Deriving RBE in ^{12}C ion therapy by means of microdosimetry and Geant4

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Heavy Ion Therapy (HIT) with ^{12}C ions is an emerging and attractive radiotherapy treatment for radio-resistant, deep-seated tumours thanks to its high relative biological effectiveness (RBE). Thanks to the Bragg Peak (BP) characterising the energy deposition, HIT allows for high conformal tumour treatment, sparing surrounding healthy organs. The determination of RBE at the BP and beyond is crucial for therapeutic ^{12}C ion beams, as the biological dose is required as a parameter in patient treatment planning and to evaluate the radiation risk to surrounding healthy tissues. Determination of RBE of a ^{12}C therapeutic beam is very difficult as it changes dramatically with depth, especially towards the end of the Bragg Peak, due to the very low energy ^{12}C ions in this region. Additional complexity is associated with the nuclear fragmentation process which leads to the production of lighter charged ions, causing a low dose tail extending beyond the distal edge of the BP. We are currently investigating the possibility to use Silicon-on-Insulator microdosimeters designed and developed by CMRP and collaborators to determine the RBE of a ^{12}C therapeutic beam with sub-mm spatial resolution, never reached before, fundamental for ^{12}C ion treatment Quality Assurance. As first step, we are studying the capability of Silicon-On-Insulator microdosimeters to derive RBE at the SOBP and beyond, by means of Geant4 simulations. We will present the first results of the project at the conference.