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WORKING GROUP MEETING AND SECOND ITER QUADRIpartite EDA NEGOTIATION (QEN)

Twenty-three representatives and experts met at the JAERI Tokyo Office on March 24-27, 1991 under the chairmanship of Dr. Mike Roberts, US DOE. The Working Group had been assigned two primary tasks during the first meeting of the QEN (held in Vienna, February 11-12). The tasks were to complete the proposed text of the Agreement for ITER Engineering Design Activities and to work on comparisons of the three sites (Garching, Naka, and San Diego) that were proposed at the first meeting of the QEN.

After four days of intense discussions, including "burning the mid-night oil" on the last day, the Group successfully completed their tasks. A complete draft text of an Agreement was prepared; and a detailed, comprehensive table was prepared summarizing information that had been provided for the three existing site proposals. These were presented for consideration at the second meeting of the QEN.

The Second ITER Quadripartite EDA Negotiation (QEN) was convened in the Japanese Foreign Ministry Building on April 18-19, 1991. The four Delegations that attended the meeting were headed by Mr. Hiroshi Ota, Director-General for Scientific and Technological Affairs in the Foreign Ministry for Japan, Mr. Paolo Fasella, Director-General DG XII for the EC, Mr. Boris V. Nikipelov, First Deputy Minister, Ministry of Atomic Power and Industry for the USSR, and Mr. James F. Decker, Acting Director, Office of Energy Research, Department of Energy for the USA.

The Delegations discussed a framework to start co-operation in the EDA. Comprehensive draft texts for an Agreement establishing the EDA and for a Protocol covering activities for the first period were developed. Progress was also made with regard to provisions dealing with such items as the scope of the co-operation, organizational structure, and dissemination of information.

Regarding the site where the centre of EDA will be located, the Delegations discussed the respective merits of three candidates, Garching, Naka, and San Diego. The Delegations agreed to continue to discuss this matter, among other issues, with a view toward reaching an agreement as soon as possible.

It was decided to set up a Working Group to explore and assess the technical and managerial possibilities, as well as costs, of dividing the responsibilities and design work of the EDA between co-centres, each having a quadripartite staff. This working group will be chaired by Dr. Mike Roberts, and it will meet in Brussels during the week of May 13.

The Delegations agreed to organize a limited number of technical workshops, in order to prepare for the smooth initiation of the EDA after conclusion of the Agreement and Protocol 1.

It was agreed to hold the third QEN in Washington, D.C. on July 8-9, 1991.

PHYSICS R&D FOR ITER

by F. Engelmann

The Physics R&D activities for ITER are ongoing as foreseen. The efforts, started early during the ITER Conceptual Design Phase to co-ordinate and document these activities, have been continuing over the last months.

As far as the R&D work done during the ITER Conceptual Design Activities is concerned, the results obtained were assessed by the ITER Physics Group and summary reports were written. The latter are collected in Part A of document IAEA/ITER/DS/19 which has been published in May by the IAEA.

A detailed documentation of the results reported at the end of September 1990 was also prepared. It consists of a booklet for each of the 23 R&D tasks for which results were communicated, containing the full reports submitted by the contributors preceded by a summary

Significant new results have been reported

written by members of the ITER Physics Group. The material was distributed to interested persons and institutions early in April 1991.

Significant new results have been reported in almost all areas covered by the programme. The following work is particularly noteworthy:

- Systematic investigations on helium transport have started and first results were reported from various devices albeit so far only for L-mode discharges; in this confinement regime the helium transport properties measured in the bulk plasma are consistent with efficient helium exhaust from a burning plasma.
- A first scaling of energy confinement τ_E in H-mode discharges was derived in a collaborative effort, while for L-mode plasmas a scan of τ_E as a function of aspect ratio was made confirming the dependence as contained in the ITER L-mode scaling.
- First results were reported on experiments in plasmas with super-Alfvénic ions in which modes were excited that have the characteristic attributes of the toroidal Alfvén eigenmode, but the threshold for instability is significantly higher than expected from present theoretical predictions.

