

CS Issues-1

- TRAVERSE
 - 3D code fails with GPU enabled PETSc
- CORI-GPU
 - 3D run now works! 2D Timing tests on next VG
- CORI
 - current build of complex version on haswell works with mumps only
 - Jin sent case to Yang Liu. He found NaN with both SLU & mumps...Resolved?
- AiMOS
 - Chang doing production runs with M3D-C1-K
 - Jin working on moving matrix assembly to GPU
- VTUNE on Eddy?
 - Jin to look at
- Option to reuse LU decomposition for velocity, field, and pressure matrices (5,6,17)?
 - Jin is working on solve2 to recover preconditioner reuse capability
 - Jin to look at SCOREC coding (Seegyoung says fortran side)
 - Chang reports having nskip > 1 speeds up code

CS Issues-2

1. comparison solve times of using 1-gpu, 8-gpu, and 16-gpu:

16-gpu run is twice as fast as a 1-gpu run.

log.mpi16_gpu1_O2

LOOP TIME 5 Tot 3.8548E+02 compute 3.6474E+02 solve 2.0741E+01

log.mpi16_gpu8_O2

LOOP TIME 5 Tot 3.7791E+02 compute 3.6452E+02 solve 1.3394E+01

log.mpi16_gpu16_O2

LOOP TIME 5 Tot 2.3248E+02 compute 2.2135E+02 solve 1.1138E+01

2. Comparison solve times of code compiled with INTEL & PGI compiler:

INTEL compiler is 3 times faster than PGI compiler

log.mpi16_gpu8_O2

LOOP TIME 5 Tot 3.7791E+02 compute 3.6452E+02 solve 1.3394E+01

log.mpi16_gpu8_pgi

LOOP TIME 5 Tot 2.8449E+02 compute 2.5149E+02 solve 3.3002E+01

3. Comparison solve time on CORI HASWELL & CORI GPU

Code runs faster on HASWELL than on CORI GPU

log.mpi16_2d_hsw:

LOOP TIME 5 Tot 9.5476E+00 compute 2.6574E+00 solve 6.8902E+00

log.mpi16_gpu16_O2

LOOP TIME 5 Tot 2.3248E+02 compute 2.2135E+02 solve 1.1138E+01

CS Issues-3

- Mesh Adaptation status

Nate implemented on 04/07/20: I implemented the capability to *restart with a different number of toroidal planes*. Presently this only works for evenly distributed planes, and where the new number of planes is an integer multiple of the old number of planes. To restart with a new number of planes, just increase “nplanes” in C1input (and adjust the number of processes and the bjacobi options accordingly).

Mark Shephard on 04/07/20: Given that, the first thing we need to develop is the ability to adapt the 2.5D mesh. *Currently we can adapt a 2D mesh* and the procedures for changing the number of poloidal planes is in the works for the 2.5D mesh. The next capability needed is to be able to reflect an adaptation of the 2D poloidal plane mesh to the 2.5D extruded mesh. That should be pretty straight forward and Seegyoung will start working on that.

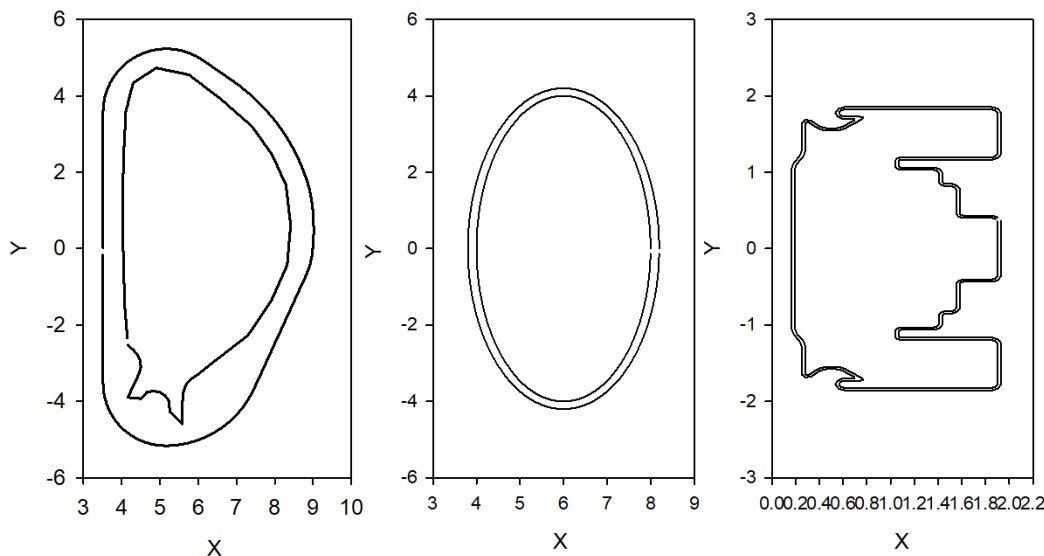
- **Done** (for now)....Brendan to send additional request
- Brendan says continuous (dynamic) adapting not working for him. Will try again and send error report if it fails
- Brendan: should eventually consider non-uniform planes

CS Issues-4

- m3dc1_meshgen

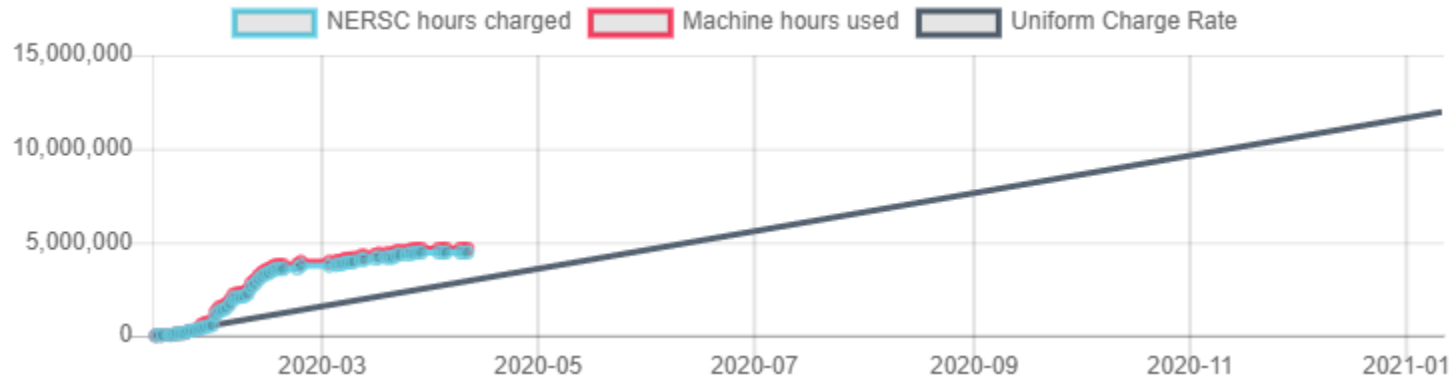
modelType=4 allows you to specify 2 boundaries, inner and outer, that border the conductor. However, the documentation leaves out some details and there are no examples.

