M3D-C1 ZOOM Meeting

6/22/2020

Agenda

1. Announcements
2. CS Issues
    1. Local installations
    2. Test of pskip and nskip
    3. NERSC Time
    4. Changes to GIT master since last meeting
3. Physics Studies
    1. New Toroidal Current plot at different toroidal planes
    2. Lyons DIII-D case led to a bug fix
    3. ITER VDE with new structure
    4. Chang Liu –New Structure Preserving Algorithm based on Slow Manifold
    5. Runaways with sources
    6. M3D-C1 coupling to KORC
    7. Other

Announcements

- Laboratory closed except for Advance Team Site Preparations
- No more partition=greene at PPPL
  - Instead use #SLURM –partition=m3dc1 (job will run on greene, 8 GB/core)
- APS-DPP Meeting is All Virtual: November 9-13, 2020
  - Deadline for Contributed papers is June 29 (Week from today)
- IAEA Technical Meeting on Disruptions and their mitigation
  - Will be held remotely 20-23 July
  - Talks are to be pre-recorded by July 13: (4:3) or (16:9) invited 25 min
- SciDAC PI meeting scheduled for July 28-30 July 2020 is *cancelled*
  - Replaced by a half-day remote panel session on July 29
- ITPA MHD Meeting at IO October 14-16 2020
  - Open to Remote Participation
- IAEA Fusion Energy Conference postponed to May 2021

Local Installations

- CENT_OS-7 on greene
  - Prentice requested we move to OS-7 on greene
  - All regressions tests passed
  - I tested a longer complex case and it passed
  - Any objections?

- Dawson (or general)
  - Still a hdf5 problem with regression tests
  - They also fail on greene
  - Should we send in a ticket to the pppl help?

Test of pskip and nskip

I did some tests with nskip. Here is an example you gave me before. I put the simulation paths in eddy:

nskip=5:/scratch/gpfs/liuchang/STing2
nskip=1:/scratch/gpfs/liuchang/STing2_test
We can see that the two simulations agrees pretty well in the linear phase. The nskip=5 case runs much faster.

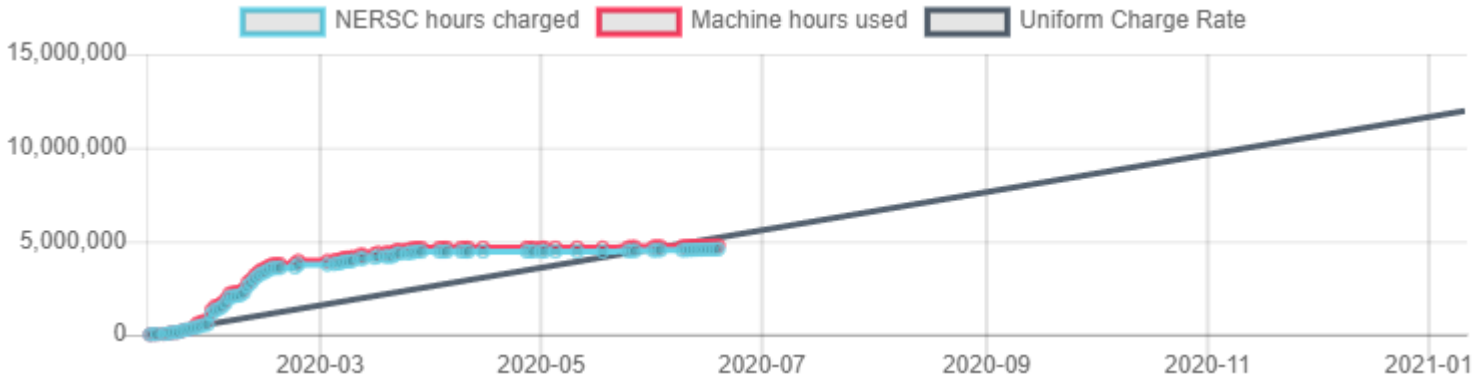
Note that here I set eqsubtract=1, but for eqsubtract=0 it also works. However, if I set up a current or density control scheme, then the simulation with nskip>1 will get a diverge in the solving process very quickly.

