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Microdosimetry with mini-TEPC in hadrotherapy

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Microdosimetry provides information about the pattern of energy deposition in biological targets that be correlated with biological effects and may be useful in planning and conducting radiation therapy. The methodology is clearly relevant to charged particle beam therapy but can provide relevant information also to BNCT, targeted internal emitters and conventional photon therapy.

In current clinical practice, the treatment planning system often includes consideration of radiation quality parameters. In proton therapy, in particular, the use of a fixed Relative Biological Effectiveness (RBE) of 1.1 to weight the physical dose is under discussion due to evidence of an increase of RBE along the depth dose profile, especially at the end of the particle range [1-2].

Considered the intrinsic uncertainty in the calculation of radiation quality parameters by analytic algorithms or Monte Carlo calculations, experimental microdosimetry is a useful tool to measure the agreement between the planned and the delivered treatment, thus reducing the uncertainties of the biological effectiveness calculated by the treatment planning system (TPS). However, at present there is no routine use of experimental microdosimetry in ion-beam therapy: while the calculated dose distributions produced by the TPS are routinely verified with ionization chambers as part of the quality assurance program, there is no commercial detector available to perform routine verification of the radiation quality.

In this talk recent development on the realization and use of miniaturized tissue equivalent proportional counters will be presented, for specific applications in particle therapy as well as in BNCT [3, 4]. Measurements performed at the 148 MeV energy-modulated proton beam at the radiobiological research line of the Trento Proton Therapy Centre will be presented and discussed.

REFERENCES

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Primary author: CONTE, Valeria (INFN - Laboratori Nazionali di Legnaro, Legnaro (PD), Italy)

Co-authors: BIANCHI, Anna (INFN - Laboratori Nazionali di Legnaro, Legnaro (PD), Italy); SELVA, Anna (INFN - Laboratori Nazionali di Legnaro, Legnaro (PD), Italy.); LA TESSA, Chiara (University of Trento, Trento, Italy. Trento Institute for Fundamental Physics and Application TIFPA-INFN, Trento, Italy); SCIFONI, Emanuele (INFN - TIFPA, Trento, Italy); TOMMASINO, Francesco (University of Trento, Italy; INFN - TIFPA, Trento); MISSIAGGIA, Marta (University of Trento, Italy; INFN - TIFPA, Trento, Italy)

Presenter: CONTE, Valeria (INFN - Laboratori Nazionali di Legnaro, Legnaro (PD), Italy)

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