- First line is integer, # of points
- Remaining lines are (R,Z) defined **counter-clockwise!**
- **Seegyoung adding to documentation and adding example files in SCORELib directory**

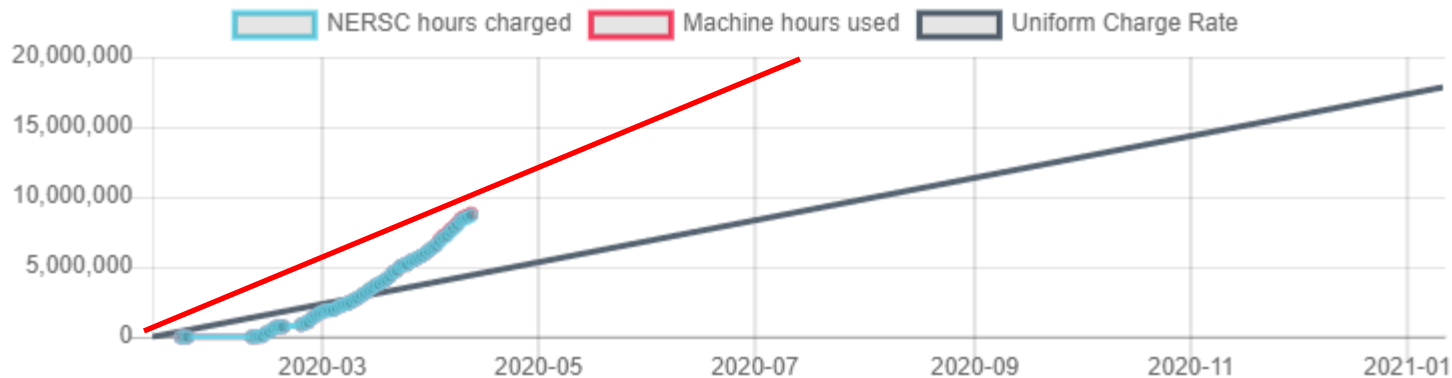


NERSC

MP288



M3163



Need to use less mp288. m3163 approaching linear usage rate

Add to batch file: `#SBATCH --account=3163`

(clauser, kleiner, lyons, strauss)

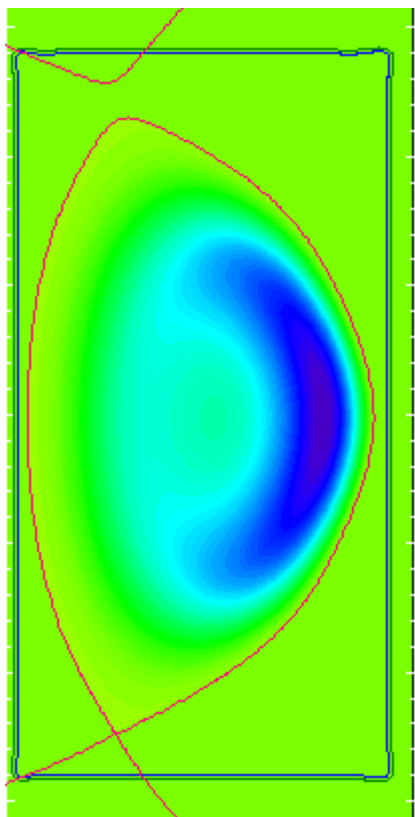
Status of new 3D M3D-C1 benchmark with JOEKE and NIMROD

