Seminar

Institute for Plasma Research

Title : Nuclear Activation Code Development and Analysis for Fusion Systems

Speaker : Ms. Priti Kanth, IPR, Gandhinagar

Date : 3rd June, 2019 (Monday)

Time : 10.30 AM

Venue : Committee Room #03, (New Building), IPR

Abstract:

Nuclear activation study of structural material in fusion devices is very crucial from an operational, maintenance and safety point of view. The neutrons produced during the fusion reaction interact with the structural materials as they travel across the device. To account for the large size and gradient of neutron spectrum, a novel algorithm has been developed during this thesis, for fast and accurate nuclear activation calculations. This algorithm performs activation for all the materials at each mesh in the entire fusion device in one single run. It has been implemented in the code ACTYS-1-GO and is found to be faster than any existing nuclear activation code.

The gamma photons emitted from activated material do not deposit their energy locally. Hence, nuclear activation codes are coupled with transport codes to evaluate the biological dose rate produced from gammas (SDDR). Under the scope of the thesis, ACTYS-1-GO is coupled with transport code ATTILA using R2S scheme to evaluate SDDR.

Apart from performing activation calculations and evaluating the radiotoxicity in the materials, another important aspect of activation codes is to provide guidelines for optimizing material composition to minimize radiological responses. In this thesis, a novel formula was developed to evaluate the best elemental composition for a material placed in spatial and temporal varying neutron spectrum based on various radiological quantities produced in the material. Furthermore, various visualization techniques have been developed for the large sets of complex inventory data and radiological quantities produced during activation calculation.