

# M3D-C1 ZOOM Meeting

6/08/2020

## Agenda

1. Announcements
2. CS Issues
  1. 3D Seg fault on eddy
  2. Failed dawson reg tests (jobs timed out)
  3. NERSC Time
  4. Changes to GIT master since last meeting
3. Physics Studies
  1. New interpretation of Strauss JET runs
  2. 2D ITER VDE with new structure
  3. M3D-C1 coupling to KORC
  4. Other

# Announcements

- Laboratory closed until June 22 (at least)
- No more partition=greene at PPPL
  - Instead use #SLURM –partition=m3dc1 (job will run on greene, 8 GB/core)
- CTTS Talk Series
  - 6/10 Cesar Clauser C-pellet disruption mitigation modeling with M3D-C1 in NSTX
  - 6/17 Charlson Kim NIMROD SPI Simulations
  - 6/24 open
- All talks posted on [ctts.pppl.gov](http://ctts.pppl.gov)
- IAEA Technical Meeting on Disruptions and their mitigation
  - Will be held remotely 20-23 July
  - Clauser, Jardin, Lyons, Strauss, Chen to present talks
  - Talks are to be pre-recorded 1 week in advance
- SciDAC PI meeting scheduled for July 28-30 July 2020 is *cancelled*
  - Replaced by a half-day remote panel session on July 29
  - Need to register....information will follow

Invited

# 3D Seg Fault

When running the 3D code, I have gotten a Segmentation Violation at seemingly random time steps. When I resubmit, it either runs ok or fails at the same place but at a different timestep. The last lines of output when it fails are always the same:

```
Advancing Temperature--end  
Advancing Fields  
  -- Reuse Preconditioner  
[70]PETSC ERROR: -----
```

This happened to me using SuperLU\_dist on cori\_knl, and also using mumps on eddy. Because this is not reproducible it will be hard to find, but it could have something to do with changes you made to allow reusing the preconditioner.

**Jin: on eddy, copy**  
**/home/jinchen/SRC/M3DC1/unstructured/eddy.mk**

Jin Chen

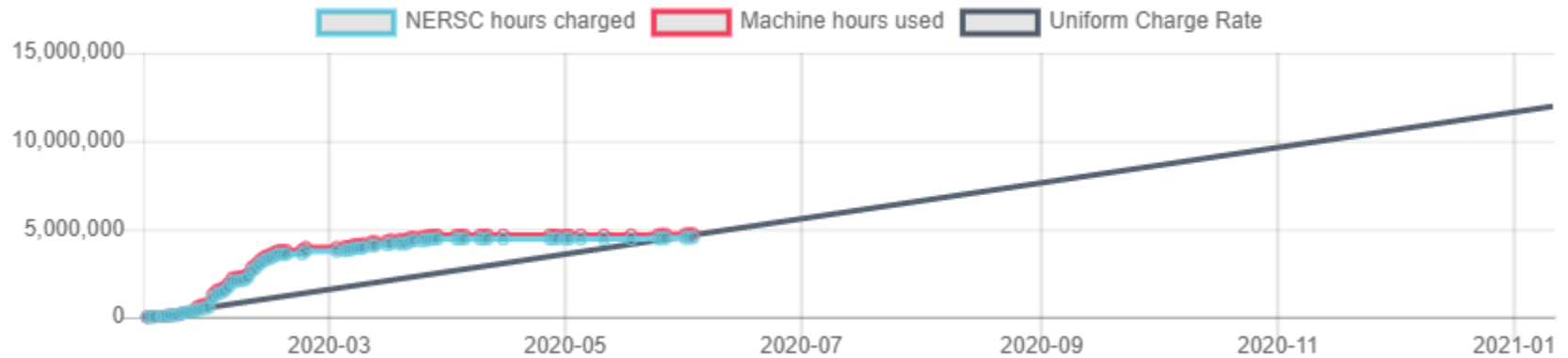
# Regression Tests failed on Dawson

All regression tests failed.

