M3D activities update

Josh Breslau

M3D group meeting

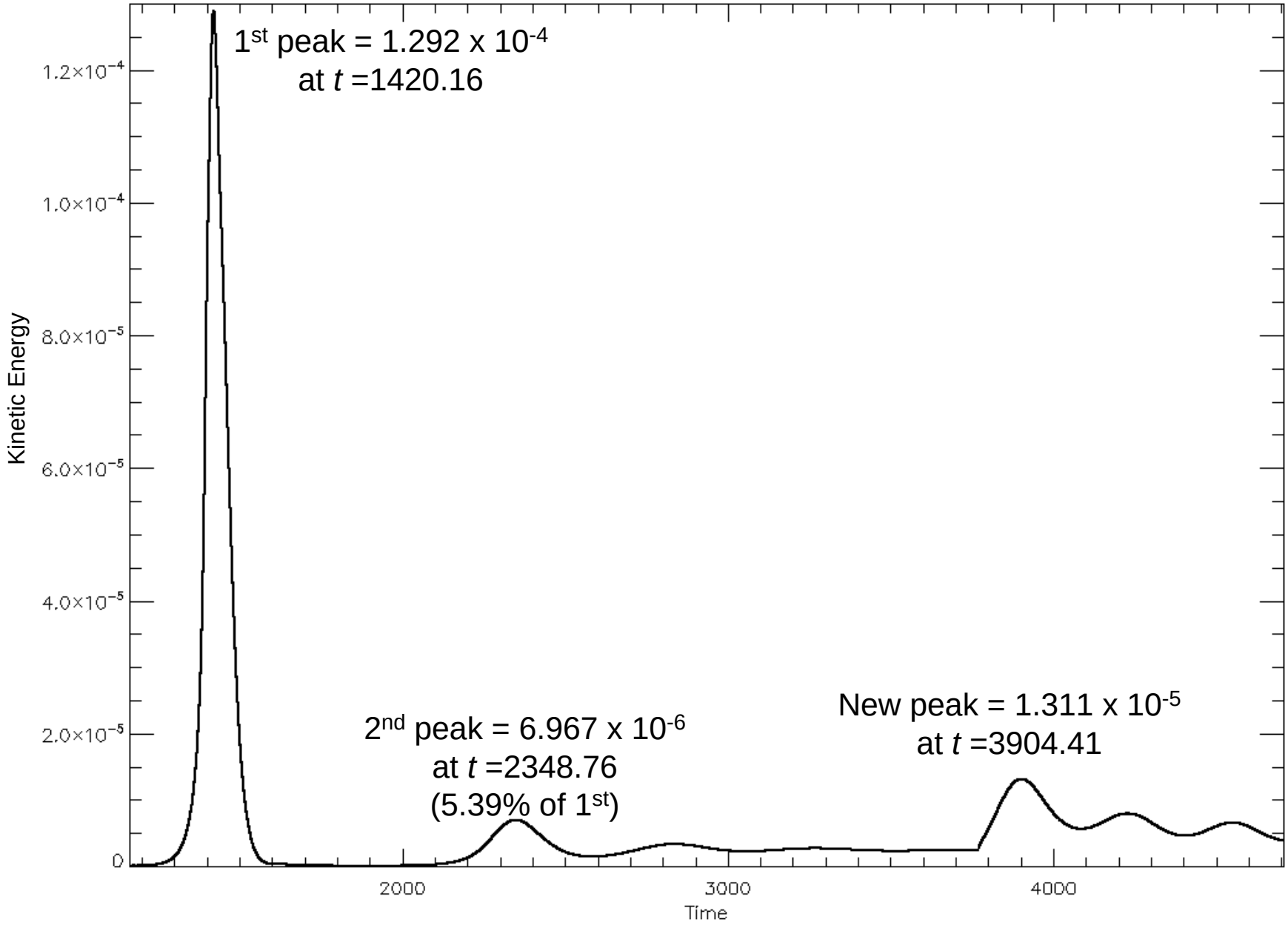
February 11, 2009

Outline

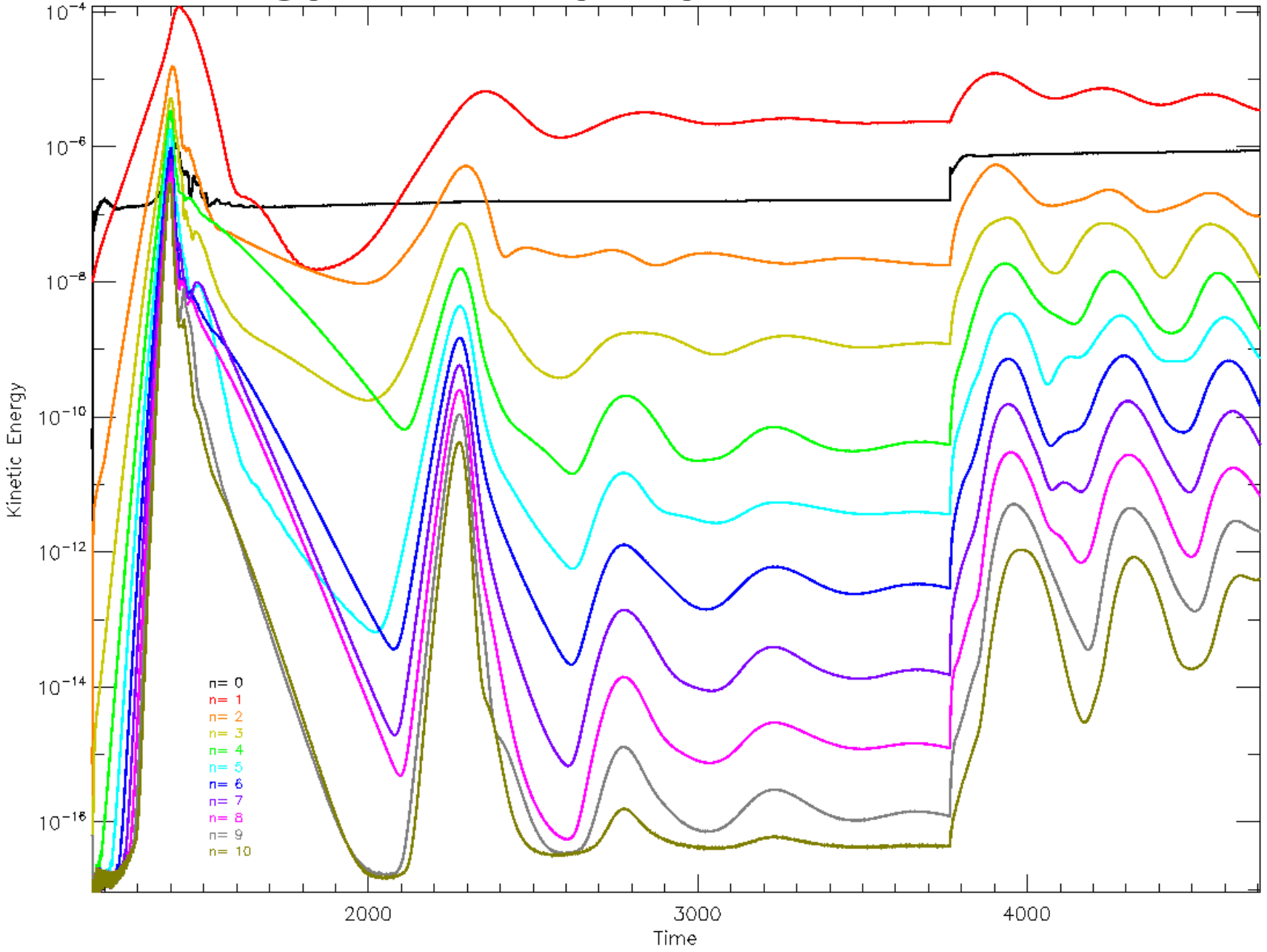
- CDX sawtooth restart, reduced viscosity
- C-Mod sawtooth with hot particles
- Error fields
