USBPO U.S. BURNING PLASMA ORGANIZATION

eNews

November 16, 2009 (Issue 38)

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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 (Tom Rognlien trognlien@llnl.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

Recent ITER Meetings

A succession of ITER meetings occurred recently in Cadarache, France. Let me try to hit some of the highlights.

The ***Science and Technology Advisory Committee*** of the ITER Council held its seventh meeting (STAC-7) during October 21-23. Due to the unusually extensive nature of the charge for this meeting, each of the ITER Members was allowed to send an additional expert. From the US, Dr. Joseph Minervini (MIT) participated in this capacity. Altogether, 38 scientists were in attendance. The four elements of the STAC-7 charge were to assess whether (1) the Projects Requirements implement the Project Specifications, (2) the Systems Requirements for major ITER systems are appropriate to meet the Project Requirements, (3) the designs of major systems satisfy the Systems Requirements, and (4) the Updated Construction Schedule and ITER Research Plan are a suitable basis for achieving Q=10. Scientific leaders from the ITER Organization presented 14 talks to the STAC during the first day of the meeting. In response to questions from the STAC members, ITER Organization personnel presented several more brief talks on the afternoon of the second day. During the rest of the meeting, the STAC deliberated in executive session and worked on writing its report. At the end of the afternoon session of the third day, the STAC summarized its findings in a briefing to the Director-General and Principal

Deputy Director-General of the ITER Organization. By the end of the meeting, the STAC had finished the first version of the entire report in draft form. The final version, to be sent to the ITER Council for its November 17-18 meeting, was completed the following week by email.

Participants at the STAC-7 Meeting in Cadarache, France

The ***Management Advisory Committee*** of the ITER Council met the following week, October 26-28, also in Cadarache. This sixth meeting (MAC-6) had a very full agenda. ITER leaders presented talks about the project baseline and also about the scope, schedule, cost, and management baseline. There was a report from the Briscoe Panel about an independent assessment of the ITER construction resource estimates and a report from a MAC subgroup about technical integration. The MAC also discussed procurement allocations, intellectual property management, and international cooperation. As with the STAC, the report of the MAC from this meeting will be submitted to the ITER Council for its November meeting.

The ***Technical Integration Subgroup*** of the Management Advisory Committee held its second meeting (TI-2) on October 19 and 20. This subgroup is tasked to advise the MAC about the integration of systems, components and structures into final design and construction for ITER. The TI-2 meeting was a follow on to its first meeting in May 2009. Four STAC representatives participated in the TI-2 meeting as official “STAC visiting members” in order to gain perspective for addressing the part of the STAC-7 charge having to do with ITER Organization procedures for implementing linkages among the Project Requirements, the System Requirements Documents, and the Detailed Design Documents.

Research Committee Meeting at the APS-DPP Meeting
The members of the USBPO Research Committee, which is comprised of the leaders and deputy leaders of the ten Topical Groups, held their first-ever in-person meeting, on Monday, November 2, in Atlanta, Georgia, during the APS Division of Plasma Physics Annual Meeting. Normally, the Research Committee meetings are held by videoconference. For this special meeting, the US coordinators and deputy coordinators for the seven ITPA topical groups were also invited to attend. The main topic on the agenda was a wide-ranging discussion of ways to enhance integration of ITPA and USBPO topical group activities. Special guests of honor at the meeting were Ron Stambaugh (chair of the ITPA Coordinating Committee) and Ned Sauthoff (head of the US ITER Project Office).

New Deputy Leader for USBPO Modeling and Simulation Topical Group
I am pleased to announce that Dylan Brennan has become the new deputy leader for the USBPO Topical Group on Modeling and Simulations. He is an expert in large-scale nonlinear simulations of extended-MHD plasma behavior. Currently, he is an assistant professor of physics at the University of Tulsa. He replaces Jon Kinsey, who had been serving as the deputy leader.

New US Members for ITPA Topical Groups
Here are two recent changes in the US membership for the International Tokamak Physics Activity (ITPA):

- Maxim Umansky (LLNL) will become a member of the ITPA Topical Group on SOL and Divertor, replacing Mathias Groth.
- Stefan Gerhardt (PPPL) will become a member of the ITPA Topical Group on Integrated Operation Scenarios, replacing David Gates.

Please remember that US scientists who are not "official" ITPA members are welcomed and, indeed, encouraged to attend the semiannual meetings of the ITPA topical groups.

ITPA Topical Group Meetings
Six of the seven ITPA topical groups held meetings in September and October. Summary reports from some of these groups are included in this issue of *eNews*, and more will appear in next month's issue. One more ITPA topical group will meet this year, in December. The topical group meetings for next year are now being decided. Here is the information that we have so far.