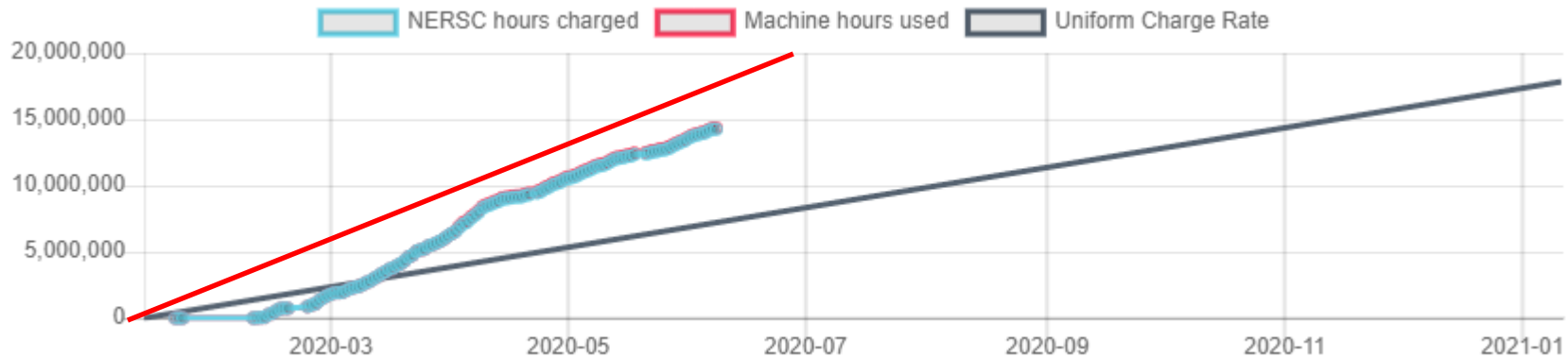
All jobs timed out after 30 min

# NERSC

MP288



M3163



Need to use less mp288. m3163 approaching linear usage rate

Add to batch file: #SBATCH -account=3163

(clauser, kleiner, lyons, strauss)

# Changes to github master since last week

- Jardin: added term to temperature diagnostic plots

For itemp\_plot=1, all terms in Te equation are now output (Clauser to verify)

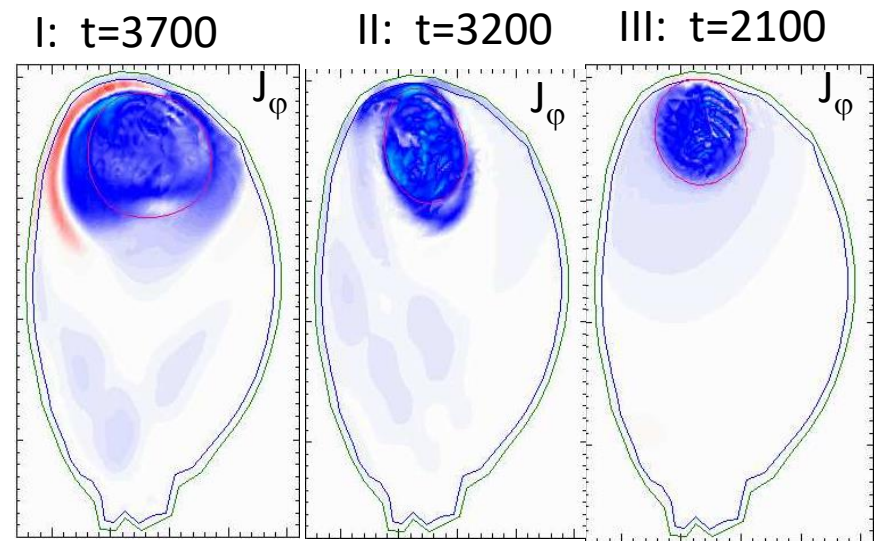
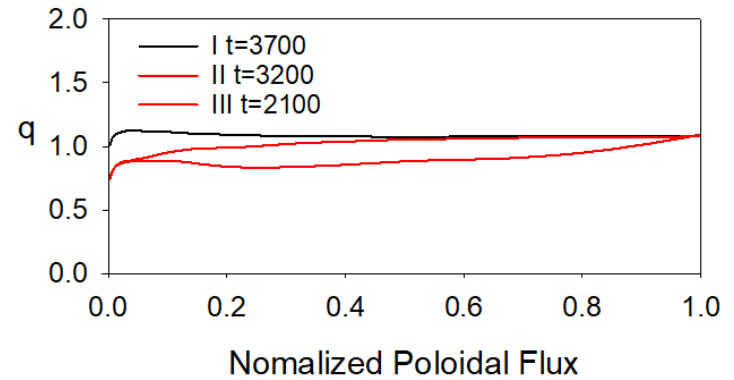
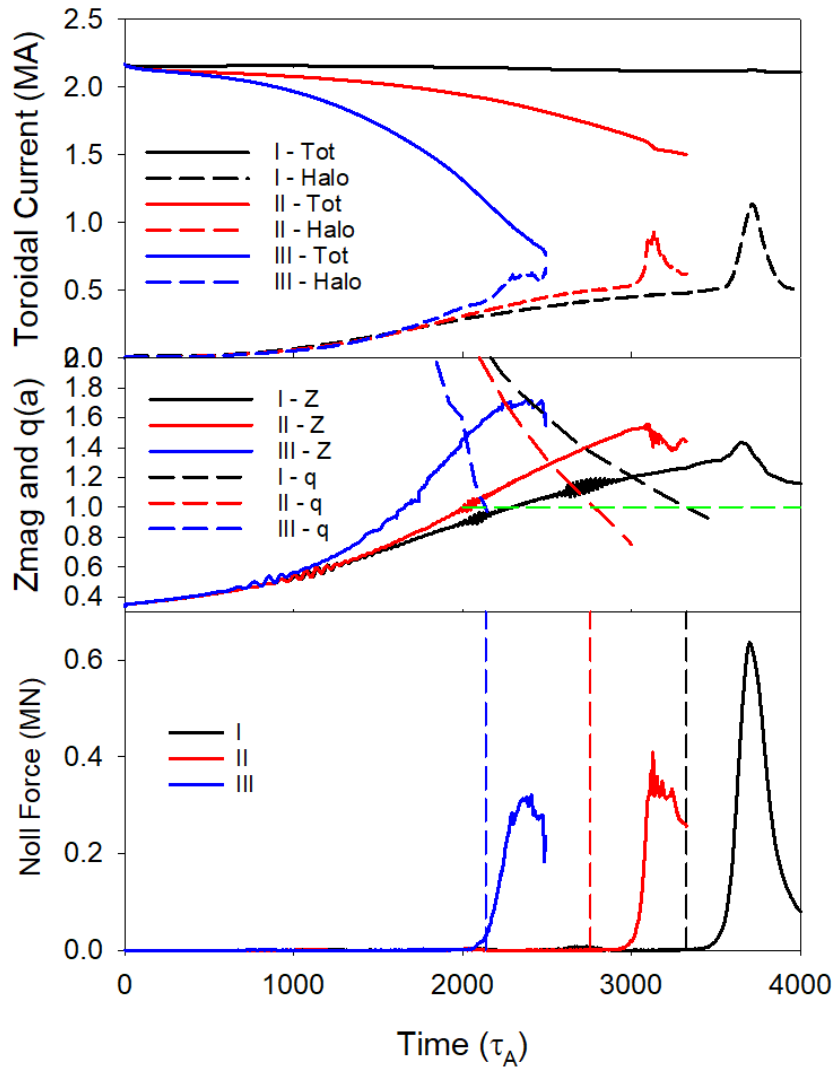
RHS of Te equation =

