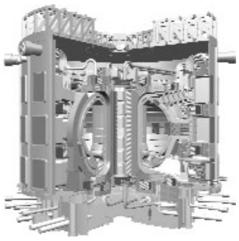

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BOARD OF GOVERNORS AGREES FOR THE IAEA TO SERVE AS DEPOSITARY FOR ITER AGREEMENTS AND TO ESTABLISH ITER TRUST FUND

The ITER Parties, at their Ministerial Meeting in May 2006 in Brussels, initialled the draft text of the prospective Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project as well as the draft text of the Agreement on the Privileges and Immunities of the ITER International Fusion Energy Organisation for the Joint Implementation of the ITER Project.

The Parties have requested that the IAEA Director General serve as Depositary of the two aforementioned Agreements and that the IAEA establish a Trust Fund to Support Common Expenditures under the ITER Transitional Arrangements, pending entry into force of the prospective Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project.

At its June Meeting in Vienna, the IAEA Board of Governors approved these requests. Please see below the remarks of Prof. Werner Burkart, Deputy Director General, addressing the Board on the subject.

Mr. Chairman, Your Excellencies, Members of the Board, distinguished delegates

The Agency has been an integral part of ITER since its inception, and we come now to the time when the Agency will take small, but legally recognisable roles for the ITER Parties. These small steps are symbolic to the Secretariat of the trust and collaboration that we have long enjoyed with the ITER Parties, and will ensure our future close involvement with the project.

The ITER Parties represent about half of the world's population. For the other half of the world, the successful realisation of ITER and its successors represents a major hope for future energy supplies, and I am sure that Member States will look to both the ITER Parties and the Agency as sources of information on the quest for fusion power as a viable, clean, practically unlimited and safe source of energy.

The Secretariat, as in the development of nuclear fission energy, stands ready to serve its Member States in the field of fusion. We are active through Coordinated Research Projects on plasma physics and on materials and systems for fusion research. This also has benefits for high temperature fission reactors and for hydrogen based energy systems. There are also CRPs in the important area of atomic and molecular data. We will be pleased to continue our role in facilitating information exchange on fusion technology issues through international conferences, such as the IAEA Fusion Energy Conference this year in Chengdu, China, other meetings and the Agency's Journal on Fusion Energy. We are ready to continue such roles as and when they are relevant to ITER, and as and when they are requested of us.

We look forward to the future, successful collaboration with ITER, also known as - The Way - in Latin, and to the day when affordable fusion energy becomes a reality.

THREE ITER PIONEERS RECEIVE RUSSIAN GLOBAL ENERGY AWARD

On 11 November 2002, at the Summit of Head of States in Brussels, the President of the Russian Federation, Vladimir Putin, announced the establishment of the Global Energy Award. President Putin pointed out that this award would always maintain its reputation and prestige. He also noted that the Global Energy prize-winners would promote the international energy dialog and develop collaboration among international scientists in the name of progress and world economic development.

The idea of the energy prize was first initiated by a group of famous Russian scientists and later supported by large international energy companies that agreed to provide regular funding of this award. Today, these companies are Gazprom, RAO EES of Russia, Surgutneftegas and Yukos.

Academician and Nobel Prize winner Zhores Alferov was the first Chairman of the Global Energy Award International Committee. Alferov was awarded the Global Energy Award in 2005.

During 2006, 628 international experts, including 226 from Russia, were entitled to nominate candidates. Scientists from Russia, Japan, USA, Spain, Australia, England, Iceland, Israel and Switzerland were nominated and 119 papers considered. No more than five nominees were to be announced by the Experts Committee. The following criteria were used to evaluate the presented works: scientific value, practical application, originality and global energy importance.

The award committee consists of thirty scientists from nine different countries, including three Nobel Laureates and other leading scientists. The oil companies are not involved in the selection process.

The prize fund in 2006 was 1.1 million USD.