M3D-C1 toroidal current density

$t = 0$

$Z_{\text{mag}} = -0.015$

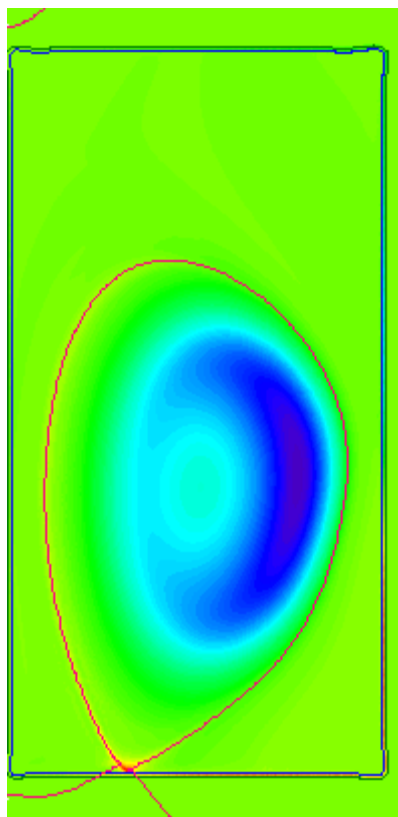
Initial equilibrium



$t = 8.95 \text{ ms}$

$Z_{\text{mag}} = -0.280$

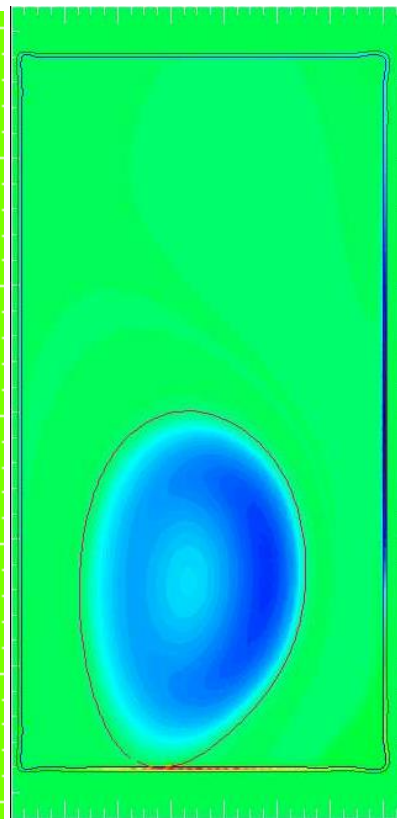
Start of 3D



$t = 9.84 \text{ ms}$

$Z_{\text{mag}} = -0.655$

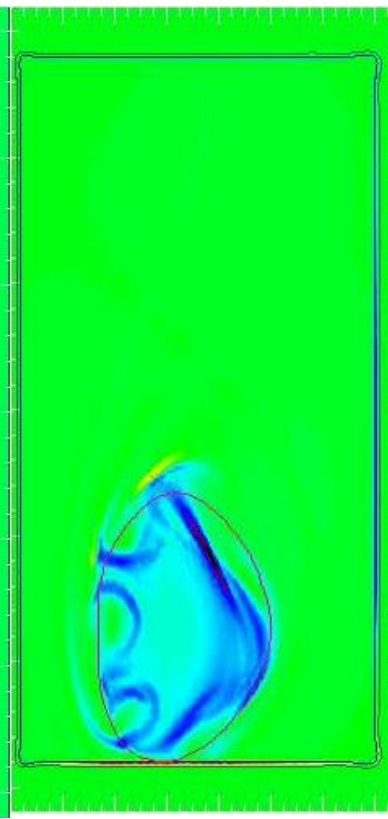
03/30/20

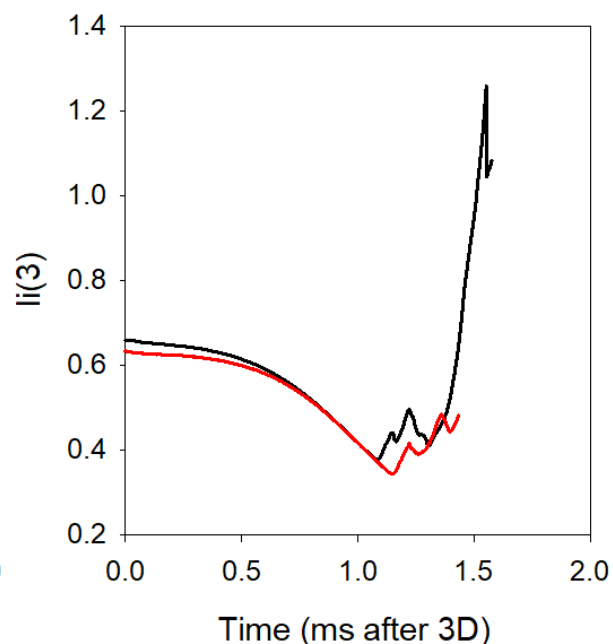
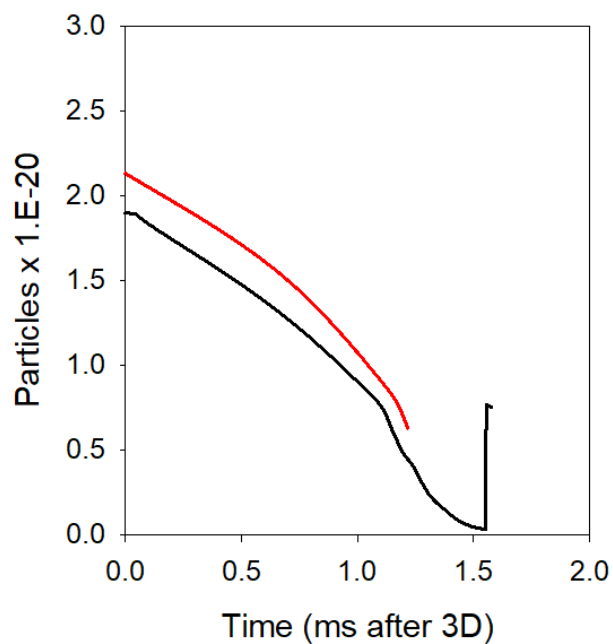
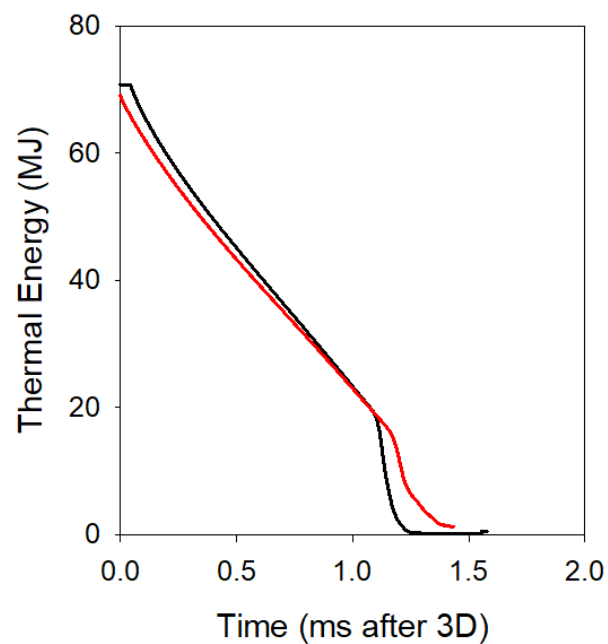
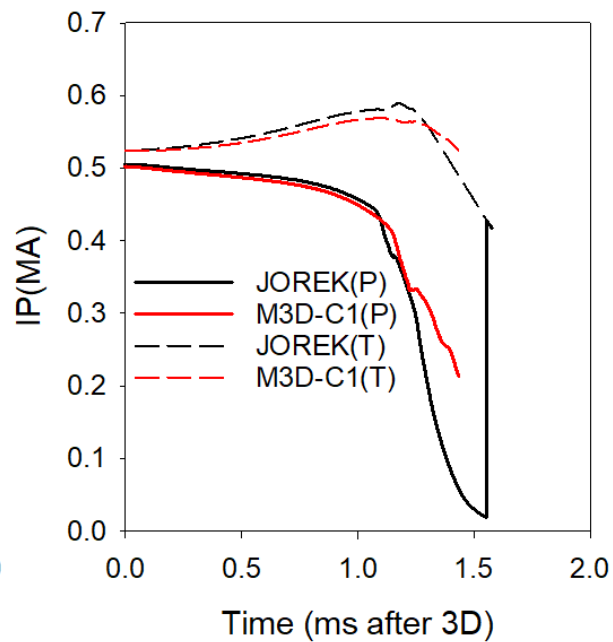
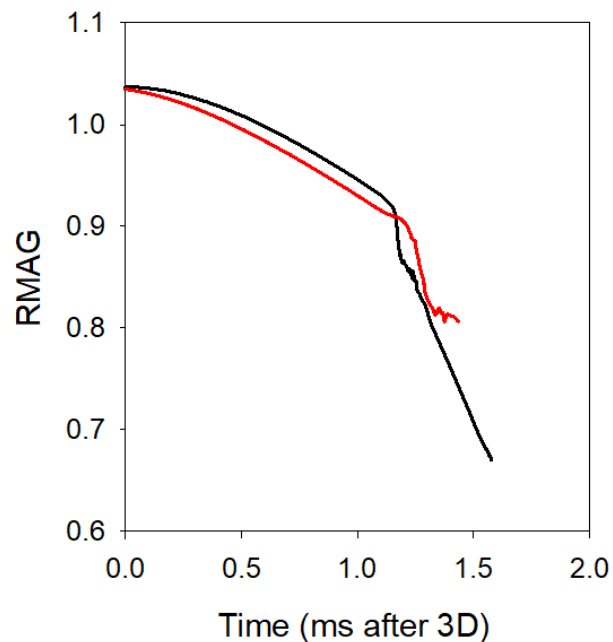
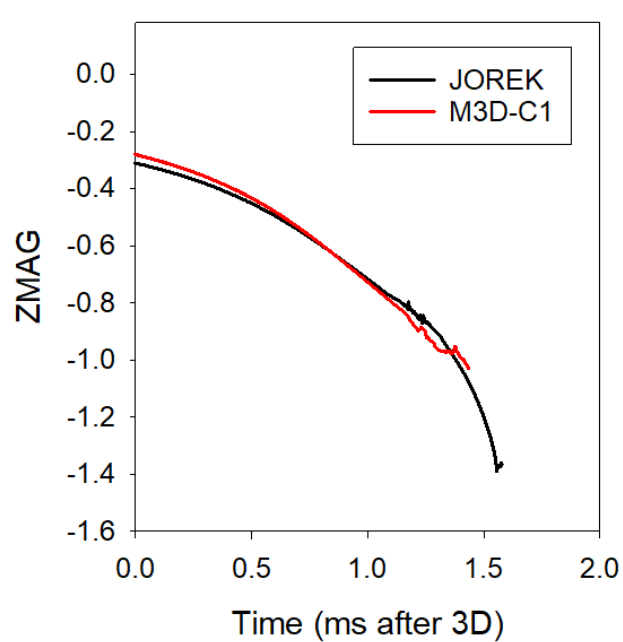


