



CONTENTS

Director's Corner	Jim Van Dam
Reports	
Report on the ITPA Energetic Particle Topical Group Meeting	Don Spong
Report of the First Meeting of the ITER Test Blanket Module Program Committee	Mohamed Abdou
Report of the Sixteenth Meeting of the ITPA Topical Group on Diagnostics	Réjean L. Boivin

2009 Burning Plasma-related Events

Dear Burning Plasma Aficionados:

This newsletter provides a short update on U.S. Burning Plasma Organization activities. E-News is also available online at <http://burningplasma.org/enews.html> Comments on articles in the newsletter may be sent to the editor (R. Nazikian mazikian@pppl.gov) or assistant editor (Rita Wilkinson ritaw@mail.utexas.edu).

Thank you for your interest in Burning Plasma research in the U.S.!

Director's Corner by J. Van Dam

Nominations for USBPO Council

The USBPO Council, at its meeting held on April 17, set up a Nominating Committee to solicit nominations from among the USBPO regular membership for candidates for election to the Council. The members of the Nominating Committee are Martin Peng (chair), Chris Hegna, Tom Rognlien, and Tony Taylor. The USBPO Bylaws say: *"Elections for Council members from the USBPO community shall be held annually to replace half of the members whose terms are ending. The remainder of the open Council seats shall be filled by appointment, ..."* This year, Rich Hawryluk, Bill Nevins, Martin Peng, and George Tynan will be completing their terms of service on the Council. I hope that everyone received the email announcement on April 20 from the Nominating Committee, requesting nominations. The deadline for nominations (May 5) has now passed. The Council's planned schedule is to announce the slate of candidates to the USBPO membership toward the end of May, request members to cast votes using the University of Wisconsin web-based polling software during the next two weeks, and announce the elected and appointed new Council members by the end of June.

STAC, MAC, and CPWG Meetings

The Science and Technology Advisory Committee of the ITER Council will have its STAC-6 Meeting in Cadarache, May 25-27. The charge for this STAC meeting, as determined at the ITER Council meeting in November 2008, is to [1] review the project team's integrated plan for the fastest path to effective D-T operations and [2] review progress on the STAC Action List, including such items as the evolving ITER Research Plan, implementation of the superconducting magnet cold testing risk mitigation strategy, progress in the design and R&D for the in-vessel coil systems considered for vertical stability and ELM control, ITER activities and schedule relating to the Test Blanket Module (TBM) Program, and technical aspects of proposals for optimization of costs during the construction period. Recently added to the STAC-6 agenda is an item concerning the status of the vacuum vessel for ITER. In preparation for this meeting, the US members of the STAC participated in a marathon five-hour videoconference briefing on May 4, at which a number of US experts provided very useful information about various items on the STAC-6 agenda. During the briefing, we also heard about new plans to carry out ITER Test Blanket Module simulation experiments on the DIII-D tokamak. The US participants at the STAC meetings are Rob Goldston (member), Stan Milora (member), Tony Taylor (expert), Erol Oktay (expert), and yours truly (expert).

The Management Advisory Committee of the ITER Council will hold its MAC-5 Meeting in Cadarache, May 27 and 28, overlapping the STAC meeting by one day. On the agenda for the MAC meeting are items such as assessing the status of recommendations from the initial progress report of the Briscoe Panel on cost and schedule, reviewing ITER efforts on cost optimization, reviewing the pilot Integrated Product Teams, and several other management-related matters. The current US participants at the MAC meetings are Charlie Baker (member), Rich Hawryluk (member), Jeff Hoy (expert), and Les Price (expert). Bob Iotti from the US is the MAC chair, and Ned Sauthoff attends as part of the ITER Organization-Domestic Agency team, along with Carl Strawbridge (USIPO) and Tom Vanek (OFES) as observers.

