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DIVERTOR REMOTE HANDLING DEVELOPMENT

by Dr. D. Maisonnier, the NET Team (EU)

The ITER divertor assembly consists of 60 cassettes located in the bottom region of the vacuum vessel. The main function of the divertor is to exhaust impurities and reaction products from the plasma. As the main interface component between the plasma and material surfaces during normal operation, it must tolerate high heat loads whilst, at the same time, provide shielding for the vacuum vessel and coils.

Each cassette comprises a stainless steel body on to which the high heat flux components are attached. Because of erosion and irradiation damage, their replacement is expected to be required 8 times during the machine lifetime. To achieve this, the cassettes will be withdrawn from the vessel through four dedicated ducts (Fig. 1) and transported to a hot cell for refurbishment. The latter process consists of the replacement of all high heat flux components in order to minimize rad-waste (weight of cassette body, weight of all the components to be replaced in the hot cell). The replacement of a complete set of cassettes is required to be executed in less than six months and their refurbishment in less than one year. **(Cont'd. on page 5)**.

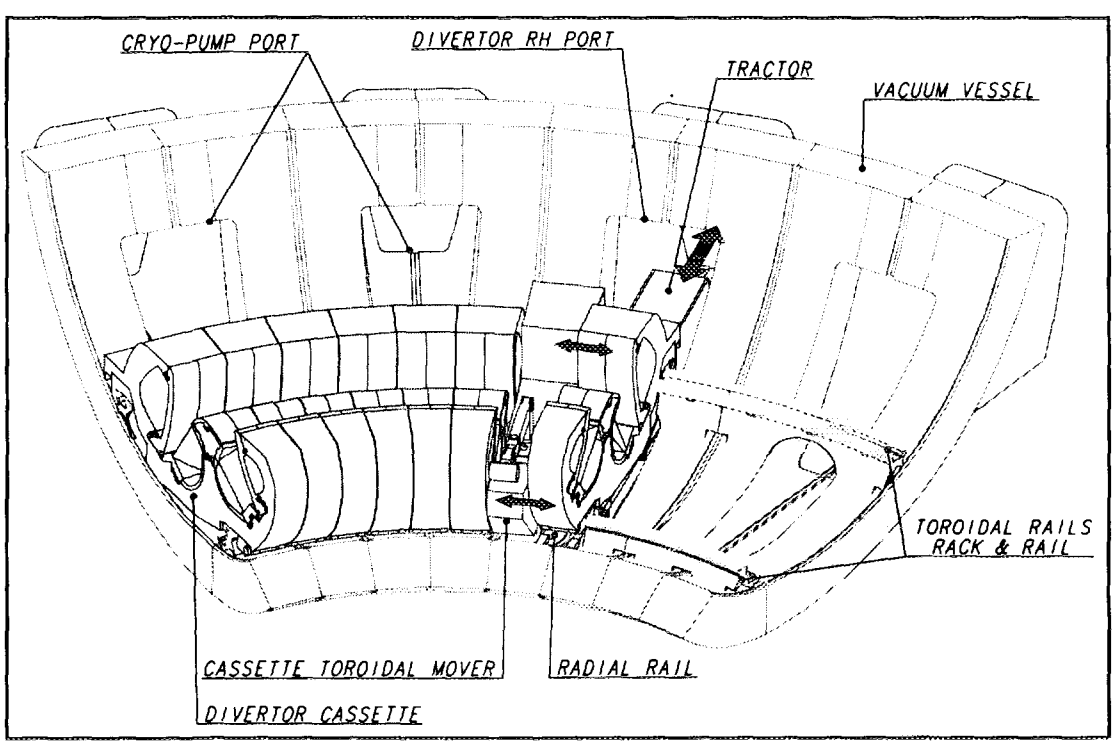


Fig. 1. The Cassette Toroidal Mover Inside the Vacuum Vessel

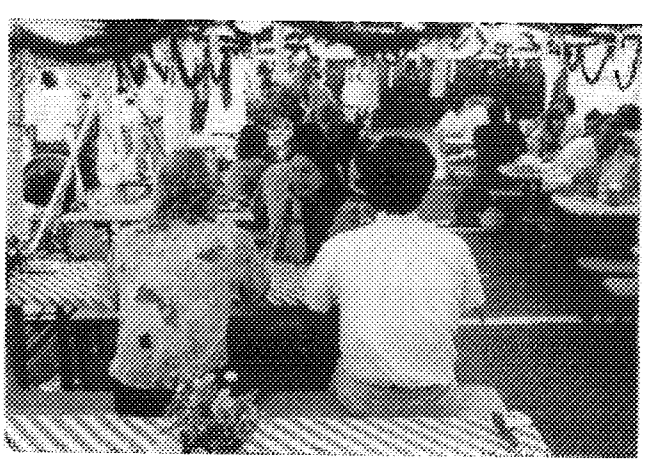
SUMMER PARTY IN GARCHING

by S. Füss, Local Administrator, ITER Garching Joint Work Site

The morning of Friday, 19 July, promised already a fine and warm summer day with skies in the Bavarian colours, blue and white, and frantic activities started outside the ITER building. Colleagues in a meeting had hard times to concentrate on the speaker, while outside the conference room beer barrels were wheeled around, barbecues were set up and the accordionist tested his amplifier. The marquee rigged up a couple of days earlier - because you never know - was decorated with festoons and table-cloth, of course also in white and blue, and by 3 p.m. the sound of Bavarian music drove everybody out of the office. Families with children arrived, and within a short time the place outside our building was filled with people. Only the poor meeting participants had to close their windows and to withstand the temptation for yet another hour.