On 13 of June 2006, three pioneers of the international fusion project ITER, Academician Evgeniy Velikhov (Russian Federation), Dr. Masaji Yoshikawa (Japan) and Dr. Robert Aymar (France), received in St. Petersburg

The Global Energy Prize Winners, Dr. M. Yoshikawa, Dr. R. Aymar, Acad. E.P. Velikhov (from left to right)

Academician E.P. Velikhov receiving the Award from President Putin

the "Global Energy Award" from President Putin, who handed over the medals and diplomas to the winners at the LenExpo exhibition hall situated on the Neva river bank.

In his speech during the ceremony, President Putin said: "I want to emphasize that as one of the world's energy leaders, Russia is not only engaged in exporting energy resources and electricity. We intend to continue supporting scientific research that will increase the efficiency and security of energy production. Russia, the United States, the European Union, Japan, Canada, China, India and South Korea have united their efforts towards creating an essentially new energy source. As far as I know, this is the first time that a collective prize has been awarded. Dear gentlemen, this confirms the unique value of your joint scientific research."

Evgenij Velikhov is one of the founders of the ITER project. During summit meetings in 1985 between Mikhail Gorbachev, then President of the former Soviet Union, and Presidents François Mitterand of France and Ronald Reagan of the United States of America, he urged the participants to embark on the ITER project as an international collaboration among the leading fusion programmes of the world. Academician Velikhov is now President of the Kurchatov Institute in Moscow, and responsible for its fusion research.

Dr. Masaji Yoshikawa has played a leading role during his career in the Japanese fusion programme. He led the construction and operation of JT-60, one of the largest and most successful fusion experiments in the world and was President of the Japan Atomic Energy Research Institute (JAERI).

In an interview given to the Russian paper "Energy of the Future" he said that "ITER is a way to practical utilization of fusion energy… ITER is a project with dual objectives, scientific and technological… ITER will become the first fusion reactor with subsystems that are going to be used at thermonuclear electrical power stations… Japan is planning on seconding 18% of the total professional staff for the ITER Organization… Japan is considering construction of a Fusion Centre in Rokasho-Mura in support of the preparation for the DEMO reactor. Other international participants will be welcome to join the future Centre."

Dr. Robert Aymar became ITER Director in 1994, and, in 2001, continued as Leader of the ITER International Team. The present design of the device was largely developed under his leadership. In 2004 Dr. Aymar left the ITER project to become Director General of CERN.

Dr. Aymar underlined the great contribution made to this project by scientists from many countries. He made special emphasis of the contribution of the Kurchatov Institute, acting as a driving force of this project. "The ITER project combines the efforts of scientists of the whole world", he said.

Dr. Aymar gave also an interview to "Energy of the Future", saying "the first thermonuclear experimental power station will be constructed in France… The ratification of the ITER Agreement is expected at the end of 2006. ITER is a mega project and therefore a number of difficulties are, of course, to be expected. To solve these problems we need to make sure that the project is supplied with the sufficient number of professional staff to provide a good level of competence and quality. A project this big will have financial and technical challenges. However, ITER has to become a final experimental project to substantiate the working conditions and parameters of the DEMO reactor. Safe energy based on fusion reactions is of great interest to the world."

The former Chariman of the Russian Union of Industrialists and Entrepreneurs and Member of the Board of Trustees of the "Global Energy Award", Mr. Arkady Volsky, sent a note of congratulations: "I would like to warmly congratulate the winners, Acad. E. Velikhov, Dr. M. Yoshikawa and Dr. R. Aymar for this important and justly awarded prize and to wish them further success and good luck with creative development. Each of them can be proud of his personal priceless contribution to solving future energy problems of mankind."

During the ceremony, the Ambassador of France in the Russian Federation, Mr. Jan Kade, read a message of congratulations from the French President Jacques Chirac. "Together with all representatives of the world's scientific society, I am very pleased that the International Committee of the "Global Energy Award" has made this choice.....By this decision, the Committee recognizes the tremendous contribution of each of you in the successful realization of the ITER project. Please accept my warmest congratulations."