I think we need to do some more work on the control procedure. Anyway, I think we should not remove it from the work.

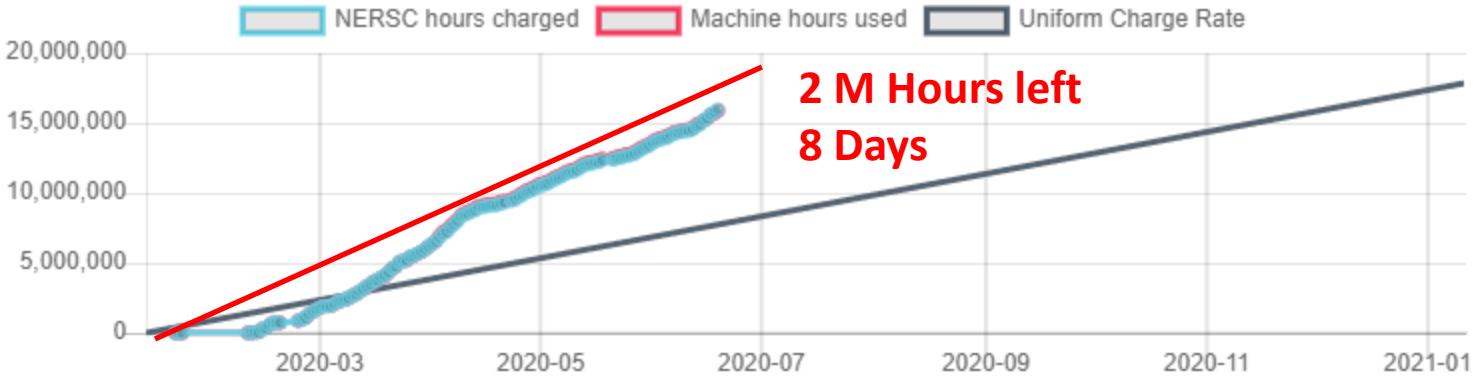
Chang Liu email June 18

NERSC

MP288



M3163



mp288. now consistent with linear usage rate

M3163 to expire in 8 days: 2M HRS remaining

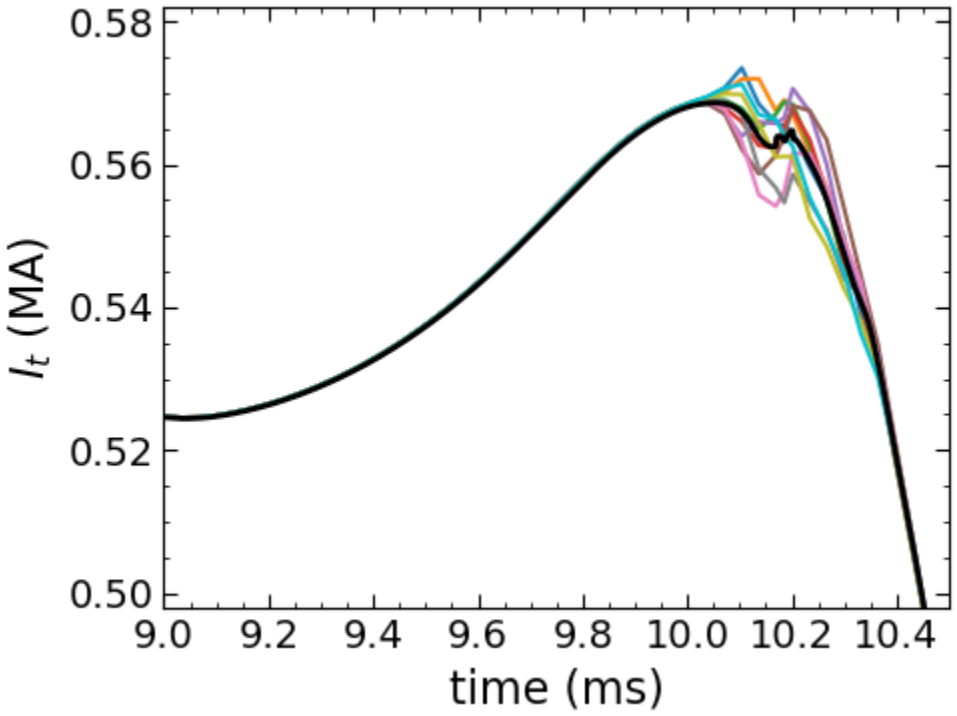
(clauser, kleiner, lyons, strauss)