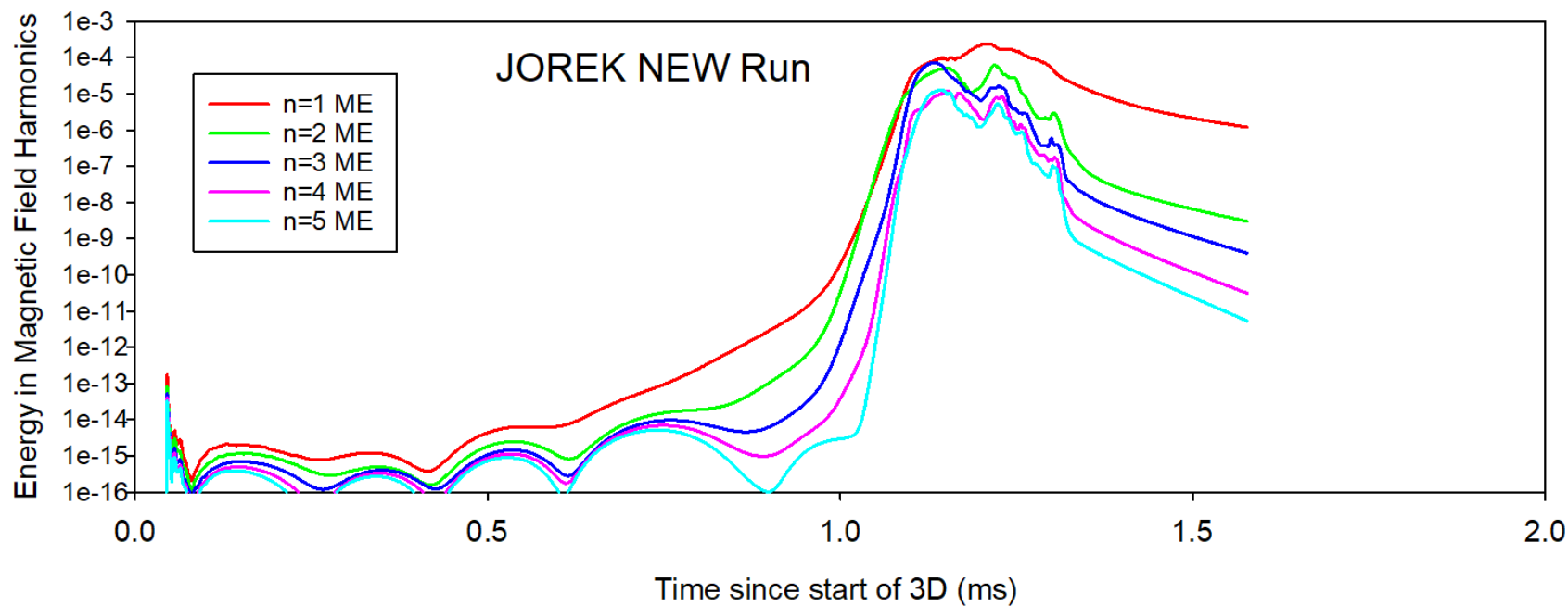
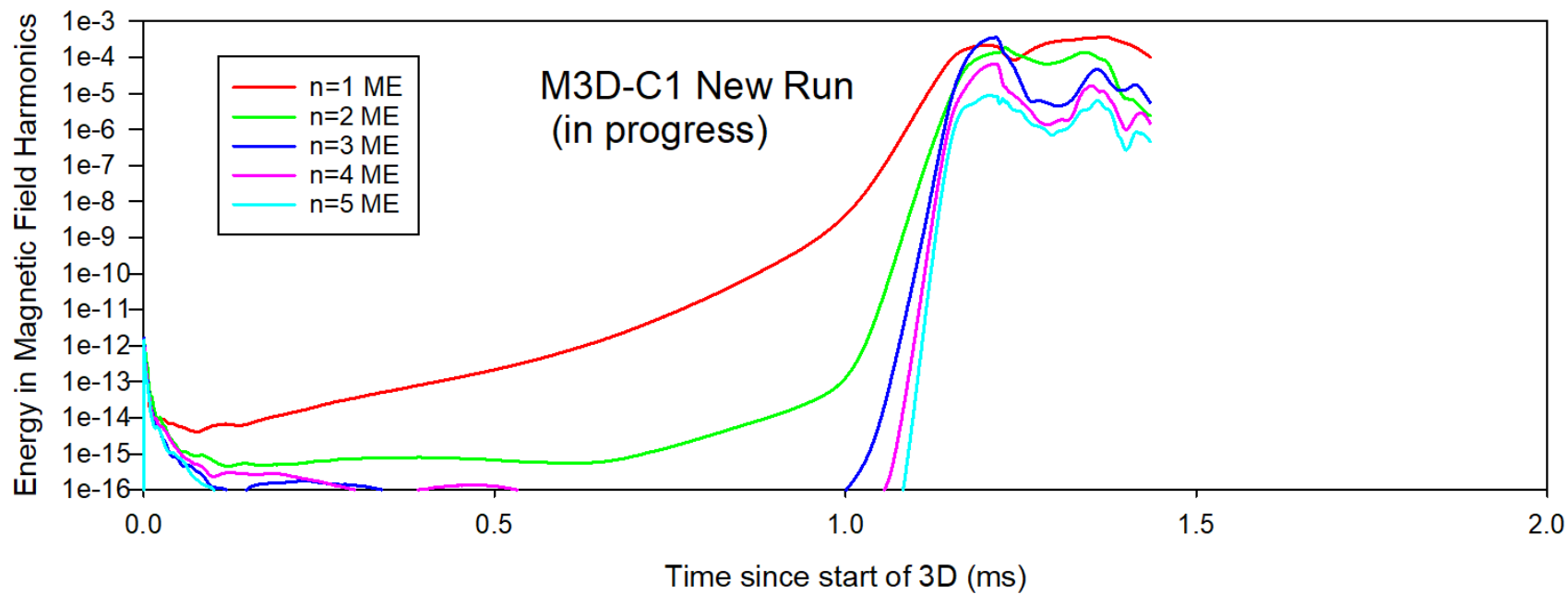
$t = 10.13 \text{ ms}$

