

Beam Time request for the 3MV tandem accelerator.

CONTRACT: No. C4-12 / CEA-IFA agreement.

Title of the contract:

Markers implant for determining erosion and deposition effects on PFCs used in the first phase of the WEST PROJECT – CEA

Project leaders: Eric Gauthier (F) and Catalin Stan-Sion (RO)

Short description: Tore Supra is a circular plasma device with a toroidal limiter, enabling advance research and experiments for a most efficient future Tokamak fusion power plant. The Institute for Magnetic Fusion Research at Cadarache France, in the frame of the WEST project (acronym derived from Wolfram - Environment in Steady-state Tokamak, will modify the facility to become a test platform open to all ITER partners. Consequently, the goal is to equip the tokamak with an actively cooled tungsten divertor, benefiting from its unique long pulse capabilities, its high level of additional power and the unique experience of operation with actively cooled components. To emphasize that the divertor is a key component in a Tokamak fusion reactor which faces the largest part of the heat and particle fluxes coming from the core plasma during experiments and maintains the thermal equilibrium of the plasma discharge.

The upgrade of Tore Supra in the frame of the WEST PROJECT consists firstly in inserting additional in-vacuum vessel magnetic coils to allow the production of divertor plasma shapes, just like those which ITER will use. The WEST tungsten divertor elements will use the same design and manufacturers as the ITER ones. Therefore, in a first phase The WEST Project will enable its teams to explore the issues involved in plasma physics over long periods of time in a tungsten environment thanks to its unique capacities concerning its pulse durations.

In the present proposal for a bilateral scientific cooperation the France-Romanian teams involved in the research have a wide experience in the fusion research, performed in the frame of the EURATOM project. Their research was dealing with the diagnose of plasma-wall interaction , fuel retention , retention reduction by W- coating, transport of materials and depositions on the PFCs in the Tokamak.

The goals of the project proposal are emerging directly form the objectives of the WEST PROJECT .

One main objective of WEST will be to study the ITER baseline H mode over long periods of time, by tackling in particular the problem of controlling the contamination of the plasma caused by tungsten. For this purpose, the characterization of deuterium retention in Tungsten materials represents an important research task together with the characterization of erosion and deposition effects on the PFCs of the Tokamak reactor.

In our project proposal, erosion/ deposition values will be measured quantitatively by use of energetic implanting of depth markers into specialized testing samples that can be afterwards mounted onto the PFCs. The remnant length of the marker or its depth positioning will reveal the erosion or deposition of material.

The measurement of deuterium retention will be performed by use of a method for concentration depth profiling based Accelerator Mass Spectrometry (AMS).

Following the priorities of CEA in accordance with the Romanian and European strategies, the objective of the Project proposal is defined as : The characterization of erosion/deposition on Tungsten materials and the determination of deuterium retention, according the WEST Project.

Activities will be subdivided in the two phases of WEST as :

- 1) The implantation of Markers in the PFCs used in the first phase of WEST.
- 2) Determination of erosion/ deposition by identification of the Markers positioning in the depth of the tiles. Measurement of the deuterium retention inventory in tungsten PFCs of Tore Supra*.

Requested beam time:

2 x 7 days , first period in November and second in March, next year.