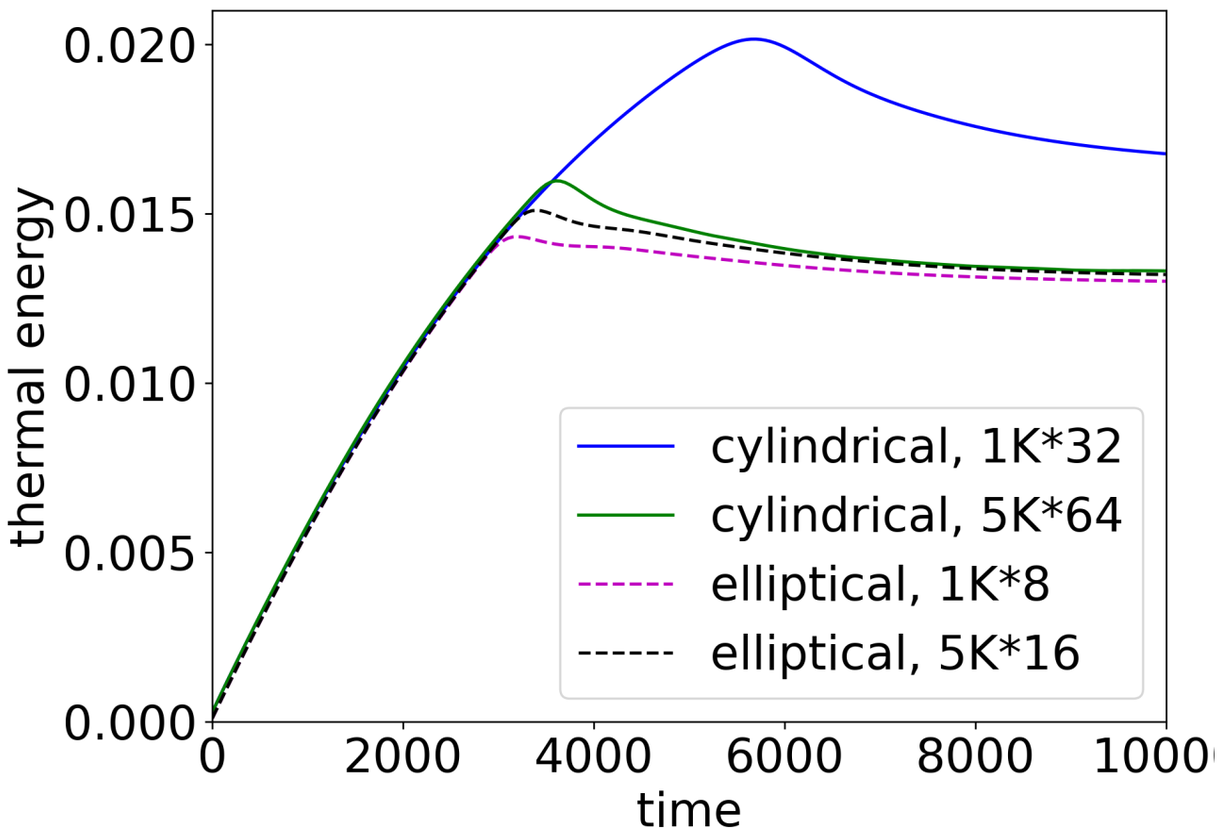
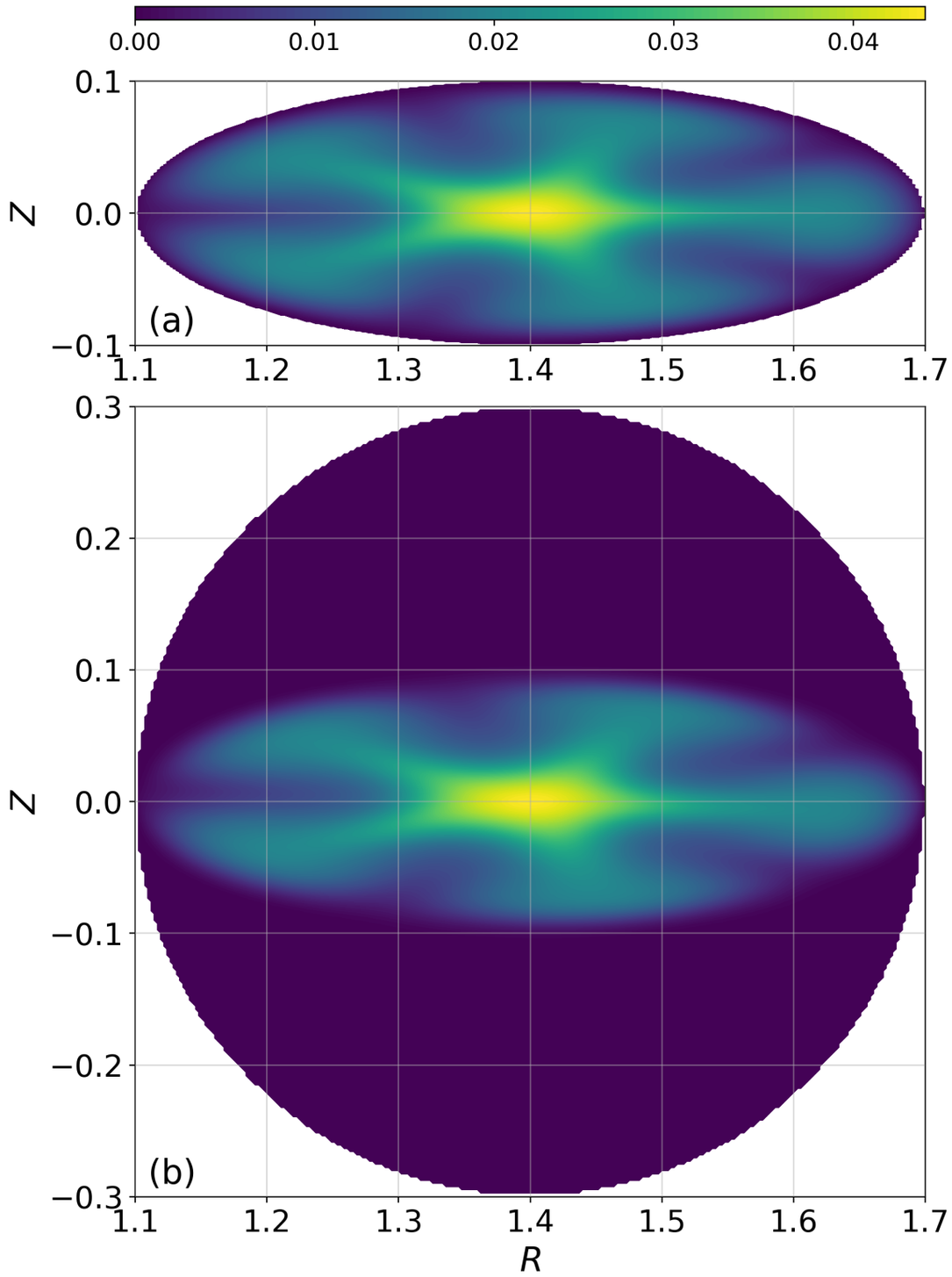
Stellarator version is mostly working

