The algorithms that have traditionally been used for dose computation in radiotherapy treatment planning (RTP) rely directly on measured data in water. The so-called model based algorithms (convolution, Monte Carlo) are now emerging as the dose engines of choice for the 3D RTP as they can more accurately predict the dose distribution in the patient.

In this work, we studied the effect of the dimensionality of a convolution/superposition dose algorithm on the absolute dose and relative dose distribution computed.

The algorithm, calculates the dose at a point by summing together the total energy released per unit mass (TERMA) at all primary interaction sites as modified by the convolution kernel that reflects the percent of the energy released that is absorbed at the dose deposition site. Patient tissue inhomogeneity can be (i) ignored, (ii) included in the TERMA calculation only and (iii) included in both the TERMA and the convolution kernel. The resulted isodose distribution and monitor units correspond then to a homogeneous, 2.5D and 3D calculation type respectively.

We used two clinical cases, a lung and a pelvis patient, to study the dimensionality of the dose engine. Compared to the homogeneous dose calculation, the 2-field lung plan showed a 7.3% increase in absolute dose and relative dose distribution. The 4-field prostate plan showed a 7% decrease in absolute dose and relative dose distribution. The dosimetric and clinical implications in the choice of the algorithm dimensionality will also be discussed as applied to the examples presented.