Changes to github master since last week

- Chen: ported to cent OS7
  - Added regressions tests and readme file
- Clauser:
  - Some IDL field improvements
  - Bug fix for E_par in 3D
- Seegyoung
  - Updated makefile and readme for SDUMONT
- Jardin
  - KPRAD change to be discussed later

Documented changes in NEWDOC-latest: m3dc1.pppl.gov

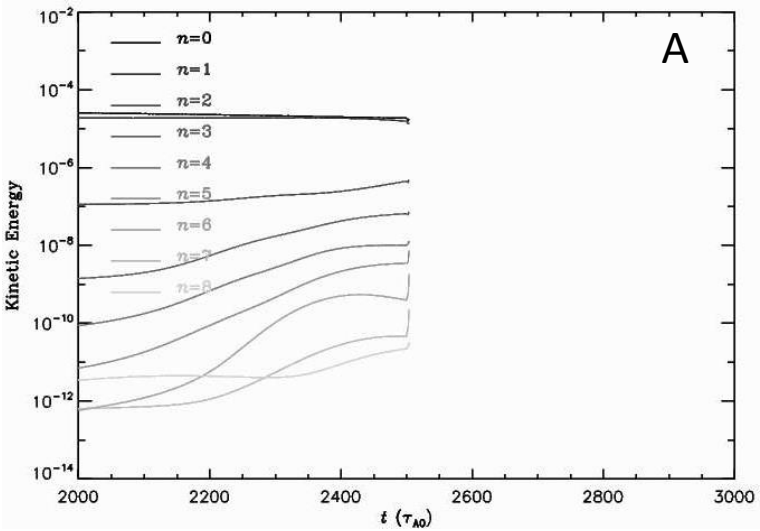
New Toroidal Current plot

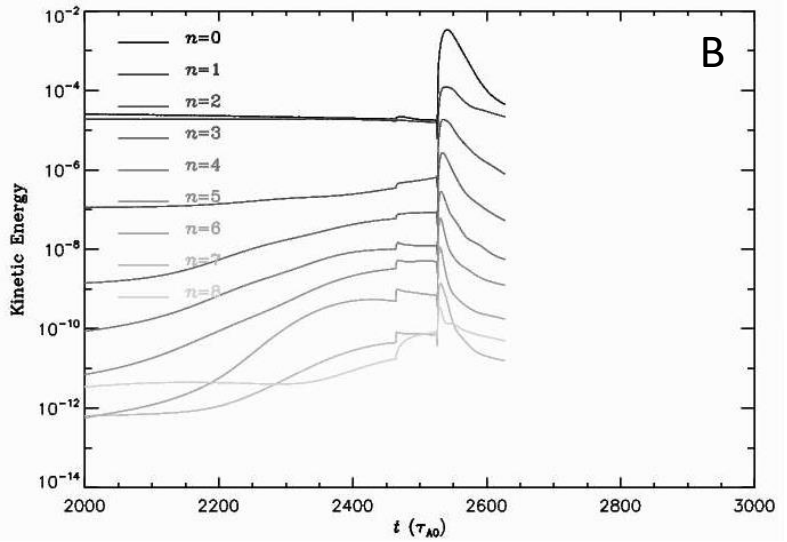


Cesar Clauser: Toroidal current at different toroidal angles for 3D VDE benchmark problem

