Contribution ID: **35** Type: **not specified**

# Methodology to address radioprotection and safety issues in the IFMIF/EVEDA accelerator prototype

*Friday, June 4, 2010 11:30 AM (20 minutes)*

International fusion materials irradiation facility (IFMIF) is one of the three projects of the fusion broader approach between Japan and the European Union, planned to be performed in parallel of ITER project. The objective of IFMIF is to study the behaviour under irradiation of materials and components in conditions close to a nuclear fusion reactor. Engineering validation and engineering design activities (EVEDA) is the first phase of the IFMIF project.
In the IFMIF/EVEDA accelerator prototype, deuteron interacts with the materials of the accelerator components due to beam losses and in the beam dump, where the beam is stopped. The production of neutrons/photons and radioactive inventories due to deuteron-induced reactions is a major issue for radioprotection and safety assessment. In addressing these issues some developments regarding computational tools and nuclear data are required in order to solve the following limitations:
i) The built-in nuclear models included in current MC codes do not allow predicting, with reasonable accuracy the production of secondary particles and residuals from deuteron interactions in the energy range up to 9MeV.
ii) The lack of transport coefficient data for diffusion simulation to determine the deuterium concentration profile inside the copper lattice (required for neutron and tritium production from d-D reaction)
We present in this paper the work we are performing in order to have a computational methodology able to address the major radioprotection and safety issues in the IFMIF/EVEDA operational scenarios.
Firstly, we present the outcome from a benchmark performed to assess the availability and quality of cross section data for neutron generation due to incident deuterons. Calculations for d-Material interactions are performed using the nuclear models included in MCNPX and PHITS, as well as the dedicated nuclear model code TALYS and corresponding TENDL2009 data library. The ENDF/B-VII.0 data library was used for d-D interactions.
Secondly, the need of some extensions to current MC codes is required. A solution to the limitations above indicated is the MCUNED code, an extension to current MCNPX code, which main features will be presented, showing its power in addressing like-EVEDA problems.
Thirdly, as for deuteron activation cross sections, results from the above-mentioned benchmark are presented and the pros and cons of using EAF2007 and TENL2009 data libraries are discussed. Regarding activation codes, ACAB is proposed as one of the reasonable options.
And finally, the diffusion transports coefficients proposed to be used by the TMAP7 code for deuterium and tritium profiles assessments is presented as well as its impact compared with others standard approaches.

## Summary

The production of neutrons/photons and radioactive inventories due to deuteron-induced reactions is a major issue for radioprotection and safety assessment. In addressing these issues in the IFMIF/EVEDA accelerator prototype some developments regarding computational tools and nuclear data have been required. The methodology to address it is presented.

**Primary author:** Mr SANZ GOZALO, Javier (UNED)

**Co-authors:** Mr MAYORAL ESTEBAN, Alicia (UNED); Mr LOPEZ GONZALEZ, Daniel (UNED); Mr OGANDO, Francisco (UNED); Mr GARCIA CAMACHO, Mauricio (UNED); Mr SAUVAN, Patrick (UNED); Mr JOYER, Philippe (CEA/IRFU); Mr BLIDEANU, Valentin (CEA/IRFU)

**Presenter:** Mr SANZ GOZALO, Javier (UNED)

**Session Classification:** Session 6 - Present status of data and code libraries

**Track Classification:** Present status of data and code libraries