Project No: C2-04
in the frame cooperation CEA-IFA

CEA: Dr. Eric Gauthier, IRFM, CEA Cadarache
IFIN-HH : M. Enachescu, C. Stan-Sion, A. R. Petre
Partener I : UPB, E. Petrescu

Project title: **AMS analyses of concentrations of hydrogen isotopes and other elements in tiles dismounted from the Toroidal Pump Limiter at Tore Supra Tokamak.**

Duration: 2012-2014

**Scientific motivation of the experiment**

The project uses the Accelerator Mass Spectrometry (AMS) for the research of fusion facilities and for the experiments contributing to the finalising the construction of the first International Thermonuclear Reactor (ITER) in Cadarache, France.

Tokamaks around the world, including the Tore-Supra having the longest duration for a plasma confinement, are performing experiments to resolve the last problems related to this goal. This Tokamak performs the longest fusion discharges (30 min.) testing the plasma interaction with different materials and devices installed in such a machine.

Sensitive analyzing by AMS will be performed for the first time on samples from Tore Supra. The particle deposition will be investigated in the depth of the protection tiles of the Toroidal Pump Limiter (TPL) and will deliver information of the transport of particles in the reaction vessel.

The main objective of this project is to study the particle accumulation in the TPL at Tore Supra.

Since this assembly is removing the most of the emitted particles during the fusion discharges the AMS analysis of concentration depth profiling of different elements would provide interesting information not only about particle transport and erosion deposition but will reveal also information about the fusion efficiency during the tokamak discharges.

We will analyze by AMS samples cut from tiles dismounted from the TPL, located in the center of the limiter.

A number of 9 relevant locations around the torus will be chosen. These samples were exposed to the plasma discharges in the Tore Supra and AMS will
determine the *deuterium concentration depth profile and the deposition of other elements on the surface*.

The poloidal distribution of particle retention on the limiter will also be studied. The samples will be cut from locations on tiles situated in radial direction (4 different locations on the circumference). Form each location time 5 samples will be extracted from one end to the other of the radius.

Concerning the AMS analysis of depth profiling (DP) of material concentrations, it requires standard samples that must correspond in structure with the material under investigation. Thus, the host materials should have the same atomic matrix and the calibration of standards is not always a simple task.

**In this experiment we will perform the objective from Stage III**

We will perform AMS DP of deuterium concentration in the 9 samples from TPL (4 from erosion area and 5 from thick deposition area) after 1 year and a set of 10 powder samples representing dust samples from Toroidal Pump Limiter at Tore Supra Tokamak. From these samples by cutting according to AMS target size, resulting 28 samples analyzed.

**Beam Time Request**

**We ask for 3 days of beam-time.**

The experiment will use the 7.5 MV value of the terminal voltage to determine deuterium concentration and several sequences of short time (10 min.) will use the 7.5 MV value of the terminal voltage for pilot beam ($^{12}$C).

Dr. Mihaela Enachescu