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Creation of clinical proton minibeams using magnetic focussing

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Minibeam radiation therapy (MBRT) is a promising cancer treatment method that can help increase the sparing of healthy tissue while simultaneously allowing for higher doses to be administered, thereby making new types of cancers (hypoxic tumors) accessible to this type of treatment. While MBRT with x-rays is already being put to use in hospitals, the advantages of irradiating with protons and heavier ions could be included in the treatment by considering MBRT with protons (pMBRT) or other hadrons (hMBRT). A particle beam is considered a minibeam when the full width at half maximum of its lateral profile is 1 mm or smaller. Focussing proton beams used for clinical purposes (energies ˜70 to 230 MeV) to such small sizes is a challenging task that until now has been achieved through mechanical collimation (i.e. the beam is routed through a metal block with thin slits or holes). However, this method of mechanical collimation is inefficient, inflexible and creates harmful secondary neutrons. Thus, a method focussing the proton beam only with magnetic fields would present a great improvement.

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