Date	Topical Group	Location
14-18 December 2009	SOL and Divertor	San Diego, US
22-25 March 2010	Transport and Confinement	Culham, UK
19-23 April 2010 *	Integrated Operation Scenarios	Princeton, US
21-23 April 2010	Pedestal	Naka, Japan
10-14 May 2010 *	Diagnostics	Oak Ridge, US

* Tentative dates

IEA-ITPA Joint Experiments Meeting
The International Energy Agency sponsors an annual meeting of fusion facility program leaders from around the world, at which the ITPA Topical Groups present proposals for new joint experiments on multiple facilities and also report about the results from previous such experimental activities. This process has been quite successful in developing crosscutting synergies among the world fusion programs. Theoretical modeling and simulations constitute a growing component of these activities. The next such meeting will be held December 15 and 16 at the National Fusion Research Institute in Daejeon, Korea.

Coconuts and ITER
ITER fans might be interested in an article with the intriguing title "Warning: Future Fusion Facility Contains Coconuts," which can be found at the Environmental Protection web site <http://eponline.com/articles/2009/11/03/warning-future-fusion-facility-contains-coconuts.aspx>. The explanation given for the title is that ITER will use coconut-shell charcoal as an absorption medium for helium and hydrogen exhaust. The same article contains a link to a fascinating video clip on YouTube that shows an animation of how the assembly of the ITER device will be carried out.

ITER Article in *Science* Magazine
The November 12, 2009, issue of *Science* magazine has an article about ITER entitled "ITER Blueprints Near Completion, But Financial Hurdles Lie Ahead."

Reports

Meeting of the ITPA Topical Group on Diagnostics

Written by R. L. Boivin (General Atomics, USA)

The 17th Meeting of the ITPA Topical Group (TG) on Diagnostics, organized by the Postech Institute, was held in Pohang, Korea from October 12-15, 2009. A Total of 44 researchers participated from Korea (10), China (6), EU (12), India (2), Japan (6), Russia (3), USA (2), and the ITER IO (3). The agenda included a Progress Meeting on ITER relevant diagnostic developments in Korea, which took place on October 12. During the Progress Meeting, Korean scientists reported work related to their ITER scope. Additionally, a number of other Burning Plasma relevant diagnostic developments in Korea and latest diagnostic developments on KSTAR were discussed. The remainder of this summary outlines the issues and good progress reported on six high-priority diagnostics for use on ITER.

1. *Development of methods of measuring the energy and density distribution of escaping alpha particles.* A key task is to identify alpha particle orbits that can reach the detector. These orbits are calculated in 2 scenarios and show that a smooth/flat outer wall would prevent a direct detection. Options including wall modifications are being evaluated, but are highly dependent on the details of the first wall 3-D shape. Irradiation tests (total dose) for scintillators are ongoing together with evaluating activation techniques.

2. *Assessment of the calibration strategy and calibration source strength needed.* The Neutron Working Group reported progress in regards to the calibration strategy where the dynamic range in neutron detection is large. Dedicated plasma discharges are used, supported by Monte Carlo (MCNP) calculations. It is expected that the foil activation will be the most stable and reliable neutron yield monitor. The calibration of all neutron systems is expected to require approximately 5-7 weeks.

3. *Determination of life-time of plasma facing mirrors used in optical systems.* A prioritized work plan of the international R&D in the field of first mirrors has been developed and is being implemented. Recent progress in mirror cleaning techniques was reported on TEXTOR, DIII-D, and JET using plasma and laser-based techniques. Significant improvement of optical reflectivity of all treated mirrors was reported. A number of critical tasks requiring additional resources are:

- Assessment of the performance under erosion- and deposition-dominated conditions: material choice.
- Mitigation of deposition of beryllium, carbon, and carbonaceous material.
- Cleaning of deposited layers from carbon and carbonaceous deposits for mirror surface recovery.
- Predictive modeling of irradiation effects and their impact on the optical characteristics of mirrors.

4. *Assessment of techniques for measurement of hot dust.* A capacitance micro-balance is being proposed for local cold dust measurements as a Joint ITPA Experiment. An ellipsometry technique was also presented for erosion/deposition measurement purposes.

5. *Assessment of impact of in-vessel wall reflections on diagnostics.* Because of the large ITER plasma, stray background light will be much larger than in existing tokamak plasmas. More detailed measurements and modelling are needed for existing devices with different materials to properly evaluate the problem. Beginning work was reported on reflection measurements and model development, including extended spectroscopic measurements.

6. *Assessment of the measurement requirements for plasma initiation and identification of potential gaps in planned measurement techniques.* The initial and final transient phase of a discharge will likely require some different diagnostics than the steady-state phase. The transient periods include in-between discharges, breakdown, and ramp-up and ramp-down periods. Calibration of magnetic structure measurements is especially important. Results from KSTAR, EAST, JET, ASDEX, DIII-D, C-Mod, TCV, and others were presented. The needs for ITER have been tabulated and will be reviewed before the next meeting.

