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Radiobiological characterization of laser driven particles

The long-term aim of developing laser based particle acceleration towards clinical application requires not only substantial technological progress, but also new technical solutions for dose delivery and quality assurance as well as comprehensive research on the radiobiological consequences of ultra-short radiation pulses with high pulse dose. During the last years the laser driven technology was developed at such a rate that cell samples and small animals can be irradiated. Within the joint research project "on COOPtics" extensive in vitro studies with several human tumor and normal tissue cells were already performed revealing comparable radiobiological effects of laser driven and conventional electron and proton beams. Using the same cell lines, these results were substantiated comparing the radiobiological response to ultra-short pulsed electron bunches (pulse dose rates of ≤1012Gy/min) and continuous electron delivery at the radiation source ELBE. In a second translational step, in vivo experiments were established. Although the experiments were motivated by future proton trials, first attempts were performed with electrons at the laser system JETI4, since the delivery of prescribed homogeneous doses to a 3D target volume is easier for electrons than for protons. A full scale animal experiment was realized for the HNSCC FaDu grown on nude mice ear. The radiation induced tumor growth delay was determined and compared to those obtained after similar treatment at a conventional clinical LINAC. Again, no significant difference in the radiation response to both radiation qualities was revealed, whereas the successful performance of such a comprehensive experiment campaign underlines the stability and reproducibility of all implemented methods and setup components. During this experiment campaign the changing tumor take rate and a high rate of secondary tumors were identified as limitations of the model that have to be improved before proton experiments and tumor control studies can be performed. In order to optimize the model Matrigel as medium for tumor cell injection and the glioblastoma cell line LN229 as interesting entity for proton treatment were introduced. Results of this optimization process and the status of the experiments with laser driven protons at the laser system DRACO will be presented.

Biography

Elke Beyreuther has completed her PhD at the age of 28 years and postdoctoral studies from Helmholtz-Zentrum Dresden. She has published more than 15 papers in reputed journals.

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