M3D-C1 ZOOM Meeting
01/30/2023

CS Issues

1. BGMB update – Jin and Adelle
2. RPI Update on Meshing and Adaptation
3. m3dc1_meshgen on stellar - Seegyoung
4. New Latex documentation -
5. NERSC Time for 2023
6. Changes to github master since last meeting
7. Regression tests
8. isurface removal

Physics Studies

1. Update on NSTX shot 124379 and infernal modes and GATO
2. Energy conservation on KSTART runs -- Brendan Lyons
3. Anything else

In attendance

Steve Jardin
Hank Straus   Seegyoung Seol
Adelle Wright   Usman Riaz
Andreas Kleiner
Jin Chen
Chen Zhao
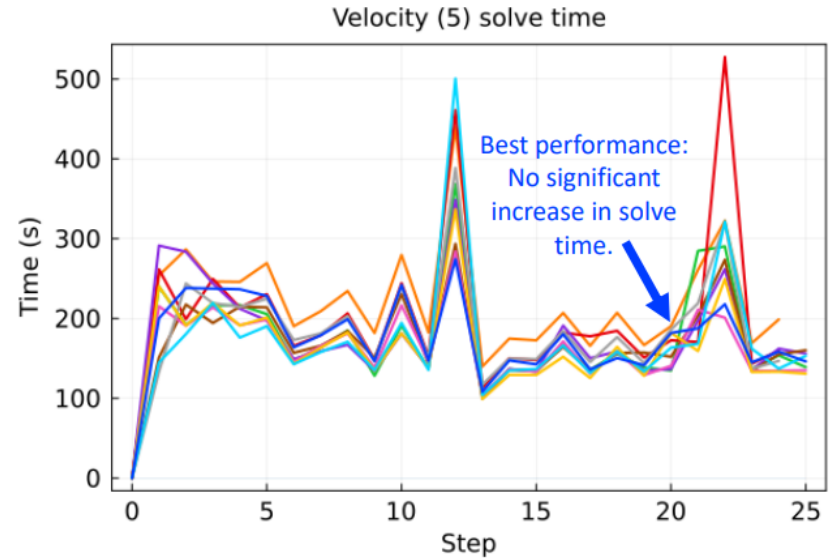Chang Liu
Brendan Lyons
Cesar Clauser
Dingyun Liu
P. Sinha

Update on BGMG

Jin Chen.

Testing BGMG preconditioner on hard-to-run stellarator cases.

- In stellarator geometry, 5 (velocity) is the difficult solve.
- Without BGMG, the QH case does not run (5 diverges at first step).
- With BGMG preconditioning on 5 (`nplanes=64`):

Best performance when: `rtol->0` (`10e-11` compared to `10-e9` or `10e-10`) and `GMRES_restart=100`.

- Decreasing `rtol` doesn't significantly increase solve time but reduces variation in iterations.
- This suggests that for these problems, a very good initial guess (coarse solution) is required to maximize efficacy of preconditioner on the full matrix.

Adelle

RPI update on Meshing Capabilities and Adaptation

M3DC1_meshgen installed on stellar

Seegyoung installed the mesh routines on stellar and they are described in the readme.stellar files