  - Straight cylinder
  - DIII-D
- Disruption modeling
  - Resistive wall MPP code debugged
  - Wall force calculations
  - External kink

CDX sawtooth

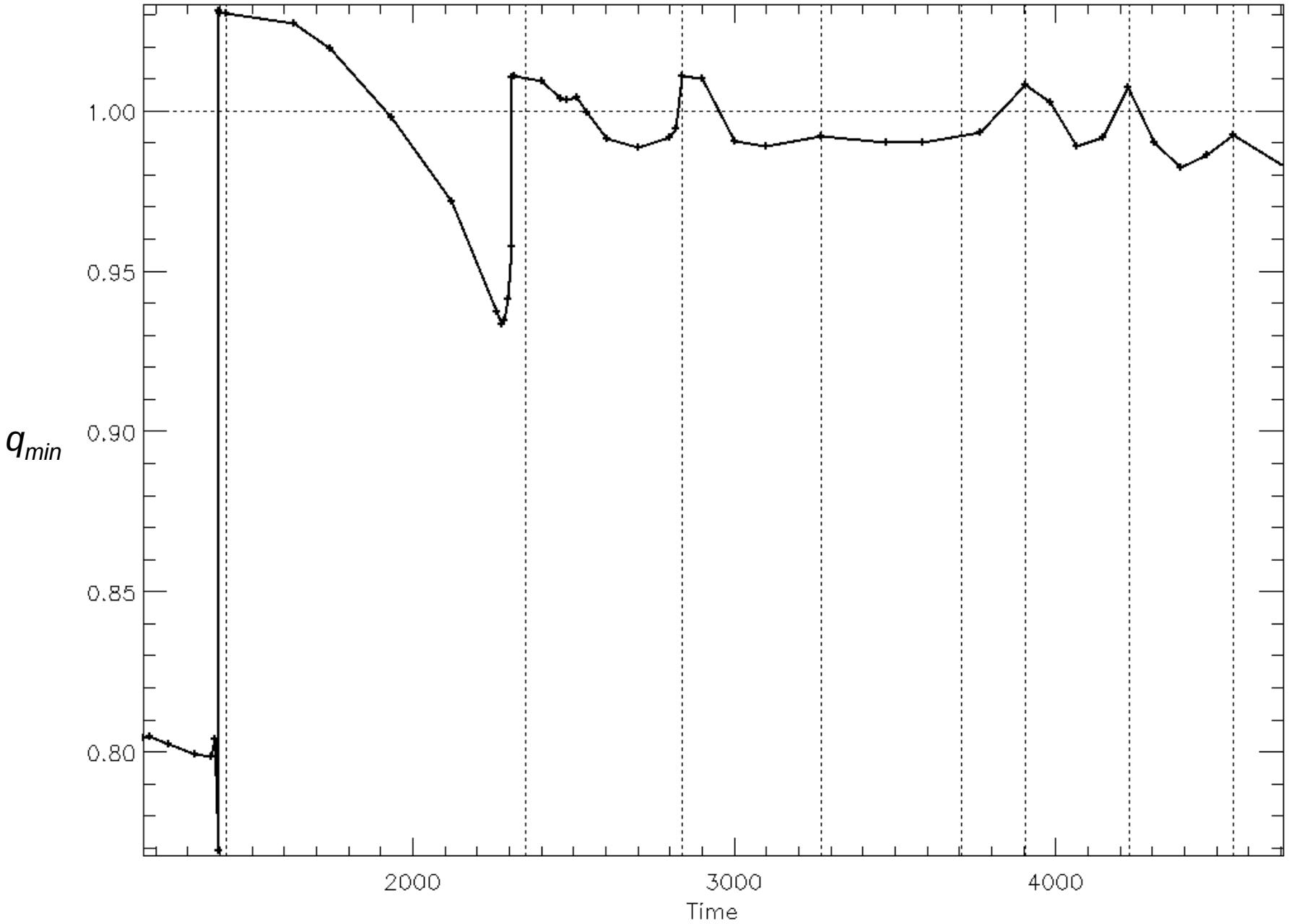
Restart from t=3765.27, reducing rmu from 1.835e-4 to 5.803e-6