Sausages and chops on a charcoal grill, salads and pretzels were prepared by helpful colleagues from the Institute for Plasma Physics, our host institute, under the direction of our stationery and catering expert, Frau Lehnert, who was very appropriately dressed in Bavarian style. Together with the music, this all formed a very Oktoberfest-like frame* where obviously everybody enjoyed himself chatting along to other JCT members, families and visitors. The most prominent visitor was the ITER Director, whose stay in Garching was concluded with this enjoyable afternoon.

Various contraptions like a scaled-down bowling alley for beer mugs, a doughnut ejector which one had to hit with a tennis ball from a five-yard-distance amused children and adults alike, and many tested their skills trying to score a basket.



Later, the musician honoured the ethnic diversity of the audience by digging deeply into his international repertoire, and soon mixed groups could be seen dancing Cossack style with great enthusiasm.

At the end of the day, everybody went home in a good mood, and the success of our summer party will nourish hopes for a repetition next year.

* *The Oktoberfest in Munich is the most famous beer festival in the world*

Photos on the left page:

- *Everybody dancing. Frau Lehnert, of course, in the centre of activity*
- *There is always a place for talking*

Photos on this page:

- *It's the Director's responsibility to show the way (recipients are Masanori Onozuka and his wife Joy)*
- *The Bavarian One-Man-Band*
- *At the food counter*
- *Happy trio: Mary Schaubel, her son Dylan and Olga Utina with a lot of beer, partially invisible*
- *Masao Yamada (JCT) at his best*

PRESENTATION OF AWARDS TO DR. R. AYMAR AND DR. R. IOTTI

Dr. Martha Krebs, Director, Office of Energy Research, U.S. Department of Energy, visited the San Diego ITER Joint Work Site on Friday, June 14. While there, she presented awards to Dr. Robert Aymar, ITER Director, and Dr. Robert Iotti, ITER Administrative Officer, recognizing their contributions to the ITER EDA.

Dr. Aymar received the Department of Energy Exceptional Public Service Award. This award is presented to individuals whose significant achievements have supported Department of Energy missions or goals. The citation included with the award reads:

> "In recognition of your personal dedication and outstanding leadership in directing the ITER project. Your extraordinary ability to melt diverse groups and views into a superb project team has been recognized throughout the world. You are to be commended for your managerial and technical skills and the vision of ITER that you have brought to the project."