The Contact Persons Working Group (CPWG) of the ITER Council will meet May 29 and 30 in Cadarache immediately following the MAC Meeting, in order to prepare for the next ITER Council Meeting, which will be held June 17 and 18 in Japan. The US Contact Person is John Glowienka.

Update on Physics Task Agreements for ITER

Several of the task agreement solicitations from the ITER Organization that were reported in the April eNews have reached their respective due dates, but others are still active. In addition, two new solicitations have been added since then, one on error field measurements with plasma response taken into account and another on transport simulations with fixed-boundary plasma equilibria. The active solicitations are listed in the table below.

Task	Due to USIPO	Due to ITER	Period
Task on error fields measurements in ITER using plasma response	May 26	June 9	12 months
Task on simulations of toroidal field ripple and TBM effects on energetic particle losses in ITER	June 5	June 20	12 months
Task on magnetic reconstruction of the plasma boundary	June 5	June 20	12 months
Task on analysis of Resistive Wall Mode control by in-vessel (RMP) coils	June 5	June 20	12 months
Task for self-consistent transport simulations of plasma scenarios with fixed-boundary equilibria	July 10	July 24	12 months

As a reminder, the work solicitations are to be set up as task agreements between the ITER Organization and the US ITER Project Office. Anyone who is interested in submitting a proposal on these tasks should send it to the US ITER Project Office for review and acceptance. Pricing information should be submitted in a separate attachment. The US ITER Project Office will determine the appropriate credit to be requested from the ITER Organization, obtain approval signatures, and finalize submittals to ITER. For proposals that the ITER Organization accepts, the US ITER Project Office will set up the necessary contracts with the task performers, since the funding will be provided through the US ITER Project Office. If there are any questions about the task agreements, please contact Wayne Steffey <steffeyrw@ornl.gov>, 865-574-8364.

Recent Reports

The 2008-09 Annual Report about USBPO activities, which was recently submitted to the Office of Fusion Energy Sciences, is posted on the USBPO web site ("References" section).

The Technical Advisory Committee of the US ITER Project Office held a meeting in Oak Ridge, TN, April 14-15. On behalf of the USBPO, I presented a talk about "ITER Physics Initiatives and ITER Research Plan." (It is posted on the USBPO web site.) On behalf of the Virtual Laboratory for Technology, Richard Nygren presented a talk about "Support of ITER in the VLT's Base Technology Program."

It should interest our readers to know that at this year's Sherwood Fusion Theory Conference (May 3-5), which was combined with the American Physical Society Spring Meeting in Denver, Ray Fonck, the founding director of the USBPO, presented an invited talk on "Scientific Developments in the Journey to a Burning Plasma (ITER)."

ITER on YouTube

ITER now has its own channel on YouTube, with a selection of 16 videos to watch, many of them very recently posted (as of three weeks ago). Be sure to tune in and enjoy at <http://www.youtube.com/user/iterorganization>.

📣 Announcements

Submit BPO-related announcements for next month's eNews to Raffi Nazikian at rnazikian@pppl.gov.

Reports

ITPA Energetic Particle Topical Group Meeting

Written by Don Spong, Oak Ridge National Laboratory

The second meeting of the ITPA Topical Group on Energetic Particle Physics was held at Daejeon, Republic of Korea, April 21-24, 2009. The presentations can be found at: <http://itpa.ipp.mpg.de/> (i.e., follow these links from the main web-page: Topical groups ⇒ Energetic Particles ⇒ 2nd meeting of the ITPA-TG ⇒ Agenda and contributions). The topics that were discussed included: effects of ripple and ferritic materials on the equilibrium and alpha particle losses, runaway electron generation, Alfvénic instabilities and associated losses, Alfvén stability code benchmarking, fast ion transport by core turbulence, and fast particle effects in stellarators.