President Putin, in his closing statement, noted that already in the former Soviet Union great results were achieved in the sphere of nuclear engineering, both for military and civil use. "But the Chernobyl tragedy taught us a lesson to develop a secure power system. Russian citizens appreciate the efforts made to solve the problem more than any other nation. This is why Russia is entitled to formulate the ideas regarding global energy. And we are going to support all efforts of those people who work on this issue."

In the evening of the same day, the winners of the award and the participants of the Economic Forum visited the "Petergoff" museum and attended the "ceremony of the fountains" and a performance of the "White nights" drama. Magnificent fireworks over the Gulf of Finland made a fitting conclusion to the celebration.

TENTH MEETING OF THE INTERNATIONAL TOKAMAK PHYSICS ACTIVITY TOPICAL GROUP ON DIAGNOSTICS

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

The Tenth Meeting of the International Tokamak Physics Activity (ITPA) Topical Group (TG) on Diagnostics was held at the Kurchatov Institute, Moscow, from 10 - 14 April 2006. One day of the meeting was held at the Triniti Institute, Troitsk. The meeting was combined with a meeting on ITER-relevant diagnostic developments on-going in the Russian Federation, which took place on 10 April. About 70 participants attended the meeting drawn from China, EU, India, Japan, Russia, Ukraine (nominated via the EU), USA and the ITER IT. Special sessions were devoted to progress in the field of fusion product measurements, to the measurement requirements of ITER parameters and their justifications, and to progress in research on first mirrors.

The meeting was opened by Professor Smirnov, Director of the Nuclear Fusion Institute of Kurchatov. Professor Azizov, Director of the Fusion Institute of Triniti Troitsk opened the special session on fusion product measurements that was held at Troitsk. These addresses formed excellent introductions to the presentations and discussions of the TG.

During the meeting on ITER-relevant diagnostic developments on-going in the Russian Federation, the Russian scientists presented their work on a variety of diagnostic systems, concentrating mainly on those that they are preparing for ITER.

The progress was reviewed in the five high priority working areas of the ITPA TG on Diagnostics.

1. Assessment of the various options for the installation of the Vertical and Radial Neutron Cameras to measure the spatial profile of the neutron emission and asymmetries in this quantity

The installation of a vertical viewing neutron camera (VNC) on ITER is a difficult technical challenge because of the need to accommodate collimators and detectors in the divertor ports and to provide uninterrupted lines of sight of the plasma. In principle, if the neutron emission could be relied upon to be constant on a magnetic flux contour, then the spatial profile of the neutron emission could be obtained from a knowledge of the flux contours obtained from the magnetic diagnostics and from measurements made with the radial viewing camera (RNC). (The RNC does not have the same difficulties of installation.) The question arises then - is the neutron emission constant on a flux contour? This is being investigated in current work.

Studies are being made of the neutron emission profile in JET and JT60-U. New results were presented at the meeting and clearly showed pronounced asymmetries in the neutron emission profile. Following tritium pellet injection in JET, a large peak in the neutron emission is observed near the plasma edge. The condition is transient and has a duration of about 50 ms. Abrupt Large Amplitude Events occur in JT-60U and give rise to asymmetric neutron emission. If such events occurred on ITER, a VNC would certainly be needed to diagnose them. While the observed pellet event on JET is transient it would probably be sustained on ITER where there will probably be continuous fuelling with pellets. In parallel to this activity, the technical aspects of installing a VNC on ITER are being developed.

2. Development of methods of measuring the energy and density distribution of confined and escaping alpha particles

One product of the fusion between the deuterium and tritium fuel ions is energetic helium ions (alpha particles) and these are confined by the magnetic fields and give up their energy by collisions to the background plasma. This alpha particle energy is the self-heating source of the fusion plasma. Measurements of the confined alpha particles (their energy, density, spatial distribution) are central to the development of our understanding of this process and especially to the validation of models of the self-heating. Some phenomena can lead to enhanced losses of the alpha particles and so measurements of the alphas that leave the plasma are needed as well. Measurements of both the confined and escaping alphas are difficult and involve substantial technical challenges.

