SERVICE DE METROLOGIE NUCLEAIRE

Proposition de stages et mémoires

2021-2022

Le Service de Métrologie Nucléaire poursuit des activités dans les domaines de la proton thérapie et de la physique des accélérateurs avec plusieurs partenaires incluant l'Organisation Européenne pour la recherche nucléaire (CERN), Ion Beam Applications (IBA), le SCK-CEN et Royal Holloway (University of London). Les mémoires suivants sont proposés dans le cadre de ces collaborations aux étudiants de MA2 pour l'année académique 2021-2022.

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4. Evaluation of the beam losses and activation in realistic geometries of proton therapy installations using BDSIM/Geant4

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The realistic modeling of particular accelerators and beam transport lines including complex geometries, detailed magnetic fields models and beam dynamics using Monte-Carlo simulation codes is a challenging task. BDSim is a software built on top of the Geant4 Monte-Carlo library developed at Royal Holloway – University of London (RHUL).
A recent collaboration between IBA and RHUL lead to the modeling of the IBA compact proton therapy solution "Proteus One". This work will pursue that effort by developing simulation tools and methods using BDSim for high-energy machines such as the CERN Proton Synchrotron (PS).

For the PS, the detailed study of the beam losses is necessary to reduce the activation of the machine elements and allow long-term operation, safe main- tenance, and ultimately a high machine availability. A BDSIM model of the CERN Proton Synchrotron has already been made. The student will have to use it and improve it in order to correctly model the residual activation induced by the beam losses. Simulations will also be carried out to study the beam extraction processes.

Figure 4: Picture representing a part of the CERN Proton Synchrotron