



# ITER ITA NEWSLETTER

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## INFORMATION FROM THE EDITOR

A further article on the Twentieth IAEA Fusion Energy Conference was received from the Local Organizing Committee and its Chairman, Prof. C. Varandas, providing additional information on the conference and its various satellite meetings (see also article in the previous issue of the ITER ITA Newsletter).

## TWENTIETH IAEA FUSION ENERGY CONFERENCE

by Prof. C. Varandas, C. Silva, F. Serra and M.F. Pinto, Instituto Superior Técnico, Lisbon

The “20th IAEA Fusion Energy Conference” (FEC-2004) was organized by the “International Atomic Energy Agency” (IAEA) and hosted by the Portuguese Government through “Instituto Superior Técnico” (IST), at the Marinotel Conference Centre, in Vilamoura, from 1 to 6 November 2004. The local organization was assured by “Centro de Fusão Nuclear” (CFN) acting on behalf of the Contract of Association between the “European Atomic Energy Community” (EURATOM) and IST.

The conference was opened with welcome speeches by Werner Burkart (Deputy Director of IAEA), Carlos Varandas (Chairman of the Local Organizing Committee) and Pedro Sampaio Nunes (Portuguese Secretary of State of Science and Innovation).



*Visit of the authorities to Fusion EXPO*

The scientific programme, elaborated by the Programme Committee chaired by P.K. Kaw, included 3 special lectures in the Fusion Pioneers Memorial Session given by Carlos Matos Ferreira, Chris Llewellyn Smith and Y. Shimomura, 23 overview talks, 103 oral presentations, 250 regular poster presentations, 154 posters from overview and oral presentations and 5 summary talks given by H. Ninomiya, R.D. Stambaugh, J.W. Connor, M.M. Basho and Y. Wan. Summaries of the main talks were published in the issue nº 18 of the ITER ITA Newsletter.

The Conference Proceedings are available under <http://www-naweb.iaea.org/naweb/physics/fec/fec2004/datasets/index.html>.

Additional information can be retrieved from <http://www.cfn.ist.utl.pt/20IAEAConf/Announcement.htm>

The social programme included a welcome reception for about 900 persons (on Monday), a show with Portuguese traditional music (on Tuesday), the conference dinner (on Thursday) and special tourist events for the accompanying persons.

FEC-2004 was attended by 604 participants from 33 countries and 3 organizations (please see table below).

#### NUMBER OF PARTICIPANTS PER COUNTRY AND ORGANIZATION

| Country   | Nº | Country | Nº | Country               | Nº  | Country                  | Nº  |
|-----------|----|---------|----|-----------------------|-----|--------------------------|-----|
| Argentina | 1  | Denmark | 1  | Japan                 | 134 | Sweden                   | 8   |
| Australia | 2  | Finland | 4  | Mexico                | 1   | Switzerland              | 10  |
| Austria   | 6  | France  | 34 | Netherlands           | 7   | Turkey                   | 3   |
| Belgium   | 7  | Germany | 45 | Poland                | 2   | Ukraine                  | 3   |
| Brazil    | 3  | Hungary | 2  | Portugal              | 24  | United Kingdom           | 20  |
| Bulgaria  | 1  | India   | 8  | Russia                | 35  | United States of America | 131 |
| Canada    | 6  | Iran    | 1  | Serbia and Montenegro | 1   | EC                       | 14  |
| Chile     | 1  | Italy   | 25 | Slovakia              | 1   | IAEA                     | 5   |
| China     | 19 | Korea   | 8  | Spain                 | 12  | ITER                     | 19  |



*Students in a guided visit to Fusion EXPO*

In parallel with FEC-2004, there were the following other events:

- An exhibition about fusion related activities with stands from the following institutions/organizations: IST, EFDA, ITER, IAEA Publications, Consorzio RFX, FZK and CRPP;
- An exhibition of the Fusion EXPO, organized by CFN and Consorzio RFX, composed by thirty panels, one interactive model of a fusion reactor, two multimedia stations with CD-ROMs dedicated to general features of fusion and fusion research, the 3-D movie “Starmakers”, four panels describing the activities of the Association EURATOM/IST and a small experiment illustrating how to create and confine a linear plasma column. This exhibition was visited by about 400 students from secondary schools of the south of Portugal;
- Twenty-one satellite meetings in Vilamoura of the following Committees and/or Groups: International Fusion Research Council, FEC-2004 Programme Committee, Coordinating Committees of Bilateral Agreements on Collaboration between ITER Parties, IEA Stellarator Committee, Scientific Committee of the Committee Research Programme (CRP) on Joint Research Using Small Tokamaks, ITPA Topical Group on Tokamak Physics Basis, IEA Implementing Agreement on Reverse Field Pinches, Magnetic System for ELM Mitigation, IAEA Nuclear Fusion Editorial Office, IEA TEXTOR Executive Committee, International Advisory Committee for the 1st IAEA Technical Meeting on First Generation of Fusion Power Plant – Design and Technology, EU-US Collaborations on JET, Collaborative Activity between the Integrated Fusion Modelling Initiatives, Asia Pacific Fusion Community and Advisory Committee for the FEC-2006 Preparation (total of 407 participants);
- Seven satellite meetings held in Lisbon immediately after FEC-2004 of the following Committees or Groups: IAEA CRP on Joint Research Using Small Tokamaks and ITPA Topical Groups on MHD, Disruptions and Control, Pedestal and Edge, Confinement Database and Modelling, Steady State Integrated Operations, Divertor and SOL, and Transport Physics (total of 195 participants).

