M3D-C1 ZOOM Meeting

10/03/2022

Upcoming meetings and deadlines

CS Issues

1. LBL Update
2. Perlmutter_cpu problems
3. New Latex documentation
4. New meshing capabilities and adaptation update -
5. NERSC Time and NERSC policy change
6. Changes to github master since last meeting
7. Regression tests
8. isurface discussion
9. reproducibility problem

Physics Studies

1. Chen Zhao, Brendan Lyons updates
2. Anything else

In attendance

Steve Jardin
Dingyun Liu
Cesar Clauser
Andreas Kleiner
P. Sinha
Chen Zhao
Nate Ferraro
Brendan Lyons
Adelle Wright
Cesar Clauser
Hank Strauss
Chang Liu
Jin Chen

Mark Shephard
Seegyoung Seol
Morteza
Usman

Sam Williams
Sherry Li
Nan Ding
Yang Liu

Upcoming Meetings

APS-DPP

Oct 17-21 In Spokane Washington

26th Workshop on MHD stability Control is on Oct 14-15

CTTS SciDAC meeting is on Sunday Oct 16

LBL Update

Large job problems on Perlmutter_cpu

I have a large mesh (98K faces) with 128 partitions that I would like to run on Perlmutter_cpu. The base directory is:
/global/cfs/cdirs/mp288/jardin/m3dnl/Perl_cpu/128-K

- Runs ok with mumps with 4 planes with 64 CPUs/NODE (Run02d)
- Same run FAILS with superlu_dist (Run02a) (also failes with older versions of SLU)
- Runs ok with mumps with 8 planes with 64 CPUs/NODE (Run05d)
- FAILS in initialization for 18 (or more) planes (Run08a)

For jobs that fail, last line of output is often:

one field period…. (from scorec_mesh.f90)

Can we add more diagnostic printouts?

New LaTex Documentation

A cleaned version of M3DC1 user's guide is uploaded to M3DC1/doc and this version compiles on all machines using the command "pdflatex M3DC1.tex".

Updated since 8/29/22
app-paraview.tex mesh-gen.tex building.tex app-paraview.tex doc.tex
20+ new figures

All C1input varialbes are now documented (sectin 8)

Should Appendix B (SCOREC API) be eliminated or revised.
Should Sec. 6 (BC) and Sec. 7 (Discretization) be moved to an Appendix?

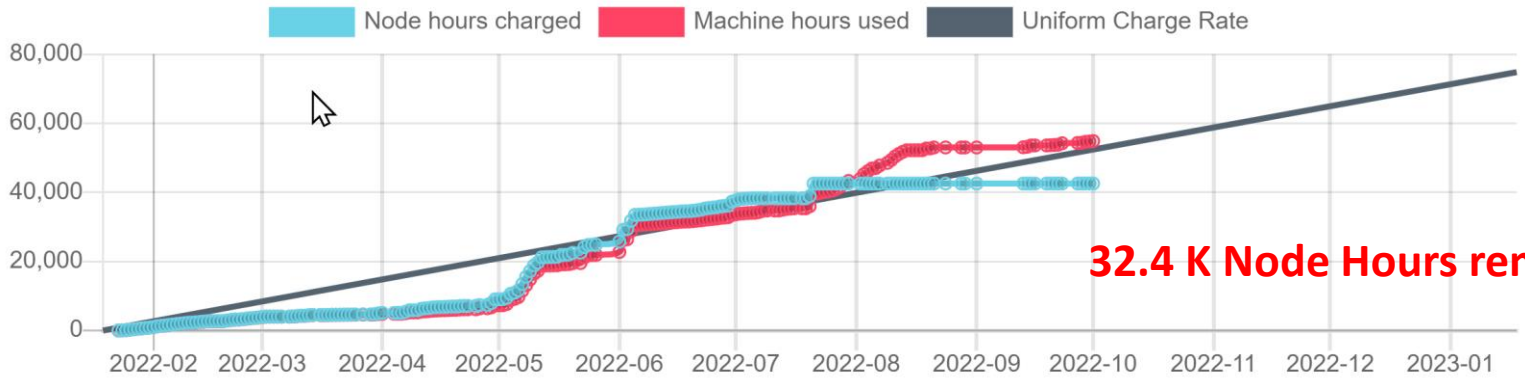
The LaTex documentation has been added to the m3dc1.pppl.gov with the label NEW (in-progress). The old Word document is there as well.
Sill work to be done. Order of sections, obsolete sections, incomplete, etc.

