

Workshop Discussion Notes and Action Items

Disclaimer

This document is an informal record of comments made during general discussions that occurred during the workshop. They should not be considered as consensus views of the participants, nor are they to be taken as conclusions.

Workshop on MFE Roadmapping in the ITER Era
Princeton, NJ U.S.A.
7-10 September 2011



What are some critical questions coming from this workshop?

“Critical” means: important at a strategic level, technically based, controversial.

Examples:

- How essential is IFMIF, how urgent is it, what are short routes to accelerator neutron sources (de-scoped IFMIF, other options)
- What is the split of materials studies between IFMIF and a fusion nuclear science facility (FNSF)?
- What is the status of the steady state tokamak for DEMO? Is the pulsed tokamak, as a possible outcome, pessimistic or realistic for DEMO? What research can be done that can establish the basis for a steady state tokamak, or are the data really already available?
- How important is the stellarator option?
- How important is it to have a dedicated PMI facility?
- Some roadmaps have a fusion nuclear facility (FNF), in addition to ITER, prior to a full-scale DEMO. What are the pros/cons (technically, schedule-wise, cost-wise) of such a facility?
- Why so much variation in the timing of the next fusion nuclear facility (from ~2020 to ~2040)? Risk tolerance? Mission/scope? Availability of funds?
- Why so much variation in the size of tokamak Demo designs? (from ~5m to 9m or even larger)?

Discussion - 1

- Roles of FNSF and IFMIF:
 - Many different missions / definitions for FNSF (in U.S.). The different missions and their roles need to be clarified in order to compare with IFMIF.
 - FNSF/CTF is complementary to IFMIF
- Alternatives to IFMIF for mat'l. irradiation? What is the minimum we need? Must move forward with *something!!*
 - Data from IFMIF is data base for *full* characterization of materials. If we could focus on one material, it would narrow the requirements.
 - If we eliminate IFMIF, then what instead?
 - What is the dpa requirement for Demo? Is 50 dpa sufficient for Demo? Irradiation needs should be assessed based on Demo dpa, and Demo He appm per dpa requirements.
 - Intermediate irradiation facilities may be needed / useful for getting to Demo, even if we do ultimately need IFMIF for a power plant.
- Clarify the needs in PMI- what data do you need? Do you need a PMI facility?
 - How much can you get from separate facilities short of a PMI facility?
 - Single-effects → integrated. Need full range of facilities
 - Is PMI too narrow a focus? Plasma → PMI → PFC is what matters. Walls as well as divertor.
 - Can a simulator *really* simulate tokamak divertor effects / environment? Divertor simulator was considered for ITER during EDA.
 - How much can we get out of ITER? Do we have a plan to maximize what can learn from ITER? What are its limitations?
 - Need gap analysis, how much can be learned in existing devices?, what other device do we need?
 - Like IFMIF: what do you get from things short of PMIF? Ion beams, simulator, etc. From a PMIF *plus* smaller facilities? **International** group should discuss.
- Quoting Eisenhower- Roadmap *Planning* is essential– focus on the issues and the programs/facilities needed, keep plans up to date. Forget the one-slide “cartoon” roadmap.

Discussion - 2

- Fusion nuclear facilities: Cost, scope, schedule, and risk:
 - Failure tolerance goes down as cost goes up?
 - Need hard-nosed risk assessment. Agree with Najmabadi: small-scale things to inform risk assessment before big facility.
- What will ITER contribute to the roadmap? How can we make the most of it?
- What affects the variations among the different roadmaps in the timing of next FNF?
 - Variation in assumptions / optimism, e.g., current drive efficiency.
 - Plasma-technology interface gaps not getting evaluated. Germany study emphasizes closing these gaps.
 - Early FNF requires conservative choices.
 - Next-step schedule is partly influenced by politics. Can we really move forward without waiting for ITER results? Is it just a matter of money and risk tolerance?
 - JET & TFTR went ahead before data from predecessor machines were in. But complexities of MFE were not foreseen in TFTR design days.
 - Much R&D to do to prepare for an FNSF (Najmabadi argument)
 - Biggest factor / variability is the scope of the envisioned FNSF. Smaller scope could be done sooner? Phasing of the mission matters.
 - Can start with ~10-20 dpa data.
 - Observation (Prager): Diverse opinions on FNSF readiness. Need a collective study to converge on a common technical basis.

Next Steps, Internationally

- Joint work and a follow-up workshop(s) on the critical questions?
 - Some follow up work, electronic meetings, workshop, e.g. IFMIF, PMI. Demo R&D working groups
 - EFDA (Romanelli): will have a preliminary work plan, by end of 2012 and final view of Demo R&D priorities, by end 2013. – (Federici leadership). Need to follow this process then they can plan int'l collaborations. End of 2012: good time for a workshop?
- UK (Cowley): interest in CTF. Likes working groups idea from Prager. Readiness is a function of how we plan to operate the facility, e.g. bootstrap from stage to stage. Can apply to Demo also. Phasing of capabilities.
- R&D priorities depend on the missions. What issues get addressed in and for Demo? FNSF?

Action Items Coming From the Workshop

- From D. Maisonnier summary →→

Set up mechanisms / discussion fora for:

- ❖ Systems code benchmarking
- ❖ Materials development programme
- ❖ Review merits of non-nuclear facility (primarily for PMI) and of nuclear facility (primarily for FNST) for the development of fusion energy

Consider revising the format of the IAEA TM on First Generation Fusion Power Plants (every 2 years, last one in June this year).

Possible breakdown of sessions: Roadmapping, Next Step Facilities/DEMO, Power Plants.

- Inquire whether follow-up technical actions (e.g., see above) could/should be carried out under IAEA auspices. Contact R. Kamendje at IAEA. **H. Neilson**
- Consider licensing issues more strongly: interact with nuclear regulators, review ITER licensing process / materials. **Action (H. J. Kim):** provide link to relevant Korean licensing information.
- Collective discussions on readiness for next-step FNF (as suggested by Prager, Cowley). **Action: ?**
- Workshop organizing committee should review / clarify / expand the action list to ensure important next steps are identified. **Actions:**
 - Contact committee members to ascertain interest in continuing with further effort by existing members, with possible substitutions as appropriate. **H. Neilson**
 - Review workshop presentation, summaries, etc. to identify or clarify needed actions. –**Committee Members**
 - Assuming positive response, schedule a conference call in ~3 weeks' time to review progress and update the action plan. **H. Neilson**