## **SEVENTH MEETING OF THE ITPA TOPICAL GROUP ON DIAGNOSTICS**

**by Dr. A. J. H. Donné, FOM Institute for Plasma Physics Rijnhuizen, and Dr. A. E. Costley, ITER International Team**

The Seventh Meeting of the ITPA Topical Group (TG) on Diagnostics was held at the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP), Hefei, P. R. China, from 11 – 15 October 2004. About 35 participants attended the meeting and all six ITPA partners were well represented. This was the first ITPA TG meeting ever held in China. It was also the first ITPA TG meeting attended by members from Korea.

Since this was the first opportunity for in-depth discussions between the members of the Diagnostic ITPA TG and diagnostic specialists in China, extended overview/review talks on ITER/Burning Plasma Experiment (BPX) diagnostic developments on-going in Europe, Japan, Korea, the Russian Federation, and the US, and diagnostic activities within the ITER International Team (IT), were presented on the first day of the meeting. These presentations form a succinct summary of the work on ITER/BPX diagnostic development on-going in the laboratories of the ITPA partners and serve as a good introduction to this field.

The meeting included a special session on diagnostic developments on-going in China in which Chinese scientists presented their work on diagnostics for their machines, particularly the operating tokamaks HT-7 and HL-2A and the superconducting tokamak presently under construction, EAST. The TG looked specifically for items in two areas: (a) where the Chinese work overlaps and has relevance to the ITPA work on ITER/BPX diagnostics, and (b) where the TG can help the Chinese workers specifically with advice and suggestions. Several topics were found in each component.

The progress in the working tasks of the ITPA Diagnostic TG designated as high priority was reviewed. Generally good progress has been made.

1. One of the outstanding questions connected to the measurement of the alpha/neutron source profile is whether the neutron emission profile can be expected to be a constant on a magnetic flux surface. If so, the need for a Vertical Neutron Camera (VNC) on ITER is much reduced because it would be possible to obtain the profile of the neutron emission from measurements with the radial camera (RNC) and

magnetics. This question has been further investigated. Many examples of asymmetries in JET, measured with the JET VNC and RNC, have been found. Modelling work has been started in Europe to find out whether the neutron emission profile might also be asymmetric on ITER. Possible designs for a VNC have also been further developed.

2. Since the last meeting (April 2003) significant results on JET have been obtained in the development of methods of measuring the energy and density distribution of confined alpha particles. Extensive measurements have been made of the gamma ray emission and have demonstrated that quantitative information on the confined alpha particles can be obtained in this way. However, application on ITER requires that gamma detectors can be used in the presence of a high background of neutrons and gammas and further design is needed to ensure that this can be done.
3. Several machines are now undertaking experimental work on erosion/deposition effects on mirrors and the results of the experiments are becoming available. The effects vary from machine to machine and it is not easy to understand how the results scale to ITER. It is recommended that specific experiments that simulate more closely the planned applications of mirrors in ITER should be started and the Special Working Group on First Mirrors will make a proposal and prioritization of experiments to be done.

Mitigation measures such as baffles and shutters should reduce the erosion and deposition. An overall strategy for the use of shutters is being developed and some candidate shutter designs have been identified.

4. Progress was reported on the need and methods of making measurements of steady state magnetic fields. Long-time integrators have been developed for Tore Supra, KSTAR and W7-X that are compatible with >1000 s operation. Radiation-hard Hall probes have been tested under irradiation and are (near certain) applicable ex-vessel on ITER. There are also prospects to develop Hall-probes for in-vessel use.



*Participants at the Seventh Meeting of the ITPA Topical Group on Diagnostics  
Hefei, China, 11 - 15 October 2004*

The understanding of the important radiation effects such as Radiation Induced Electromotive Force (RIEMF), Thermally Induced Electromotive Force (TIEMF), and Radiation Induced Thermo-Electric Sensitivity RITES is gradually increasing. Recent experiments have demonstrated which effects are important as well as their relative amplitudes. However, there are still considerable uncertainties and more experiments are needed with prototype coils in reactors.