New Meshing Capabilities and Adaptation Update

- m3dc1_mfmgen, m3dc1_meshgen, polar_meshgen
- Simmetrix (other machines besides centos7 and stellar?)

NERSC Time

mp288



32.4 K Node Hours remaining!

- MP288 usage is on track. Both value and rate are ok.
- All users now have access to Perlmutter_cpu.
  - Some issues for large problems…see previous slides
- We have 7000 GPU node hours as well.

NERSC Policy

- Perlmutter scratch file system is now available, but there may still be some performance issues

- The “free of charge” phase on Perlmutter has been extended. (last notice 9/28/22)

- ERCAP proposals for CY 2023 time due TODAY.
  - I submitted a mp288 renewal for 120,000 node hours (cpu), 12,000 node hours (gpu)

Changes to github master --after 2022-8-29

Steve Jardin:

09/28/22: Added Chen Zhao's updates to runaway routines

Nate Ferraro

09/02/22: Fixed bug in plot_m_vs_r for linear cases

09/06/22: Added eta_zone and etaRZ_zone options for specifying wall resistivity in different zones

09/07/22: Removed obsolete description of thin-wall boundary conditions option. Added description of bound_type, zone_type, eta_zone, and etaRZ_zone

09/09/22: Updated documentation of license agreement to add reference to PPPL code access request form

Jin Chen:

09/19/22: Perlmutter_cpu.mk update

Yao Zhou

09/30/22: Enabling vacuum field subtraction in stellarator simulations

09/29/22: Changes on restarting from eqsubtract=0 to 1

Changes to github master --after 2022-8-29

Riaz Usman

09/02/22: The multi_meshgen.cc has been updated with improved Model and Mesh Control
09/02/22: meshGradationRate Parameter has been added. Document has been updated
09/04/22: A minor issue with the creation of the vacuum boundary is fixed

Seegyoung Seol

09/02/22: Fixing geom-classification error with multi-face mesh generator
09/04/22: Adding Paraview section in User's Guide
09/04/22: Improvement in user's guide section 2.2
09/06/22: Added section for finite thickness wall in UG
09/06/22: minor update in m3dc1_mfmgen in UG
09/09/22: fixing smb version mismatch error with mesh generator
09/12/22: traverse makefile and readme updated
09/22/22: adding stellar config.h for meshgen

Local Systems

- PPPL centos7(10/01/22)
  - 7 jobs PASSED
- PPPL greene (10/01/22)
  - 5 jobs PASSED
- STELLAR (10/01/22)
  - 7 regression tests **PASSED** on stellar
- TRAVERSE_gpu(10/01/22)
  - Compilation error

NERSC

- Cori-KNL (10/01/2022)
  7 regression tests **PASSED**

- Cori-Haswell (10/01/22)
  7 regression tests **PASSED**

- Perlmutter (10/01/2022)
  all regression tests **FAILED..error in partitioning the mesh**

- Perlmutter_cpu (10/01/22)
  6 jobs passed
  NCSX failed with very small difference in C1ke

