Post-doctoral fellow in Physics

Measurement and simulation of secondary particles for ion-beam therapy and space radiation applications

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Institute :	Institut Pluridisciplinaire Hubert CURIEN (UMR 7178), Strasbourg (France)
Scientific managers:	Dr. Marie Vanstalle Dr. Nicolas Arbor
Date of employment:	01/10/2022
Contract details:	Full time for a duration of 2 years
Remuneration:	Between 2690,43 and 3821,07 €/month (gross salary) according to experience
Education level:	PhD in Subatomic or Medical Physics

Nuclear reactions between the primary beam and the target volume plays an important role in ion-beam therapy and space radiation. In both fields, it is necessary to quantify these processes in order to calculate precisely the received dose by humans. In particle therapy, the use of protons and carbon ions for cancer treatment is very interesting due to a better dose conformity compared to conventional therapy. Their favorable depth dose profile allows irradiating precisely the tumor while sparing the surrounding healthy tissues. However, nuclear fragmentation between the primary beam and the target volume leads to the production of lighter fragments, which can contribute to unwanted doses inside the healthy tissues.
In space radiation, long-term deep-space missions, e.g. Mars mission, are foreseen in the near future. Nevertheless, it is important to study the radiations coming from space in order to quantify the received dose by the astronauts and to optimize the shielding materials of the spacecraft. Dose calculations in ion-beam therapy and space radiation are performed by high performance algorithms including physics and biological processes, based on basic data provided by Monte Carlo simulations. However, experimental data in the range of 10 MeV/u to 10 GeV/u are missing, which leads to non-accurate dose calculations by the transport codes. Therefore, experimental campaigns to measure the missing data are crucial.

The main work of the candidate will focus on performing physics experiments for nuclear data measurements needed in the fields of ion-beam therapy and space radiation. These experiments will be mainly performed in hadrontherapy clinical center,

such as CAL (Nice, France) or CNAO (Pavia, Italy), but also in NIRS (Chiba, Japan). The obtained results will be compared to Monte Carlo simulations carried out with Geant4/Geant4-DNA, PHITS or MCNPX. The candidate will also be offered to join the FOOT (FragmentatiOn Of Target) international collaboration, which aimed at measuring differential cross sections for both hadrontherapy and space radiation protection.

Activities

For this work, he/she will contribute to different activities:

- Study of nuclear reactions in ion-beam therapy and space radiation.
- Development of an experimental setup to measure secondary particles with different detector systems such as scintillators or CMOS pixel sensors.
- Planning and conducting one or more experimental beam time campaign.
- Data analysis and development of inter-comparison codes (measurements and calculations) for different experiments (CLINM, FOOT...)
- Monte Carlo simulations (with Geant4, PHITS, MCNPX...)
- Work on global reconstruction code of FOOT (TOE)

Skills:

- Good knowledge and skills in subatomic/medical physics, instrumentation and data analysis
- Good experienxe in C++ programming and/or PYTHON.
- Experience in Monte Carlo simulations (Geant4 or similar) would be an advantage.
- Team working ability
- Level of English B2 according to the Common European Framework of Reference for Languages

The international, multidisciplinary and collaborative context of this project requires that the candidate has a strong motivation, curiosity to expand his area of expertise, autonomy and ability to work in a team with strong constraints to meet deadlines.

Working environment:

The IPHC, a joint research unit under the co-supervision of CNRS and Strasbourg University (UMR7178), is a pluridisciplinary laboratory where research groups from various scientific fields (ecology, physiology and ethology, chemistry and subatomic physics) develop high level research program with a strong instrumentation basement. IPHC is composed of 4 departments and counts a total number of 393 agents including

257 permanent position (119 researchers, assistant-professors and professors and 138 engineers and technicians), 46 fixed term contracts.

The Institut Pluridisciplinaire Hubert Curien (IPHC) at Strasbourg is opening a 24-month postdoctoral position in medical physics focused on the measurement and modelling of secondary particles produced in hadrontherapy and space radiation protection. This research activity will be carried out within the DeSIS team, which is right now composed of 5 permanent researchers, 1 engineer, 1 technician, and several phD students. The group is part of international collaborations, such as GATE and Geant4-DNA. In addition, the DeSIS is also involved since 2017 in the international FOOT experiment, which will allow the candidate to join the collaboration. The candidate will therefore work in close collaboration with international collaborators from Italy and Germany, as well as with the Radiochemistry team of IPHC.

Constraints:
Work in staggered schedule during beam time experiments.

Follow this weblink to apply.

For more details, you can contact:
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