$$\begin{aligned} &= \text{eta\_jsq} \quad (\gamma - 1) \left[ \eta J^2 + S_e + S_{rad} \right] \\ &+ \text{vdotgradt} \quad -n \mathbf{V} \cdot \nabla T - (\gamma - 1) n T \nabla \cdot \mathbf{V} \\ &+ \text{deldotq\_perp} \quad -(\gamma - 1) \nabla \cdot \mathbf{q}_\perp = -(\gamma - 1) \nabla \cdot \kappa_\perp \nabla T_e \\ &+ \text{f3vplot} \quad (\gamma - 1) (T_i - T_e) n_e (QD) \\ &+ \text{deldotq\_par} \quad -(\gamma - 1) \nabla \cdot \mathbf{q}_\parallel = -(\gamma - 1) \nabla \cdot \kappa_\parallel \mathbf{b} \mathbf{b} \cdot \nabla T_e \\ &+ \text{f2eplot} \quad -T_e \nabla \cdot D \nabla n_e - T_e S_{ne} \end{aligned}$$

- Ferraro: Corrected implementation of denm and kappa profiles for ikappafunc=10,11 or idensfunc=10,11 in private flux region

Documented changes in NEWDOC-latest: [m3dc1.pppl.gov](http://m3dc1.pppl.gov)

# JET sequence with prescribed $I_p(t)$



- Prescribed  $I_p$  vs  $t$  (top left)
- Z-motion faster for faster CQ
- Plasma scrapes off until  $q(a) = 1$
- Halo current and Noll force spike @  $q=1$
- Largest force for slowest CQ

Case	Strauss case	n=1 peak value	@time	@slice	@q(a)
I	9a	11	3700	150	1.07
II	9f	4	3200	118	1.07
III	fb	.1	2100	39	1.07