Dr. Iotti received the Department of Energy Distinguished Associate Award. This award is presented to individuals employed by a Department of Energy contractor whose outstanding efforts on major programs or projects have exceeded contract requirements. The citation included with the award reads:

> "In appreciation for your outstanding leadership of and personal commitment to the ITER project. Your important contributions are a tribute to your skills as a manager, diplomat and tireless team member."

(Continuation of page 1)

Maintenance operations inside the vessel are performed in parallel in four quadrants of the machine. In each quadrant, a radial duct has been dedicated to the insertion/withdrawal of the cassettes. Outside the vessel, the cassettes are transported to the hot cell inside contained transfer casks.

The relatively high frequency of schedules replacement of the divertor assembly has a considerable impact on the ITER availability. It is, therefore, of utmost importance to demonstrate experimentally that the operations are feasible and that they can be executed within the prescribed duration. For this reason, one of the seven large R&D projects (L-7), which are the core of the ITER EDA, is fully devoted to divertor maintenance. For this project, under the Euratom-ENEA Association, two test facilities, namely the Divertor Test Platform and the Divertor Refurbishment Platform, will be set up at the ENEA Research Centre of Brasimone, near Bologna (Italy).

- The Divertor Test Platform (DTP), used to simulate in full scale all handling operations inside the vacuum vessel (Fig. 2). The platform will represent a 72° sector of the lower portion of the vacuum vessel with four radial ducts to allow operations to be simulated in parallel. Prototype "movers" will be installed to handle cassette mock-ups. A proof-of-principle "skid" will be available to simulate plug handling operations whilst prototype bore tools will be used to simulate cutting and welding of the cassette cooling pipes.

