AbstractID: 9486 Title: Laser-Proton Inter-Track Effect and the DNA Double-Strand Break

Purpose: Ionizing radiation deposits energy and generates ionizing events non-uniformly in the medium through which it passes. Particle track and event spatial distribution may have a strong impact on the DNA damage. The aim of this work was to determine the increase of the Most Effective Event pairs (MEE, adjacent event pairs with distance between 1 and 3 nm) by inter-track effect of a laser-proton beam.

Method and materials: The proton beam from ultra-short pulse laser acceleration is pulsed radiation with extremely short durations. Events (spurs and blobs) from proton tracks of one single proton pulse are almost generated at the same time, at which inter-track effects may become significant. A model was built for the tracks of laser protons. In this model radicals are supposed to be formed in spherical events, each having a fixed amount of energy deposit (~200 eV). The spacing of events is random although the number of events is made to agree with the LET of the proton track. Proton tracks of one pulse were assumed to be parallel to each other while the spacing is random. The variation of MEE was considered, which is supposed to be the major cause of DNA lethal lesions.

Results and conclusions: Calculations were carried out assuming different combinations of parameters characterizing the production of MEE. No large variations in the yields of MEE were found at low doses. However, as the given dose becomes higher, the ratio of MEE numbers between the laser-proton beam and conventional proton beam increases quickly because of the intra-track effect. The ratio reaches about 1.09 in the radiosurgery dose range, which may affect the final RBE significantly for laser-proton radiation therapy.