More detail on this ITPA meeting is available in the full TG report available at http://itpa.ipp.mpg.de/. The next Diagnostics meeting is planned for May 10-14, 2010 in Oak Ridge, Tennessee.

Meeting of ITPA Topical Group on Integrated Operation Scenarios

Written by Chuck Kessel (Princeton Plasma Physics Laboratory, USA)

The ITPA-IOS meeting was held in Frascati, Italy on October 20-23, 2009. US attendees were Robert Budny, Paul Bonoli, Don Batchelor, Stefan Gerhardt, Amanda Hubbard, Chuck Kessel, Tim Luce, Masanori Murakami, J.M. Park, and Ron Prater.

Reports were given by the experimental tokamaks (JET, DIII-D, C-Mod, NSTX, FTU, TJ-II, ASDEX-U) on topics including L-to-H transition power, impurity seeding, current ramp-up and ramp-down, steady state and hybrid plasmas, ELM control, and a similarity experiment between DIII-D and JET on hybrid discharges. Shunsuke Ide (chairman) reported on the ITPA Coordinating Committee meeting, indicating that data would be available after publication among all the tokamaks, and possibly a private database for the IOS group to work on exclusively. However, George Sips indicated that this is not the case for JET, where users must come to JET to access and work on the data.

Joseph Snipes outlined major ITER topics and recent decisions, in particular, the decision to proceed with a Neutral Beam (NB) Test Facility and the enabling of electron cyclotron current drive steering angles, including reverse current drive, in spite of no clear advantages being identified. Alexei Polevoi presented 0-D analysis of the steady-state operating space for ITER.

The ICRF simulation benchmark exercise is going very well, with the baseline (15 MA / 5.3 T) tests nearly complete and the lower-field operation being examined. The NB simulation benchmark is nearing completion. Don Batchelor reported on the Integrated Plasma Simulator providing fast turn-around on TORIC/NUBEAM calculations through parallelization.

The MHD Topical Group provided a correlation of key parameters (internal inductance-li, elongation-kappa, MHD stability margin) for use in simulations of the ramp-up and ramp-down phases, to determine vertically stable operating points.

There were several modeling presentations covering topics such the impact of sources on the GLF23 transport model, TOPICS modeling of the hybrid mode, TASK analysis, ASTRA modeling of KSTAR, TSC/neutrals analysis of current ramp-down, ONETWO modeling of the steady state scenario and hybrid, ACCOME modeling of the steady state scenario, PTRANSP modeling of the steady state scenario, and ramp-down simulations with DINA/ASTRA.

There were discussions of the modeling work and joint experiments, with two new proposals for joint experiments involving plasma control and lower hybrid. There were discussions of the candidates for IAEA papers, and finally a presentation on the proposed European FAST satellite tokamak for ITER.

More detail on this ITPA meeting is available in the full topical group report available at http://itpa.ipp.mpg.de/. The next Integrated Operations Scenarios meeting is planned for April 19-23, 2010 at PPPL.

Meeting of the ITPA Transport and Confinement Group

Written by George McKee (University of Wisconsin/General Atomics, USA) and Stan Kaye (Princeton Plasma Physics Laboratory, USA)

The 3rd meeting of the ITPA Transport and Confinement Task Group was held at the Princeton Plasma Physics Laboratory, USA, on October 5-7, 2009, immediately following the H-mode workshop. A one-day joint session was held with the ITPA Pedestal Task Group to focus on L-H transition physics. Attendees from the US, EU, China, Korea, Japan, and Russia participated in the meeting.

Major topics of discussion included a newly developed momentum database, electron thermal transport experiments and simulations, the role of microtearing and Global Alfvén Eigenmodes (GAE) in electron transport. The momentum database is being coordinated and developed by M. Yoshida of JAEA and includes data on momentum diffusivity and pinch as a function of several critical parameters as well as the role of a turbulence-driven residual stress. Recent results on electron and general transport topics were presented from ASDEX-U, DIII-D, NSTX, and MAST. Recent experiments on DIII-D scanned plasma elongation, modulated the ratio of minor radius (a) to electron temperature-gradient scale-length (a/L_{Te}) drive term, and measured the phase between density and T_e fluctuations in order to challenge nonlinear simulations. NSTX and MAST reported on electron transport driven by GAE and microtearing modes. Also presented were the results of theoretical studies assessing the respective roles of trapped-electron modes (TEM) and electron temperature gradient (ETG) modes. Wayne Houlberg from ITER described the formation of the Integrated Modeling Expert Group (IMEG) that will model discharge evolution and assess real-time parameters.

