Burning Plasma Organization Workshop Boundary Physics Breakout Summary
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The Burning Plasma Organization (BPO) workshop held Dec. 7-9 at Oak Ridge National Laboratory was a good starting point for the discussions of the BPO structure and important tasks in the boundary physics area. The second day of the workshop was reserved for breakout sessions for each of the main areas identified by the workshop organizers. Between 20 and 30 participants attended a part or all of the boundary physics breakout session.

The group considered the issues pointed out in three plenary talks: the H-mode pedestal (A. Leonard), the scrape-off layer/divertor and plasma facing components (PFC) (B. Lipshultz), and technology program (S. Milora) contributions. Substantial input regarding the six BPO questions was received via email and prepared presentations from many individuals, representing either their group or personal answers to the charge questions. The agenda of the breakout session consisted of short presentations in the morning, followed by a joint session just after lunch with the macroscopic stability group on edge localized modes (ELMs) and disruptions. Through the presentations and discussion, it became apparent that many phenomena that are nuisances in today's tokamaks (e.g. large ELMs, disruptions, wall fuel retention) will not be so easily handled in ITER, and would be even more challenging in a reactor if projections are accurate. These issues underscore the substantial nature of the boundary physics challenges in the step from today's tokamaks to ITER. Discussion of the important near terms topics and tasks, and possible BPO structure regarding boundary physics topics comprised the final 2 and 1/2 hours of the breakout session. The remainder of this summary presents the group's discussion of answers to charge questions #2-#6.

Charge question #2: "What issues remain to be resolved for a successful BP experiment in ITER?" was discussed in general terms. In retrospect, discussion of specific tasks may have yielded more agreement of a priority order. Nonetheless, a list of issues was discussed and agreed upon as being important for ITER, although there was not consensus achieved on the detailed wording or precise prioritization. The list of topics is listed here:

1. Qualification of ITER PFC design, and research toward PFC staging strategy
2. Tritium retention and removal, including SOL transport
3. Disruption mitigation
4. Pedestal and ELM physics and control
5. H-mode power threshold
6. Plasma start-up, path to nominal regime, plasma shut-down, and afterglow phase
7. Power exhaust
8. Particle fueling and exhaust
9. Long pulse operation (wall conditions)
10. Fast particles loss to the wall
11. Diagnostic integrity with baseline operation
12. Remote handling capability in real situation
13. RF-edge plasma interactions

Charge question #3: “What are the consequences of resolving these issues, or not, in the next ~10 years?” was broached with respect to the general issues listed above. The consequences of non-resolution in the most critical areas are largely related to higher risk of operation, e.g. a low pedestal temperature in ITER could lead to reduction of ITER’s performance, and the presence of large ELMs and disruptions could lead to premature, periodic stoppages for PFC cleaning or replacement. Detailed consequences of non-resolution to specific issues in each of the above topics are known and should be discussed when specific tasks are discussed.

There was little dialog on charge question #4: “What issues should be resolved by a successful BP experiment?” and charge question #5: “What contributions can/should the U.S. fusion program make to resolve these issues?”, mainly due to the lack of time to debate the priority of specific issues. Instead the group focused on the final charge question #6: “How should the BPO be structured to best help the community make these contributions?” Two proposals for the boundary group structure within the BPO were discussed. The first proposal entailed a single group with three sub-groups for pedestal physics, SOL and divertor physics, and PFC/materials research. The over-arching goal of the main group would be for developing an integrated solution to the issues. The main objection to this proposal was possible isolation of the pedestal group from other BPO groups, e.g. the macroscopic stability and integrated scenarios groups. The second proposal entailed three high level groups instead of one: pedestal physics, SOL and divertor physics, and PFC/materials research. The main objection to this proposal was possible isolation of the three high level groups from each other, jeopardizing the development of integrated solutions for boundary physics issues. A hand vote showed that the second proposal was favored over the first by a majority of participants, but it should be noted that the shifting of opinions was evident during the discussion and voting.

The role of existing groups was also discussed with regard to charge question #6. In either proposed BPO structure, the pedestal physics group would have some relationship to the ITPA pedestal group, the SOL and divertor physics group would have some relationship to the ITPA SOL and divertor physics group, and the PFC/materials research group would have some relationship to the existing PFC program under the Virtual Laboratory for Technology (VLT). There was also discussion in using an expanded Edge Coordinating Committee (ECC) to manage the development of integrated solutions of boundary physics issues, to prevent isolation amongst the three groups or sub-groups. However, there was no agreement on this final point. In the end it was clear more time was needed to address both questions #2 and #6.