M3D-C1 ZOOM Meeting

10/04/2021

Announcements

CS Issues

1. Questions for LBL group
2. NERSC Time
3. Changes to github master since last meeting
4. Regression tests
5. Update to adapt_by_field   -- Morteza

Physics Studies

1. New code version became unstable on some problems
2. Test of ikapparfunc=1 ..Hank Strauss
3. Planning for next 5 years

Note: meeting minutes posted on m3dc1.pppl.gov

In attendance

Steve Jardin	Mark Shephard	Sam Williams
Adelle Wright	Seegyoung Seol	Sherry Li
Jin Chen	Usman Riaz	Nan Ding
Andreas Kleiner	Morteza Siboni	Yang Liu
Nate Ferraro		
Chen Zhao		
Brendan Lyons		
Chang Liu		
Hank Strauss		

Announcements

- ITPA Meeting 11-15 October

- John Mandrekas requested a 90 min presentation from all SciDACs
  - CTTS now scheduled for Oct 22 at 1:00 PM ET

- APS Nov 8-12
  - Meeting will be IN PERSON with virtual option. Will DOE allow travel?

- EPS 6/27 – 7/1 2022 in Maastricht, Netherlands
  - Nominate invited speakers by 29 October 2021

Questions for LBL group

Chang Liu:
I wonder whether there is a plan to do MatSolve on GPU. In my tests, I found that when setting the matrix type to mpiaijcusparse, then superlu_dist can do the factorization using GPU, but the iterative solver is still running on CPU, which can involve CPU-GPU communications and is slow.

2. Related to the previous question, I wonder if it is possible to offload the matrix completely after the factorization, so that communication during the iterative solving is not needed.

3. I tried to use superlu_dist on GPU with MPI. I found that if the mpi ranks is equal to the number of GPUs, then each rank will occupy a GPU. For more MPI ranks, multiple ranks will share a GPU. I wonder what is the best strategy then, should I set the rank to be equal to # of GPUs?

Jin Chen
How does superlu_dist interact with ptscotch ? What would happen without it?

NERSC Time

mp288

0.702 M Hours remaining!
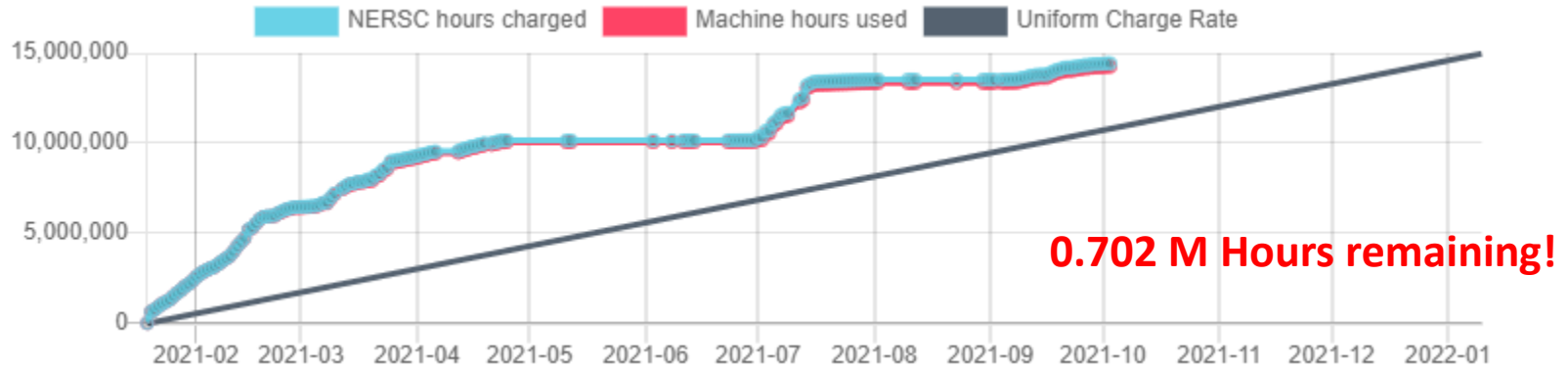
- mp288 received 10M Hrs for CY 2021, + 5M Hrs additional
- Pearlmutter time will not be charged for this FY
- We are NESAP Tier 2. . Phase-I w GPUs   We have been given a repo m3984
- N9ES-N2 M3D-C1:   J. Chen and C. Liu will be early users

