneity, conformity index, biological index and gamma index. We analyzed the results using a statistical evaluation.

Results: The gamma index and histogram gamma generated for a CT slice can be used to compare various algorithms and radiotherapy plans. We found a difference in all parameters compared when the algorithm is changed. For example, we found a 5% difference in monitors units and 7% in dose for the pulmonary cancer case, when we change from PBC to EqTAR. This may leads to an increased of 30% in the complication rate. The statistical evaluation serves as a rapid interpretation and diagnostic of dosimetric differences and allows the determination of the significance of these differences.

Conclusions: We proposed a methodology that allows the quantification of dosimetric variation during the change of calculation algorithm in radiotherapy. This methodology provides a valuable technique for quantitative comparison of various algorithms and radiotherapy plans.