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".
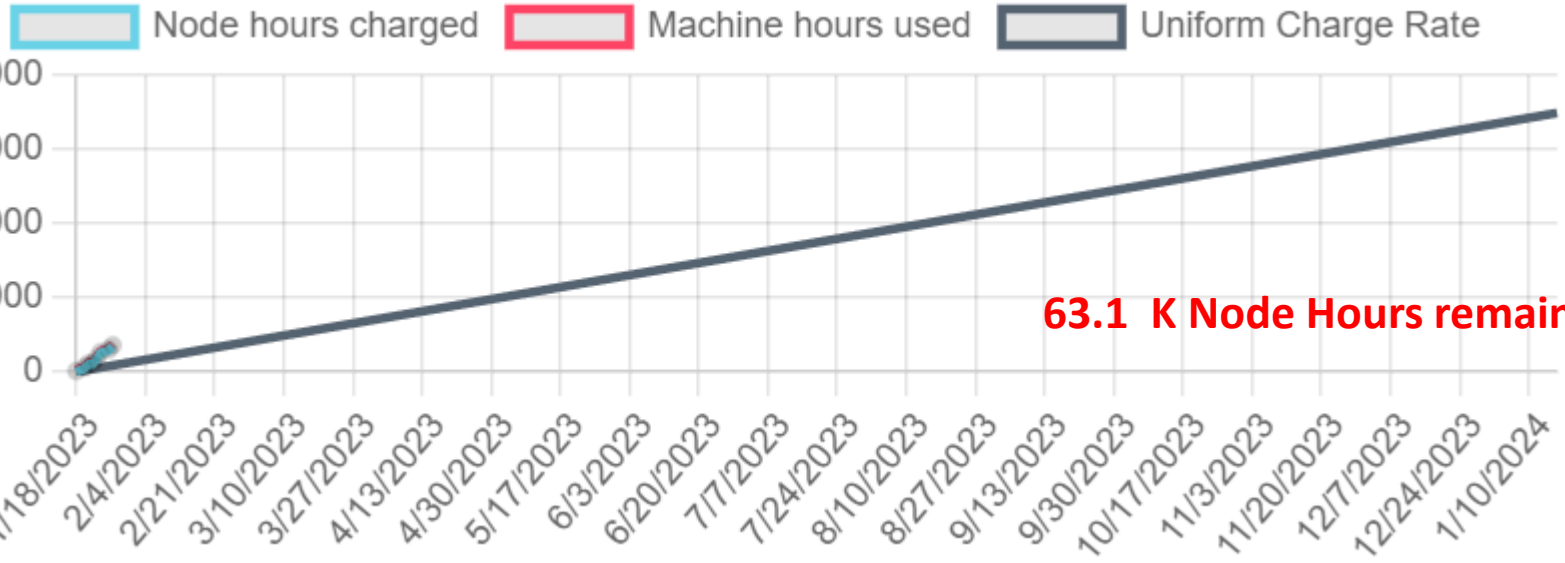
.pdf version is available on m3dc1.pppl.gov

All C1input variables are now documented (sectin 6)

Appendix B (SCOREC API) now eliminated . (Thanks to Seegyoung)

I will continue to (slowly) review sections for completeness and correctness.

NERSC Time 2023

mp288

Legend: Node hours charged | Machine hours used | Uniform Charge Rate

63.1 K Node Hours remaining!

- MP288 cpu usage slightly above sustainable rate
- We were originally given 50K node-hours, but 20K was added recently
- We have 10,000 GPU node hours as well.
- Cori to go away March 2023

Changes to github master --after 2022-12-16

Seegyoung Seol
12/16/22: adding config files for traverse nvhpc compiler
01/01/23: checking in 3D adaptation ready m3dc1_scorec (developed by Morteza)
01/05/23: reverting centos7.mk
01/12/23: adding mesh generation tips on readme.stellar
01/17/23: mesh generation s/w installed on Stellar+openmpi

Jin Chen
01/17.23: update readme.stellar to reflect current status
01/18/23: block geometry multigrid code added
01/18.23: missed changes

Chang Liu
01/17/23: updated readme.Perlmutter_gpu to reflect current status

Cesar Clauser
01/18/23: modify .gitignore to ignore doc's auxiliary files

Changes to github master --after 2022-12-16

Nate Ferraro

12/16/22: corrected units of kprad_n and kprad_n0 scalars

12/16/22: corrected units on eta_j2 field

12/16/22: changed coloring of mesh boundaries to work better with multi-region meshes

12/16/22: changed default behavior of get_slice_time to return values for all time slices

12/16/22: fixed bug where rst and zst would be continuously re-read when plotting stellarator fields with eqsubtract=1

12/21/22: Increased time limit on RMP regtest on greene to prevent timeouts

12/21/22: Changed expfit.pro to allow time shift in fit

01/13/23: Started removing isurface=1 functionality

01/17/23: mgrid fix ← **"adapt" regtest started failing**

01/17/23: Fixed bug in scorec_mesh where myrank was being used before initialization

