FESAC Public Comment

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Feb 29, 2012

We are at a crossroads in the fusion program. The FES budget plan for FY2013 is a complete disaster. Pressure to increase funding for ITER construction, combined with a declining total budget, puts us firmly on the path to dismantling the domestic program, starting with the proposed shutdown of Alcator C-Mod, and accompanied by significant cuts to most other parts of the program.

Just a few among so many key C-Mod contributions: the discovery and elucidation of the physics of intrinsic rotation; understanding plasma-wall interactions with solid molybdenum and tungsten plasma-facing components with intense Radio Frequency heating; physics of Lower Hybrid Current Drive at reactor magnetic fields and plasma densities; intermittency in cross-field scrape-off-layer particle transport; and the first detailed experimental comparisons of particle transport with non-linear gyrokinetic modeling. We are constantly responding to urgent ITER research requests; two recent ones are tests of disruption mitigation using multiple toroidal massive gas puff locations, and the first real field tests of the proposed ITER grounding system.

C-Mod is the only world-class program to study interactions between the hot plasma and the surrounding walls under plasma conditions and power densities required for ITER and for proposed fusion reactors (Power per unit area = 1 MW/m^2). C-Mod is developing a promising new plasma regime, the I-mode, aimed at high-performance, steady-state plasmas without transient heat flux to the first wall. This is a possible solution to perhaps the most critical physics issue for ITER and reactors, having huge implications for the success and cost of ITER and for the ultimate development of fusion as an energy source. C-Mod is developing the science and innovation in technology for Radio-Frequency heating and current drive systems operating at the ITER magnetic field, plasma density and RF frequencies, all prototypical of a fusion reactor. C-Mod is about to implement the first hot tungsten divertor, recognized by both FESAC panels reporting at this meeting as a critical step on the path to the development of fusion energy. The Plasma Facing Component and RF research that would be done on C-Mod are required for design of a Fusion Nuclear Science Facility, a stated aim of FES.

In the last 2 years, more than 200 scientists and students from all over the US and around the world have participated in C-Mod experiments and utilized C-Mod data in their research. Abandoning Alcator would mean the loss of decades of accumulated expertise, and of an experimental facility worth approximately $200M.

Alcator is the largest single U.S. training facility for students in the field, with intimate ties to the academic departments at MIT, particularly Physics and Nuclear Science and Engineering; at any time, the lab is home to approximately thirty graduate students, who are integral to our research planning and operation, and 15-20 undergraduates who also participate in research

projects each year. Shutting down this laboratory would result in the loss of future generations of scientists - tomorrow's leaders in energy research.

Fusion Nuclear Science, now a stated priority of the US FES efforts, exists at a unique "intersection" of nuclear science & engineering, material science and plasma confinement physics. It will be necessary to develop a new generation of personnel conversant in all three of these areas, and represents a very large re-orientation in US fusion education. This workforce development is NOT OPTIONAL. We are faced with multiple realities: the roughly 2 decade timelines of ITER and FNSF, the aging demographics of the fusion community, and a particular dearth of US expertise in Fusion Nuclear Science. MIT is not the only University with a Nuclear Engineering Department working in fusion, and C-Mod is not the only US confinement device with ties to Nuclear Engineering, but the synergy at MIT is a powerful and precious resource. The strong C-Mod emphasis on boundary and material science, with high-Z metals, results in a majority of our NSE students working at the Fusion Nuclear Science "intersection".

The abrupt recommendation to close the C-Mod program comes in the absence of peer review, community input, or a FESAC plan. In the FY2012 funding legislation, Congress has mandated that DOE provide a ten year plan for the fusion program, including how ITER will be funded without destruction of the domestic program. The community has seen nothing of this plan, and to my knowledge, has so far been asked for no meaningful input for its development. The actions taken in the FY13 budget proposal indicate to me that there is currently no rational plan; if the proposals are implemented, we will be well along on the path of destroying the domestic program to pay for ITER construction.

I recommend the following. FESAC should immediately be given a charge by the Office of Science to examine options and plans for the next 10 years leading up to ITER operation. This charge should not prejudge options. The schedule for the FESAC study should be consistent with having input in a timely fashion, before the mandated report to Congress is due, and before irrevocable decisions are made concerning FY14 funding proposals. While this study is ongoing, there should be a moratorium on irreversible decisions concerning facility shutdown.