

## عنوان مقاله:

Radiation Effects on the On-line Monitoring System of a Hadrontherapy Center

## محل انتشار:

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## خلاصه مقاله:

**Introduction** Today, there is a growing interest in the use of hadrontherapy as an advanced radiotherapy technique. Hadrontherapy is considered a promising tool for cancer treatment, given its high radiobiological effectiveness and high accuracy of dose deposition due to the physical properties of hadrons. However, new radiation modalities of dose delivery and on-line beam monitoring play crucial roles in a successful treatment. In hadrontherapy, through interactions between the primary beam and patient's tissue, secondary neutrons are produced. **Materials and Methods** This study, by using FLUKA Monte Carlo simulations, assessed the level of secondary neutron radiation, produced during patient treatment. In addition, the evaluation included secondary neutron radiation, which was produced while hitting the on-line detectors of beam delivery system by the Italian National Center for Hadrontherapy (CNAO). This study assessed the effects of secondary neutron radiation on an electronics rack (including a data acquisition system, a power supply, and a gas system) and a nozzle, where two monitoring boxes (each one consisting of two or three parallel plate ionization chambers) were installed. **Results** The resulting neutron energy spectra and radiation doses were used to determine the life performance and the probability of damage to these devices. Findings showed that by using carbon ions of 400 MeV/u, the fluence rate of secondary neutrons will be approximately  $3.4 \times 10^{10}$  n/cm<sup>2</sup> in a year. **Conclusion** This value is lower than the experimental threshold, which is responsible for less than 1% of changes in electrical characteristics, and would cause no single event upsets.

## کلمات کلیدی:

Neutron Diffraction, Proton Therapy, Radiation Effects, Monte Carlo Method

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