5. A new high priority issue was launched in June: the development of measurement requirements for measurements of dust, and assessment of techniques for the measurement of dust and erosion. Measurements of dust are important in the safety analysis of ITER. A design of a possible optical laser radar system for the measurement of erosion of the divertor plates is being developed by the ITER International Team. Developments in the field of dust measurements were reported. Specific examples are dust detection grids used in the stellarator NSTX at the Princeton Plasma Physics Laboratory, the Capacitive Diaphragm Microbalance that has been studied at the Culham Laboratory, and laser ablation techniques developed at the Ioffe Institute, Moscow. It is yet to be determined whether these techniques can be applied in ITER.

The ITPA Parties reported steady progress for many diagnostic techniques that are relevant to a BPX. Some examples of recent work are: neutron flux monitor (China), bolometry (Europe), two-colour laser systems for interferometry/polarimetry (Japan), VUV spectroscopy (Korea), dust monitor (Russian Federation), and deposition and dust monitors (United States). Since the step to ITER/BPX diagnostics is substantial, especially in the environment in which diagnostic components will have to exist and operate, dedicated development of new diagnostic techniques and components is needed on present tokamaks. A new initiative was launched by the TG at the meeting to try and identify the candidate diagnostic techniques and components, which are thought to be well suited for the ITER/BPX environment and could be tested in present-day devices. A wide involvement of the specialists working on diagnostics in the laboratories of the ITPA partners is sought in this activity.

The International Diagnostic Database (IDD), which has been created by the Diagnostic ITPA TG, is a useful resource especially for those creating new diagnostics. The Chinese and Korean tokamak teams have expressed the intention to join the IDD activity.

The Eighth Meeting of the ITPA TG on Diagnostics will be held at UKAEA, Culham from 14-18 March 2005. A special session on the contribution of JET diagnostics, both existing diagnostics and possible future upgrades and new systems, will be included. The meeting will be combined with a 1.5 day Progress Meeting on Diagnostics Design and R&D ongoing in the EU on ITER diagnostics.

The meeting ran smoothly due to the excellent organisation of the host, ASIPP, and the all the participants are grateful to the ASIPP for its hospitality and express their explicit gratitude to Drs. Li, Zhao, Wan and Gao, and Mrs. Dong for their care and attention to all the meeting arrangements.

#### **Members of Topical Group on Diagnostics**

|   |   |
|---|---|
| Rejean Boivin (GA, USA)                 | Francesco Orsitto (ENEA, Italy, EU)           |
| Alan Costley (ITER Int. Team, Naka, JA) | Mamiko Sasao (NIFS, JA)                       |
| Tony Donn  (FOM, Netherlands, EU)       | Viacheslav Strelkov (Kurchatov Institute, RF) |
| Yinxian Jie (ASIPP, CN)                 | Tatsuo Sugie (ITER Int. Team, Naka, JA)       |
| David Johnson (PPPL, USA)               | Baonian Wan (ASIPP, CN)                       |
| Yasunori Kawano (JAERI, JA)             | Qingwei Yang (SWIP, CN)                       |
| Anatoli Krasilnikov (TRINITI, RF)       | Suk Jae Yoo (KBSI, KO)                        |
| Yoshinori Kusama (JAERI, JA)            | Junyu Zhao (ASIPP, CN)                        |
| Hyeon Gon Lee (KBSI, KO)                | Yan Zhou (SWIP, CN)                           |

### **Guests and Attendees at the Topical Group Meeting**

Robin Barnsley (ITER Europe, Garching)  
Benoît Brichard (SCKCEN, Belgium, EU)  
Xuandong Ding (SWIP, CN)  
Yunbo Dong (SWIP, CN)  
Xiang Gao (ASIPP, CN)  
Ruggero Giannella (CEA, France, EU)  
Nick Hawkes (UKAEA, UK)  
Liqun Hu (ASIPP, CN)  
Christian Ingesson (EFDA, Germany, EU)  
Kiyoshi Itami (ITER Int. Team, Naka, JA)

Jiangang Li (ASIPP, CN)  
Biao Shen (ASIPP, CN)  
Dan Sporea (NILPRP, Romania, EU)  
George Vayakis (ITER Int. Team, Naka, JA)  
Christopher Walker (ITER JCT, Garching, EU)  
Guosheng Xu (ASIPP, CN)  
Jinwei Yang (SWIP, CN)  
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Wei Zhang (SWIP, CN)

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