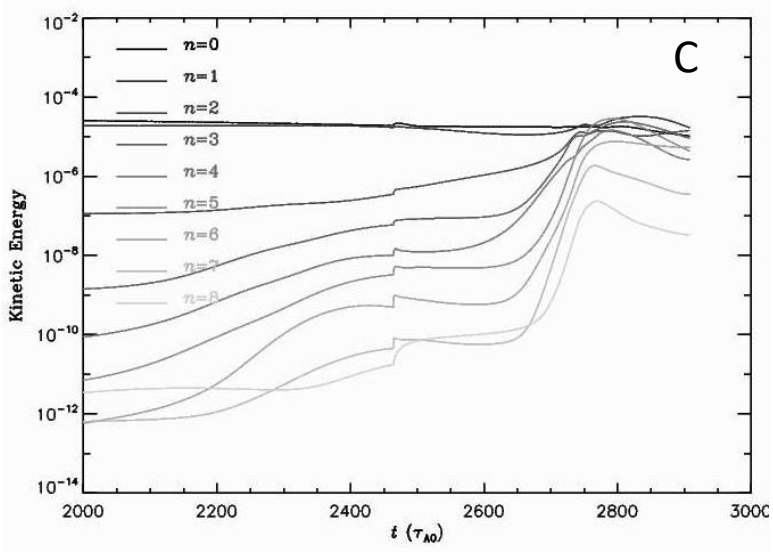
Lyons: DIII-D Case C1_28868

(crashes in KPRAD)





A. dt=1, hyperi=hyperv=1.e-9
B. Same as A, but start from earlier time
C. Same as B, but with code fix
   A. (next slide)

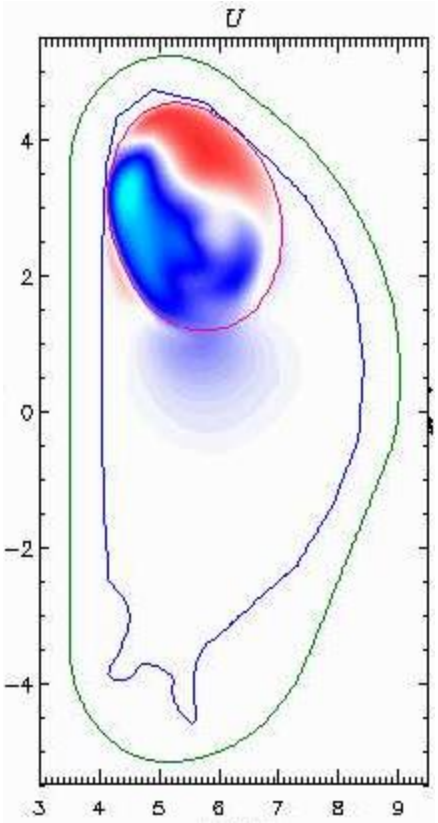


Code fix for KPRAD bug

```
      ! Line Radiation (0 if not advancing KPRAD at that point)
      temp79b = merge(dw_rad(:,kprad_z), 0., advance_kprad) / dti
      where(temp79b.ne.temp79b) temp79b = 0.
!Check for and delete spurius values   (scj 6/21/20)
      do i=1,MAX_PTS
         if(abs(temp79b(i)) .gt. 1.e0) then
           temp79b(i) = 0.
         endif
      enddo
!
      dofs = intx2(mu79(:,:,OP_1),temp79b)
      call vector_insert_block(kprad_rad%vec, itri,1,dofs,VEC_ADD)
```

Without this fix, there were isolated very large values of kprad_rad, causing spikes in pressure and magnetic field, causing the solves not to converge. Spikes could be 10^10 or 10^20 when the normal values were 10^-3 to 10^-8.