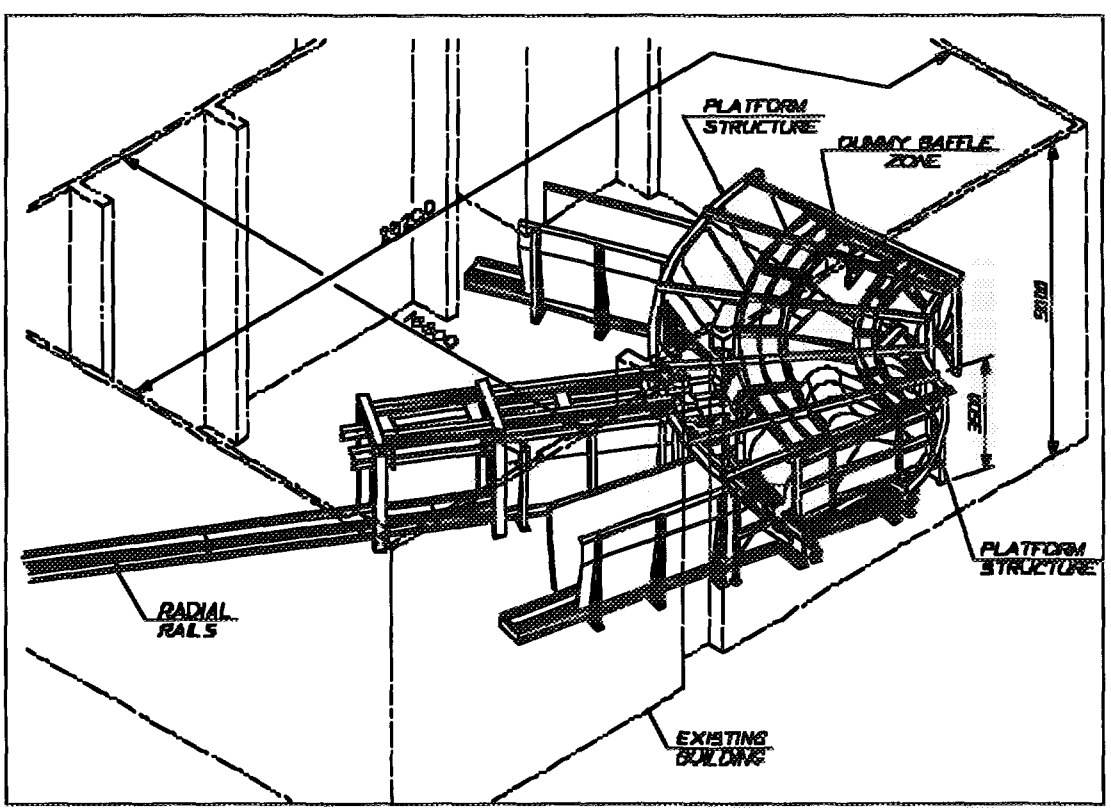


Fig. 2. Layout of the Divertor Test Platform

- The Divertor Refurbishment Platform (DRP), used to simulate, also in full scale, the most critical operations to be realized in the hot cell. The platform will represent a typical hot cell work station equipped with dexterous and heavy duty handling devices (manipulators and overhead crane). Two cassette mock-ups will be available to simulate the assembly and disassembly of high heat flux components with prototypical tools.

Testing in the DTP is scheduled to start in July '97 with the simulation of duct operations followed, in December '97, by the simulation of cassette handling. Testing in the DRP is scheduled to start in October '97.

This project is jointly performed by the European and Japanese Home Teams. Within the European Home Team, the following institutions are involved:

- The NET Team (EU), which is responsible for the co-ordination of the European contribution to ITER;
- The Euratom-ENEA Association is also responsible for design integration, for the design and procurement of several mock-ups and for the procurement and installation of the test equipment;
- CFFTP-SPAR (Canada), which have taken the main responsibility for design and procurement of the equipment required to simulate operations inside the DTP ducts and for a laser metrology system for the DRP;
- The Euratom-TEKES (Finland) Association, in charge of the design and procurement of prototype tools for handling the High Heat Flux Components and their attachments;
- Several European industries are involved in the project: EFET (European Industrial Consortium) has been responsible for the design of the cassette "movers", i.e. the handling devices used to handle the cassettes inside the vessel, and is currently developing the mechanical attachments between the High Heat Flux Components and the cassette body structure; Siemens (Germany) is in charge of the manufacture of the movers prototypes; Belleli (Italy) is in charge of the manufacture of the DTP mock-ups; CEA-Comex Nucléaire (France) is developing bore tools for cutting, welding and inspection of the cassette cooling pipes; Gradel (Luxembourg) is manufacturing several mock-ups for the prequalification of design solutions adopted for the cassette locking system.

Procurement of prototype equipment is performed according to Quality Assurance (QA) standard ISO 9001 whilst, in the case of proof-of-principle equipment, QA will be specified on a case-by-case basis (it will, as a minimum, require the execution of acceptance tests according to a QA procedure agreed between the JCT and the HT).

The Japanese Home Team is responsible for the design and procurement of one of the cassette movers, the "Central Cassette Carrier", which is required to handle the first cassette after opening the access duct, and it is also involved in several design activities with close interfaces with the European Home Team. The Institutions involved are JAERI, responsible for the co-ordination of the Japanese contribution to ITER, Toshiba and Hitachi.

The Project Management is a joint responsibility of the JCT and the EU Home Team. The JCT Project Manager, E. Martin, is responsible for the assessment of the progress and results against the ITER requirements, for the integration of the results into the design and for the identification of any new input to the implementation stage. The Home Team Project Manager, D. Maisonnier, is responsible for the implementation, co-ordination, and timely execution of all project activities. In addition, C. Damiani from the Euratom-ENEA Association, is responsible for the design integration for the overall project.

Although the importance of Remote Maintenance was recognized very early during the EDA, it has been a slow starter by comparison with other aspects of the R&D programme. This was partially unavoidable since a prerequisite for the definition of relevant tasks was to have a conceptual design of the ITER machine sufficiently developed, which was not the case prior to the publication of the ITER Interim Design Report in December 1994. However, today, this project, together with its sister project L-6 on blanket handling, is well on its way to providing the answers required before the end of the EDA. This has been achieved because of the very close collaboration between the three Joint Work Sites and the Home Teams, and also because of the clear division of responsibilities between all Parties involved.

Items to be considered for inclusion in the ITER Newsletter should be submitted to B. Kouvchinnikov, ITER Office, IAEA, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: +43 1 237762, or e-mail: basaldel@ripo1.iaea.or.at (phone +43 1 206026392).

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