Several sources of ripple will be present in the magnetic field in ITER, including discrete TF coils, ferritic inserts, ferritic materials in the test blanket modules (TBM), ELM and Resistive Wall Mode (RWM) suppression coils, and various ferritic materials in the vacuum vessel, neutral beams, and other structures. A benchmark case had been established following the previous ITPA-EP meeting for Scenario 4 profiles that included TF ripple, ferritic inserts, and three asymmetrically located TBM's. A number of alpha particle Monte Carlo loss calculations were reported for this case. While the different codes use a range of models for the loss analysis, all reported peak heat loads that were less than the ITER design criterion of 0.5 Mw/m^2 . Besides heat removal, another, possibly more constraining issue discussed was helium-induced blistering. Blistering analysis will require further materials science input regarding the energy dependence of this effect, but was mentioned as being important even for heat loads as low as 0.03 Mw/m^2 . An external coil that DIII-D will be installing to simulate the $n = 1$ perturbations of TBM's was described. For the next topical group meeting, new benchmarks will be used that include the ELM/RWM coils; also, runaway electron losses will be analyzed. In addition, the TBM perturbation issue will be passed on to the MHD Topical Group for evaluation regarding locked modes, rotation breaking, etc.

A one-day joint session was held with the ITPA MHD Topical Group on the subject of runaway electron losses. The focus was on mitigation schemes for steady-state runaway beams and runaway avalanches that may rapidly form during disruptions, vertical disruption events, etc. The final mitigation method for ITER has not been selected, and several candidate schemes are under investigation, including massive material (gas or pellet) injection, application of resonant magnetic perturbations, or induction of a reverse one-turn voltage. Experimental talks were presented from TEXTOR and JET. TEXTOR finds that moderate high-Z gas injections can produce runaways; their runaways can be suppressed by stronger gas injections, vertical field control, and resonant magnetic perturbation (RMP) coils. JET attempted runaway mitigation using increased TF ripple and RMP coils, but, in both cases, found negative results due to the ripple strengths and resonant perturbations being too small in the regimes where runaways could be produced.

In the area of fast particle interactions with MHD and Alfvén modes, experimental contributions were given from JET, NSTX and ASDEX. JET has studied the effects of fast particles on sawtooth destabilization and RWM's. NSTX has analyzed fast ion transient losses during Toroidal Alfvén Eigenmode (TAE) avalanches. ASDEX has successfully excited TAE's with ICRF beat-waves and finds good agreement with modeling for fast ion losses in overlapping TAE and beta-induced Alfvén eigenmodes (BAE). Joint experimental work was discussed in the areas of antenna excitation, damping measurements, and beat wave excitation. JET has improved its antenna mode selection and coupling and finds increased damping as the elongation is increased for medium-mode-number modes. MAST has successfully excited TAE's with antennas, but has not inferred damping rates yet. TEXTOR plans to attempt TAE excitation using their dynamic ergodic divertor coils.

A TAE benchmark exercise was set up prior to the meeting for TAE simulation codes. Results were reported from the HGMC, TAEFL, AE3D-K, and MEGA codes. All codes, due to the fact that they inherently include continuum damping, found the drive of the test case too weak for instability and adapted, either by increasing the fast particle β or by measuring the mode structure and damping rates. A new benchmark case will be established for the next topical group meeting. The linear stellarator particle-in-cell code, called GYGLES, was also described and applied to several benchmarks with the CAS3D-K code.

The effect of core turbulence on fast ion transport has been suggested as a possible explanation for the anomalous loss of fast ions observed on a number of experiments. Previous calculations, based on electrostatic turbulence, have indicated a $1/E$ energy scaling of the effective fast ion diffusion coefficient, which would imply negligible transport at the energies of interest. Newer simulations that include electromagnetic turbulence were reported that indicate a significantly higher level of diffusion and weaker energy scaling. The connections of this result to anomalously low NBI current drive on ASDEX and fast ion losses on TFTR at high β were discussed.