A discussion of low-to-high (L-H) confinement transition physics and experimental results was held in conjunction with the Pedestal group. The parametric dependence of the L-H transition power threshold P_{LH} on such parameters as the ion species, rotation, magnetic configuration (X-point height, triangularity), as well as so-called "hidden variables" was discussed at length. In several cases, disparate results have been reported. For example, JET, DIII-D, C-MOD, and MAST show a 40-80% increase in P_{LH} with He compared with D, while AUG and NSTX showed little difference. In addition, the strong dependence of P_{LH} on rotation demonstrated on DIII-D has not been convincingly observed on other experiments, though the DIII-D results have been connected to variations in edge radial electric field shear and turbulence flows. Application of toroidally varying edge magnetic fields (with toroidal mode numbers n=1 to 3) is found to have an adverse effect on the P_{LH} threshold power. While a first-principles understanding of the transition mechanism and scaling behavior is highly desirable, the complexity and nonlinearity of the phenomenon will likely require the continued reliance on empirical scaling laws for the foreseeable future, though significant variation in P_{LH} and lack of physical mechanisms challenges this approach.

As ITER is expected to operate with auxiliary power near P_{LH}, participants agree that confinement in this regime needs to be studied more comprehensively. This regime is often characterized by Type III ELMs and non-steady discharge behavior and poorer confinement, while steady performance with a confinement enhancement factor of H~1 is presently achieved at higher input powers with Type I ELMs, which would be unacceptable on ITER.

The status of the 15 joint transport and confinement experiments were discussed. These experiments cover high priority research topics ranging from confinement dependence on plasma beta and isotope, L-H threshold dependencies, turbulence mode identification, to particle and momentum pinches. Also discussed were details of an L-H threshold database that would include local edge parameters, a plan to address the validation of ITER target scenarios during the ramp-up phase, and ideas for a joint experiment on pellet injection.

A more detailed summary of the meeting is available at http://itpa.ipp.mpg.de/, and presentations are at: http://efdasql.ipp.mpg.de/lgd/PublicH-Mode/TandC/TandC.htm. The next ITPA T&C meeting will be held at Culham Laboratory, UK in March, 2010.

Announcements

Submit BPO-related announcements for next month's eNews to Tom Rognlien at trognlien@llnl.gov .

Upcoming Burning Plasma Events

2009 Events

Nov 15-19
ANS Winter Meeting
Washington, DC USA

Dec 2-3
Fusion Power Associates Annual Meeting
Washington, DC USA

Dec 8-11
The 19th International Toki Conference (ITC19)
Ceratopia Toki-City, Gifu, Japan

Dec 14-17
ITPA SOL & Divertor Topical Group Meeting
San Diego, California USA

2010 Events

January 18-21 UPDATED
Workshop on Opportunities in Plasma Astrophysics (WOPA)
Princeton, USA

February 16-19 UPDATED
Innovative Confinement Concepts Workshop (ICC 2010) abstracts due **12/4/09**
Princeton, USA

Week of 22 March
ITPA Transport & Confinement Topical Group Meeting
Oxfordshire, UK

Spring
ITPA IOC Topical Group Meeting
Princeton, New Jersey USA

April 12-15 UPDATED
16th Joint Workshop on Electron Cyclotron Emission and Electron Cyclotron Resonance Heating
Sanya, China

April 13-16 UPDATED
U.S. Transport Task Force Workshop
Annapolis, Maryland USA

April 13-16
International Conference on Plasma Diagnostics
Pont-à-Mousson, France

April 19-21 UPDATED
Sherwood Fusion Theory Conference (abstracts due Feb. 26)
Seattle, Washington USA

May 16-20
18th ITPA Diagnostics & HTPD Topical Group Meetings
Wildwood, New Jersey USA

May 19-21
STAC-8
Cadarache, France

May 24-28 UPDATED
19th International Conference on Plasma Surface Interactions (abstracts due Nov. 20)
San Diego, California, USA

May 31-June 4 UPDATED
4th ITER International Summer School
Austin, Texas USA

June 21-25 UPDATED
37th European Physical Society Conference on Plasma Physics
Dublin, Ireland

Sept 27-Oct 1
26th Symposium on Fusion Technology (SOFT2010)
Porto, Portugal

Oct 24-29
9th International Conference on Tritium Science and Technology
Nara, Japan

Nov 10-16 UPDATED
23rd IAEA Fusion Energy Conference
Daejon, Korea

Fall
ITPA Transport and Confinement Topical Group Meeting (following IAEA)
South Korea

Fall
ITPA IOC Topical Group Meeting (following IAEA)
South Korea

Fall
ITPA Diagnostics Topical Group Meeting (following IAEA)
Japan

2011 Events

Spring
ITPA Transport & Confinement Topical Group Meeting (following US/EU TIF)
San Diego, California USA

Please contact the administrator with additions and corrections.