Changes to github master since 09/27/21

Nate Ferraro:
9/27/21:   Updated centos7.mk to include link to netcdf fortran library and module
9/29/21:   Minor change to debug output formatting to account for fact that curv has 3 elements
               Declared gsl functions as "external" to avoid compiler warnings
               Changed BC of fp back to fp=0 unless ST=1

Jin Chen:
9/28/21: stellar readme file and regtests option files update

Brendan Lyons:
9/30/21: Allow for coarser mesh refinement above/below certain Z values (useful for reducing unnecessary mesh refinement near Z-points)

Chang Liu:
09/30/21: Increase time limit of regtests for traverse
10/01/21: fix the wrong compiler flags in traverse_gpu.mk
10/02/21: set OMP_NUM_THREADS to fix timeout error

Yao Zhou
10/02/21: Removed quadruple precision in read vmec

Local Systems

- PPPL centos7(10/01/21)
  - 6 regression tests **PASSED** on centos7
  - adapt **FAILED**
- PPPL greene (10/01/21)
  - All tests **FAILED** --- error partitioning the mesh
- STELLAR (10/01/21)
  - 7 regression tests **PASSED** on stellar
- TRAVERSE(10/04/21)
  - 6 regression tests **PASSED**
  - adapt **failed**

Other Systems

- Cori-KNL (10/01/2021)
  - 6 regression tests **PASSED** on KNL
  - ADAPT **failed**

- Cori-Haswell (10/01/2021)
  - 5 regression tests **PASSED** on cori
  - ADAPT **failed**
  - NCSX failed

- MARCONI
  - All regression tests PASSED on MARCONI (J. Chen, 9/04/20)

- **ADAPT   fails in same way on Haswell, KNL, centos7, traverse**

New adapt option

Author: Morteza H. Siboni <hakimm2@rpi.edu>
Date: Tue Sep 21 16:16:15 2021 -0400

Updates the new logic for adapt_by_field

The 14th parameter in sizefieldParam (if exists) should be either 0 or 1
and with this change the following behaviours can be expected

(1) if there are 13 parameters things will work as before
(2) if there are 14 parameters the last parameter should be either 0 or
1 (any other value will cause an error).
   (2a) value of 1 will leave coarsening "on"
   (2b) value of 0 will turn coarsening "off"
(3) if there are more than 14 or less than 13 parameters in
"sizefieldParam" this will cause an error.

