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Dosimetry of laser-accelerated particle beams used for cell irradiation experiments

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The development of laser particle accelerators for radiotherapy application is the goal of comprehensive long-term research, established in close cooperation between the National Center of Radiation Research in Oncology (OncoRay) at Dresden University and the Helmholtz-Zentrum Dresden-Rossendorf (HZDR).

In a first step of the necessary translational chain from basic research to clinical application extensive radiobiological cell irradiation experiments have been performed. In order to determine the biological effectiveness of laser driven beams dose response curves have been measured. However, the mandatory precise dosimetric characterization is challenged by the specific properties of laser driven beams, namely the delivery of ultra-short pulses with very high pulse intensity.

In the presentation the more than four years experimental experience with both, laser accelerated electron and proton beams, will be overviewed. After introducing the dosimetric requirements the advantages and drawbacks of the different detectors and dosimeters in use like radiochromic film, Faraday cup, transmission ionization chamber, solid state detector etc. will be discussed. Furthermore, results of the cell irradiation experiments will be presented demonstrating that precise absolute and real time dosimetry is achieved by combining several detectors and dosimeters in an integrated irradiation and dosimetry system. Finally, the present developments toward clinical radiotherapy application will follow.

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Session Classification: Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers