DEVELOPMENTS OF THE VALIDATION AND DESIGN ACTIVITIES OF IFMIF

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The Engineering Design and Engineering validation Activities of the International Fusion Materials Irradiation Facility (IFMIF/EVEDA) aim at producing by mid 2013 a detailed design of IFMIF, enabling for decision of its future construction. The project, started mid 2007 in the framework of the Broader Approach agreement between Euratom and Japan, has been focused on the validation activities, and in particular:

- The Accelerator Prototype, the full scale low energy section (9 MeV) of IFMIF future accelerators (40 MeV), with full current (125 mA) in continuous wave. The following status will be developed:
  - The injector is now in construction; its tests are foreseen to start in 2010 in Saclay. The optimization of the extraction section (limitation of the electric field) and compensation for space charge (by injection of krypton or argon) has led to an original design, improving its reliability.
  - The radiofrequency quadrupole (RFQ) engineering design is now complete; several important mock-ups have been built: a 1:1 scale aluminium mock-up to check the tunability of the cavity (and dipole / quadrupole modes separation), a module in copper to validate the brazing procedure, a representative cooling mock-up to measure the heat exchange coefficient in the actual geometry.
  - The cryomodule, which brings the energy from 5 MeV (output of the RFQ) to 9 MeV is under design finalization; several mock-ups are also under fabrication (and in particular one of the 8 superconducting cavities in niobium) to validate its design. RF couplers will also require a specific experimental programme (transition from room to cryogenic temperatures).
  - Other elements (i.e. the beam dump, the RF power system) have successfully passed their conceptual design phase and are now under detailed design.
  - The infrastructure in Rokkasho is under finalization (the building will be ready in spring 2010).
- The EVEDA Lithium Test Loop is now under construction in Oarai, Japan, and should be completed before end 2010. This second major validation tool aims at the demonstration that a stable lithium flow (10~20 m/s, 25 ±1 mm thick, 10 cm wide) can be guaranteed for a long period of time. This requires in particular a very efficient purification system, in order to limit the erosion and corrosion of the lithium in the loop, and in particular in the target assembly section, where the speed is maximum. Developments of purification techniques have shown that the objective of less than 10 wppm in nitrogen, oxygen and hydrogen (less than 1 wppm in tritium) can be probably achieved. Two target assembly concepts are being considered: a first stainless steel “integral” concept and in a second phase a more challenging “bayonet” removable backplate in reduced activation ferritic/martensitic steel (Eurofer and F82H).
- The high flux test modules are also subject to an extensive validation programme with the construction of a full scale module, in order to measure its performance, as well as the “rigs”, containing the samples that will be irradiated in IFMIF. These rigs full scale prototypes will be irradiated in the Belgian reactor BR2, and some key elements will be checked during these experiments (NaK behaviour, heaters resistance to irradiation, instrumentation for neutron rate measurement, etc).

In parallel, IFMIF engineering design activities are progressing, and in particular the core of the plant: the test cell, hosting the target assembly and all other modules (high flux, but also medium flux, such as creep fatigue test module and low flux).