1. 2. 2. .01 .4 .01 .4 .1 .1 .01 .02 .05 .5 0
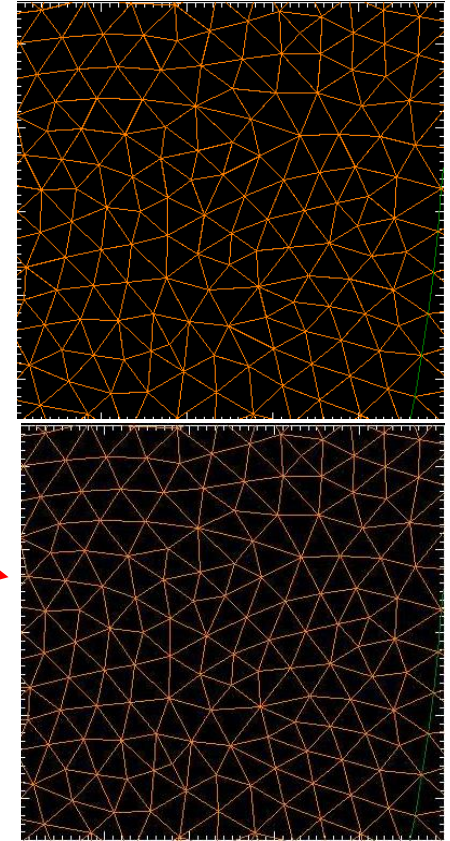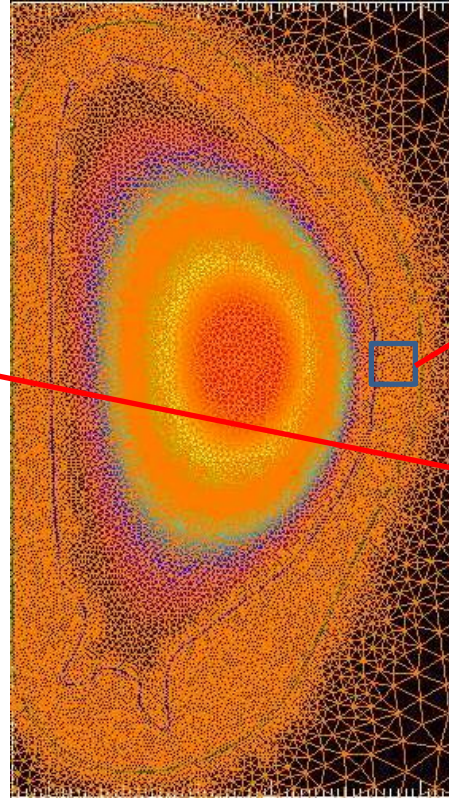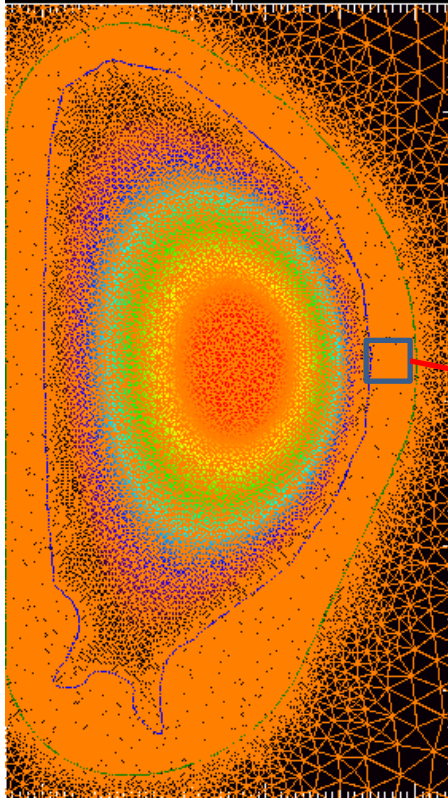
Testing on ITER equilibrium -- 1
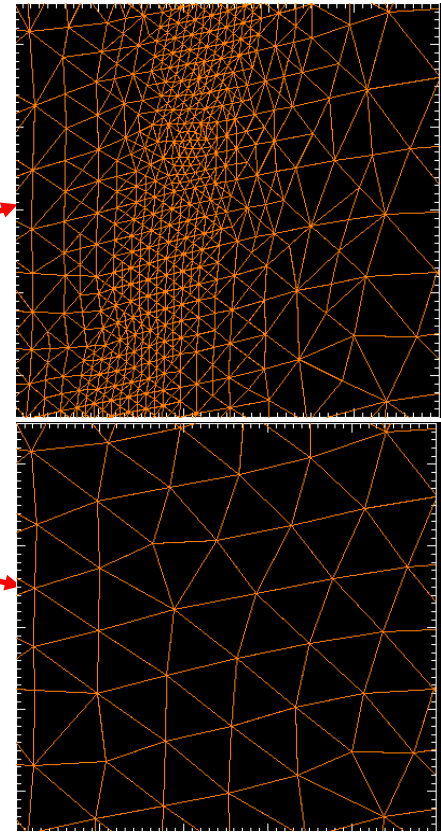