One possible technique for measuring escaping alphas uses scintillators mounted in the vacuum vessel, and progress in the implementation of this technique was reported at the meeting. It has been shown that scintillators could be mounted in special cut-outs on the sides of the blanket modules and observation would be in the visible frequency range by a viewing system fitted with filters and mounted in a diagnostic port. Modelling calculations of the loss orbits of the alpha particles are required to predict on which blanket modules the scintillators should be mounted. A possible alternative method for measuring escaping alpha particles by observing the gamma rays emerging from the back of the beryllium targets at the first wall has also been proposed, but needs to be further developed.

For the confined alpha particles, neutron emission spectroscopy (NES) has the potential to provide some information, and some presentations at the TG meeting were devoted to this technique. To resolve the alpha particle population under various ITER heating scenarios, different views of the plasma would be needed. In principle, the confined alphas can be measured by gamma ray spectroscopy and tests of this technique are being performed on JET. The confined alphas can also, in principle, be measured by a scattering technique - Collective Thomson Scattering (CTS). A CTS system has been designed for ITER and a system is in operation on TEXTOR and others are in preparation for ASDEX and JT-60U.

3. Determination of life-time of plasma facing mirrors used in optical system

All the optical diagnostics and many of the spectroscopic diagnostics have a mirror as their first optical element and potentially the mirrors can be damaged by particles and radiation emanating from the plasma and the first wall. These effects can lead to erosion and/or deposition and degradation of the reflector properties of the mirrors. Several different research investigations are under way in which candidate mirror materials are subject to bombardment of energetic ions and installed in tokamaks and simulators.

Results of dedicated tests on machines in Russia (Globus-M and T-10 tokamaks) and in laboratory facilities (Ioffe Institute) were presented at the meeting. They have shown that by operating the mirror at elevated temperatures the deposition can be reduced significantly and are consistent with earlier results obtained on DIII-D, but the mitigation process is complex and strongly depends on exposure conditions. Results on the TEXTOR and TCV tokamaks and in laboratory tests have shown that the choice of the substrate (mirror) material strongly influences the deposition efficiency. Research on mirror cleaning techniques and the use of protective shutters and baffles is also ongoing. Models of the performance of mirrors that take into account the erosion and deposition processes in typical situations are needed and modeling of some of the experiments in current machines has started. However, dedicated modelling of the performance and lifetime of mirrors in the ITER environment has yet to be initiated.

4. Development of new methods to measure steady state magnetic fields accurately in a nuclear environment and assessment of thermal EMF on irradiated coils used for magnetic field measurements

Steady progress in the understanding of the effects of neutron and gamma radiation on coils and cables used in magnetic diagnostics, and on candidate sensors for measuring steady state magnetic fields (Hall probes), is being made and the latest results were reported. There is significant progress on the understanding of TIEMF (Temperature Induced Electro-Motive Force) in mineral-insulated cables, and there is design work ongoing to optimize coil design to reduce the effects (for example, to minimize thermal gradients to cope with TIEMF). While the effects are still not fully understood it is believed that good progress is being made and that an effective irradiation testing programme is underway. Progress was also reported in the development of integrators for measuring the signals from the magnetic sensors during long plasma pulses (> 1000 s).

5. Development of measurement requirements for measurements of dust, and assessment of techniques for measurement of dust and erosion

Dust, caused by the erosion of divertor and first wall material, is potentially a radiological and safety hazard in ITER and it may be necessary to measure the type and quantity of dust at specific locations. Since dust has not been a problem in tokamaks before, techniques for its measurements in a tokamak environment have not been developed. An initial investigation of the needs for the measurement and possible measuring techniques has been made and the results were presented and discussed at the meeting.

A system based on optical radar for measuring the erosion of the divertor plates has been designed and potentially fulfils the ITER measurement requirements. Before implementation on ITER, however, some R&D is needed and it is recommended that this would be best done by installing a trial system on a present-day tokamak. It was felt that the problems of erosion, dust and tritium retention are closely related and the work on these problems should be coordinated.

In the special session on fusion product measurements, the recent progress was presented in the main neutron diagnostics selected for ITER. A central issue in the discussion was the calibration strategy and the strength of the neutron calibration source that will have to be mounted temporarily in the ITER vacuum vessel for the in-situ calibration. It was agreed that a study is required to find the optimum balance between the costs of the calibration source (related to the available source strength) and the time needed for the calibration.

