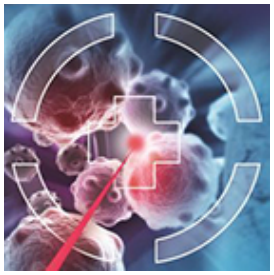

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Inter-fractional monitoring in Carbon ions Particle Therapy treatments with the Dose Profiler detector

Thursday, 5 September 2019 12:20 (20 minutes)

The use of C, He and O ions in Particle Therapy (PT) exploits the enhanced Relative Biological Effectiveness and Oxygen Enhancement Ratio of such projectiles to improve the treatment efficacy in damaging the cancerous cells while reducing the dose to the surrounding Organs At Risk.
The possible occurrence of inter-fraction morphological changes into the patient or patient mis-positioning with respect to the planned position are taken into account by the Treatment Planning System introducing safety factors preventing the target volume under-dosage. The treatments are optimised also avoiding an over-dosage of the healthy tissues surrounding the tumour area at the cost of reducing the very high tumour control PT capability.
An online monitoring device, whose technical implementation is still missing in clinical routine, is eagerly awaited in order fully profit from the PT efficacy reducing the needed safety margins.
Nowadays in clinical practice the re-planning of the treatment, and hence the acquisition of a new Computed Tomography scan of the patient, is done only in the occurrence of macroscopic morphological changes or whenever severe toxicities are expected or observed.
The Dose Profiler (DP) detector was developed within the INSIDE project as a beam range monitor for the CNAO (Centro Nazionale d'Adroterapia Oncologica) therapy center (Pavia, Italy) where it is currently installed and ready for use in the clinical environment.
It consists of a scintillating fibre tracker that exploits the detection of charged secondary fragments escaping from the patient, reconstructing their emission vertex.
The DP capability to spot the inter-fractional changes in the dose deposition has been investigated by means of a Monte Carlo simulation using the FLUKA software based on a dataset of patients that underwent a treatment re-planning because of the appearance of severe toxicites. The acquired emission profiles in different conditions have been compared by means of statistical tests. The expected performance of the technique for different treatments and patient conditions will be reviewed.
The results have also been validated using the data taken during a clinical trial occurred at the therapy center of Pavia in the summer of 2019. The simulation and data-taking results will be discussed, in view of assessing the DP capability of spotting inter-fractional changes in clinical conditions.

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