01/17/23: Updated regtest batch script on greene to exclude greene033 node

Changes to github master --after 2022-12-16

Andreas Kleinder

01/24/23:   updates to Python routines:

- New function 'reduce_ts' that writes a new h5 file from existing time slice that only contains chosen fields
- New function to plot field vs phi
- New function 'compare_kinetic_profiles' allows comparison of p, p_e, and p_i
- New functions to plot flux and j_phi from G-EQDSK flle
- Added more fields to flux average calculation
- Major updates to plot of eigenfunction
- Improved plot labels for fields and time traces
- TIme traces can now be plotted as a function of ms (set units='mks' AND millisec=True)
- Plot_signal can now group multiple probes and plots average signal of grouped probes
- Update docstrings
- extend_profiles more robust
- Other small bug fixes and improvements

01/24/23:   Updates to python routines—added missing file

Local Systems

- PPPL centos7(01/30/23)
  - 7 jobs PASSED

- PPPL greene (01/30/23)
  - 5 jobs PASSED

- STELLAR (01/30/23)
  - 7 regression tests **PASSED** on stellar

- TRAVERSE_gpu(11/04/22)
  - Compilation error   (being looked at by Seegyound , Jin, and Chang)

NERSC

- Perlmutter_cpu (01/27/23)
  6 jobs **PASSED**
  NCSX failed with very small difference in C1ke

- Perlmutter_gpu (01/27/23)
  – All jobs failed loading shared libraries

isurface

- Nate is removing this option

Update on NSTX shot 124379

I have asked Kathreen Thome and Joey McClenaghan (GA) to look at
these cases with the ideal MHD codes GATO and DCON.

