Contribution ID: **55** Type: **Oral presentation (preferred)**

Source term assessments for air activation in hadrontherapy facilities

Thursday, 30 May 2024 15:30 (15 minutes)

Hadrontherapy is a radiotherapy technique that exploits accelerated particles to treat oncological patients. Protons are the primary particles utilised in such treatments, although there are only a few centres worldwide where also carbon ions are adopted. One of these centres is The National Center for Oncological Hadrontherapy (CNAO), located in Pavia, Italy. The facility accelerates protons up to 250 MeV and carbon ions up to 400 MeV/u since 2011. In the near future CNAO has planned to install a new ion source that also enables the adoption of He-4, Li-7, O-16 and Fe-56 ions, for both clinic and research applications using the actual synchrotron. Typical radiation protection issues of these installations include the activation of materials, water and air both due to the primary and secondary fields. Specifically, when the beam interacts with either the patient or the machine components, it generates a secondary neutron field, which is also capable of producing radionuclides in the surrounding materials.
In this study, the production of radionuclides in the air within a hadrontherapy environment is evaluated for the particles accelerated at CNAO as listed above. Subsequently, the simulations are validated through experiments conducted under reference conditions using particles that are currently available, such as protons and carbon ions.
Two kinds of source terms are assessed: the first addresses activation resulting from the beam's free path in air, while the latter considers radionuclides generated by secondary radiation, when the beam impinges on different targets. Source term calculations are performed using the Monte Carlo code FLUKA.
Those results are normalised and generalised in order to allow their utilisation as source terms for air activation in standard conditions. So that, they can be useful for raw valuations of air activation, in various conditions and across different kinds of accelerator facilities.

Scientific Topic 1

Source terms, new accelerator facilities and related topics

Scientific Topic 2

Scientific Topic 3

Scientific Topic 4

Scientific Topic 5

Induced radioactivity and decommissioning

Scientific Topic 6

Scientific Topic 7

Medical and industrial accelerators

Scientific Topic 8

Primary authors: Dr INTROINI, Daniele (Fondazione CNAO); Dr BONFORTE, Francesco (Fondazione CNAO); GARLASCHELLI, Giorgio (Fondazione CNAO); Dr DE BATTISTA, Irene (Fondazione CNAO); Dr FERRARINI, Michele (Fondazione CNAO)

Presenter: GARLASCHELLI, Giorgio (Fondazione CNAO)

Session Classification: Session 6 - Medical and industrial accelerators

Track Classification: Medical and industrial accelerators