M3D-C1 ZOOM Meeting

7/27/2020

Agenda

1. Announcements
2. CS Issues
    1. Local systems
    2. New system benchmark status – (Jin Chen ?)
    3. NERSC Time
    4. Changes to github master since last meeting
    5. 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
- IAEA Technical Meeting on Disruptions and their mitigation
  - Completed. Excellent M3D-C1 representation
- W. Fox Proposal in "Frontier Plasma Science" accepted
  - Examine sawtooth oscillations in DIII-D with new BES diagnostics
  - Compare with M3D-C1 simulations
- JPP Seminar by S. Cowley on Wed July 29 11:00 AM
  - "Plasma equilibrium, the energy landscape and explosive ballooning instabilities"
    - May be some opportunities to perform nonlinear MHD simulations to compare with analytic theory
- SciDAC-4 PI Virtual Meeting Wed July 29 1:00-4:00
- ITPA MHD Meeting October 14-16 2020
  - Fully Remote
- IAEA Fusion Energy Conference postponed to May 2021

Local Systems

- PPPL
  - Should compile on centos7 node (sunfire15, sunfire14,…)
  - All 6 regressions tests PASSED on partition=centos7
  - Partition=m3dc1 (now centos7) gives “segmentation fault”
    - Prentice investigating
    - Nate found “workaround” by rebuilding with INTEL MPI. Can this be made available to others?

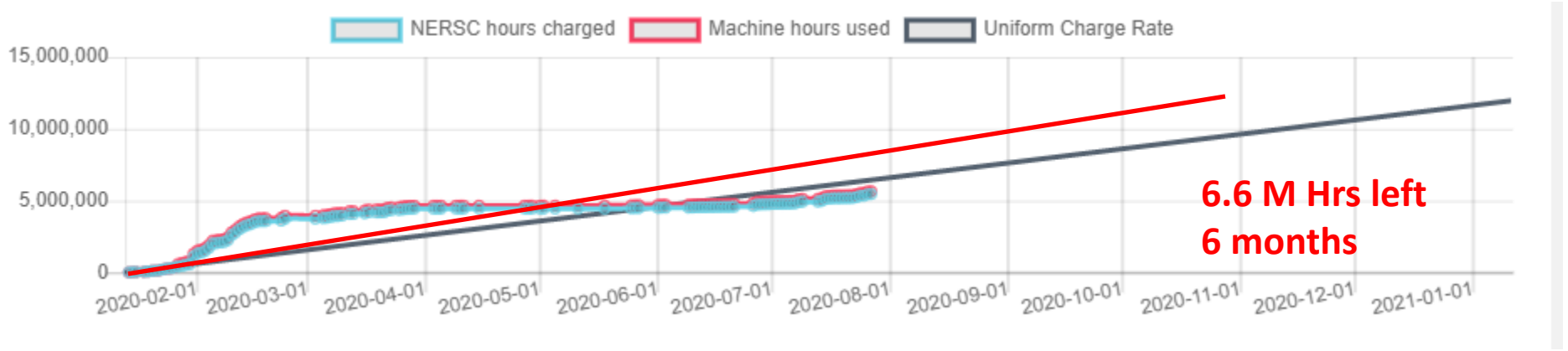
- EDDY
  - All 6 regression tests PASSED this morning

New system benchmark status

Jin Chen ?

NERSC Time

mp288



m3163

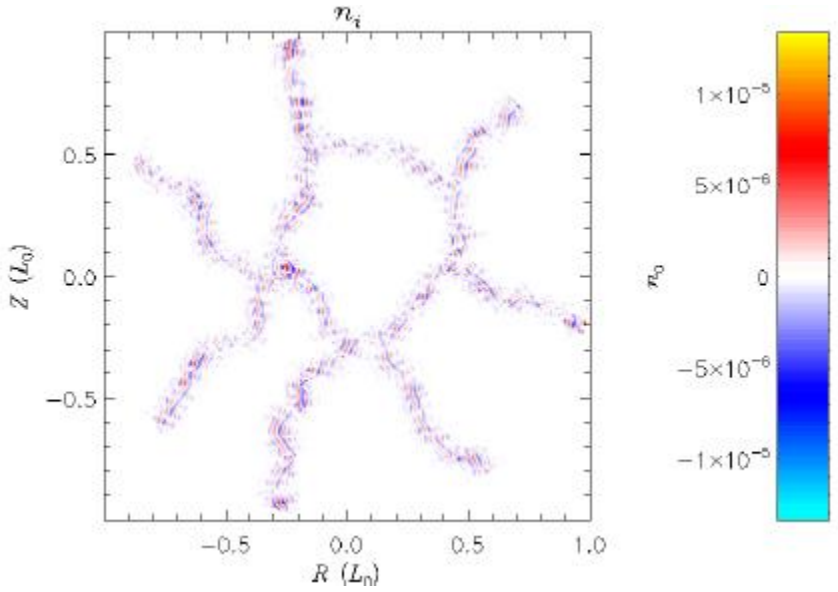
Closed for general use

- 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

- Ferraro:
  - 07/20/20:
    - Updated C1ke for adapt regtest
    - Added batch script for eddy in adapt regtest
    - Reordered regtest/CHANGELOG so newest changes are on top
  - 07/22/20
    - Bugfixes to cole_ntv field in read_field.pro
    - Added r0 parameter in flux_average_field.pro (this was apparently inadvertently removed a while ago)
    - Added “smooth” parameter to write_neo_input.pro

Errors along MPI boundaries with gmres-update



- **Problem solved**.
- Yao had mistakenly set pc_bjacobi_blocks = #MPI processes (64) instead of nplanes (8) so he had 8 SuperLU_dist solvers per plane, thus the 8 domains
- This is a common mistake. Should we automate it?