So far they have not found any instabilities!
Alan Turnbuill asked for a higher resolution geqdsk (original one 82 x 82).
I generated a 512 x 512 with the IDL write_geqdsk.
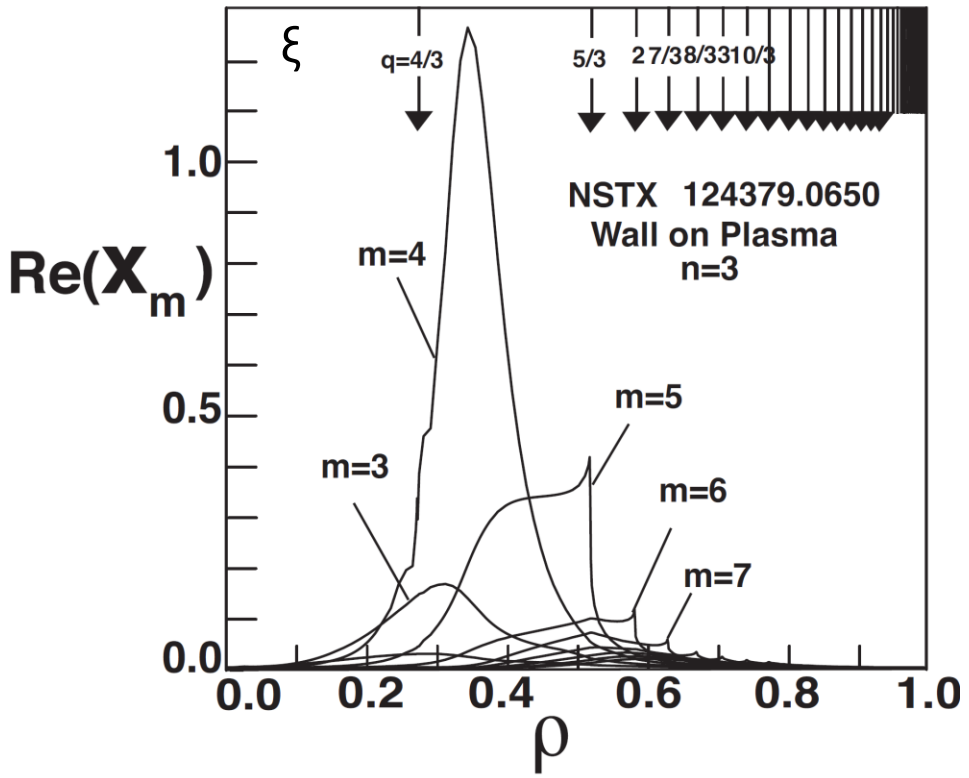With this he found an unstable n=3 mode with GATO. (next slide).
Higher-n modes are very difficult for GATO
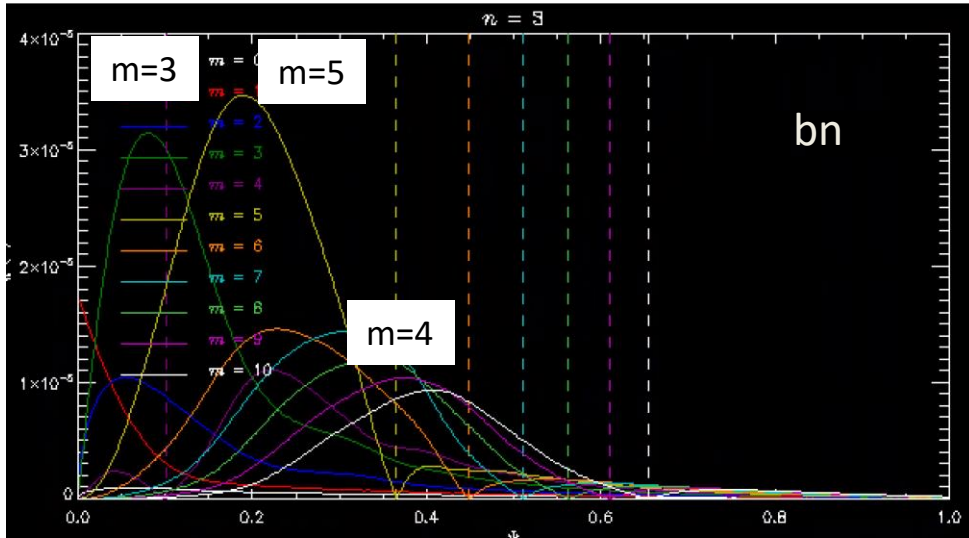
GA tried and failed to get DCON to work on this case
"