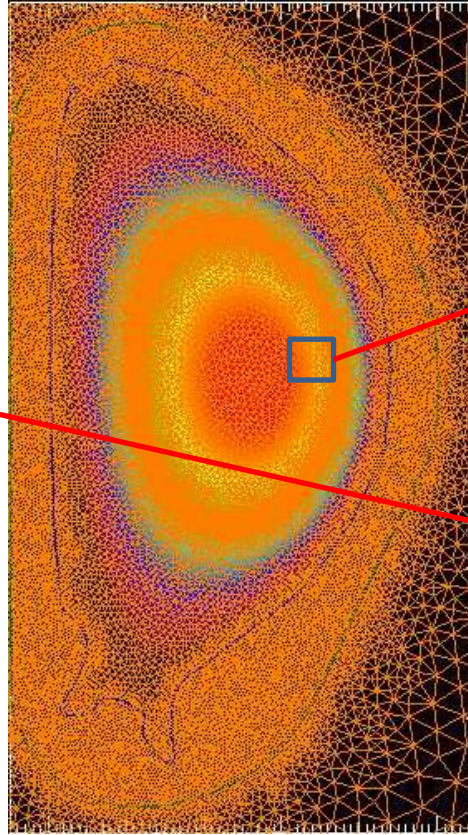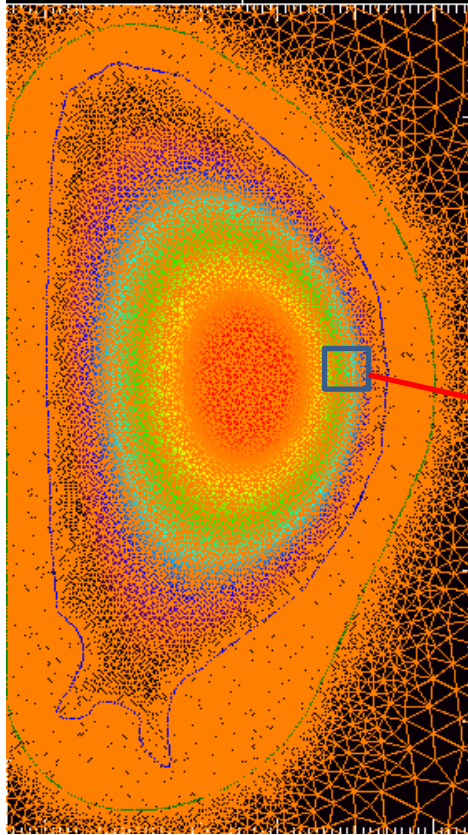
/p/tsc/m3dnl/ITER/NewMesh/Eq2   and …/Adapted   Refines plasma region ok
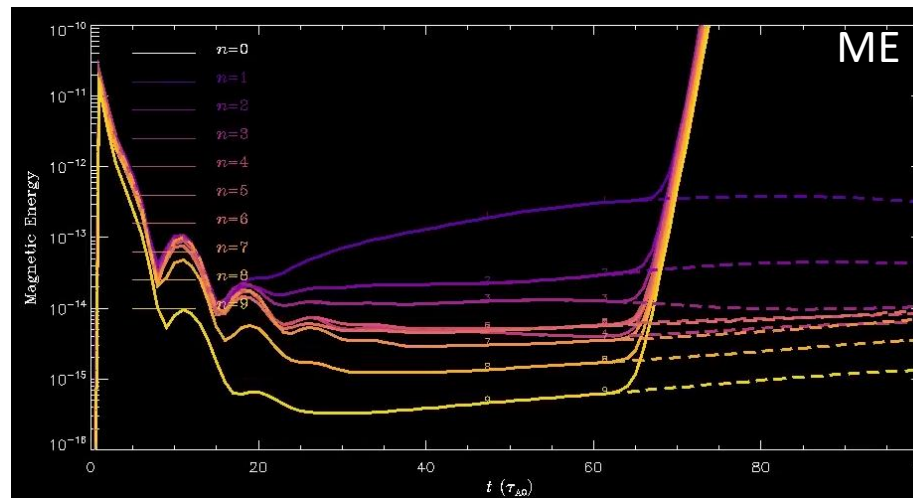
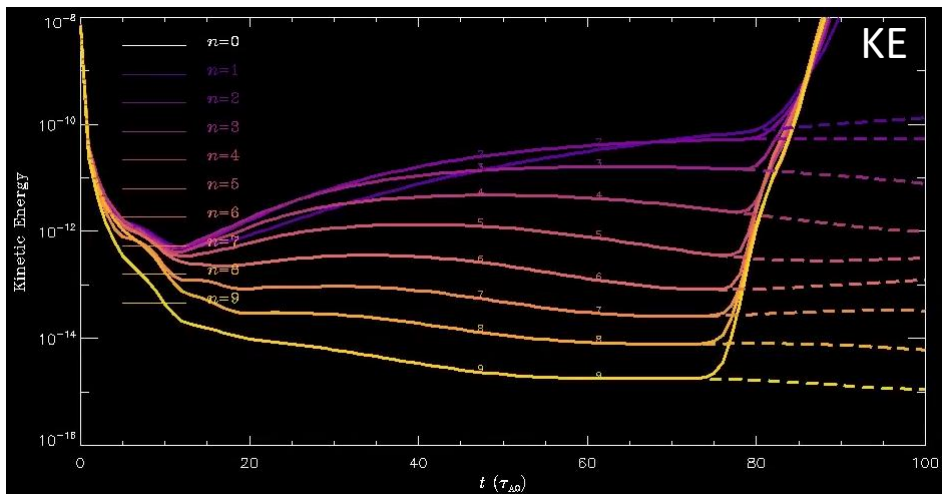# Testing on ITER equilibrium -- 2

/p/tsc/m3dnl/ITER/NewMesh/Eq2   and …/Adapted

Leaves wall zones untouched!
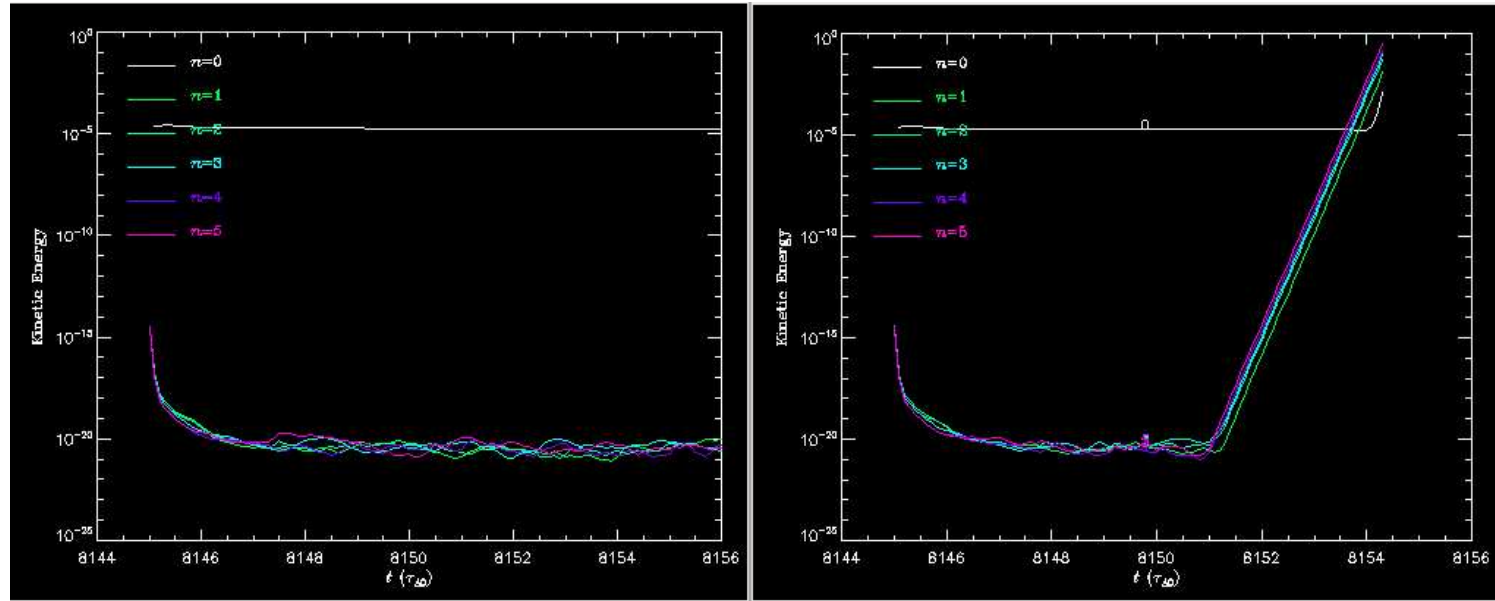
New Code version becomes unstable on some problems