A final session was devoted to fast particle effects in stellarators. This was motivated by the fact that similar fast ion physics issues are present in stellarators and tokamaks. Also, since ITER will have weak 3D effects, some of the modeling tools used for stellarators may be needed specifically to examine non-symmetry issues for ITER. On the experimental front, recent Reversed Shear Alfvén Eigenmode observations in the Large Helical Device heliotron/torsatron were described. These occur when the q-profile has a local maximum (minimum in iota) and exhibit both down-chirping and up-chirping in frequency, with a finite minimum frequency related to acoustic couplings. Stellarator codes that were described include GYGLES, CAS3D-K, CKA, GNET, STELLGAP, and AE3D-K. These codes will be included in future Alfvén benchmark cases.

The next ITPA Energetic Physics Topical Group meeting will be held in Kiev, Ukraine Sept. 21-23, 2009, in conjunction with the IAEA Technical Committee Meeting on Energetic Particle Physics.

First Meeting of the ITER Test Blanket Module Program Committee

Written by Mohamed Abdou, University of California, Los Angeles

The TBM Program Committee (TBM-PC) held its first meeting March 25-26, 2009, in Aix-en-Provence, France. The TBM Program Committee was created by the ITER Council in November 2008 to “govern” all ITER activities related to Test Blanket Modules (TBM) and to report to the ITER Council. ITER will provide three ports (#16, #18, and #2) for TBMs. Each port will test two TBM concepts. At this meeting, the TBM Program Committee selected the Port Masters and the TBM Leaders. The Port Masters are European Union (Port 16), Japan (Port 18), and China (Port 2). The European Union is the leader for the Helium-Cooled Lithium-Lead (HCLL) concept and the Helium-Cooled Pebble Bed (HCPB) concept. Japan, China, and India are the leaders, respectively, for the Water-Cooled Ceramic Breeder (WCCB) concept, the Helium-Cooled Ceramic Breeder (HCCB) concept, and the Lithium-Lead Ceramic Breeder (LLCB) concept.. Each concept leader will head up a consortium of other “partners” from the 7 ITER Parties.

The US position expressed at this first meeting of the TBM Program Committee is that the US will participate as a TBM partner, but cannot decide to be a concept leader at this time. The participants at the TBM Program Committee meeting decided that the Dual-Coolant Lithium-Lead (DCLL) concept of the US is very innovative and represents an important path toward high performance. Therefore, the TBM Program Committee decided to dedicate one half-port to testing the DCLL concept. The US was requested to be the “Interface Coordinator” for the DCLL concept. The US representatives at the TBM Program Committee meeting were Jeff Hoy as member, with Mohamed Abdou, Mike Hechler, and Larry Leiken as experts.

The TBM Program Committee discussed the issue of ferromagnetic materials and correction coils. A workshop will be held on this issue in December 2009. The TBM Program Committee requested the ITER Organization to make a recommendation at this December meeting. The TBM Program Committee also discussed the issue of intellectual property rights. Parties can share data from TBM operation in ITER. However, information on fabrication and on the design, configuration, and material composition of TBMs will not be shared except through a negotiated agreement between a concept leader and partners.

Sixteenth Meeting of the ITPA Topical Group on Diagnostics

Written by Réjean L. Boivin, General Atomics

The Sixteenth Meeting of the ITPA Topical Group on Diagnostics was organized by the Efremov and Ioffe Institutes in St. Petersburg, Russian Federation, from 20 to 24 April 2009. The meeting

was combined with a Progress Meeting on ITER relevant diagnostic developments in the Russian Federation, which took place on 20 April. The meeting was attended by 71 participants.

During the Progress Meeting on ITER-relevant diagnostic developments in Russia, Russian scientists presented the latest work in connection with their ITER scope. Additionally, a number of other burning plasma-relevant diagnostic developments in the Russian Federation were also discussed.

A large portion of the meeting focused on high-priority items:

1. Development of methods for measuring the energy and density distribution of escaping alpha particles

One key task that was identified at the last topical group meeting corresponded to the need to identify proper alpha particle orbits that can reach the detector. These orbits were calculated in two scenarios and show that a smooth/flat outer wall would prevent the direct detection of particles. Options including wall modifications are being evaluated. Orbit calculations will be continued, which would include a quantification of alpha particle populations in the relevant orbits.