$Z_{\text{mag}} = -0.88$

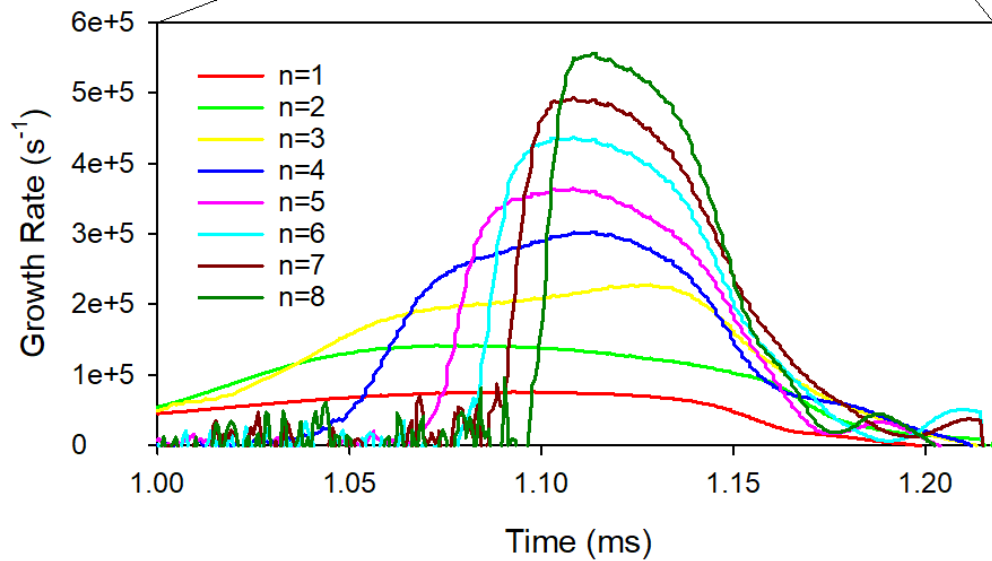
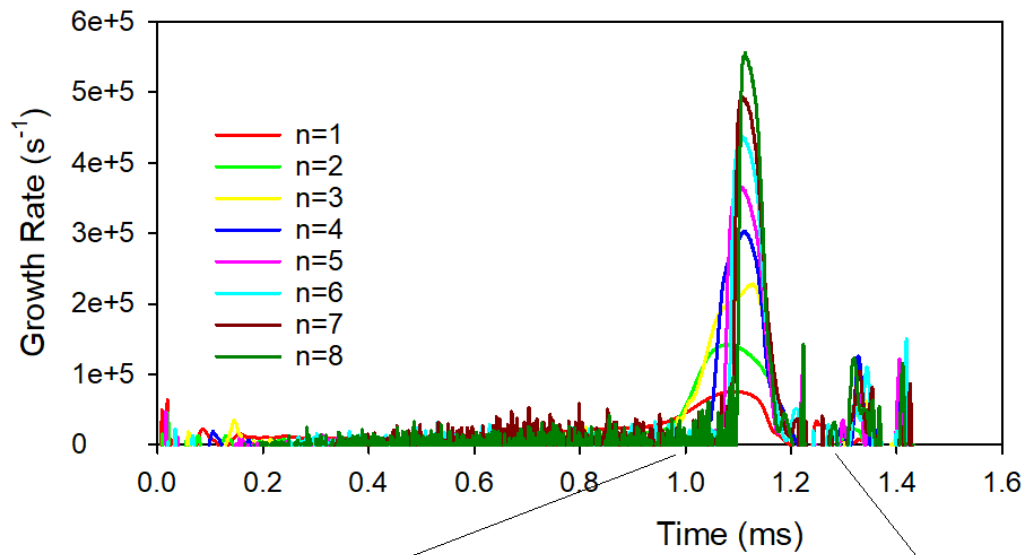
04/06/20



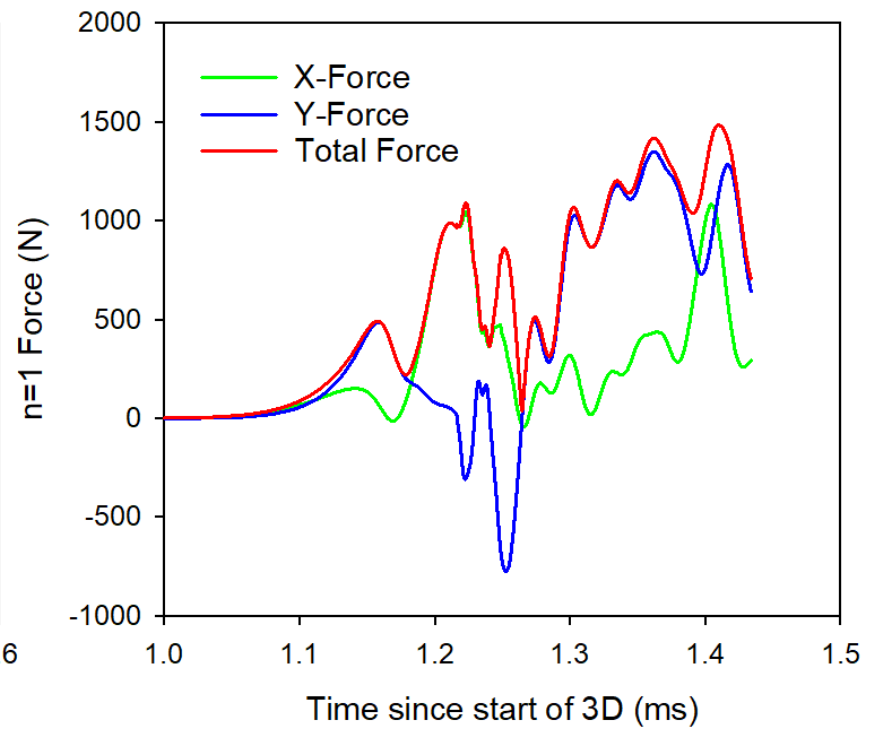
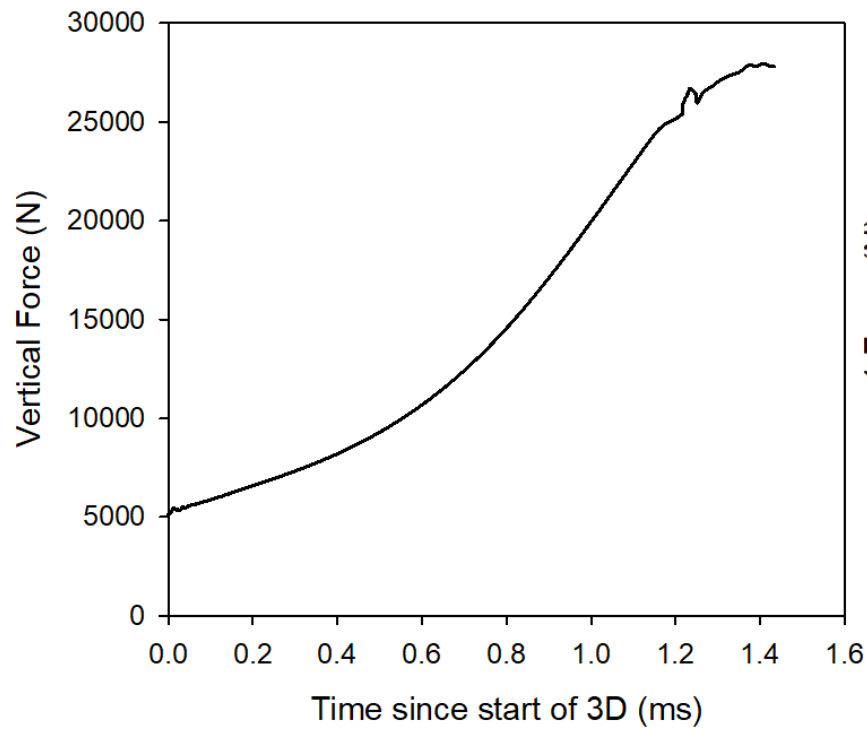