Energy History by Mode Number

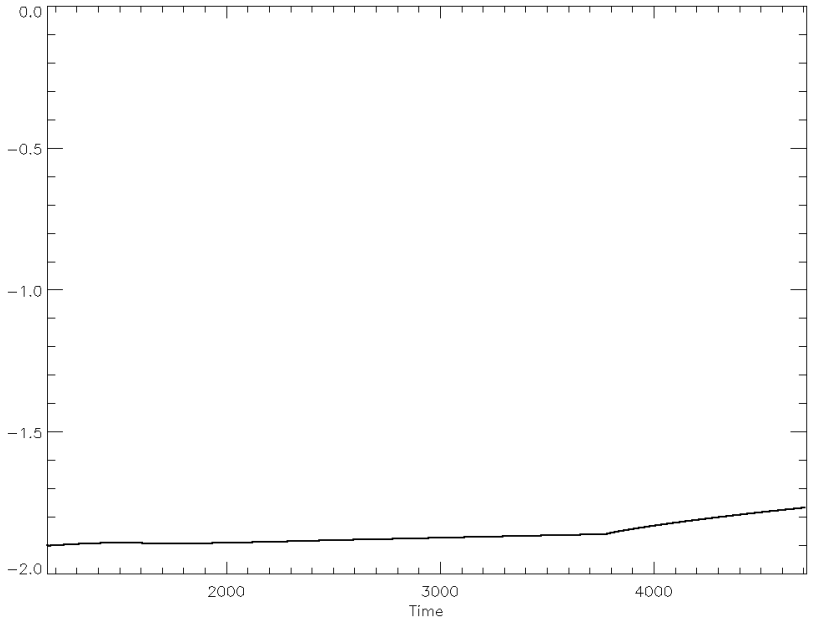


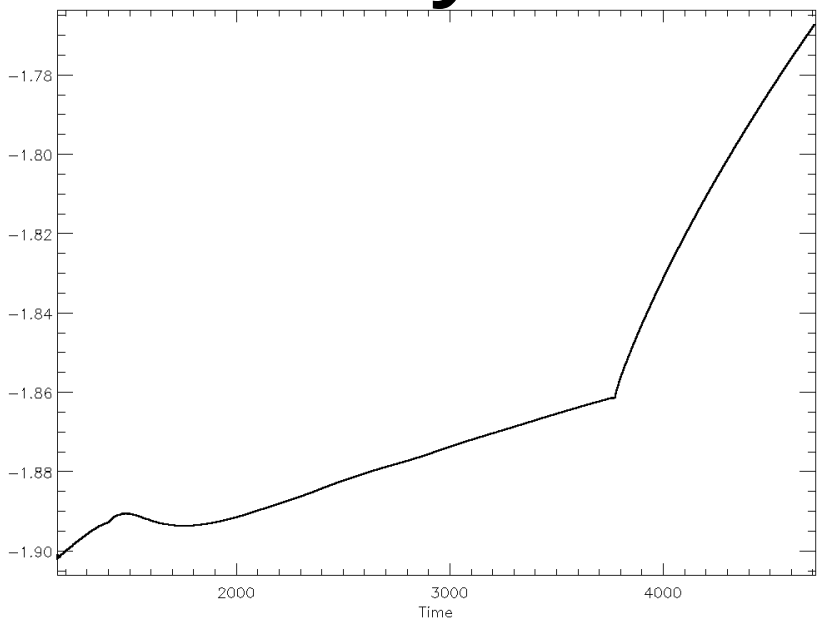
q_0 history



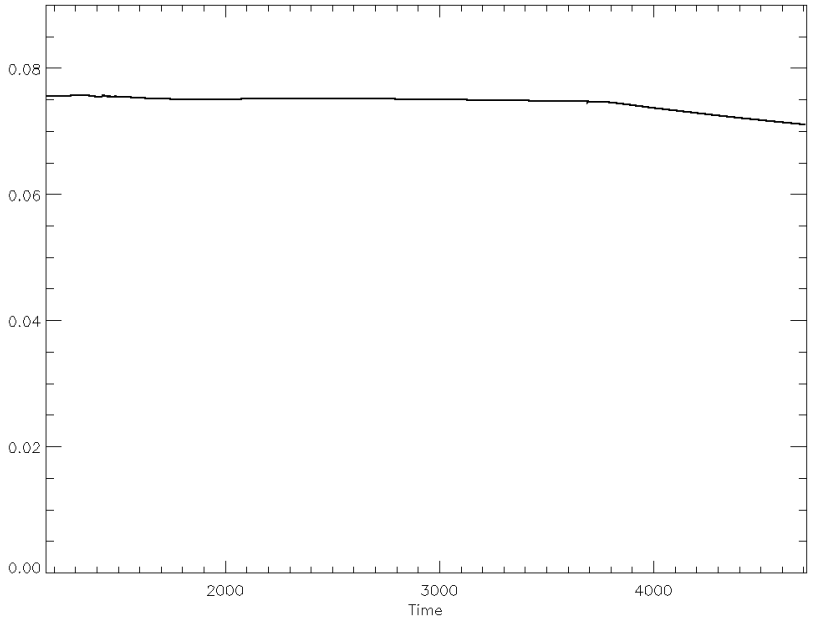
Conservation History

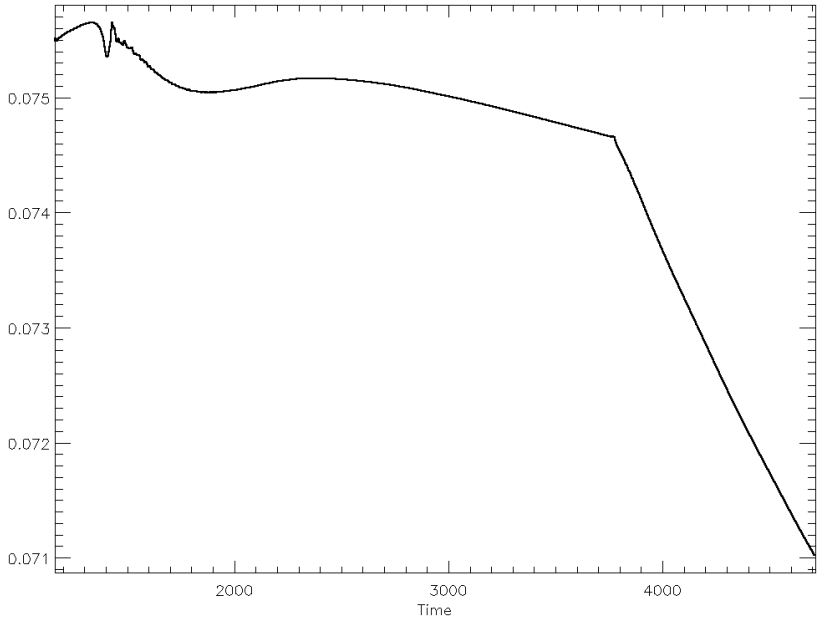
Total plasma current





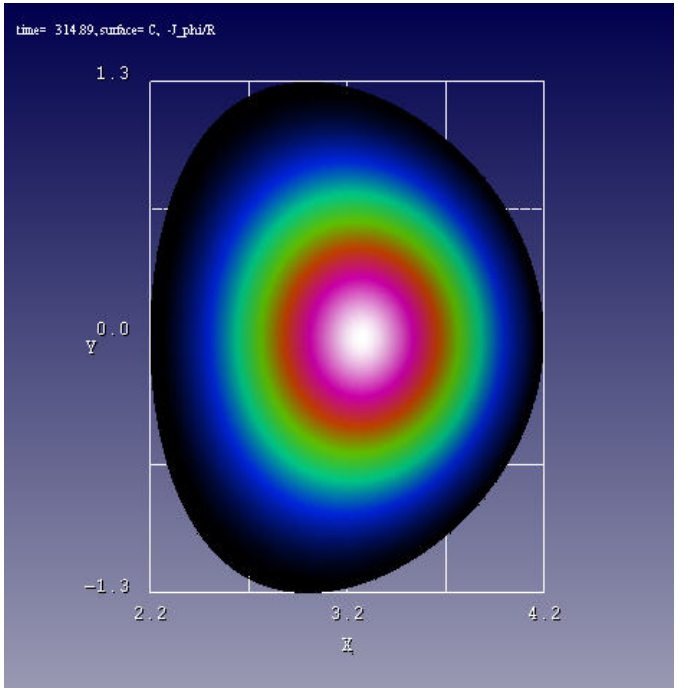
Total thermal energy





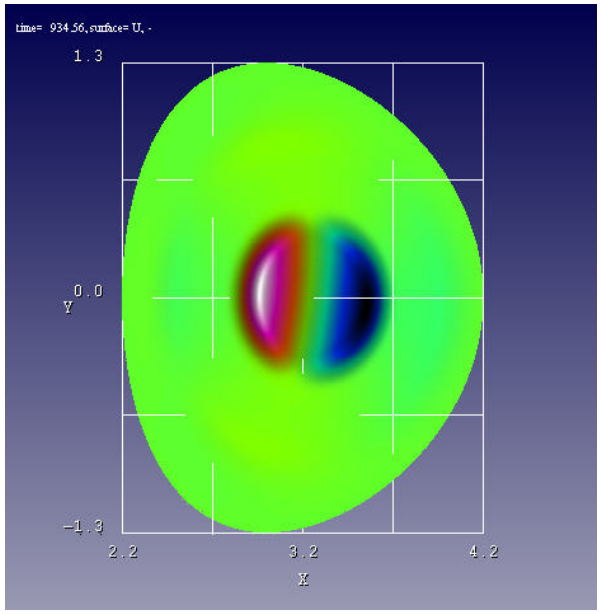
