Second Workshop on Particle Minibeam Therapy



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## Technologies of Proton Minibeam production and application

Preclinical studies comparing proton minibeams (pMB) with proton broad-beams (pBB) have demonstrated that pMB can improve the sparing of healthy tissues while there are also indications for an increase in therapeutic index. Minibeams can be generated either via collimation, a method easier to apply regarding technical purposes, or via magnetic focusing, which even though it is more challenging, avoids the generation of secondary particles and can preserve high currents and peak-to-valley dose ratio (PVDR). The application methods vary based on the pMB type, which can either be pencil or planar, the dose distribution, which can be homogeneous or heterogeneous and the energy degrading method. Typically in radiotherapy, a SOBP is created to properly cover a tumour. In case of pMBs, this can be done with a range shifter placed as close as possible to the target. However, this method can enlarge the beam and make FLASH applications more difficult. Those problems can possibly be minimized by investigating the use of ridge filters. All the aforementioned aspects regarding the pMB delivery and application should be further tested along with the study of different therapeutic intents. The construction of a preclinical proton minibeam radiotherapy (pMBT) facility for small animals can offer the opportunity to investigate all those parameters. Through systematic investigation and development of new technologies, pMBT can eventually enable clinical trials.

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