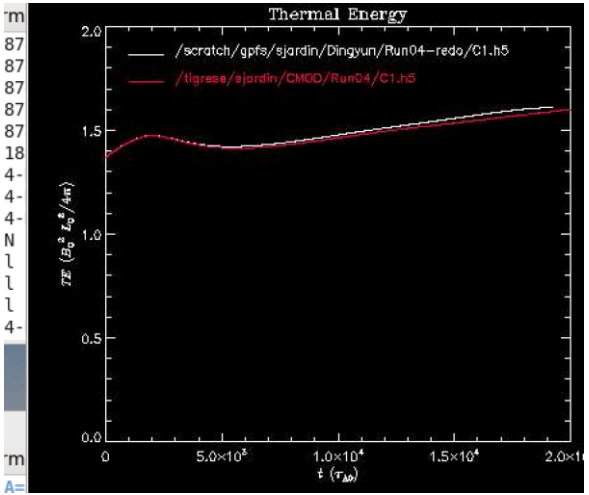
isurface

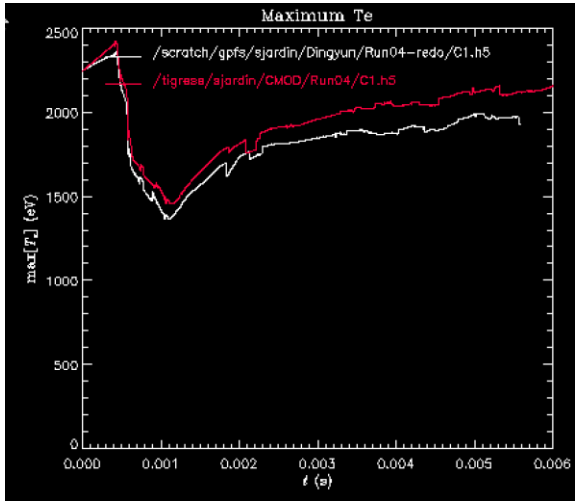
- We plan to remove this option

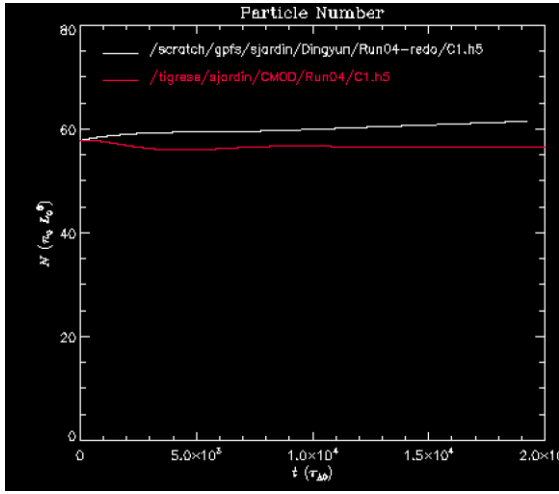
Reproducibility problem

Dingyun, is trying to reproduce a sawtooth case I published in 2018

- Stored energy now agrees after reducing kappa0 and kappar by 2
- However, now “temax” and “particles” differ
- I am continuing to look into this







Update on other Jobs

- Chen Zhao is having trouble rerunning his Disruption Mitigation with pellets and runaways with a smaller thermal conductivity .
  - Lowering the timestep did not help
  - I suggested increasing denm (previously 1.e-6)

- Brendan, status of ITER DM run?

- Other

That’s All I have

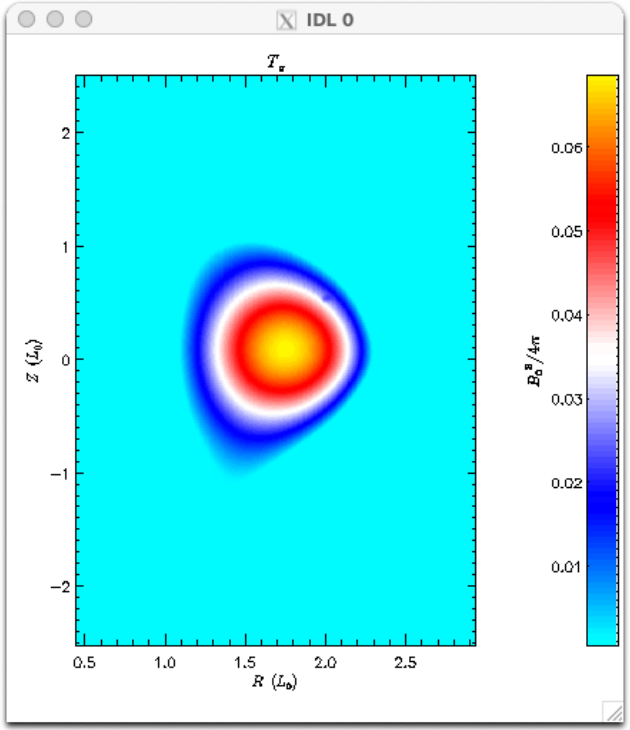
Anything Else ?