Solid: /home/sjardin/data/Ideal/3D-2F6   Sept 22 git master version
Dashed: /home/sjardin/data/Ideal/3D-2F6b   Sept 16 code version
Also fails at NERSC

Another unstable case

/home/sjardin/data/ITER/Run05NM-redo-2-3D   good (Sept 16 version)
/home/sjardin/data/ITER/Run05NM-redo-2-3DF   fails (Sept 22 version)

Debugging status

1. Tried swapping out ludef_t.f90 ... did not help

2. Next routines to swap out: (changed after 9/16...in time loop)

basic_mesh.f90   scorec_mesh.f90

biharmonic.f90   scorec_vector.f90

boundary.f90   spline.f90

element.f90   transport.f90

m3dc1_nint.f90

metricterms_new.f90

model.f90

newpar.f90

petsc_vector.f90

update

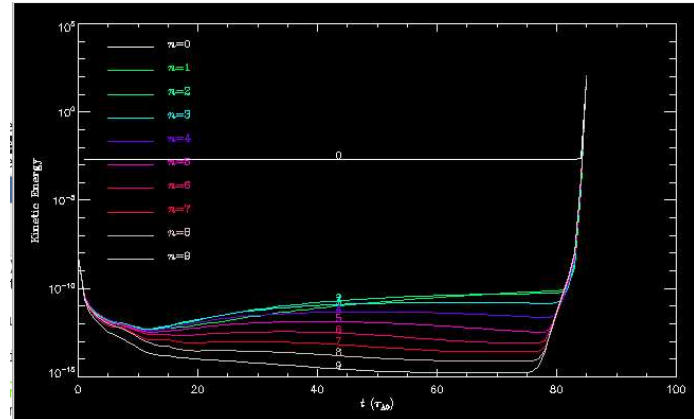3. Next routines to swap out: (changed after 9/16...in time loop)
   use new versions   **use 9/16 versions**

scorec_mesh.f90   model.f90   ludef_t.f90

scorec_vector.f90   newpar.f90   metrictrms_new.f90

spline.f90   petsc_vector.f90   transport.f90

basic_mesh.f90   element.f90   m3dc1_nint.f90

boundary.f90

Unstable!

changes

scorec_mesh.f90:   in subroutine _local_dofs:
            changed: call rotate_dofs(temp(j:k), dof(j:k), norm, 0., -1)
            to: call rotate_dofs(temp(j:k), dof(j:k), norm, curv, -1)

scorec_vector.f90:   change curv to curv(3) in 4 routines only

spline.f90: in subroutine get_hermite_coefs
         changed: a(1) = s%y(s%n)
         to: if(ex.eq.0) a(1) = s%y(s%n)
basic_mesh.f90:   in subroutine load_sms_mesh
         changed: nodes(i)%curv = ……..
         to: nodes(i)%curv(1) = ……
boundary.f90:   chane curv to curv(3) in 14 routines only

Changes (cont)

