

Center for Extended MHD Modeling

Providence, Rhode Island

28-Oct-12

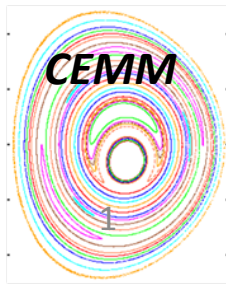
Westin Providence-RI Convention Center

Providence Ballroom I/IV

Status and Agenda

S. C. Jardin

PPPL



Award Letter: Nov 4, 2010

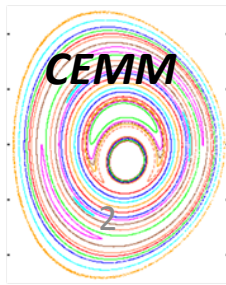
I am pleased to inform you that the five-year proposal entitled “Center for Extended Magnetohydrodynamic Modeling” you submitted to this solicitation, is one of five that have been recommended for funding. FES is planning to allocate \$1,050,000 of FY 2011 funds to continue your current project. Funding beyond the first year is contingent upon the availability of funds, progress of the research, and programmatic needs. Funding for the final two years is contingent upon satisfactory completion of a progress review during the third year of the project.

- FY 2011
- FY 2012
- FY 2013 --- started Oct 1, 2012
- FY 2014 } *satisfactory completion*
- FY 2015 } *of progress review*

Requested: \$ 1.20 M/yr

Awarded: \$ 1.05 M/yr

(87.5 %)



Proposed Work

4.1 ELMs and ELM Control using RMP (3 talks today)

- Linear RMP modeling has received high visibility.
 - Can we model a complete non-linear ELM cycle (with XGCO ?)
 - Can we reproduce $\gamma_{MHD} < \omega_* / 2$;
 - Particle transport in RMP fields

4.2 Disruption Studies and Mitigation

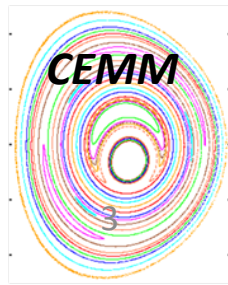
- Present modeling has high visibility (DIII, ITER, ITPA, Theory Milestone)
 - Wall force, boundary conditions, MGI, runaways, DIII-D, NSTX
 - Causes of disruptions?

4.3 Giant Sawteeth Studies

- Will this work continue? Should we shift focus to comparison of sawteeth in Ellipse and Bean

4.4 Resistive Wall Mode

- M3D-C1 ... longer term once kinetic terms are in place
- NIMROD ???



Proposed Work-2

4.5 Neoclassical tearing modes

- Work underway with both NIMROD and M3D-C1
- Two fluid tearing benchmark (NIMROD, M3D-C1, GEM?)

4.6 Error Fields and 3D Perturbations

- Error fields in the presence of plasma rotation

4.7 Model Development – continuum kinetic

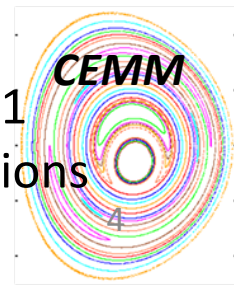
- Held, et al work on NIMROD (reported today)
- Lyons, Ramos, et al work in M3D-C1...plans reported today

4.8 Model Development – hybrid kinetic

- Drift-kinetic ion model (from M3D?) into M3D-C1?
- Lorentz ion model into NIMROD

4.9 Applied Math and CS

- M3D-C1 development (on schedule)
- Advanced algorithmic development in HiFi then ported to M3D-C1
- NIMROD algorithmic development and comparison of basis functions



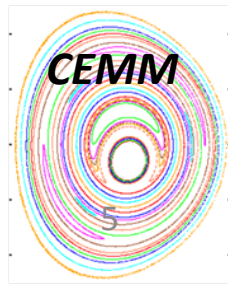
Verification and Validation Plans

Code Verification plans:

- Section 4.5: Compare bootstrap current predictions from NIMROD and NEO
 - Done. Will also include M3D-C1
- Section 4.5: Two-fluid tearing mode benchmark
 - M3D-C1 to do NIMROD Ahedo and Ramos benchmark
- Section 4.6: NIMROD/M3D –C1 comparison of effects of error fields with rotation
 - New benchmark case? Waelbrock interested.
- Section 4.8: Expand the two-fluid tearing mode benchmark to include GEM
 - Scott Parker, et al

Validation with Experimental Data as discussed in Proposal:

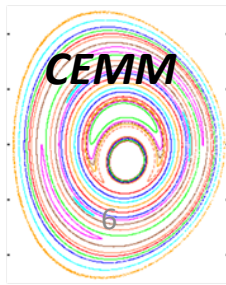
- Section 4.1: ELM modeling in DIII-D, NSTX, and Alcator C-mod
- Section 4.2: Comparison of disruption halo current predicted with NSTX data
- Section 4.2: Comparison of Runaway Electron calculations with CMOD and DIII-D
- Section 4.3: Comparison of Giant Sawtooth simulations with DIII-D
 - Extend this to include simulation of sawteeth in Beans/Ellipses with M3D-C1 ?
- Section 4.4: Comparison of kinetic resistive wall mode with NSTX and DIII-D
 - Could follow from Ramos/Lyons work



Progress Reports are Due

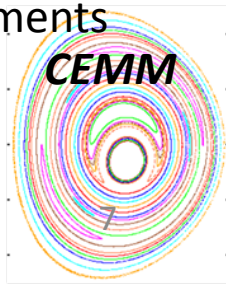
John Mandrekas reminds us that Progress Reports for non-Lab PI's are due:

November 16th



Today's Agenda

- Glasser: Use of M3D-C1 velocity representation in HIFI
- J. King: Modeling of EHO on DIII-D
- P. Zhu: Plasma response to RMP in unstable pedestal
- Ferraro : RMP modeling
- Callen, Smith: Modeling of RMP flutter-induced transport in DIII-D
- J. Cheng: Hybrid simulation of multiple islands in magnetic reconnection
- Sovinec: Summary of NIMROD applications
- Sugiyama: MHD and compressibility: Sawteeth and snakes
- Jardin: M3D-C1 Sawtooth modeling and plans
- Ramos: Kinetic-MHD and its quasineutrality condition(as special limit test)
- Held: Drift kinetic bulk ions and hot particles in NIMROD
- Lyons: Plans for Coupled kinetic and MHD
- Jenkins: Simulations of ECCD-induced tearing mode stabilization.
- Callen, et al: Discussion of kinetic closures for MHD codes
- Paccagnella: M3D simulations of disruptions and comparison with experiments
- Strauss: Plasma disruption modeling



IAEA/APS ScoreCard

- M3D (2)
 - Strauss, Pankin
- M3D-C1 (2)
 - Ferraro, Jardin
- NIMROD (7)
 - Sarff, Shumlak, Zhu, Kruger, Izzo, Jarboe, Sovinec

APS word search: M3D/M3D-C1-18, NIMROD-28