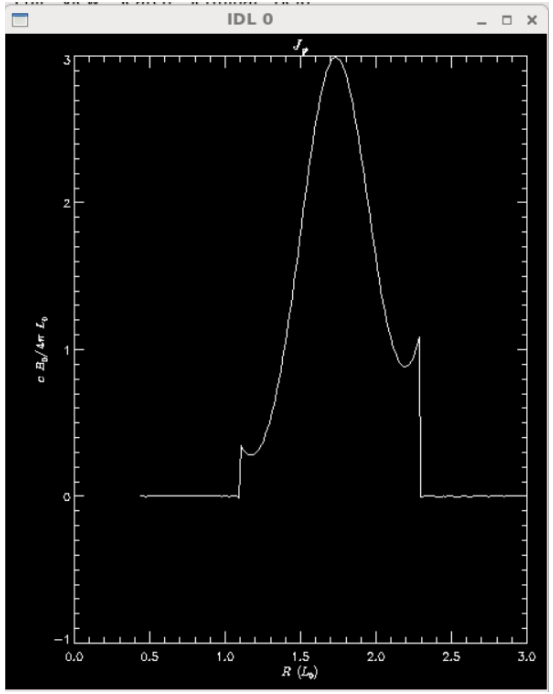
Papers in Preparation

- Chen Zhao, C. Liu, et al, “Simulation of DIII-D disruption with pellet injection and runaway electron beam”
  - ***Chen is rerunning this now with a lower isotropic thermal conductivity***

Note: May want to plot total thermal energy vs time to compare with experiment….not Te_max

Chen DIII-D VDE case

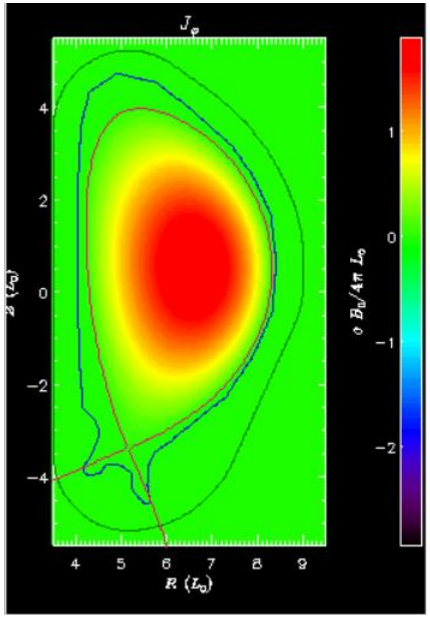


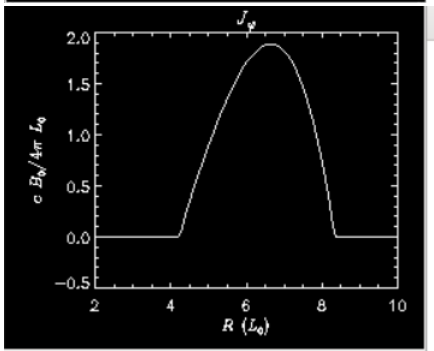


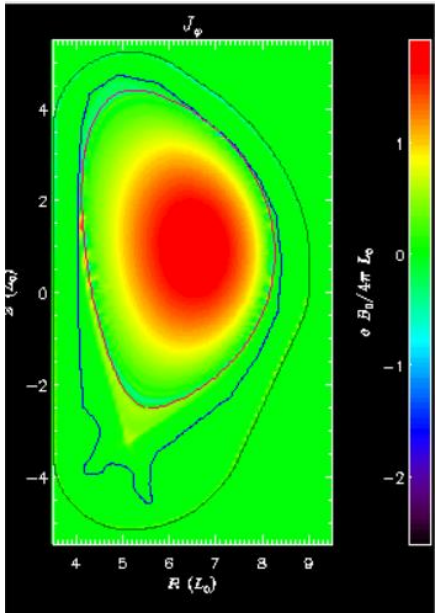
This current profile will not work for a VDE case.
Current density must go smoothly to zero!!

