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RayStation research version for proton SFRT and small animal irradiation planning

A research version of the RayStation treatment planning system dedicated to particle therapy related explorations has been developed. It provides, for research purposes (ie. non-clinical use), the following features not available in clinical releases of the RayStation system:
• Scorers: Trackends, LETd, LETt, Qefft,Qeffd, dose components, 10+ RBE models (McNamara, RMF, DDK⋯), dose rate, positron yield, nuclear absorption, SPR, WEPL, proton/carbon Alanine response, ⋯
• Optimization functions: Min/Max dirty/clean dose, Min/Max LETd, Min/Max LETt, Trackend fraction penalty, dose painting using PET/MR input, Maximize/Minimize Mean Dose in ROI, Maximize/Minimize Mean LETd in ROI
• Dose calculation/optimization in magnetic field specified by 3D field map incl. full fringe field
• Pareto front navigation (MCO) in dose & LET domain
• Scissor-beam planning
• Use of slit/grid collimation in dose calculation and optimization (some details below)
• Conformal/transmission FLASH with energy deposition time trace scorer for dose rate assessment
• Voxelwise energy, LET, lineal energy spectrum scorers (linear/log binning).
• WIP: Support for small animal irradiation beam lines like SIRMIO, OncoRay and PARTREC (as part of the micro-RayStation platform).
All functionalities are available for protons as part of the proton Monte Carlo dose engine. Some scorers are also available for helium and carbon ions in the pencil beam dose engine.
For spatial fractionation studies a slit collimator geometry can be specified by the user. The sample command string below (entered in the Edit Plan dialog of the RayStation user interface):
/SLIT=G(0.4,0.1)D(Y)N(31)T(5)R(1)L(12)
specifies a slit collimator with 31 parallel 1 mm slits in Y-direction with 4 mm pitch, length of slits 12 cm, thickness 5 cm with range shifter 1 cm upstream of the slit collimator. The dose calculation uses RayStation's Monte Carlo transport from through the range shifter, via the slit collimator and to the patient/phantom.
To handle excessive memory usage in patient sized volumes, an optional "hypergrid"energy scorer can be used for scoring dose in the patient with high resolution. The particle transport is done in standard clinical resolution (1- 3 mm) while, in parallel, scoring dose in an independent hypergrid with resolution down to 2 µm (this is works in progress).
The functionalities are provided in versions 9A-IonPG, 11B-IonPG and 2023B-IonPG (note: not all in all versions). Access is subject to special agreement between institution and RaySearch.

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