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Real-time dose imaging for hadrontherapy

In this contribution is presented a research project focused on the development of a dose release imaging device to be used during solid tumors irradiation with light ion beams (hadrontherapy). Hadrontherapy achieves high conformal capability of irradiation, allowing to spare the healthy tissues around the tumor, but in order to get an effective quality control of the dose delivered during the treatment, new monitoring techniques need to be developed to match the dose release precision of this new technique. We design a new imaging systems to monitor in real time the distribution of the deposited radiation inside the patient, with particular care given to the longitudinal (along the beam) component. To match the radiotherapy quality standard the device ("profiler") should achieve a space resolution on the dose profile of the order of millimeter. Such a detector will exploit the information of two different kind of secondary radiation, produced by the beam in the path inside the patient: single
photons from prompt nuclear de-excitation and heavy charged particles (mostly protons) due to (target and/or projectiles) nuclear fragmentation. The operation principle is then twofold: it will act at the same time as a tracking detector (for protons) and as a Compton camera for prompt photons.
In this contribution we will present the measurement of the secondary flux produced by carbon therapeutical beam at Laboratori Nazionali del Sud of INFN (Catania) and at GSI laboratories in Darmstadt (Germany). The working principle and the simulatd performance of the profiler will be also shown.

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