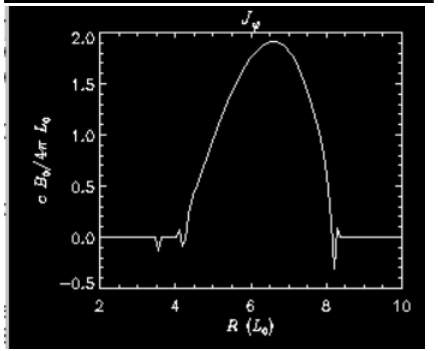
ITER 2D VDE

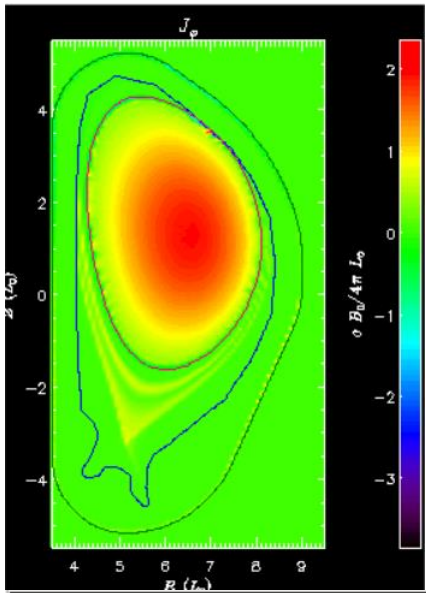
/scratch/gpfs/sjardin/ITER2D/ITER-03NM-H-64

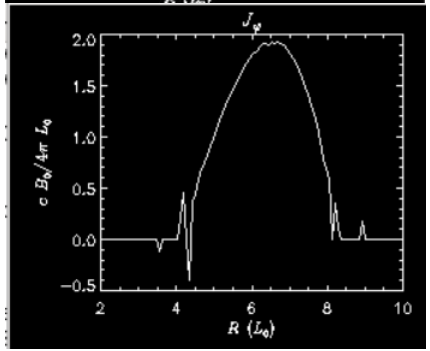












ITER Boundary Conditions

6/27/22 Brendan Lyons

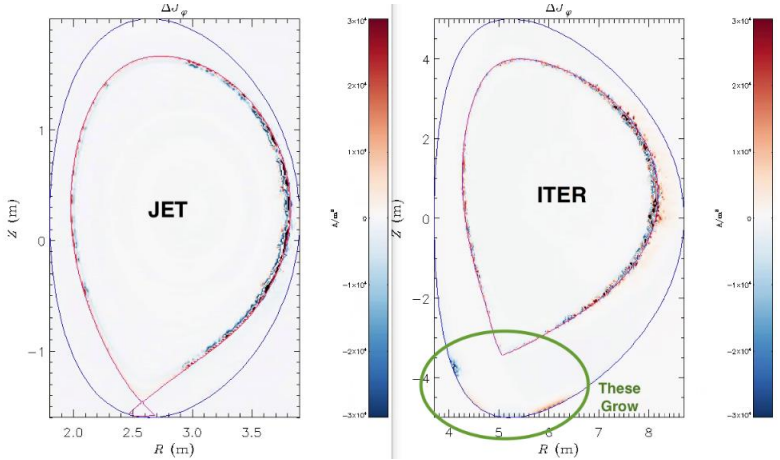
I'm still struggling to get an ITER case to run with the new inoslip_pol=2 boundary condition. I can use it in DIII-D, JET, and KSTAR runs without too much of a problem, but ITER develops an instability at the boundary right away. This is hindering our ability to bring M3D-C1 to bear on ITER SPI modeling, …..

7/11/22 S. Jardin

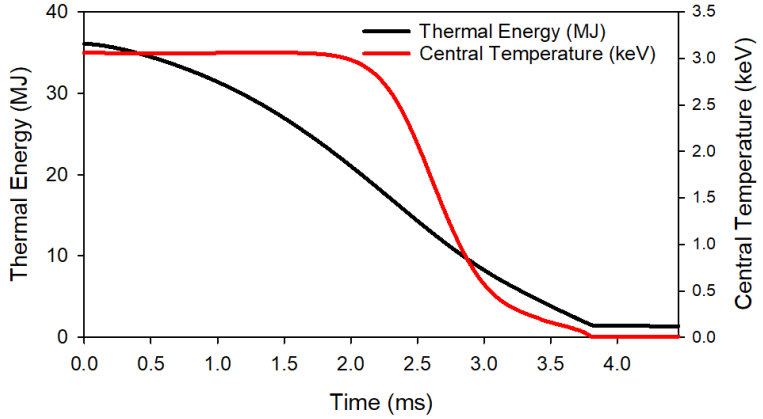
Only solution I have found is to set inoslip_pol=1. Is this acceptable?