The ITER-related Physics R&D Programme for the years 1991-1992 (and beyond) which was developed in 1990 (see ITER Newsletter, Vol. 3, No. 10, October 1990, pages 2-5) has been reviewed in a collaboration between the ITER Physics Group and the contributors in the laboratories of the four ITER Parties to improve the coverage of the programme and enhance the relevance of the various contributions. In particular, an effort was made to improve the coupling between experimental activities on one hand and theoretical analyses and modelling work on the other, to ensure that validated physics models are being developed which can be used for extrapolation to ITER.

The Physics R&D plan

The Physics R&D Plan that has resulted from this review is not yet finalized. It will be ready for distribution in May 1991. First results are planned to be reported in the middle of 1991; a precise date, however, can only be determined when the start of the ITER Engineering Design Activities has been decided.

FUEL CYCLE DESIGN FOR ITER

By P.J. Dinner

During the CDA phase, ITER Fuel Cycle (FC) conceptual design was performed using well-advanced technologies to determine if:

- (a) Acceptable process options exist for all essential FC functions.
- (b) Subsystem concept design requirements are correct, since FC systems involve many "recycle" loops.
- (c) Impacts of the FC on plant arrangement, safety, and cost are acceptable.
- (d) Specifications for ITER FC R&D have been correctly formulated, and R&D priorities are consistent with the design process and schedule.

This effort CDA established that feasible design concepts exist for all ITER FC elements. The required R&D to validate these concepts was assessed and appears manageable given the resources available for FC R&D in the ITER Parties.

FC design will be continued during ITER EDA

During the ITER Engineering Design Activities (EDA), it is assumed that the process of FC design begun in the Conceptual Design Activities (CDA) will be continued, but with increased emphasis on producing an integrated design which balances design criteria while continuing to meet all project requirements. This will require that these requirements are well understood by all levels of the project, and an engineering management structure exists to ensure orderly evolution of the design and consistency with interfacing systems and proposed operating scenarios. With these assumptions, it is possible to define the steps in preparing an optimized FC design. In the early stages of the EDA, it is reasonable to expect complete review of all CDA options will be conducted. In addition to the main approaches used in the CDA, this re-assessment should include a review of novel concepts and approaches to design implementation, some of which may have emerged during the period between the CDA and EDA.

Optimization of the FC design

While the CDA demonstrated that feasible design options exist for all essential FC elements, only limited optimization of the FC design was possible during the CDA (Fig. 1). Optimization of the design, in the EDA phase will involve the following steps:

- Confirmation of machine parameters, design and operational requirements
- Establishment of system boundaries
- Revision of FC System Conceptual Design requirements
- Updating of Conceptual Design descriptions prepared during the CDA phase
- Review of related operational experience and development status associated with the various options
- Detailed comparison and ranking of alternatives according to criteria to be established by the ITER project
- Review of the preferred alternatives with other design and project groups to assess impacts on interfacing systems, machine integration, safety, etc.
- Selection of reference design concepts (with alternatives as necessary)

- Calculation of overall FC flowsheet under steady-state and transient conditions
- Preparation of detailed design requirements and design descriptions for individual FC systems.
- Revision to R&D programs to ensure timely availability of required design information
- Layout and machine integration of individual systems
- Preliminary safety assessment.

FC optimization to be a continuing process

Final design and safety assessment is assumed to take place during the Construction Phase. As for the CDA, optimization will likely involve several iterations between steps. In particular, it is to be expected that quality engineering, safety, and reliability assessments will impose additional requirements (and milestones) on the design as the project proceeds through the EDA. It is obvious from this sequence of activities that an "optimized" design for the Fuel Cycle is tied integrally to the overall process of ITER design integration and can only emerge towards the end of the EDA. Furthermore, it will depend on component development schedules followed by the ITER Parties. Extended testing of components, particularly those for which operation in tritium is foreseen, will only be possible in the period 1995-98. Finally, requirements will inevitably shift during the course of the EDA, as more is learned concerning the physics from operating machines. Therefore, design optimization must be seen as a continuing process, requiring project commitment throughout the EDA. It should begin at the outset of the EDA with an open-minded review of all options, their design and development status, technical potential, and level of support. Successful design optimization will depend strongly on the project organization and resources.