C-Mod Equilibria
(enhanced svn JSolver)

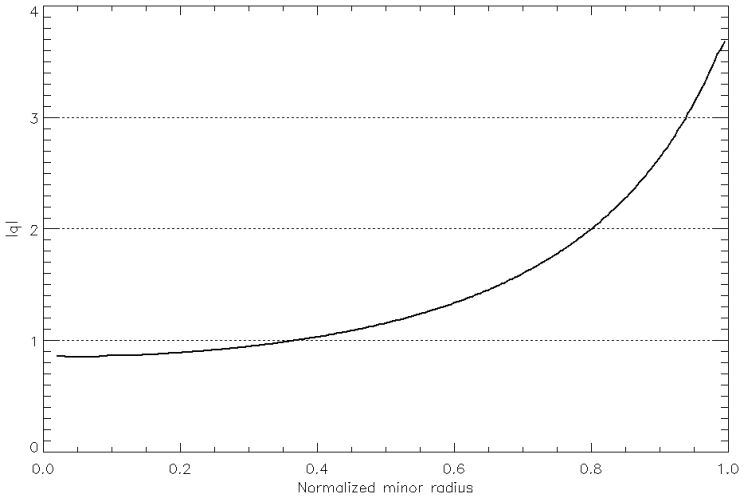
$q_0 = 0.837$



Analytic equilibrium:
xzero = 0.67 m
aguess = 0.21 m
epsu=epsl = 1.3
duguess=dlguess = 0.2
btor0 = 5.3 T
p0 = 0.1812 ($\beta \approx 1.25\%$)
tzero = 3.0 keV
n0 = 1.5 x 10^{20} m^{-3}
Ip (TOT) = 0.7808 MA
κ_{eff} = 1.15 x 10^{-5}

