M3D-C1 ZOOM Meeting

8/03/2020

Agenda

1. Announcements
2. CS Issues
    1. LBL Report
    2. Local systems
    3. SciDAC-4 29 July 2020 Summary
    4. NERSC Time
    5. Changes to github master since last meeting
    6. Errors along MPI boundaries with gmres-update
3. Physics Studies
    1. RE Fluid Modeling of DIII-D Experiments
    2. Evolution of q(a) during a current quench
    3. Runaways with sources
    4. M3D-C1 coupling to RE code KORC:
    5. Consistent use of eta_te_offset
    6. Other

Announcements

- Laboratory closed unless authorized
  - Once authorized, need to get single access code at http://rtw-screen.pppl.gov
- Pellet Ablation Code Camp Aug 3-6 (Brendan Lyons)
  - Coupling of local LP code to M3D-C1/NIMROD
- JPP Colloquium Wed Aug 5 11:00 AM ET
  - C . Collins: Understanding & Controlling Transport of Fast Ions by Alfven Eigenmodes in Tokamaks
- NERSC Users Group Meeting August 17, 2020
  - Registration Required
  - Possibility of presenting 10 min talk
- ITPA MHD Meeting October 14-16 2020
  - Fully Remote
- IAEA Fusion Energy Conference postponed to May 2021

LBL Report

- Focus on GPUs?

Local Systems

- PPPL
  - Should compile on centos7 node (sunfire15, sunfire14,…)
  - Meshing utilities at: /p/swim/jchen/PETSC/core/build/bin
    - create.smb
    - collapse
    - split_smb
    - make_model
  - partition=m3dc1 (greene large mem) now works (with centos7)
  - Regression tests PASSED on both greene and centos7
    - Use SuperLU_dist for real 2D and 3D, mumps for linear 2D (complex)
  - Simmetrix m3dc1_meshgen NOT available on centos7
    - Use old system on portal until centos7 version available
    - Seegyoung is working on this and the associated documentation

- EDDY
  - All 6 regression tests PASSED this morning

SciDAC-4 Description of Upcoming Systems

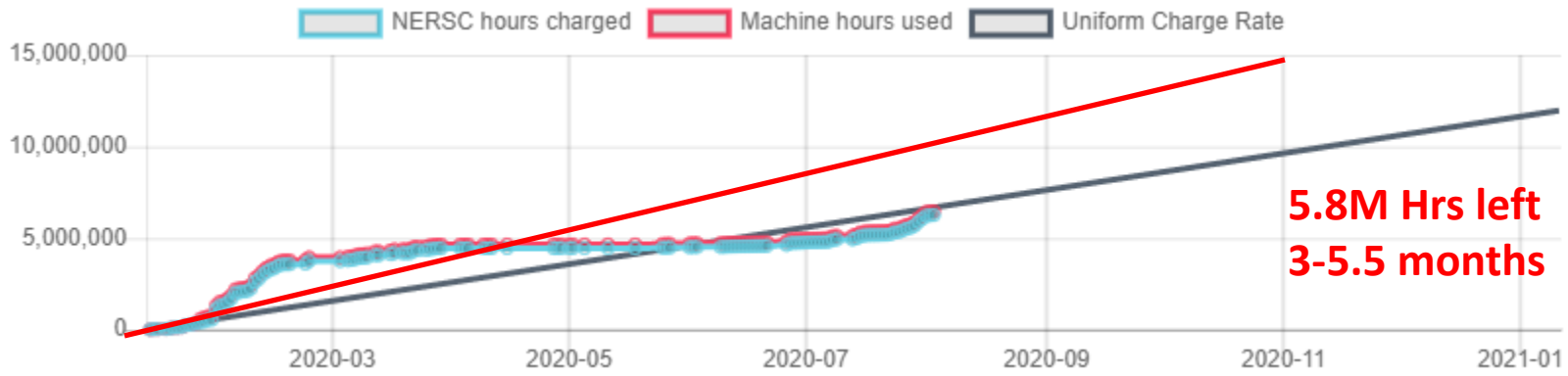
- Barbara Chapman/BNL
- Jack Deslippe/NERSC (Perlmutter, 3-4 time Cori)
- Bronson Messer/OLCF (ORNL, Summit 0.2 EF)
- Scott Parker/ALCF (Argonne, Aurora > 1 EF)
- Christan Trott/SNL

All systems will obtain performance via GPUs

- Started a discussion with Todd Munson (ANL) about sparse matrix solves on GPUs
  - He brought in Richard Mills and Barry Smith
  - They have requested output from a run with the –log_view option
  - Jin Chen to follow up

NERSC Time

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
- Please use time sparelingly !