Now, trying to resurrect the PEST linear ideal MHD code as a check (with
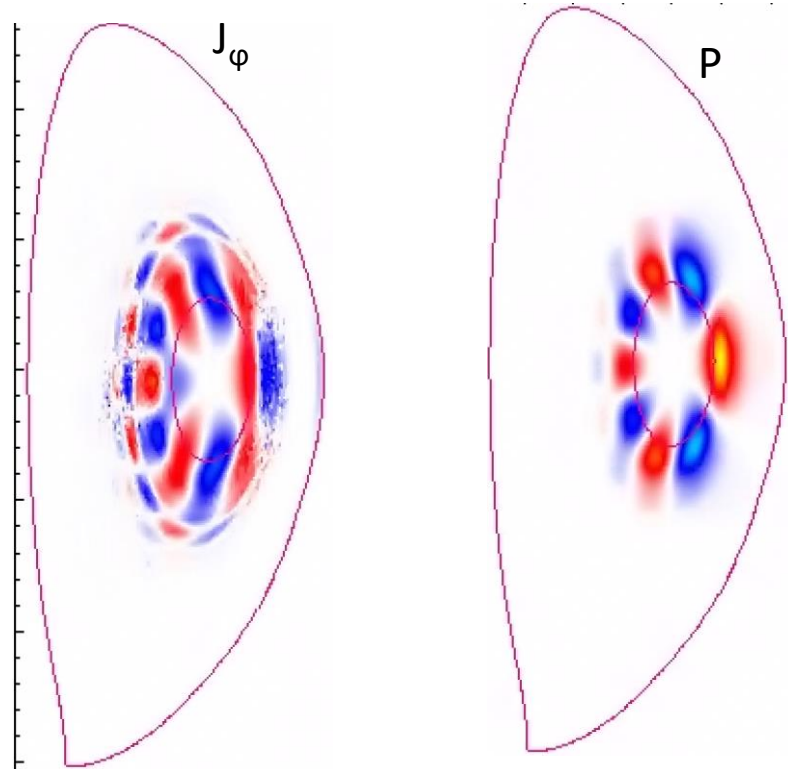J. Chen).   We have the code but no documentation or sample input files.
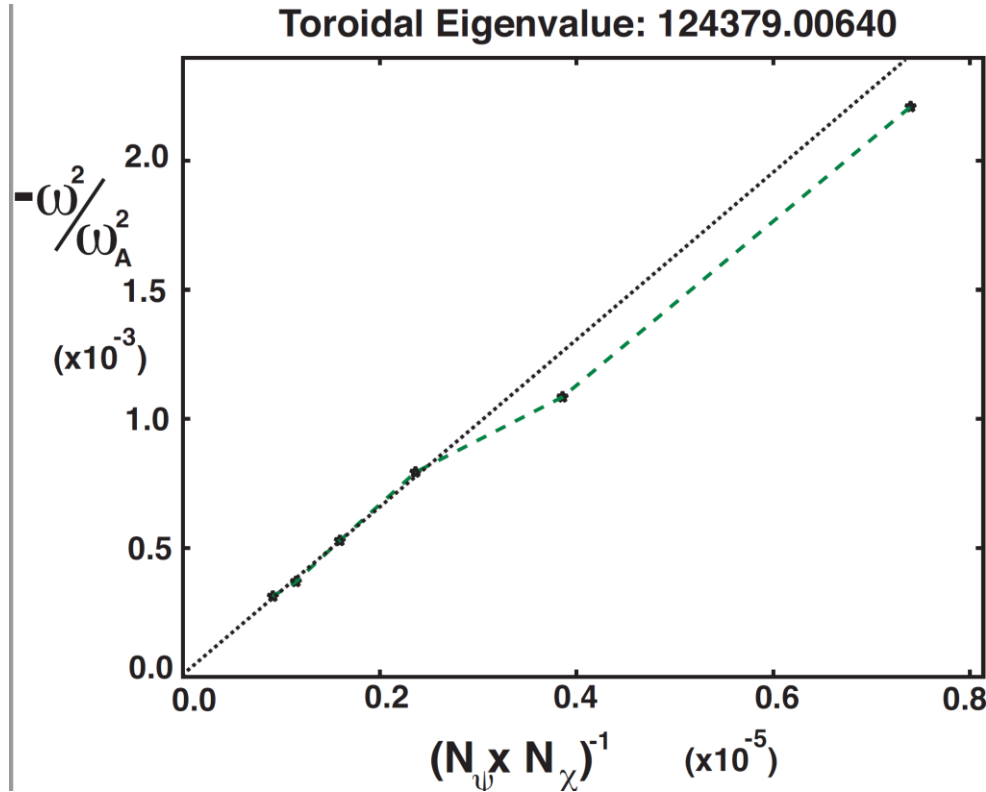
Comparison of GATO and M3D-C1 for n=3
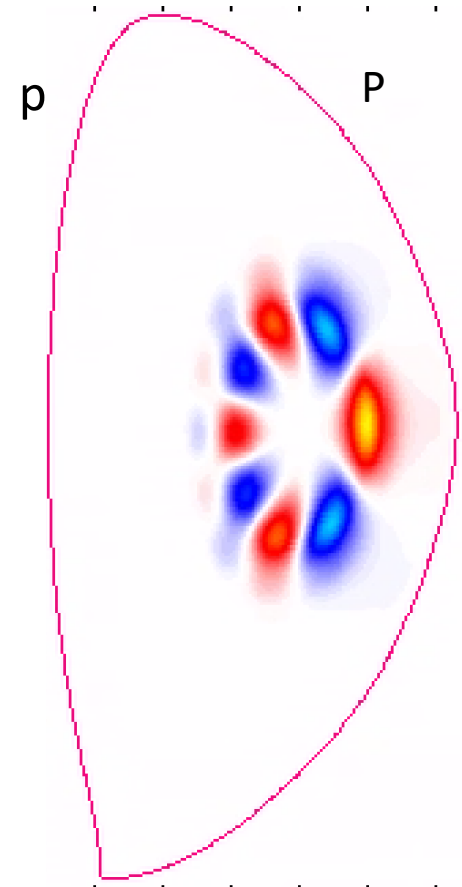
More on the M3D-C1 n=3 mode

