SERVICE DE METROLOGIE NUCLEAIRE

Proposition de stages et mémoires
2022-2023

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 2022-2023.

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Mémoire et possibilité de couplage avec un stage MA2

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The realistic modelling 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). 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).
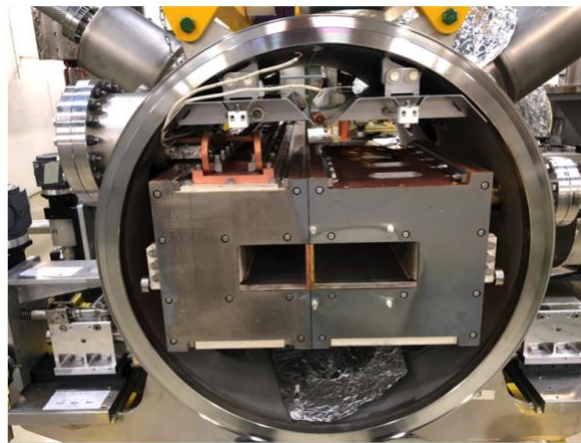

Figure 1: The new septum magnet (left) and the bumper (right) have been clamped together and inserted inside a vacuum tank (Image: CERN)

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 maintenance, and ultimately a high machine availability. A BDSIM model of the CERN Proton Synchrotron has already been built. 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 and validate the results against experimental data.

Previous Master's theses

[1] B.Ndihokubwayo, *Mixed beam-matter interactions and transport simulations Applications to the MYRRHA linear accelerator and to the CERN Proton Synchrotron.*

[2] S.Musibau, *A self-consistent approach to the numerical evaluation of the beam losses at the CERN Proton Synchrotron.*

[3] R.Dantinne, *Evaluation of the beam losses and activation in realistic geometries of the CERN Proton Synchrotron using BDSIM/Geant4.*