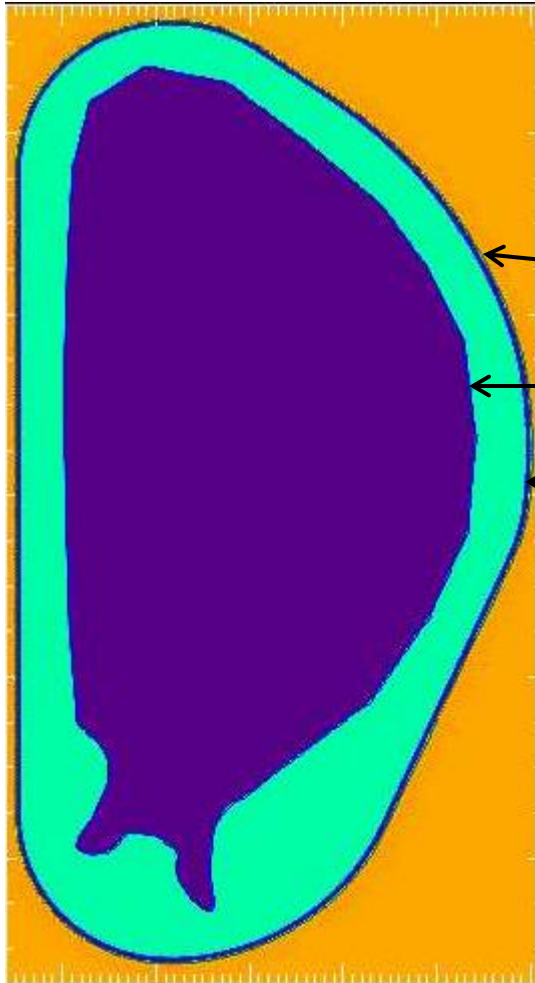
M3D-C1 Growth Rates during 3D Phase



M3D-C1 Forces on Vessel



3D ITER VDE – coupling to CARIDDI



Implemented a more realistic ITER model with 2 conducting wall regions.

Contour 1. outer vessel wall

Contour 3: Plasma facing wall

Contour 2: inside Contour 1 by 6 cm, the actual thickness of the ITER VV

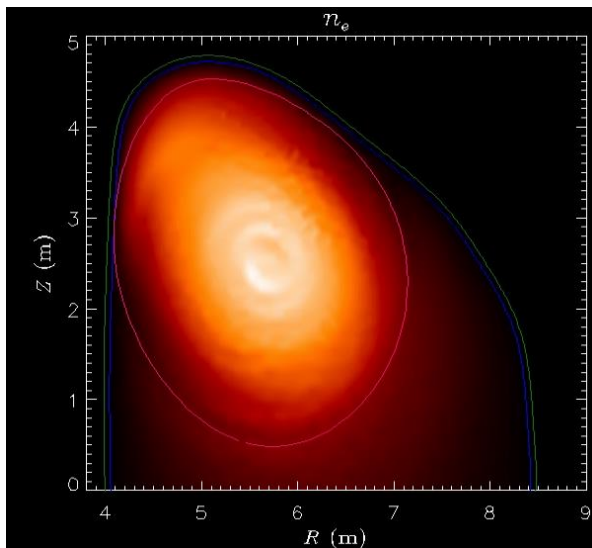
Contour 1 and contour 3 defined by m3dc1_meshgen
modelType=4

Contour 2 defined in new M3D-C1 input option to
define different resistivity regions in conductor.
iwall_regions, wall_region_filename, wall_region_eta

L/R test with no plasma
now being performed

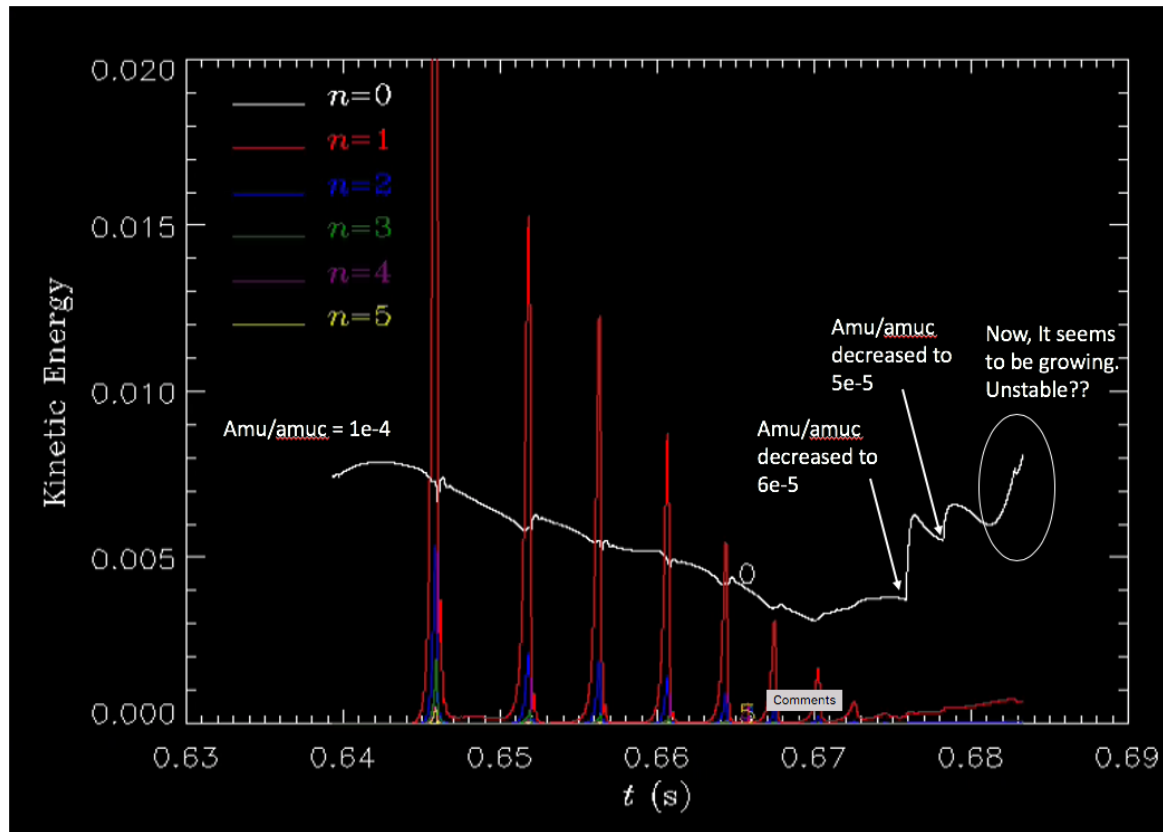
Nate implemented 06/15/2018
Now in documentation

Cesar Question (4/13/20)



I'm still running this large halo VDE case.

I tried to reduce the viscosity since I've noted that the density/pressure do not follow flux surfaces so far.



But now, the kinetic energy seems to be growing. The time step was also reduced from 4 --> 3 and then to 2.5. Should I go back to the time when I reduced amu/amuc to 6e-5 and keep amu/amuc = 1e-4?