/global/cscratch1/sd/hstrauss/JETm3dc1\_0.12h9

h9f

h9b



# 2D ITER VDE with new ITER structure

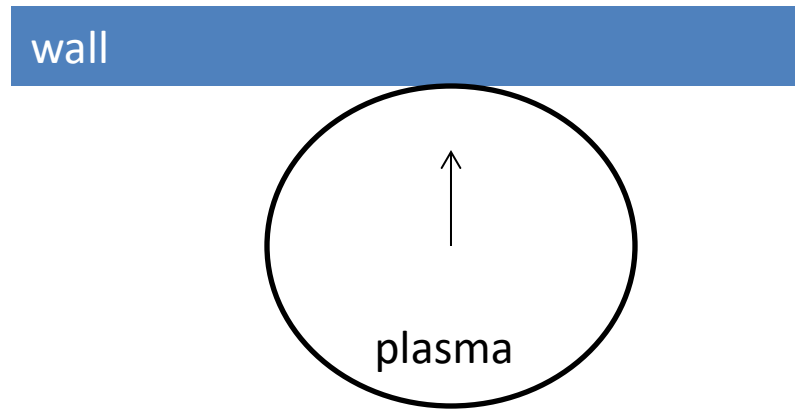
- Cesar to show vgs

# Ratio of VDE time to current quench time matters

$$q(a) \cong 2\pi \frac{B_T a^2}{R \mu_0 I_p}$$

$$Z_p = Z_0 e^{\gamma_{VDE} t}$$

$$I_p = I_{p0} e^{-\gamma_{CD} t}$$



$q(a)$  will decrease during the current quench

only if  $\gamma_{VDE} > \frac{1}{2} \gamma_{CD}$

if  $q(a)$  doesn't decrease during the current quench,

there will be very little MHD activity and sideways force

# M3D-C1 coupling to RE code KORC

- ZOOM call held Friday June 5
  - Matt Beidler, Diego Del-Castillo-Negrete (ORNL)
  - S. Jardin, N. Ferraro, Chang Liu (PPPL)
- KORC can now run using fields, densities, and temperatures from M3D-C1 hdf5 files using Nate's Fusion-IO routines
  - Nate to add impurity densities

What to do next ? Oct30 email from Carlos Paz-Soldan (GA)

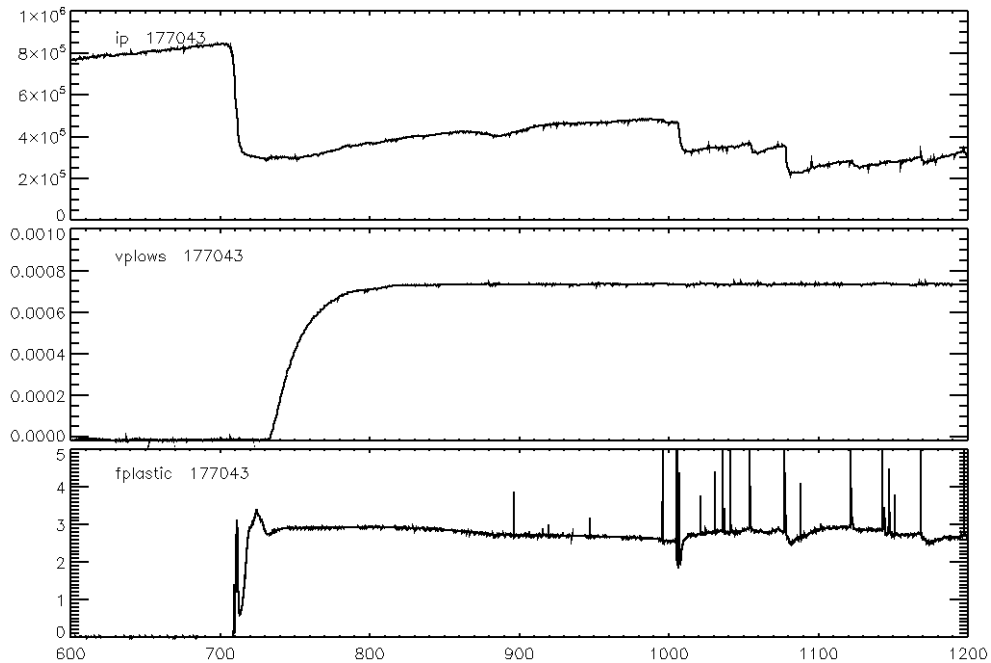
I am attaching many files for one case, **177053**. It is a low Te (few keV) case with 800 kA of pre-TQ current. The RE seed production is present (few 10s%) after Ar pellet injection.

This is not a particularly exciting discharge but it is a case that I previously sent to Brendan Lyons for M3D-C1 modeling (Brendan - correct me if I'm wrong). I'm not sure what EQ is being considered for NIMROD+CQL3D.

Down the road, I have equilibria scanning the pre-disruption Te and the pre-disruption IP which would be valuable to study further.

The Te effect is something I am focusing on right now and is a big effect. I would propose that be a candidate sequence for both M3DC1/KORC and NIMROD/CQL3D for the theory milestone if RE seed modeling is the target. The below EQ is NOT part of the Te scan sequence but anyway its a vanilla starting point and the input formats will be the same.

# DIII-D shot 177053



- Should we propose KORC /M3DC1 to model this shot?
- Model the Argon pellet ?
- Who would be the experimental contact?
- Benchmark with NIMROD/CQL3D ?

That's All I have

Anything Else ?