R&D tasks must be specified

Timely availability of information from the R&D program is essential to the design process. Each of the primary and alternative FC system design options has associated with it a long-term R&D task. R&D tasks must be specified in detail and schedules fixed at the start of the EDA. During the first year, the objective should be to complete R&D activities necessary to confirm the choice of options for FC design. Following confirmation of the reference FC options, the Long-Range R&D tasks should be reviewed and modified. Resources should then be re-distributed to emphasize developments likely to yield the most desirable engineering solutions, and to contribute most significantly to the overall project goals. This will require a high degree of responsiveness to ITER design needs on the part of "home teams" engaged in R&D, i.e. willingness to modify or terminate tasks and initiate new activities on short notice. The need to level manpower and capital demands of the component development program is likely to be a significant factor in scheduling R&D and design milestones.

Criteria for FC R&D resource allocation

Criteria for FC R&D resource allocation should recognize potential contributions to:

- Safety, in particular those features which could improve "passive safety", primarily T inventory minimization.
- Provision of essential technical information for discussion with regulatory bodies to advance to the ITER construction phase on schedule.
- Technological risk minimization, i.e. reducing the level of uncertainty posed by engineering solutions.
- Reduced development cost and time. This would permit development resources to be focussed on the most important design feasibility issues.
- Reduced capital cost (for overall project as well as fuel cycle).

Organizational measures

A number of organizational measures should be taken to facilitate design optimization at the start of the EDA phase. These include:

- Identification of specific laboratories to take a "lead role" in the testing of reference design concepts. Design variations and alternatives should be tested in the same loops, and under similar conditions.
- Establishment of a computerized data base for approved design requirements which can be remotely accessed by all Parties.
- Identification and support of common software tools for all aspects of FC design. For example, for vacuum pumping, process flow-sheeting, drawing and document transfer.
- Establishment of a computerized "Tritium Manual" data base for defining standard designs of components which form the building blocks of systems. Applications, cost, experience and other data should be retrievable on a component by component basis.

FC design optimization must occur as part of the overall ITER design integration and optimization process. New design concepts continue to evolve. During the EDA, all FC design concepts must be reviewed according to criteria and within a framework provided by ITER Project Management, to select the preferred processes and ensure these are adequately covered by the R&D programs of the Parties. R&D program emphasis should focus on prototyping needs for the preferred design options, while retaining flexibility to address new problem areas as these arise during design. A number of organizational measures can be taken to facilitate FC design optimization during the EDA, such as standardization of component testing, and development of common data bases and analysis programs for design.

ABOUT THE ITER NEWSLETTER

A primary responsibility of the IAEA towards its Member States is the dissemination of information relating to nuclear energy. In view of the potential of co-operative efforts on ITER for worldwide benefits, the IAEA is continuing to publish this Newsletter, on an interim basis at a reduced frequency, during the period between the completion of the CDA and the possible initiation of the EDA. It will be distributed to interested parties throughout the IAEA Member States. The purpose and the editorial policy of the Newsletter are as follows.

- Its purpose is dissemination of broad information and understanding only, and not to be an official record.
- It shall include information that materially affects ITER.
- Articles shall not be restricted to technical facts about ITER but shall also depict the personal and institutional involvements in this international co-operation.
- Material for inclusion in the Newsletter shall be solicited through all involved organizations.
- *Responsibility for the Newsletter rests, during the period between the completion of the EDA and the possible initiation of the EDA, with the IAEA.*
- The Newsletter shall be assembled by the IAEA and published bi-monthly in Vienna.
- Items from the Newsletter may be extracted or reprinted, provided that acknowledgement of the source also appears.

FORTHCOMING EVENTS

ITER Blanket Meeting	Garching, Germany	10-14 June
Third QEN Meeting	Washington, D.C., USA	8-9 July
Physics/System Analysis meeting	San Diego, CA, USA	10-13 July *)
ITER Magnet Meeting	Naka, Japan	23-27 September *)

*) tentatively

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