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
- Tentatively scheduled ZOOM call for Tuesday July 28 @ 1:00 PM ET
  - Chang Liu
  - Chen Zhao
  - Brendan Lyons (yes)
  - Steve Jardin
  - Nate Ferraro
  - Yueqiang Liu (yes)
  - Carlos Paz-Soldan (did he respond?)
- Zoom setup?

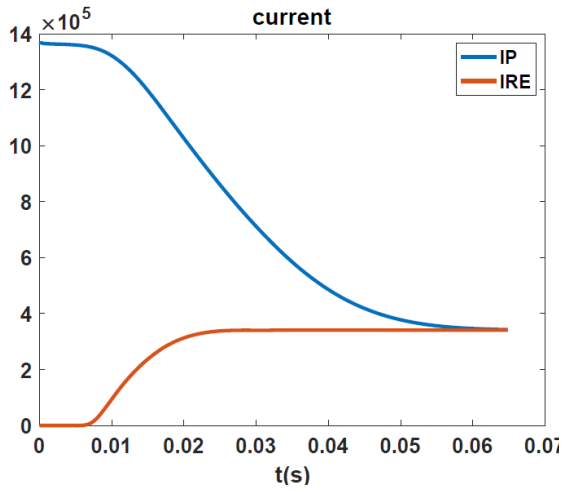
Evolution of q(a) during current quench

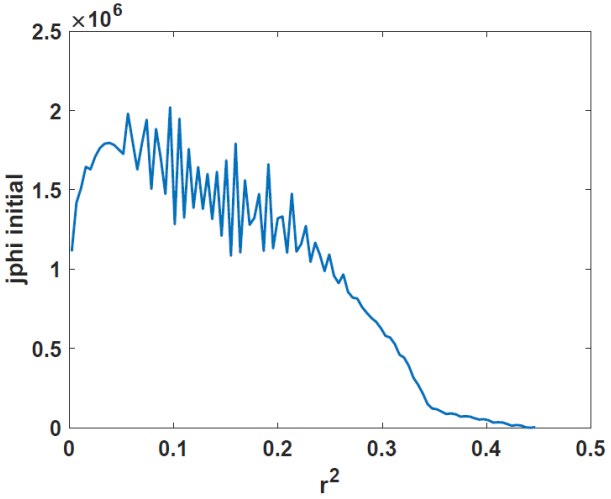
- Boozer, “Halo currents and vertical displacements after ITER disruptions”, Phys. Plasmas 26, 114501 (2019) makes some predictions regarding ZMAG(t) and qa(t) after a partial current quench

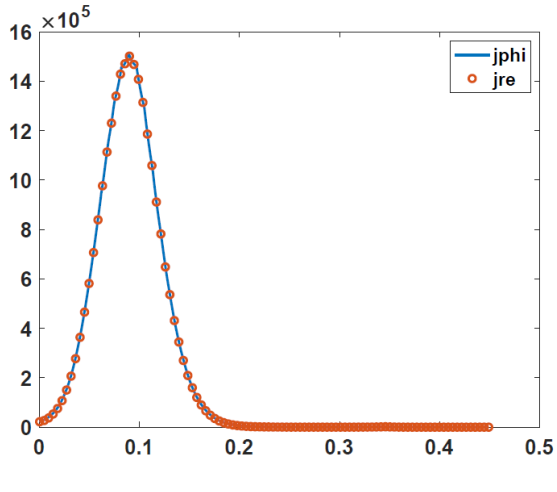
- It would be relatively straightforward to compare this with what Cesar finds in his M3D-C1 simulations…including the effect of halo currents which were not considered in the article.

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

Runaways with Sources



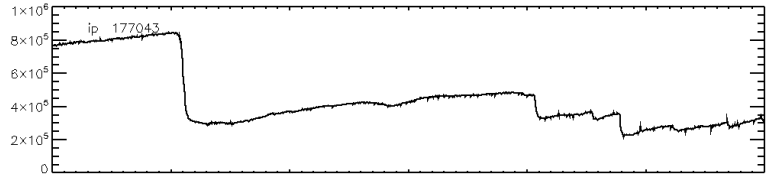




- 1D (MATLAB) calculation starting from 2D Equilibrium IDL printout
- Why is initial JPHI so noisy?
- How does this differ from full 2D calculation?

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.

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

- This is presently used just for the resistivity calculation, but not in the pellet ablation or radiation routines

- Should we modify those routines to treat the electron temperature as (Te – eta_te_offset) rather than Te ??

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 ?