An update on the development of the imaging bolometer was also presented, along with the potential application to escaping alphas.

It was agreed that a significant push on orbit calculations, along with detection efficiency, is required in order to assess the possibility of direct loss detection. This activity will continue.

2. Assessment of the calibration strategy and the needed calibration source strength

The Neutron Working Group has reported much progress in regard to MCNP code calculations in support of the calibration strategy. It was determined that the deuterium-tritium neutron generator is much preferred for the neutron calibration compared to the use of an isotope (e.g., Cf^{252}) source. The opposite would be true for the deuterium-deuterium calibration. While taking into account presently available neutron generator yields and source strengths, the calibration of all neutron systems would require approximately a month for the deuterium-tritium case and slightly more for the deuterium-deuterium case. Efforts are continuing in devising ways to reduce the time necessary in the deuterium-deuterium case.

3. Determination of the lifetime of plasma-facing mirrors used in optical systems

The report of the Specialist Working Group on First Mirrors gave an overview of all activities in the field of first mirrors. A roadmap was developed to guide the international research and development in the field of first mirrors and was further detailed into a work plan that covers six main areas. This plan has been widely distributed in close cooperation with the ITER Organization. Many detailed discussions were held during the breakout session. An urgent call is being made to the ITER Organization and the Domestic Agencies to coordinate and promote dedicated efforts in order to perform the necessary research and development in this area.

4. Assessment of techniques for measurement of hot dust

An update on the dust and tritium control strategy was presented. A capacitance micro-balance is being proposed for local cold dust measurements. This is being proposed as a Joint Experiment. The ITER Organization's diagnostic group will refine the requirements for the test micro-balance to be presented at the next ITPA Coordinating Committee meeting and the next ITPA/IEA Joint Experiment meeting.

The development of a technique for measuring hot dust remains an outstanding issue. Coordination with experts in the field is sought.

5. The assessment of impacts of in-vessel wall reflections on diagnostics

Many of the optical diagnostics will have to work against the background of stray light coming from the plasma and, because the ITER plasma is much larger than existing tokamak plasmas, this problem will be more severe than that experienced thus far. The problem needs to be evaluated through a process of modeling and measurements on existing machines and through measurements of the reflectivity of relevant materials. Work is continuing at Tore Supra in quantifying the effects of reflections on the infrared imaging of the first wall. The work also includes a quantification of the reflectivity of tiles as a function of angle of reflection for materials found in the tokamak. More information is expected at the Fall 2009 and Spring 2010 topical group meetings.

6. Assessment of the measurement requirements for plasma initiation and identification of potential gaps in planned measurement techniques

The early phase of plasma formation and control may require additional or special measurements that are different from those used during the flat top phase. The task aims at assessing these needs and identifying any gaps in the associated techniques. A work plan is being developed and a special session is proposed for the Fall 2009 topical group meeting in Korea.

Other topics covered

An overview of the issues in the field of diagnostic integration into ITER was presented, with an update on construction. The impacts of the design changes were also briefly discussed. The new baseline (2009) process was also described, along with Scenario 1 tokamak implementation and start-up.

The ITPA Parties reported steady progress in the development of many ITER-relevant diagnostic techniques. Some examples of recent work presented at the meeting are: High Field Side reflectometer system (from RF), upgraded gamma ray spectrometers on JET (from EU), upper port plug diagnostic housing (from IN), THz laser polarimetry (from JA), neutron activation system (from KO), and fast RGA system (from US).

The Special Working Group on Reflectometry produced a comprehensive report on the potential deleterious effects of stray ECH radiation on diagnostics and related equipment.

