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Neutron Dose Evaluation in Hadron Therapy Centers and in High-Energy Neutron Reference Fields: Results from the LINrem Project

Introduction:
Neutron dosimetry is still facing important challenges, particularly in mixed radiation fields of high intensity and energy, such as those found in particle accelerators or hadron therapy facilities, where neutrons are generated as secondary particles. The task becomes even more complex in pulsed radiation structures, as encountered in advanced therapeutic approaches like FLASH therapy or in ultra-intense pulsed laser sources. Another critical drawback is the limited portability of many devices currently used for active neutron dosimetry in radioactive environments. To address these shortcomings, the LINrem Project, a Spanish initiative, aims to develop innovative solutions for neutron area dosimetry and to overcome the main limitations that affect this field today

Materials and methods:
The LINrem Project consists of two patented dosimeters: the LINrem, with sensitivity up to 10 MeV, and LINremext dosimeter, designed for an extended range [1,2].
Both systems are available in active and passive versions. Their innovative design enables their use in very high dose environments, in both continuous and pulsed radiation fields.
This work presents the outcomes of Monte Carlo simulations alongside validation and intercomparison studies of the LINrem dosimeter response in various experimental scenarios. These include tests with high-energy neutron reference fields (CERF at CERN), secondary neutrons generated in hadron therapy facilities under near-clinical conditions (IBA Proteus Plus), as well as pulsed neutron fields produced by ultra-intense laser systems (CLPU).

Results and Conclusions:
The LINrem dosimeters showed reliable performance in validation tests at reference facilities (within 10% deviation) and excellent agreement with commercial devices, such as WENDI-II, in hadron therapy environments. In pulsed fields, the use of charge-integration neutron counting [3] allowed accurate measurement of doses above 500 nSv/bunch. This work summarizes the project's progress, key validation and intercomparison results in fast, high-energy, and pulsed neutron fields, and outlines its potential impact on neutron dosimetry.

References:
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