The work on radiation effects to date has been mainly focused on understanding the processes that affect mechanical and physical properties of materials and on testing some specific diagnostic components. As the design of ITER diagnostic systems has matured, several new potential radiation issues have appeared. Hence, for this meeting, an initial review was undertaken of the outstanding needs of the diagnostic systems to try to identify any significant gaps in the current radiation effects knowledge base. It appears that there are indeed significant gaps. A new topic of work for the TG was agreed - to try to identify those areas where additional specific radiation effects research is needed.

The outcome of a recent survey on measurement requirements, held within the TG, was presented and discussed in the special session on measurement requirements. It was agreed to add a number of new parameters to the list of parameters to be measured: specifically neoclassical tearing modes, resistive wall modes, turbulence (rapid variations in temperature and density), and parameters of the fast ion population. There was also reasonable agreement between the responders on a number of proposed changes to the detailed measurement requirements (parameter ranges, resolutions, etc), and these will be included in the version of the measurement requirements table created and managed by the ITPA Diagnostic TG.

Representatives from India attended the TG meeting for the first time and gave an overview of the diagnostic programmes for the SINP, ADITYA and SST-1 tokamaks. The TG members were impressed with the level of development of diagnostics in India and are confident that India will be able to make a major contribution to the ITPA diagnostic effort. The Indian ADITYA group has joined the International Diagnostic Database (IDD).

All Specialist Working Groups (SWG) reported excellent progress on many of the outstanding action items. Much of the work described above under the high priority issues has been the result of the coordinated effort within the various SWGs.

The location and date of the 11th Meeting of the ITPA TG on Diagnostics was discussed. It is provisionally proposed to hold the meeting in Sendai, Japan from 4-8 September 2006. A special session will be organized on radiation effects (diagnostic needs). The meeting will be combined with a one-day Progress Meeting on ITER Relevant Diagnostic Developments on-going in Japan.

The meeting ran smoothly due to the excellent organisation of the Kurchatov and Triniti Institutes, and all participants are grateful for the hospitality and they express their explicit gratitude to Drs V. Zaveriaev, K. Vukolov, A. Khramenkov of the Kurchatov Institute and Drs A. Krasilnikov, Yu. Kaschuk, S. Tugarinov of the Triniti Institute for their care and attention to all the meeting arrangements.

Participants in the meeting

Participants to the 10th Meeting of the ITPA Topical Group on Diagnostics, Moscow, Russia, 10 - 14 April 2006

Members of Topical Group on Diagnostics

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Tony Donné (FOM, Netherlands, EU)
David Johnson (PPPL, USA)
Yasunori Kawano (JAEA, JA)
Anatoli Krasilnikov (TRINITI, RF)
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Gennadiy Razdobarin (Ioffe, RF)
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Konstantin Vukolov (Kurchatov, RF)
Henri Weisen (CRPP, Switzerland, EU)
Qingwei Yang (SWIP, CN)
Victor Zaveryaev (Kurchatov, RF)

Members of Topical Group that could not attend

Rejean Boivin (GA, USA)
Wonho Choe (KAIST, KO)
Hans Hartfuss (IPP, Germany, EU)
Yinxian Jie (ASIPP, CN)
Kazuo Kawahata (NIFS, JA)
Sang Gon Lee (KBSI, KO)
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George McKee (Wisconsin, USA)
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Hoon Kyan Na (KO)
Yong Un Nam (KO)
Tony Peebles (UCLA, USA)
Baonian Wan (ASIPP, CN)
Glen Wurden (LANL, USA)
Junyu Zhao (ASIPP, CN)
Yan Zhou (SWIP, CN)

Guests and Attendees at the Topical Group Meeting

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Luciano Bertalot (ITER IT, Garching, EU)
Inessa Bolshakova (MSL, Ukraine via IPP-CR,EU)
A. Bondarenko (TRINITI, RF)
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