n=1 eigenmode

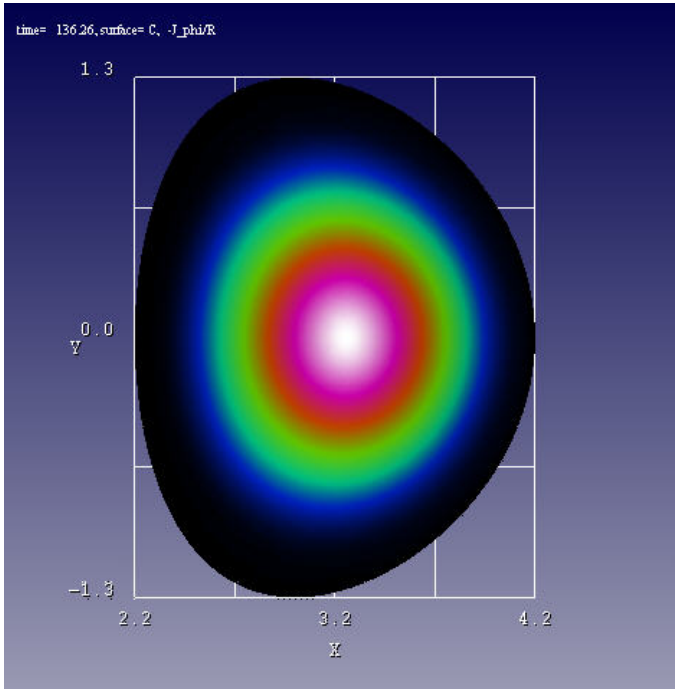




η	$\gamma\tau_A$
5 x 10^{-6}	9.8 x 10^{-3}
10^{-6}	5.5 x 10^{-3}
0	< 0

PEST, NOVA predict ideally stable.

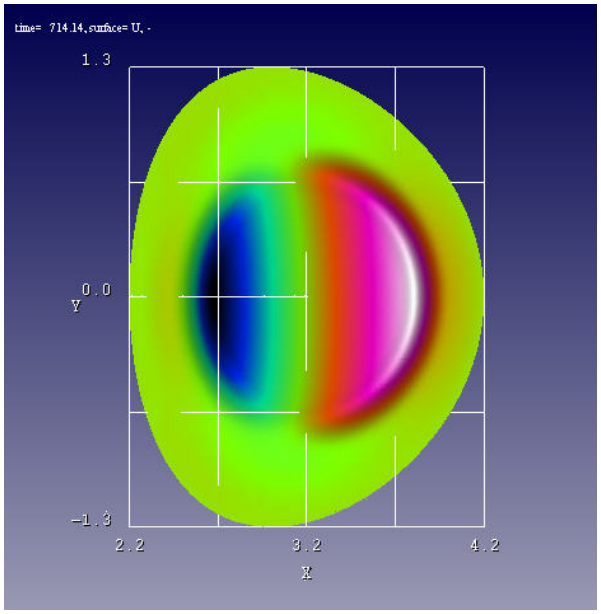
$q_0 = 0.591$

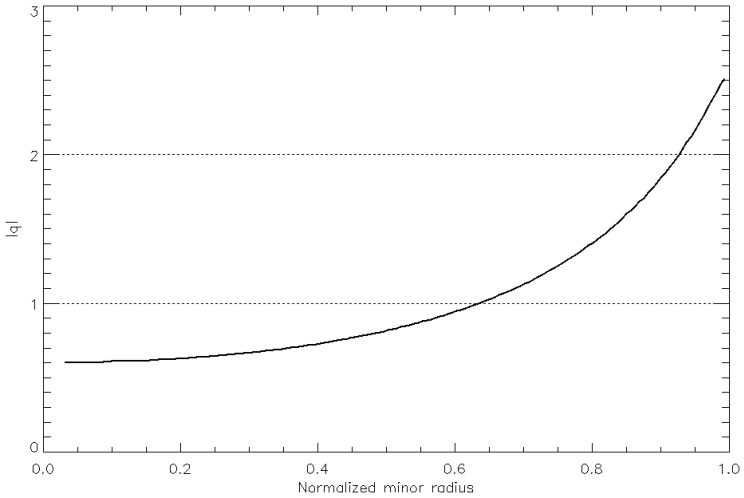


Analytic equilibrium:

xzero = 0.67 m
aguess = 0.21 m
epsu=epsl = 1.3
duguess=dlguess = 0.2
btor0 = 5.3 T
p0 = 0.1812 ($\beta \approx 1.15\%$)
tzero = 3.0 keV
n0 = 1.5 x 10^{20} m^{-3}
Ip (TOT) = 1.1325 MA
κ_{eff} = 2.52 x 10^{-5}