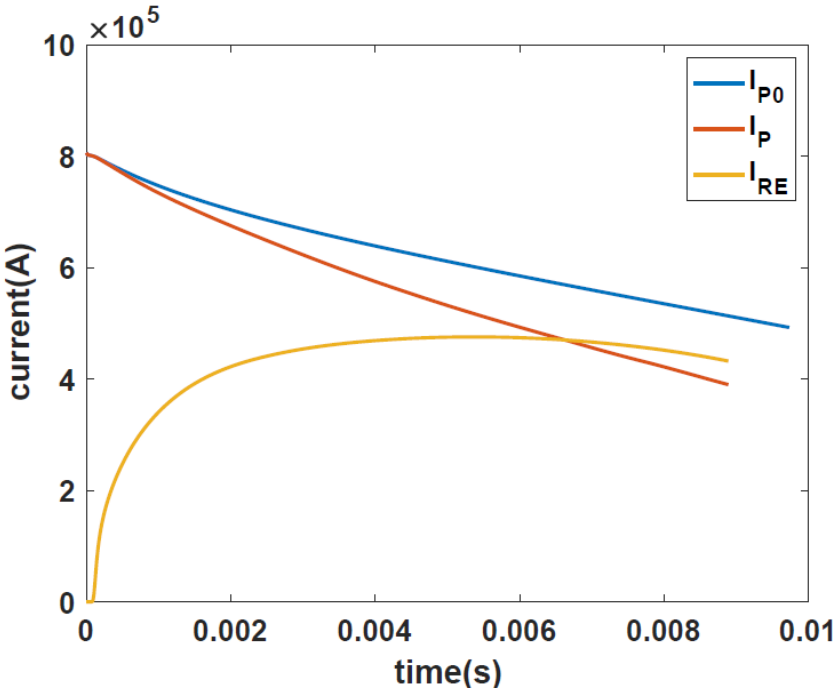
ITER VDE with new structure



New Structure Preserving Algorithm based on Slow Manifold

Chang Liu to present

Runaways with Sources

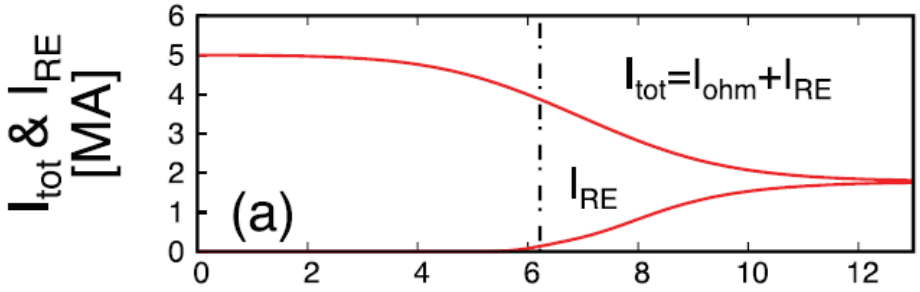


Chen: June 9, 2020

Nucl. Fusion **57** (2017) 066038 https://doi.org

Reduced fluid simulation of runaway electron generation in the presence of resistive kink modes

A. Matsuyama[a], N. Aiba and M. Yagi

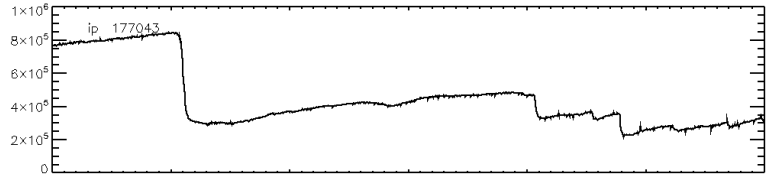


$$\frac{\partial n_{\mathrm{RE}}}{\partial t} + (v_{\mathrm{RE}}\mathbf{b} + \mathbf{u}) \cdot \nabla n_{\mathrm{RE}} = S_{\mathrm{Dreicer}} + S_{\mathrm{avalanche}},$$

$$E = \eta(J - en_{\mathrm{RE}}c),$$

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

- ZOOM call held on Thursday June 18
  - Matt Beidler was able to login to portal and transfer Cesar's NSTX-U files to NERSC
  - However, these C-pellet runs do not generate large electric fields and so there is no point in running them with KORC
  - Cesar will do some 2D runs with varying background Carbon to see what impurity level is needed to produce strong thermal and current quench

That’s All I have

Anything Else ?