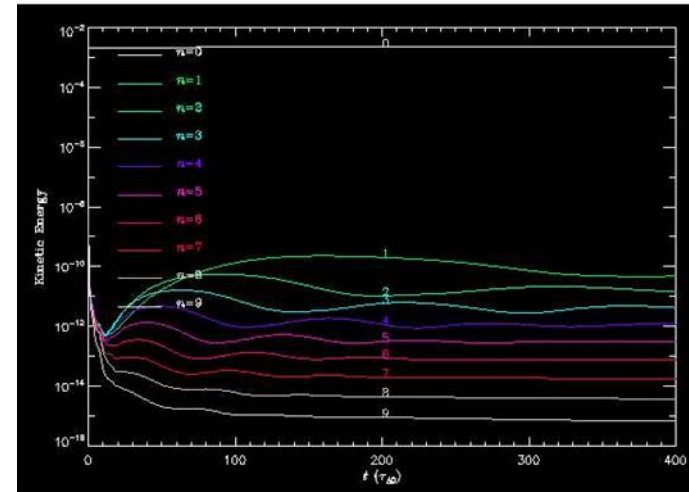model.f90   in subroutine boundary_mag
        changed: temp = 0
        to: call get_node_data(bfp_field(1), I, temp)
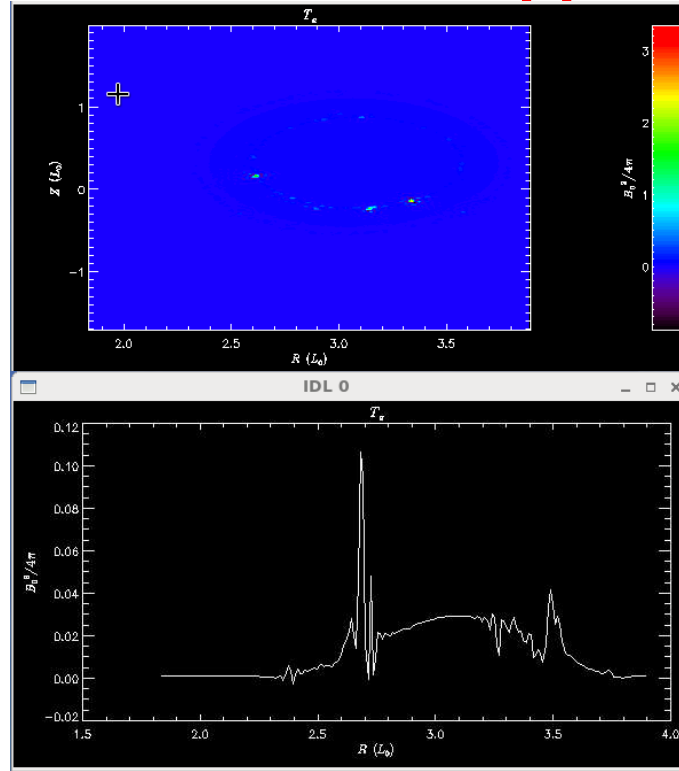
Reversed this and the problem went away!