n=1 eigenmode



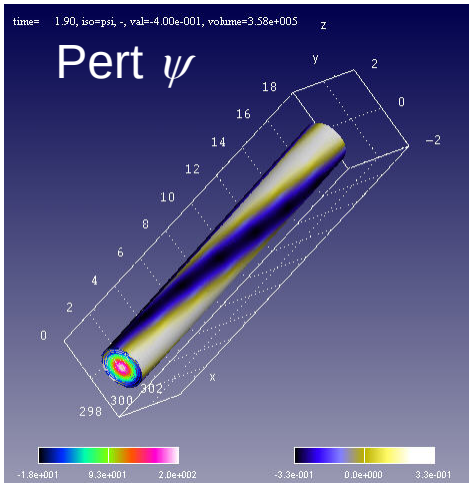


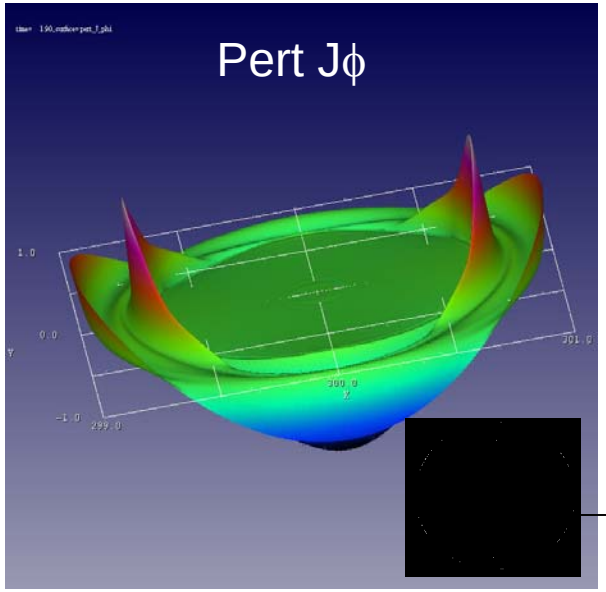
η	$\gamma\tau_A$
5 x 10^{-6}	2.44 x 10^{-2}
0	Numerically unstable

Error Fields

“Straight Cylinder”

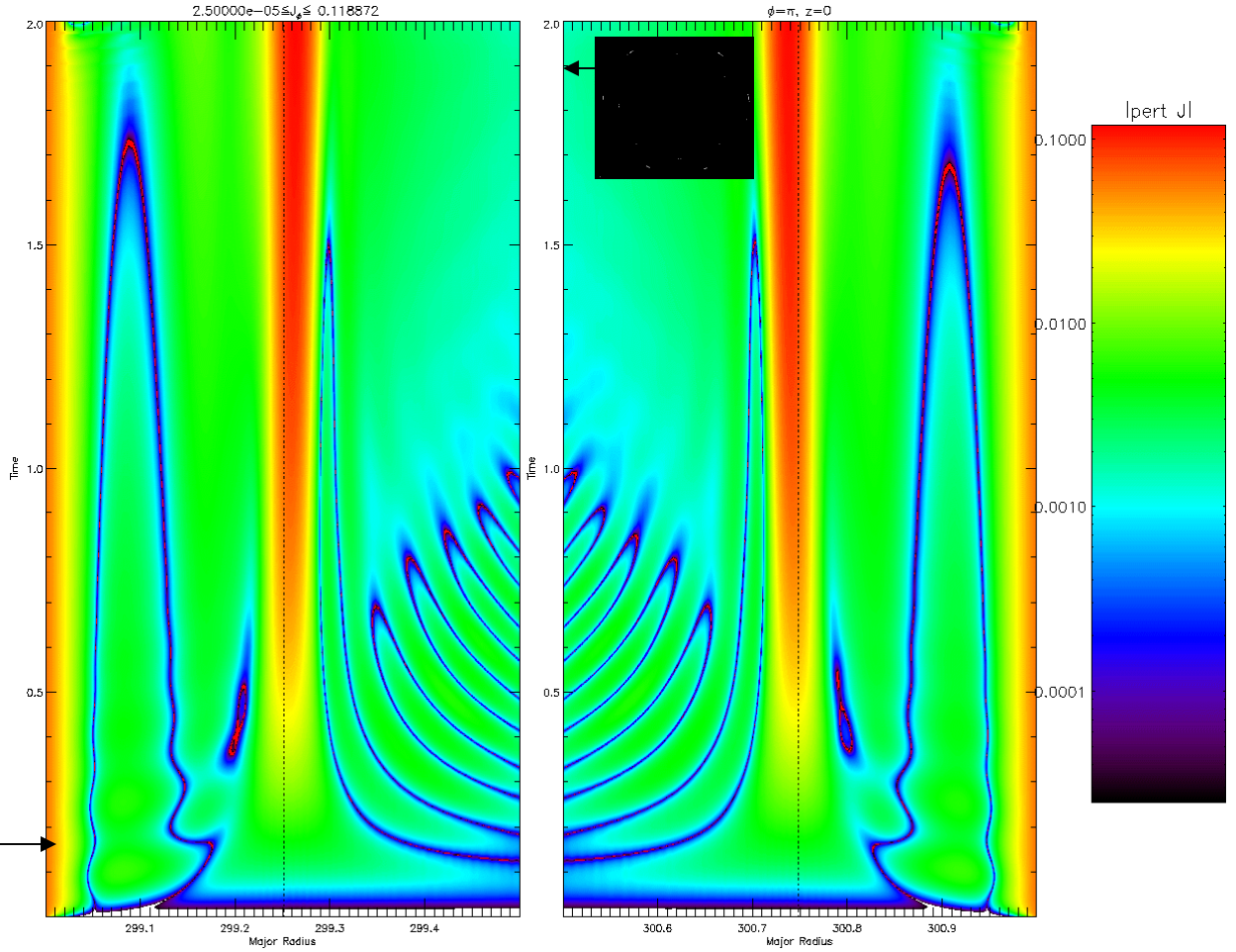
(Circular cross-section, A=300, 100 field periods)





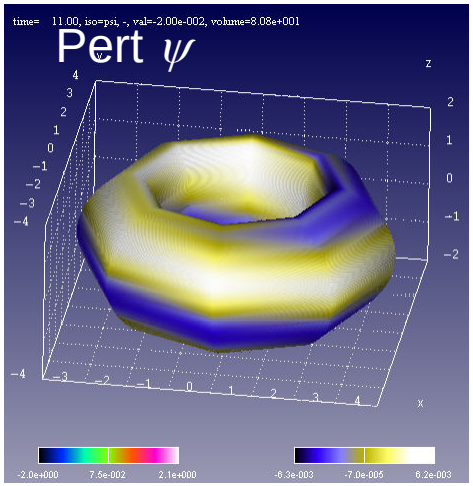
2,100 boundary pert, pmag = 0.7, t_{ramp} = 4.0 τ_A, eta=10^{-4}

