ID de la contribución : **8**

Tipo : **no especificado**

Analytical calculation of proton linear energy transfer in voxelized geometries including secondary protons

In order to integrate radiobiological modeling with clinical treatment planning for proton radiotherapy, we extended the in-house, MATLAB-based treatment planning system of the University of Pennsylvania, FoCa, with a 3D analytical algorithm to calculate linear energy transfer (LET) in voxelized patient geometries. Both active scanning and passive scattering delivery modalities are supported. The analytical calculation is much faster than the Monte-Carlo (MC) method and it can be implemented in the inverse treatment planning optimization suite, allowing us to create LET-based objectives in inverse planning.

The LET was calculated by combining a 1D analytical approach including a novel correction for secondary protons with pencil-beam type LET- kernels. Then, these LET kernels were inserted into the proton-convolution-superposition algorithm in FoCa. The analytical LET distributions were benchmarked against MC simulations carried out in Geant4. A cohort of simple phantom and patient plans representing a wide variety of sites (prostate, lung, brain, head and neck) was selected.

The calculation algorithm was able to reproduce the MC LET to within 6% (1 standard deviation) for low-LET areas (under 1.7 keV μm−1) and within 22% for the high-LET areas above that threshold. The dose and LET distributions were further extended, using radiobiological models, to include phenomenological RBE calculations in the treatment planning system. This implementation also allows for radiobiological optimization of treatments by including RBE- weighted proton dose constraints in the inverse treatment planning process.

Summary

Primary author(s) : Dr. SANCHEZ PARCERISA, Daniel (Universidad Complutense de Madrid)

Co-author(s) : Prof. CARABE, Alejandro (University of Pennsylvania); Dr. CORTES-GIRALDO, Miguel Antonio (Universidad de Sevilla)

Presenter(s) : Dr. SANCHEZ PARCERISA, Daniel (Universidad Complutense de Madrid); Dr. CORTES-GIRALDO, Miguel Antonio (Universidad de Sevilla)