After numerous years of loyal and dedicated services in support of the ITPA and ITER expert groups, Dr. Alan Costley of the ITER Organization is now stepping down as co-chair. He will be succeeded by Dr. George Vayakis (IO).

It is proposed that the 17th topical group meeting be held in Pohang, Korea, on 12-16 October 2009. The Pohang University of Science and Technology (POSTECH) has kindly offered their support to act as host. The topic for a special (focus) session will be the review of measurement requirements for plasma initiation and termination (high-priority item). It is suggested that the meeting be combined with a one-day Progress Meeting on ITER-Relevant Diagnostic Developments that are on-going in Korea. The provisional location of the 18th meeting in the spring of 2010 would be in the US, probably in conjunction with the High Temperature Plasma Diagnostics conference.

2009 Burning Plasma Events

Jan 13-14

FESAC

Gaithersburg, MD

Jan 18-23

8th IEA International Workshop on SiC/SiC

Daytona Beach, FL

Mar 2-4

4th Workshop on Stochastic Fusion Plasmas

Julich, Germany

Mar 31-Apr 2/3

Joint meeting of the ITPA Transport & Confinement TG & the Integrated Operational Scenarios TG

Naka, Japan

Apr 6-8

ITER Export Control Working Group Meeting

Washington, DC

Apr 20-22

ITPA Pedestal & Edge Physics Topical Group Meeting

Cadarache, France

Apr 20-24

ITPA Diagnostics Topical Group Meeting

St. Petersburg, Russia

Apr 21-24

Joint Meeting of the ITPA Energetic Particles TG & the MHD TG

Daejeon, South Korea

Apr 28-May 1

Transport Task Force Workshop

San Diego, CA

May 2-5

Sherwood Theory Fusion Conference/APS April Meeting

Boulder, CO

May 5-8

ITPA Sol & Divertor Topical Group Meeting

Utrecht Amsterdam, FOM Rijnhuizen

May 11-14

12th International Workshop on Plasma-Facing Materials & Components for Fusion Applications

Julich, Germany

May 25-27

ITER Science and Technology Advisory Committee STAC-6 Meeting
Cadarache, France

May 27-28

ITER Management Advisory Committee MAC-5 Meeting
Cadarache, France

May 29-30

ITER Council Contact Persons Working Group Meeting
Cadarache, France

May 31-Jun 5

[ICOPS-SOFE 2009 Conference](#)
San Diego, CA USA

Jun 14-18

[ANS Annual Meeting](#)
Atlanta, GA USA

Jun 24-26

[18th Conference on RF Power in Plasmas](#)
Gent, Belgium

Jun 29-Jul 3

[14th International Conference on Emerging Nuclear Energy Systems \(ICENES-2009\)](#)
Ericeira, Portugal

Jul 15-16

ITPA Coordinating Committee Meeting
Cadarache, France

Sep 6-11

[6th International Conference on Inertial Fusion Sciences and Applications \(IFSA 2009\)](#)
San Francisco, CA USA

Sept 7-12

[14th International Conference on Fusion Reactor Materials \(ICFRM-14\)](#)
Sapporo, Japan

Sept 21-23

ITPA Energetic Physics Topical Group Meeting
Kiev, Ukraine

Sept 21-24

[14th International Symposium on Laser-Aided Plasma Diagnostics \(LAPD-14\)](#)
Castelbrando, Treviso, Italy

Oct 5-7
ITPA Transport & Confinement Topical Group Meeting
PPPL, USA

Oct 6-8
ITPA Pedestal & Edge Physics Topical Group Meeting
Princeton, New Jersey, USA

Oct 11-16
[9th International Symposium on Fusion Nuclear Technology \(ISFNT-9\)](#)
Dalian, China

Nov 2-6
[51st APS-DPP Meeting](#)
Atlanta, GA USA

Nov 15-19
[ANS Winter Meeting](#)
Washington, DC USA

Fusion Research-related events can also be seen on the USBPO website at
<http://burningplasma.org/events.html>.