8 planes, 188 radial zones; dt = 3.2 x 10^{-4}

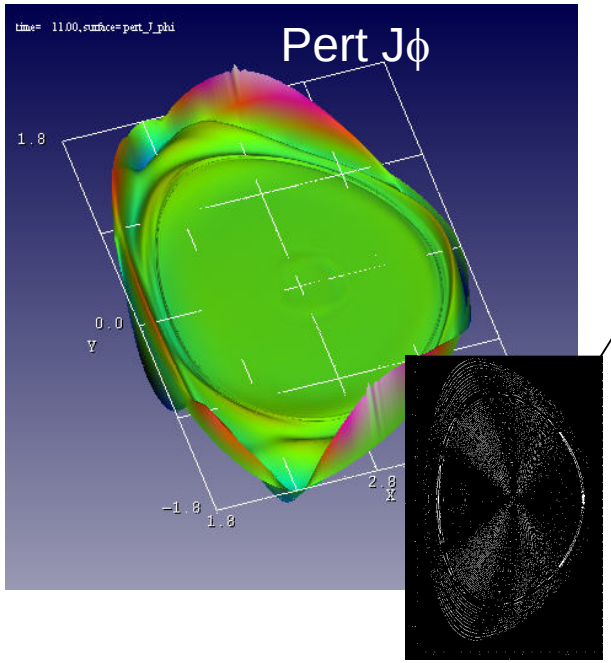


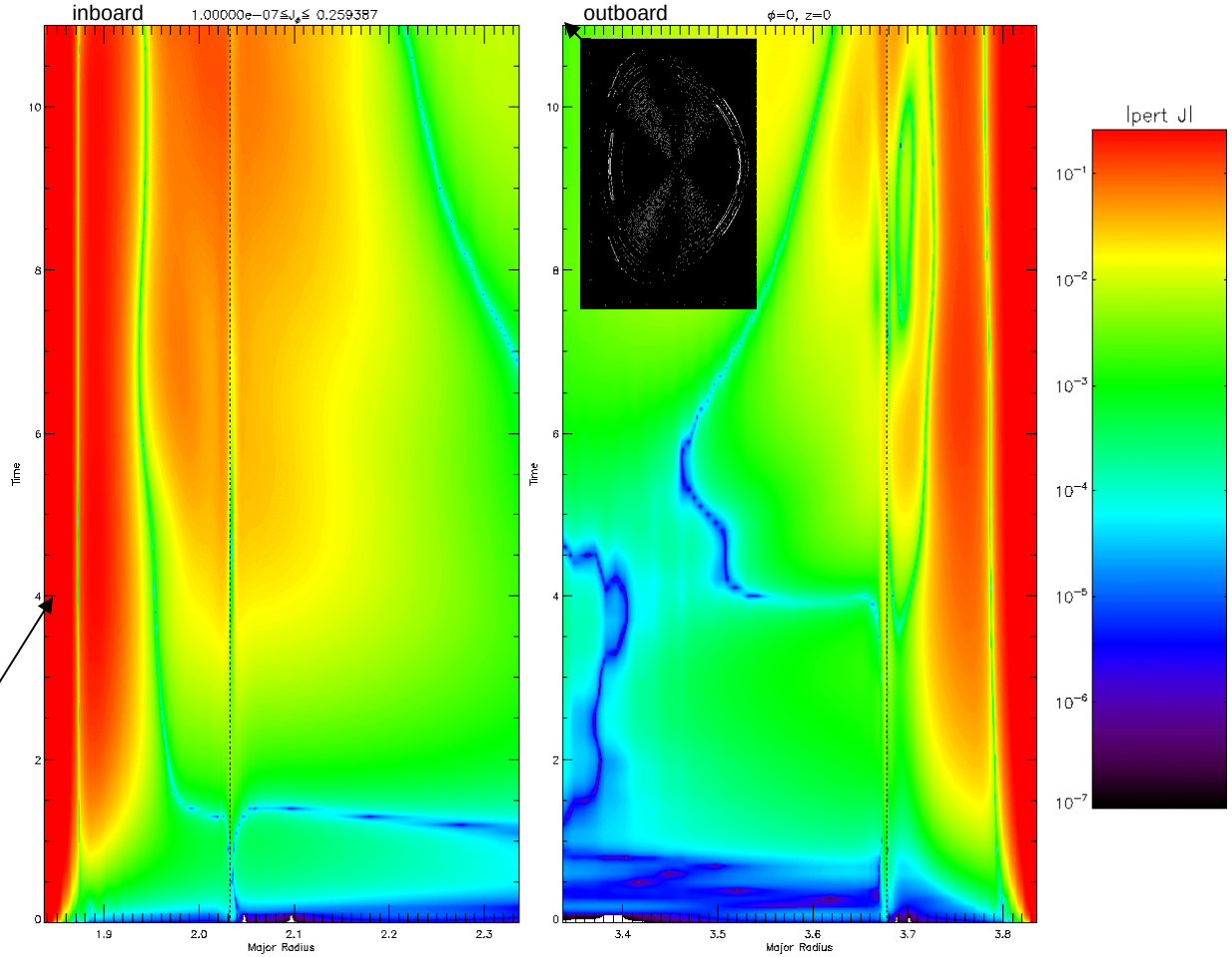
DIII-D Equilibrium

(Received from J. Park; q_{min}=1.12, q_{max}=4.20)



2,1 boundary pert, pmag = 5.0x10^{-3}, t_{ramp} = 10.0 τ_A, eta=10^{-6}
8 planes, 101 radial zones; dt = 4 x 10^{-3}