plot_br,points=400,bmncdf='bmn.nc',file='fname'
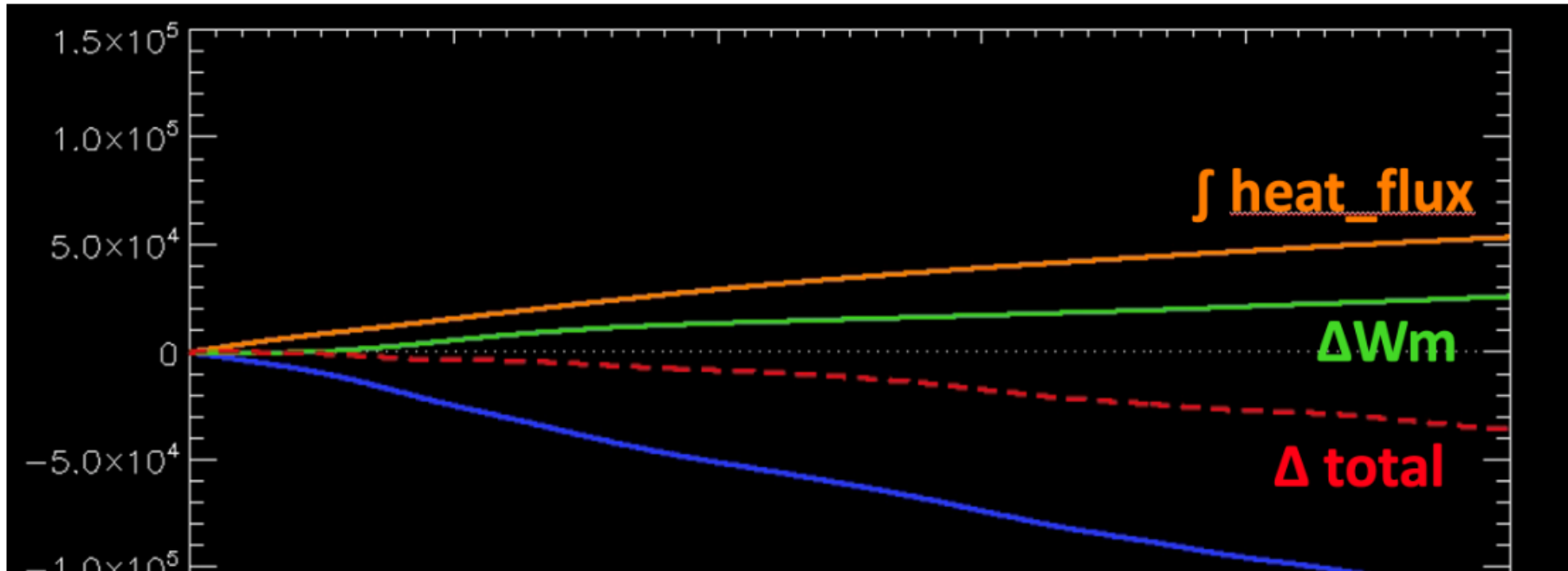plot_m_vs_r,'pmn.nc',/netcdf,mrange=[0,10]

M3D-C1 finds the n=4 to be stable

Toroidal Eigenvalue: 124379.00640

GATO also found the n=4 mode to be stable, but had to do an extensie convergence sequence.

Update on other Jobs

- Brendan, KSTAR conservation problem

That's All I have

Anything Else ?