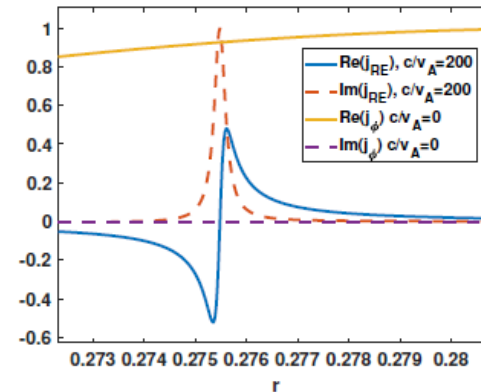
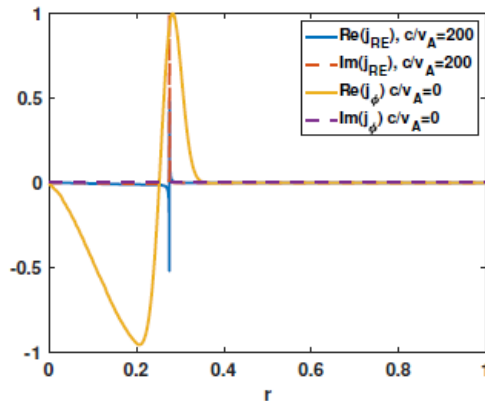
Runaway Electron Fluid Model – linear stability

Simulation of MHD instabilities with fluid runaway electron model in M3D-C¹

C Zhao¹, C Liu¹, S C Jardin¹, N M Ferraro^{1,1}

Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, New Jersey 08543-0451, US

(Dated: 23 March 2020)



1. Chen submitted to Nuclear Fusion

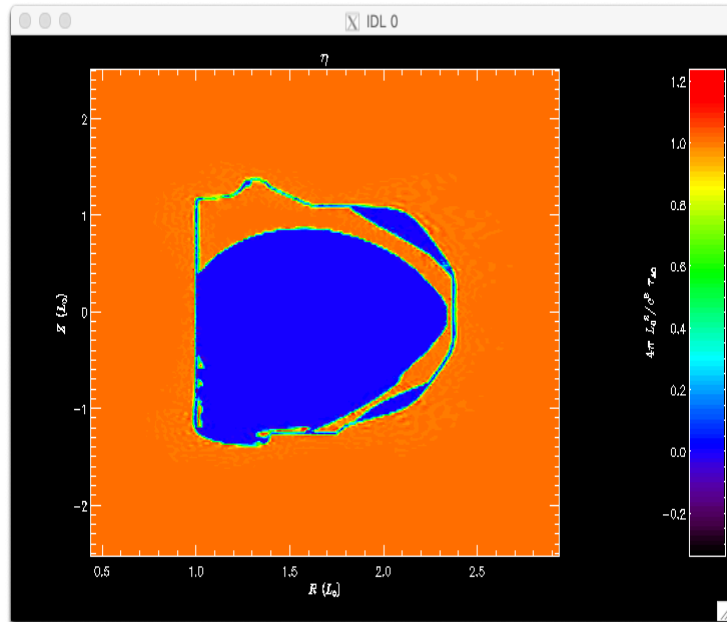


Runaway result

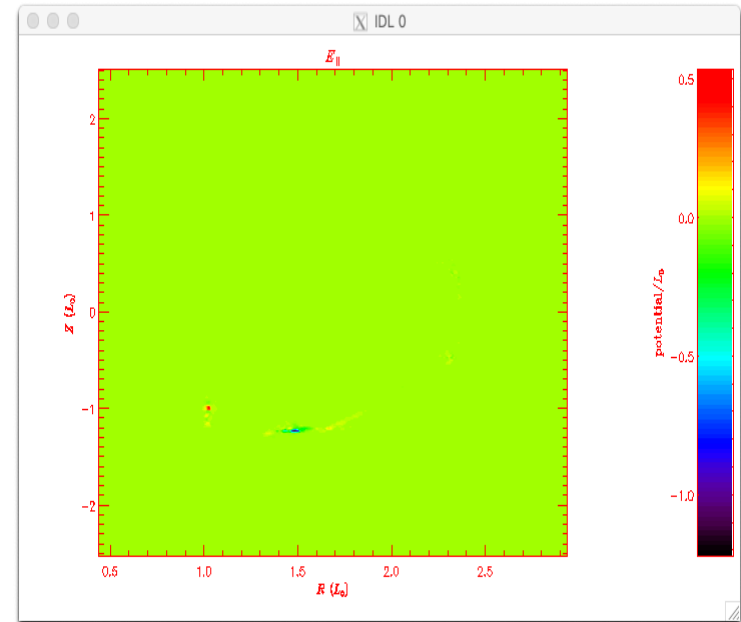
4/12/2020

Chen Zhao

η , $t = 3\text{ms}$

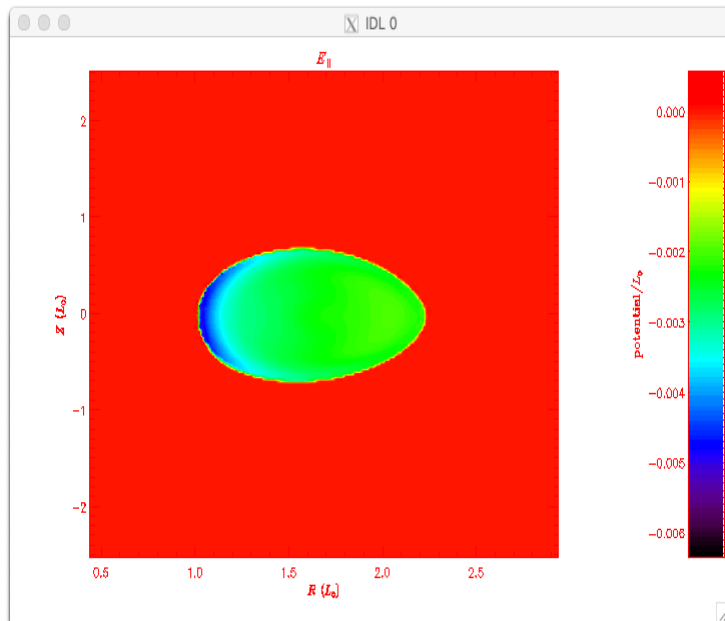


E_{par} , $t = 3\text{ms}$

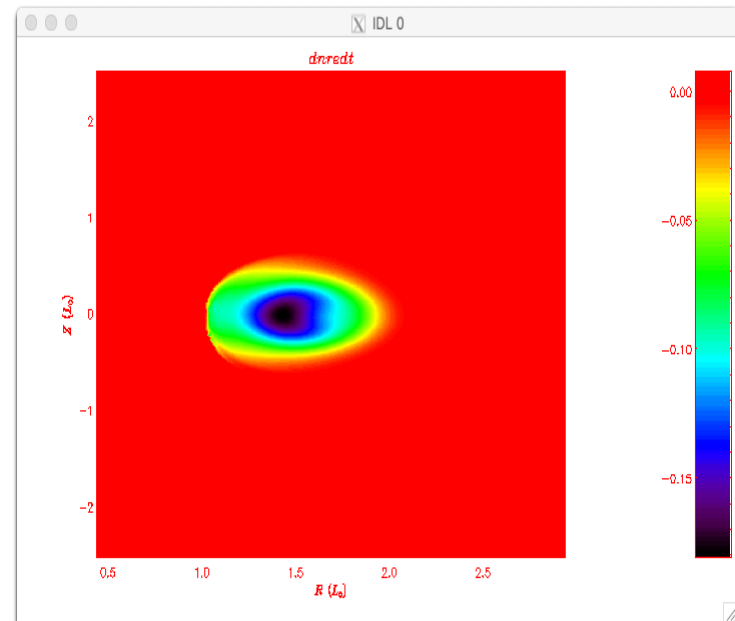


The resistivity and E_{par} are 0 at 3ms it should not have runaway generation.