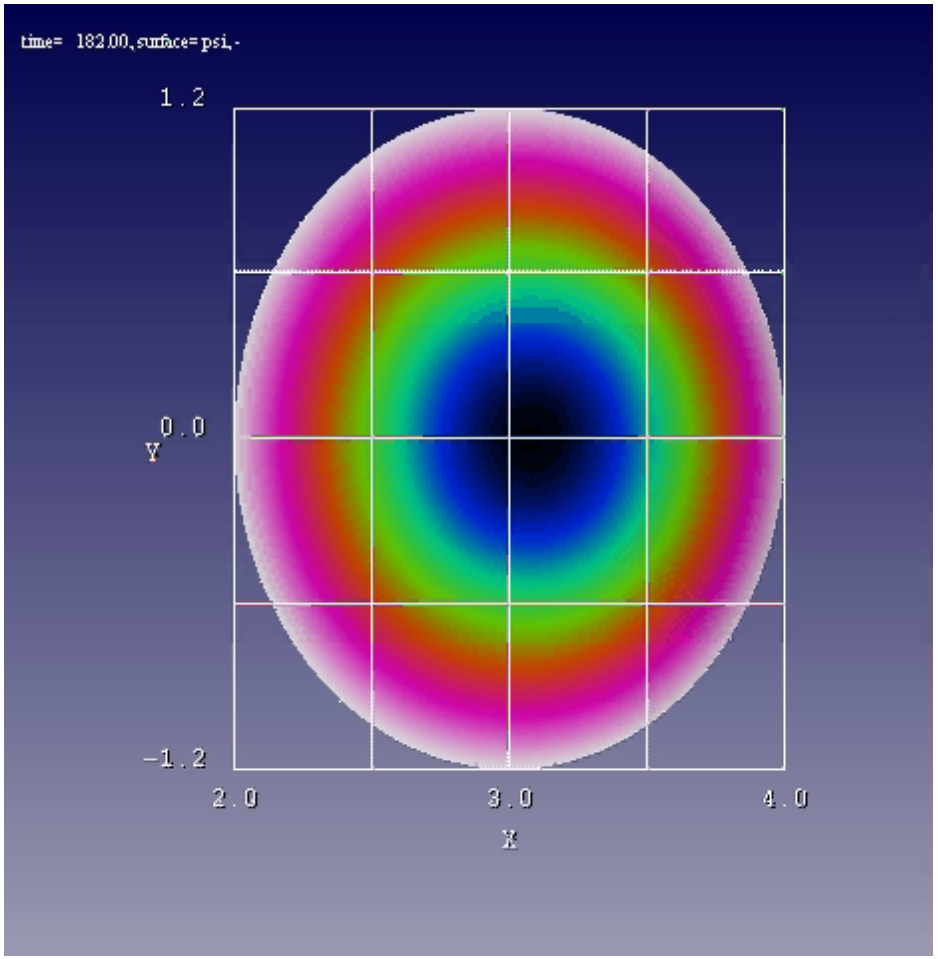


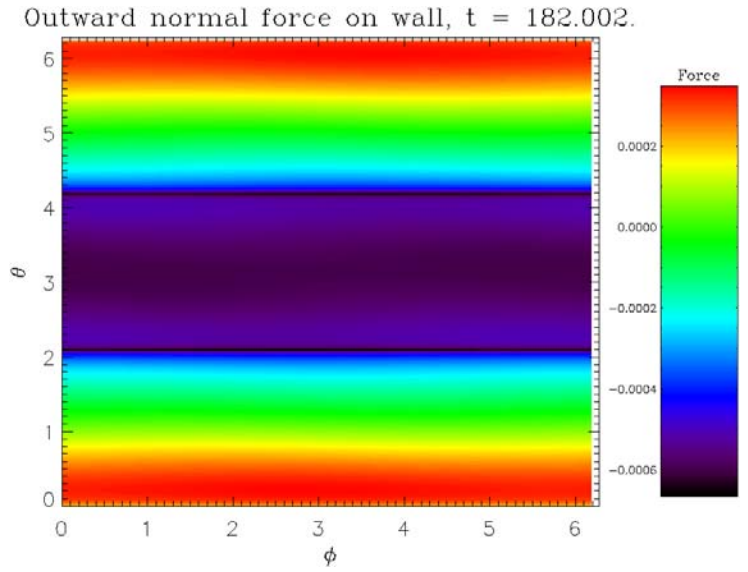
Disruption Modeling

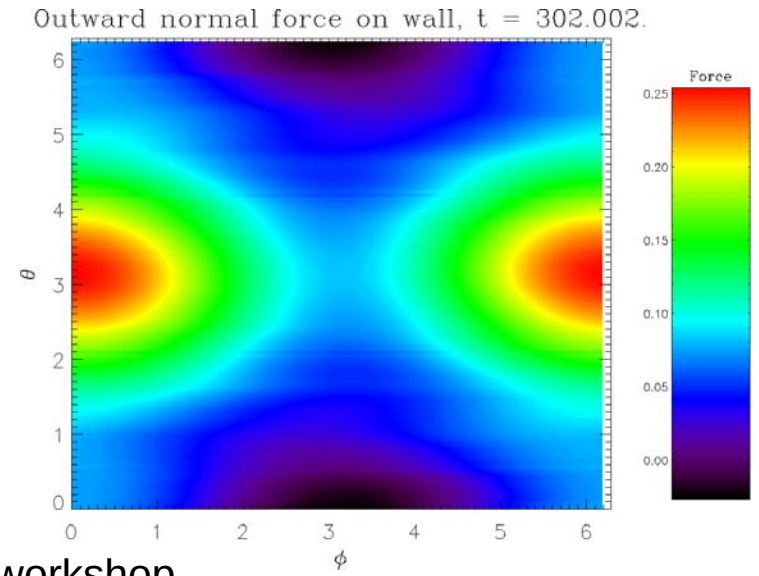
- Created GRIN-based ResistiveWall branch in svn repository for Strauss, Paccagnella.
- Ported from Jacquard to Franklin, Bassi
- Developing wall force analysis tool

Sample disruption

Analytic equilibrium, q_0=0.55







To be presented by R. Paccagnella at Cadarache workshop.