Changes to github master since last week

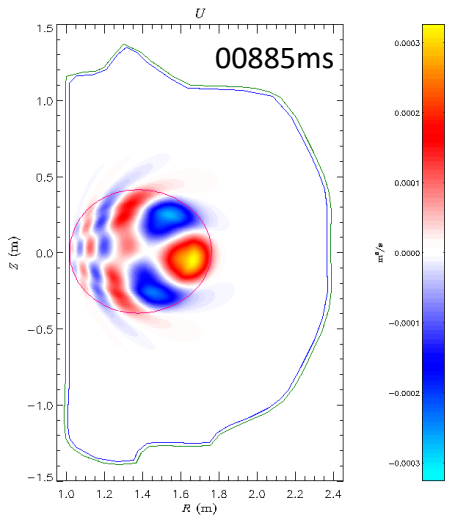
- N. Ferraro:
  - 07/31—Changed regtest/pellet to use superlu_dist on cori and cori_knl
  - 07/29—Changed batchjog.greene in KPRAD_2D, KPRAD_restart, and RMP_nonlin to use superlu; Replaced –np with –n in mpiexec line for regtest/RMP/batchjob.greene for compativility with srun; Updated write_neo_input.pro and plot_perturbed_surface.pro to take psi_norm as input instead of q; Change to flux_at_q.pro to respect /unique keyword when reading multiple files;
  - Added iread_planes option to read positions of toroidal planes from plane_positions file; Updated coding for q_contour keyword in plot_field.pro to work with updated flux_at_q.pro; Fixed typo in output of flux_at_q.pro; Fixed .gitignore to ignore results of regtests runs
  - 07/27—Updated flux_at_q to handle cases where there are multiple surfaces with a given q
- Lyons
  - 07/29– Fix flux_heat diagnostic for kappai_fac .ne. 1
- J.Chen
  - 07/29-- Stop diverged solves; run time solver option fixes
- S. Jardin
  - 07/16 – added ikprad_te_offset to apply eta_te_offset to kprad and pellet ablation

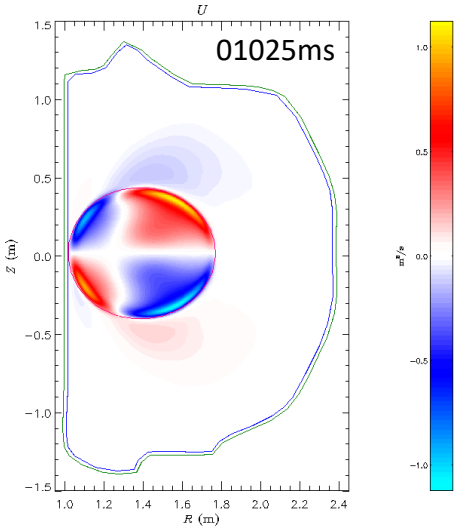
Problem when nblocks_bjacobi .ne. nplanes

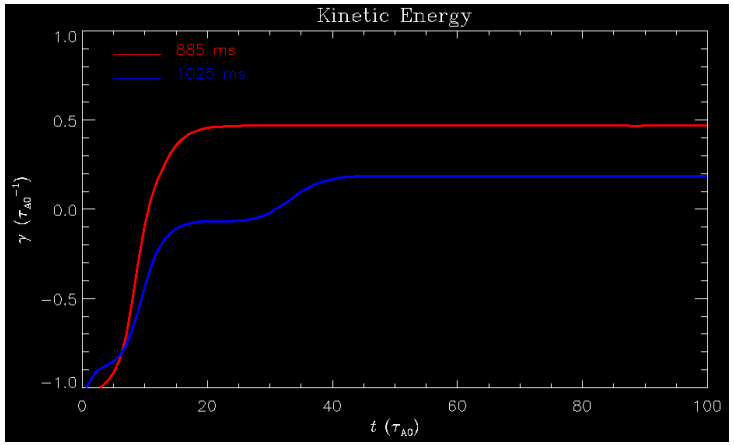
- This cannot be automated as PETSc reads options file before C1input is read in.
- However, Jin Chen put in a check and the code will print an error and end if they are not equal

RE Fluid Modeling of DIII-D Experiments

- Carlos Paz-Soldan and Yueqiang Liu (GA) are interested in having M3D-C1 perform some nonlinear runs on shots where kink-modes de-confined Res
- Brendan Lyons suggested shot 177040. These have been looked at by Liu with the (linear) MARS code
- ZOOM call held Tuesday July 28 @ 1:00 PM ET
  - Chang Liu, Chen Zhao, Steve Jardin, Yueqiang Liu, Carlos Paz-Soldan
- Brendan sent around initial free-boundary equilibrium & results:







- Chang Liu to compare with MARS results, extend to non-linear

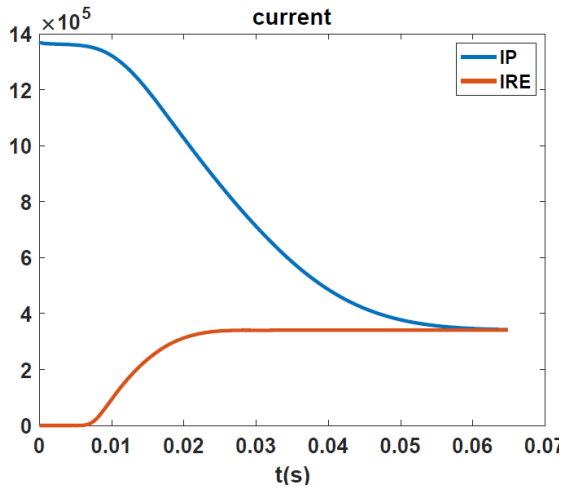
Evolution of q(a) during current quench

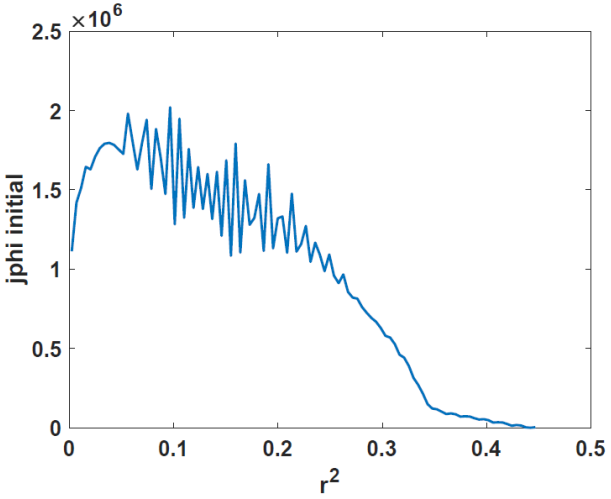
- Boozer, “Halo currents and vertical displacements after ITER disruptions”, Phys. Plasmas 26, 114501 (2019) makes some predictions regarding ZMAG(t) and qa(t) after a partial current quench

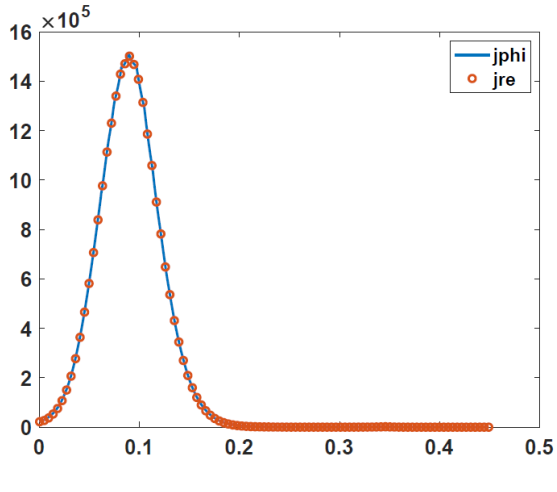
- It would be relatively straightforward to compare this with what Cesar finds in his M3D-C1 simulations…including the effect of halo currents which were not considered in the article.

- I encourage Cesar to write a short paper doing this.

Runaways with Sources



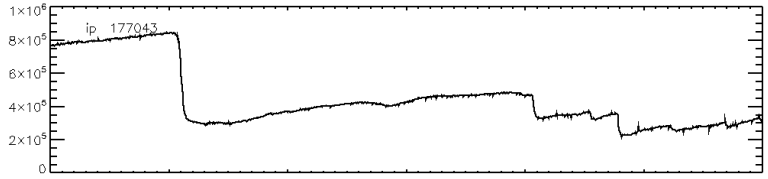




- 1D (MATLAB) calculation starting from 2D Equilibrium IDL printout
- Why is initial JPHI so noisy?
- How does this differ from full 2D calculation?

M3D-C1 coupling to RE code KORC

- Plan to target DIII-D shot 177053 after Chen has a full simulation with fluid runaway electrons



- KORC can now run using fields, densities, and temperatures from M3D-C1 hdf5 files using Nate's Fusion-IO routines

- Cesar's cases are not yet showing strong electric fields and current quench
  - ➔ no runaway formation

- Does Brendan have a DIII-D pellet injection case that has thermal and current quench?
  - Suitable for coupling to KORC ?

Consistent use of eta_te_offset

- We introduced eta_te_offset for the VDE calculations so we could obtain a large open-field-line resistivity without having the temperature (and pressure) go negative.

$$\eta(T_e) = \eta_0 \times \left(\frac{T_e - \text{eta\_te\_offset}}{T_0} \right)^{-3/2}$$

- New INPUT variable, **ikprad_te_offset.** Default 0. If equal to 1, eta_te_offset will be used in radiation and ablation routines

subroutine kprad_ionize

te = tet79(:,OP_1) – eta_te_offset

subroutine calculate_scalars

pet79(:,OP_1)/net79(:,OP_1)
- eta_te_offset

That’s All I have

Anything Else ?