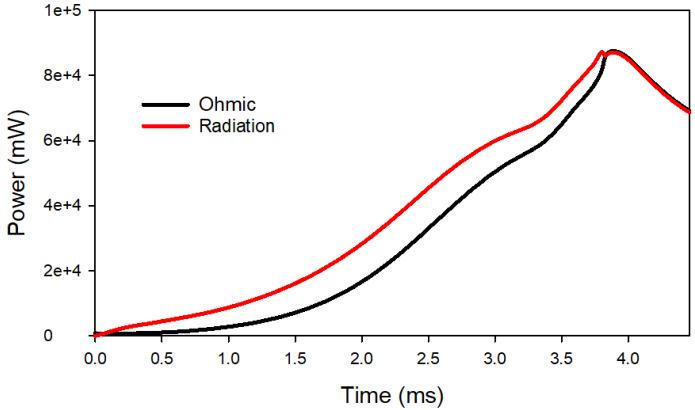
From Michael Lehnen to Brendan 8/24/22

The boundary condition problem is a severe one and maybe you can communicate with Steve Jardin about how to solve it.

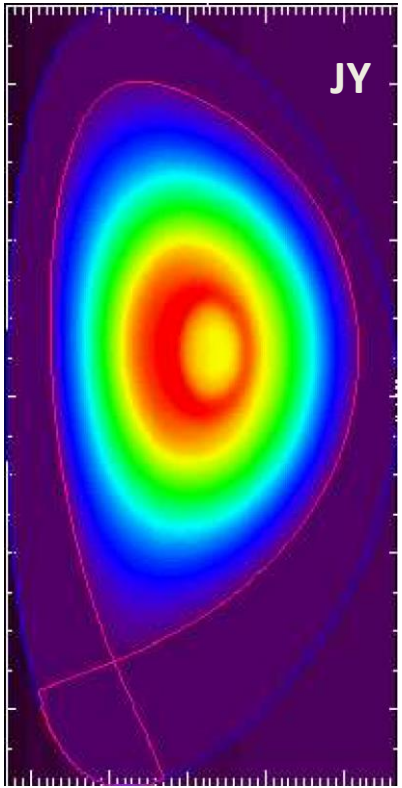


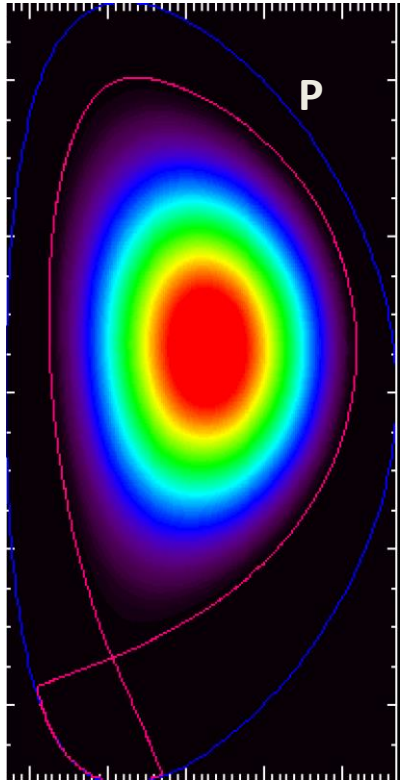
ITER 2D inoslip_pol=1 …cont





L-mode profiles



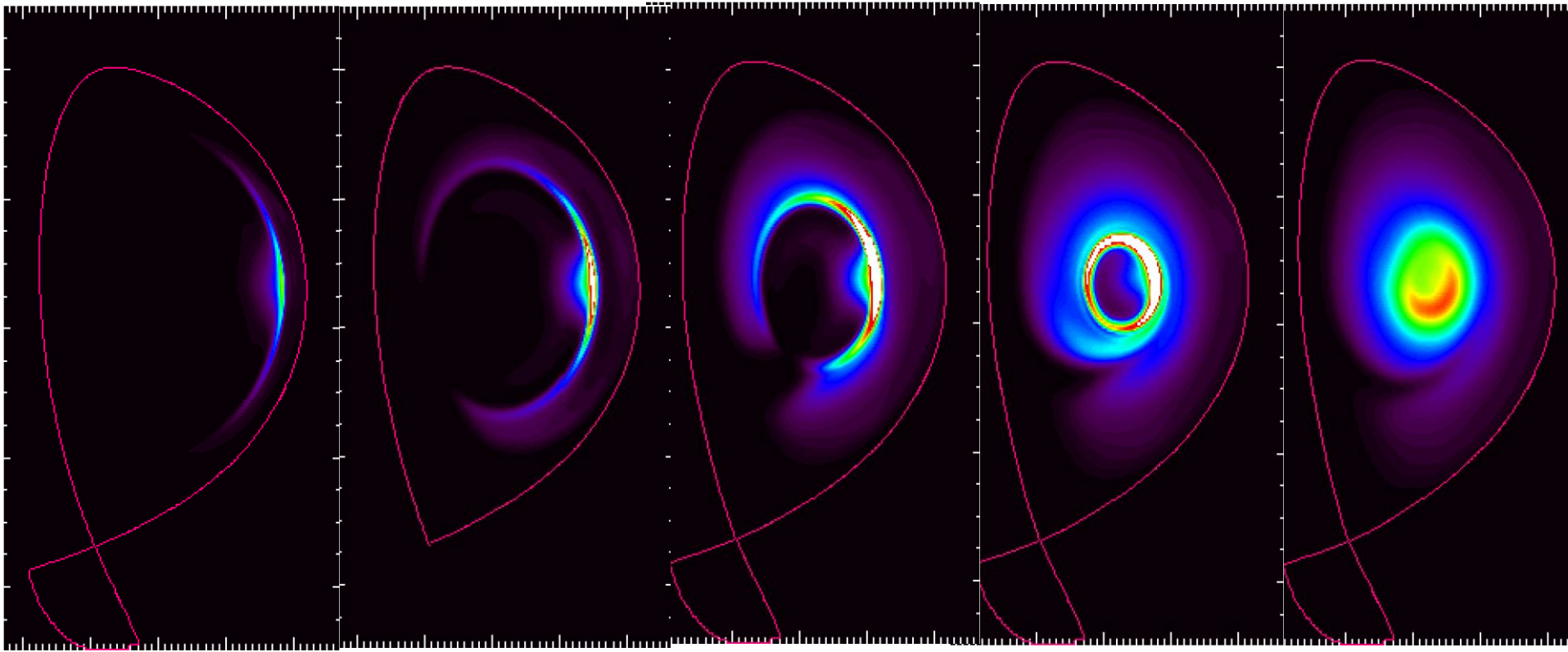


/scratch/gpfs/sjardin/BrendanP1

ITER 2D inoslip_pol=1

kprad_rad

0.89 ms 1.78 ms 2.67 ms 3.56 ms 4.46 ms



Stellarator Version Convergence

Adelle posted on SLAC on 7/14/22:

We're running into a bit of an issue with the stellarator version, and I was wondering if someone could please take a look.

- In the stellarator version, we have more difficulty getting the velocity solve to converge. In practice, this means we run at viscosities that are 1-2 orders of magnitude higher than in tokamaks. The thought is that the preconditioner is not as effective.
- Based on the fact that quasihelically symmetric (QH) cases are proving much more difficult to run than quasiaxisymmetric (QA) cases (although those are very challenging too), the issue might be specifically related to the non-quasiaxisymmetric terms in the velocity equation.
- If there is a way to improve the preconditioning, I think that would really improve the performance of the stellarator version, especially if it allows us to decrease the viscosity.

Upgrade to impurity radiation Routines

Brendan Lyons wrote to martin.omullane at ADAS on 6/22/22

Any Response?