newpar.f90   curv → curv(1)   in 6 places

petsc_vector.f90   changed curv to curv(3) in 4 routines

element.f90   changed curv to curv(1) in 30 places

Strauss test of ikapparfunc=1

Initial temperature profiles is unphysically jagged, goes negative

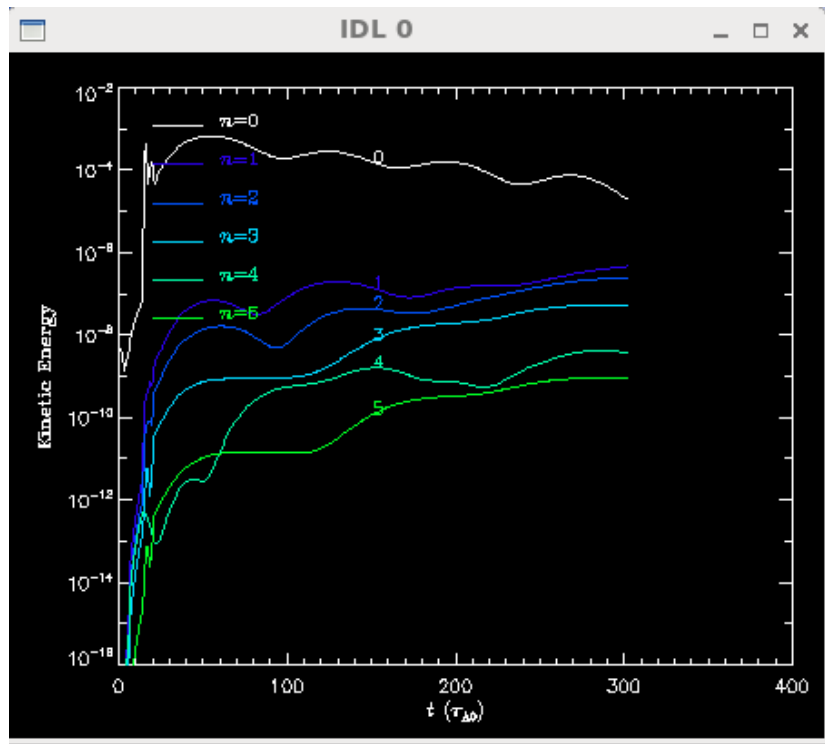/scratch/gpfs/hs9956/JETm3dc1_0.12h9_r5

Planning for next 5 years

- We should start thinking about what should be proposed for the next SciDAC

- Both from the Physics and CS sides

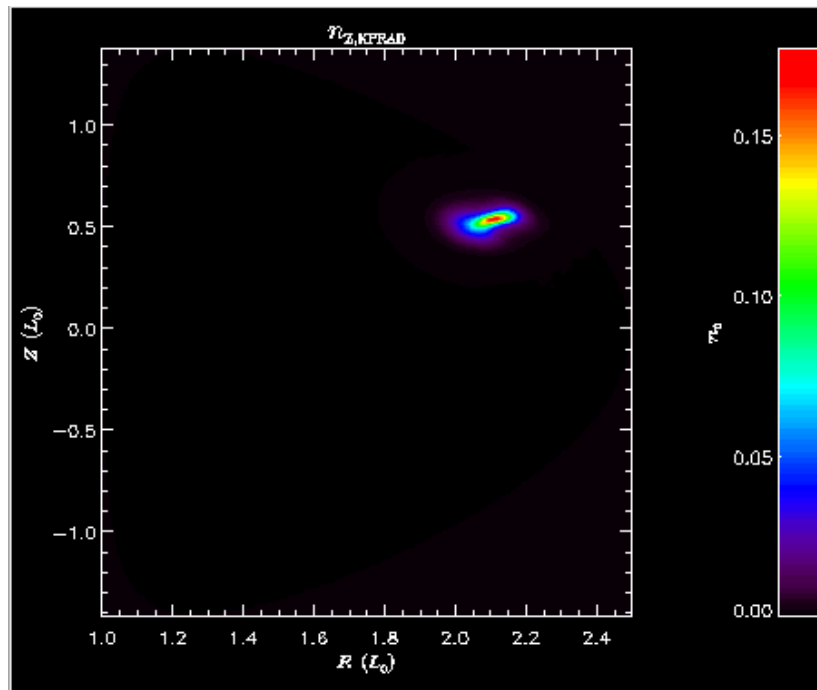- We could start a discssion via email

That's All I have

Anything Else ?

DIII-D Pellet injection case goes unstable (without RE)

plot_hmn

plot_field, 'kprad_totden'

Could the impurity density be going negative?
See /scratch/gpfs/cz12/kprad2_test

Chen Zhao

Chen Zhao paper in preparation

Simulation of the runaway electron plateau formation during current quench

C. Zhao[1], C. Liu[1], S. C. Jardin[1], N. M. Ferraro[1], B. C. Lyons[2], V. Bandaru[3], M. Hoelzl[3]

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[2] General Atomics, San Diego, CA, United States of AmericaGeneral Atomics, San Diego, CA, United States of America
[3] Max Planck Institute for Plasma Physics, Boltzmannstaße, Garching, Germany

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- Now only contains formulation and 2 test problems (1 cylindrical and 1 with JOREK)
- No section on experimental comparisons or on sawtooth
- Need some discussion on validity of Dreicer model (from Chang)
- Add section on comparison with characteristics model of advancing runaways?