# M3D-C1 ZOOM Meeting 10/05/2020 Agenda

### 1. CS Issues

- 1. GPU solve status... Chen and LBL
- 2. Local systems
- 3. Other systems
- 4. NERSC Time
- 5. Changes to github master since last meeting
- 6. Restarting with a different number of planes...Lyons
- 2. Physics Studies
  - 1. Status of first coupled M3D-C1/LP Simulation .. Lyons
  - 2. NSTX shot 134020
  - 3. New Results from Chen on Runaways with Sources

### **GPU solve status**

Cori-GPU has been unavailable all week

Any update on traverse?

Did Chang get an account on Tulip?

LBL Report ?

# Local Systems

- PPPL centos7(10/05)
  - 5 regression tests PASSED on centos7:
  - "adapt" failed due to "corrupted double-linked list"
  - All tests pass using Sept30 centos7 (S. Seol)
- PPPL greene (10/05)
  - 4 regression tests PASSED
  - "adapt" failed due to "corrupted double linked list"
  - All 5 tests pass using Sept30 centos7 (S. Seol)
  - No batch file found for pellet
  - 10/1: Yao reports long jobs often fail on greene. Try /pfs/nobackup?
- EDDY (10/05)
  - All 6 regression tests PASSED on eddy
  - problem with trace program?
- TRAVERSE(10/05)
  - Code compiles
  - Regression test failed: split\_smb not found in PATH
  - SuperLU\_dist failure resolved?

# **Other Systems**

- Cori-KNL (09/23)
  - 6 regression tests passed on KNL
  - Presently has disk problems
- Cori-Haswell j(09/23)
  - 5 regression tests passed
  - KPRAD\_RESTART did not pass, but differences are very small in velocity variables. All magnetic and thermal good. Similar difference as Cori-KNL
  - Presently has disk problems
- PERSEUS
  - All 6 regression tests PASSED on perseus (J. Chen, 9/04/20)
- MARCONI
  - All regression tests PASSED on MARCONI (J. Chen, 9/04/20)
- CORI GPU
  - Unavailable ??

# **NERSC Time (unchanged)**



#### mp288

m3163

Closed for general use

- Should be enough mp288 time to last until new PU/PPPL computer arrives in fall – red line is linear usage until Nov 1
- John Mandrakes (DOE) has 45M hours to distribute, but got requests for 3x that. Has not yet decided. We can expect ~ 5 M hours.

# **Changes to github master since last meeting**

- B. Lyons
  - 09/28/20: Prevent pellet deposition once fully ablated
- S. Jardin
  - 9/29/20: Corrected f in derived quantities for eqsubtract .eq. 0

# Jump in KE when restarting with increased planes

Brendan to show some slides how there is a glitch in the kinetic energy when he restarts with additonal planes.

Status?

# Status of First Coupled M3D-C1 / LP Simulation

#### Iterate independent simulations of MHD and LP codes

- Run pellet injection in MHD code with analytic, Parks ablation formula
- Send plasma states along pellet path to LP code to compute ablation rate at each point
- Rerun MHD codes with LP ablation rates
- Iterate between codes until convergence

#### Test case for DIII-D modeling

- 1 mm Ne pellet using extruder parameters
- 160606, standard case for SPI modeling
- 171322, super-H target for upcoming small-pellet ablation experiment
- Latter will be used for predict-first of experiment

8/10/20 – proposed 9/16/20 – Roman requested status

### DIII-D 171322 @ 2730 ms



### NSTX shot 134020

# Fast ion transport with coupled kink and tearing modes J. Yang, C. Liu



q-profile as calculated from M3D-C1 does not agree with that from geqdsk at the origin!



# NSTX shot 134020 (cont)

Fast ion transport with coupled kink and tearing modes

- J. Yang, C. Liu
- Plasma limited by mesh boundary!
- Mid-plane current density very jagged



# NSTX shot 134020 (cont)

Fast ion transport with coupled kink and tearing modes

J. Yang, C. Liu



Central value of q depends on limiter position. This geqdsk had a left boundary of 0.185 instead of 0.01 as in earlier geqdsk files. Also, mesh needs to be extended.

# **Runaways with Sources**

Chen to present

# That's All I have

Anything Else ?

# **RE Fluid Modeling of DIII-D shot 177040**

Carlos Paz-Soldan email 9/14/20

- 1) Dependence of RE current carriers (or not) on saturated mode amplitude (dB/B)?
- 2) Dependence of saturated dB/B on absolute B&I (fixed a, all q=2). —> ITER extrapolation
- 3) Dependence of saturated dB/B on absolute I (fixed B, smaller a, all q=2).





### **Dependence of Growth Rate on Plasma and Vacuum resistivity**





## **Growth Rate vs q(a)**



Batemanscale modifies F(1) but keeps p' and FF' fixed.

We should ask MARS to make a similar plot.

### 9/18/20 Chen Zhao: Shot 177040 with RE









### With ExB drift terms removed



## DIII-D Shot 177053 (with RE sources) – Chen Zhao



Code changes now committed to GIT NEXT Steps:

- 1. Study of sensitivity to  $\kappa_{\perp}$ ?
- 2. Comparison with shot results
- 3. Presentation at DIII-D disruption meeting

# 177053 Exp. Traces (Lyons 06/08/20)



# Test of Boozer Theory for Cold VDE (Clauser)

- Boozer's analytic theory that if ITER suffers a disruption on the mid-plane, such that the current decreases to I = 0.83 I<sub>0</sub>, vertical stability will be lost, even for an ideally conducting wall.
- Cesar has tried to verify this, and finds the plasma is still VDE stable with I =  $0.3 I_0$
- Difference is likely the wall model, Cesar to confirm.



Boozer, "Halo currents and vertical displacements after ITER disruptions", Phys. Plasmas 26, 114501 (2019)

# **DIII-D Neon pellet mitigation simulation (for KORC)**



/global/cscratch1/sd/blyons/C1\_33984065



### **Mid-plane Electron Temperature and Electric Field**



## **Magnetic Surface Breakup**



## **Partial Surfaces Reforming**



### 32 plane rerun now in progress



8 planes

32 planes

# 32 plane case crashed with negative density



Near the end, dt > dx / V in the toroidal direction, which can lead to oscillations. Recommendations: (1) iupstream=1, (2) smaller dt, (3) increase hyperv, (4) increase denm

# **Energy conservation**

6% error does not depend on:

- dt=0.5, 1.0, 2.0
- inocurrent\_pol=0,1
- inocurrent\_tor=0,1
- Itemp = 0.1
- jadv = 0,1
- etar = 1.e-7, 1.e-9
- idens = 0,1
- Now checking dependence on magnetic boundary conditions and form of Poyting Flux divergence: ∇•(E×B)