$E_{\text{par}} - \eta J_{\text{RE}}, t = 3\text{ms}$

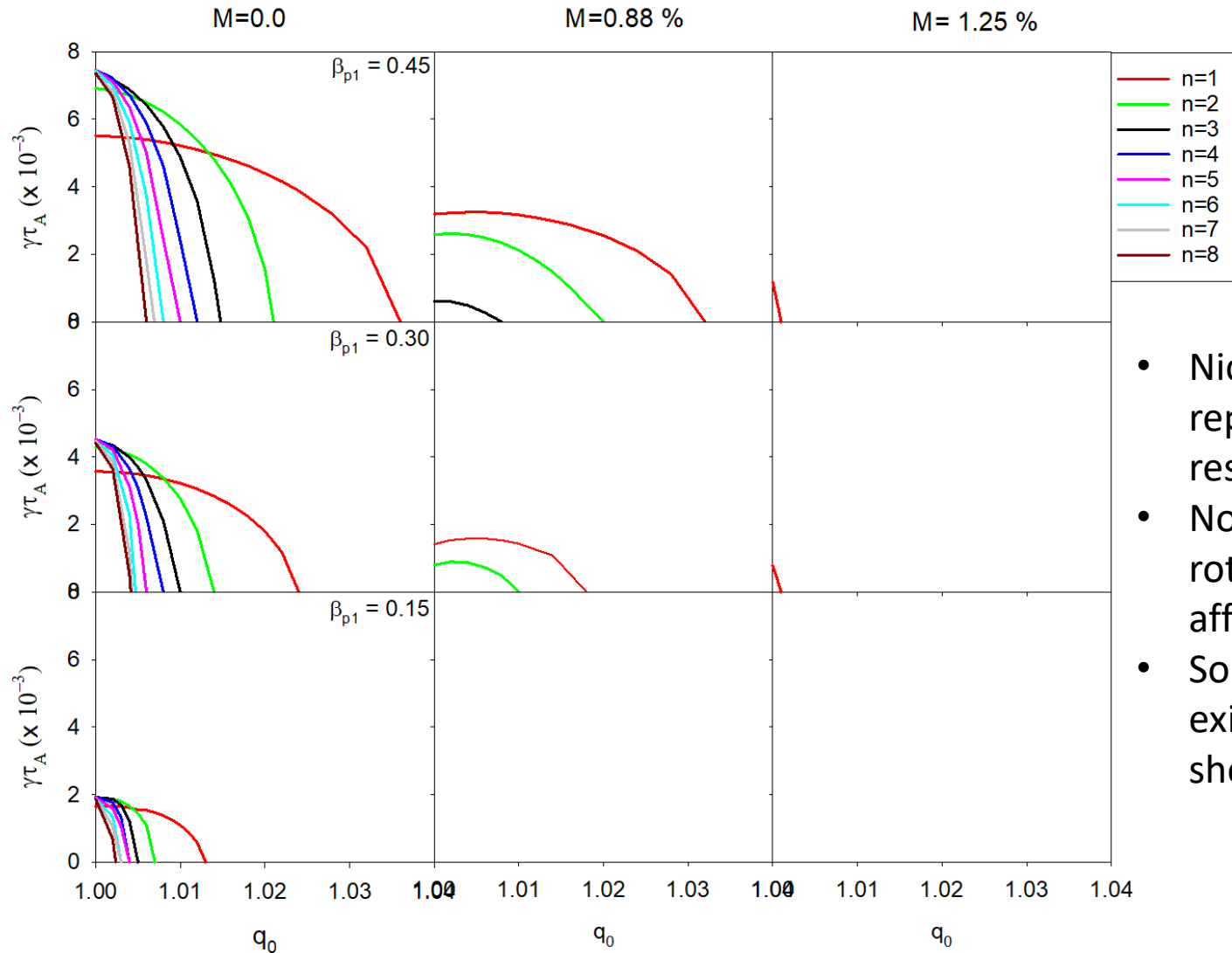


$dn_{\text{redt}}, t = 3\text{ms}$



But the e_{par} output from runaway.f90 is not zero and dn_{redt} is non-zero.

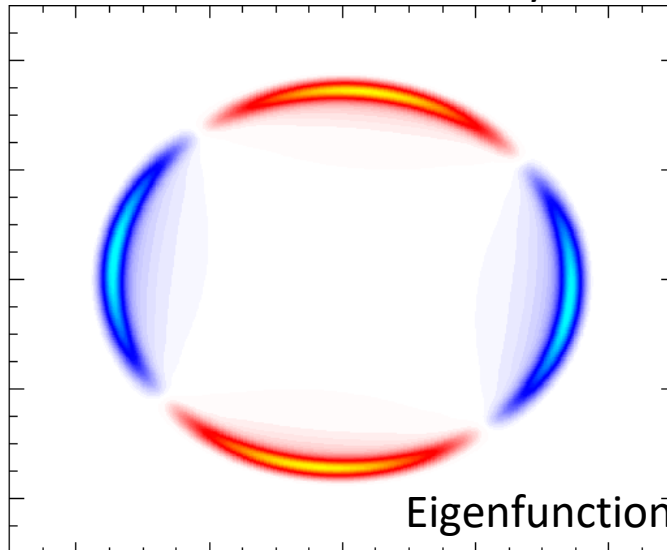
Linear stability of low-shear equilibrium in toroidal geometry with flow (important for new ST model)



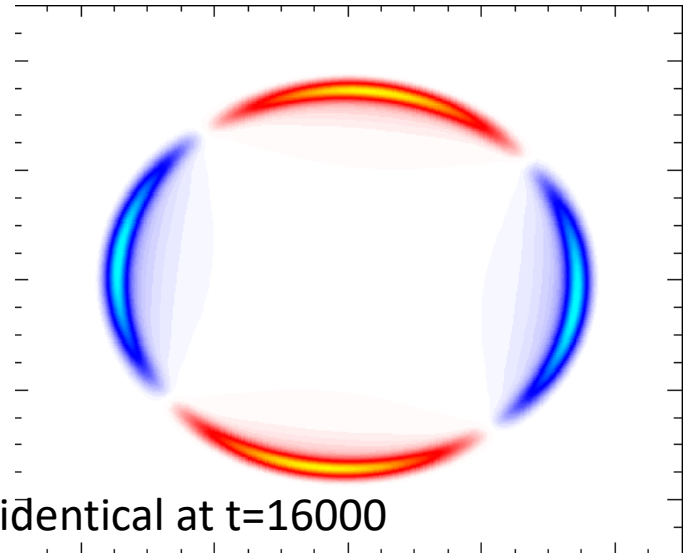
- Nicolas Lanchon has reproduced the $M=0$ results (no rotation)
- Noted that adding rotation can slightly affect the q -profile
- Some analytic papers exist for flat and sheared rotation.

Bug Report: JA-2 Test Problem, cylinder, numvar=1, tearing mode

Current version on eddy



Older version on perseus



Eigenfunctions are identical at $t=16000$