- Now stable with all parabolization terms.
  - Terms with f’ newly implemented.
  - Pull request #34, tests welcome.
- Velocity advance often fails to converge.





Typical tokamak case converges fine

Internal kink in cylindrical tokamak

dt=3, nplane = 8				
amu (and amuc)	1E-03	1E-04	1E-05	1E-06
# of iterations	~120	~139	~154	~156
amu = 1e-4, nplane = 8				
dt	1	3	5	10
# of iterations	~43	~139	~328	> 1000
amu = 1e-4, dt=3				
nplane	8	16	24	
# of iterations	~139	~318	~536	

- Here, convergence rate is very insensitive to viscosity

Non-axisymmetry complicates convergence

rotating ellipse in cylindrical domain

nplane = 24, dt = 20			
amu (and amuc)	1E-03	1E-04	1E-05
# of iterations	~135	~430	>1000
amu = 1e-4, nplane = 24			
dt	10	20	50
# of iterations	~280	~430	~700
amu = 1e-4, dt = 20			
nplane	24	32	48
	~430	~650	~930

- Convergence rate becomes sensitive to viscosity

Stellarator version can achieve convergence

rotating ellipse in elliptical domain

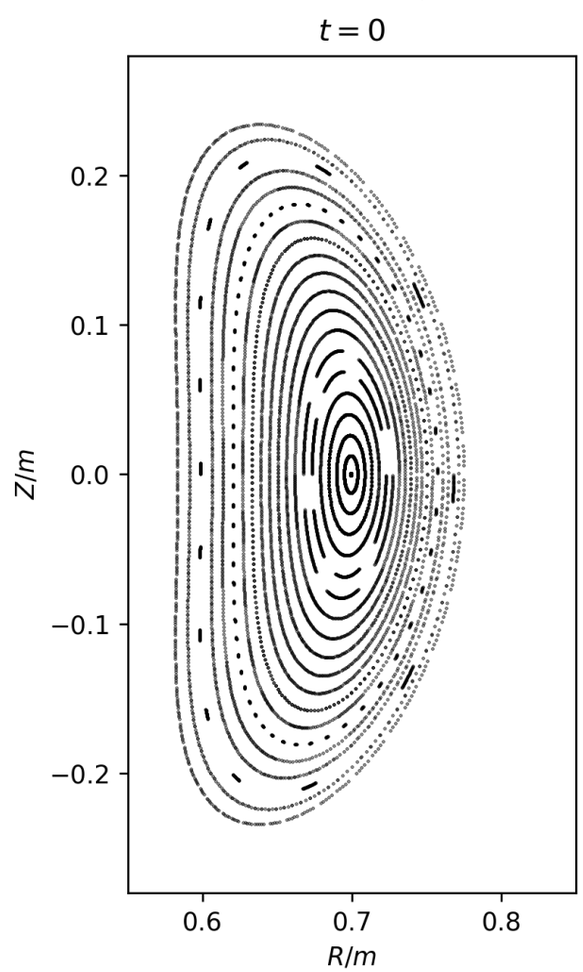
nplane = 8, dt = 20				
amu (and amuc)	1E-03	1E-04	1E-05	1E-06
# of iterations	~45	~136	~361	~865
amu = 1e-4, nplane = 8				
dt	10	20	50	
# of iterations	~91	~136	~222	
amu = 1e-4, dt = 20				
nplane	8	16	24	
	~136	~233	~399	

- Again, convergence rate is sensitive to viscosity.

Convergence becomes more difficult in realistic geometry

CTH VMEC equilibrium

nplane = 8, dt = 5				
amu (and amuc)	1E-03	5E-04	1E-04	5E-05
# of iterations	~245	~341	~539	>1000
amu = 1e-3, nplane = 8				
dt	2	5	10	
# of iterations	~111	~245	~408	
amu = 1e-3, dt = 5				
nplane	8	16	24	
	~245	~540	~806	

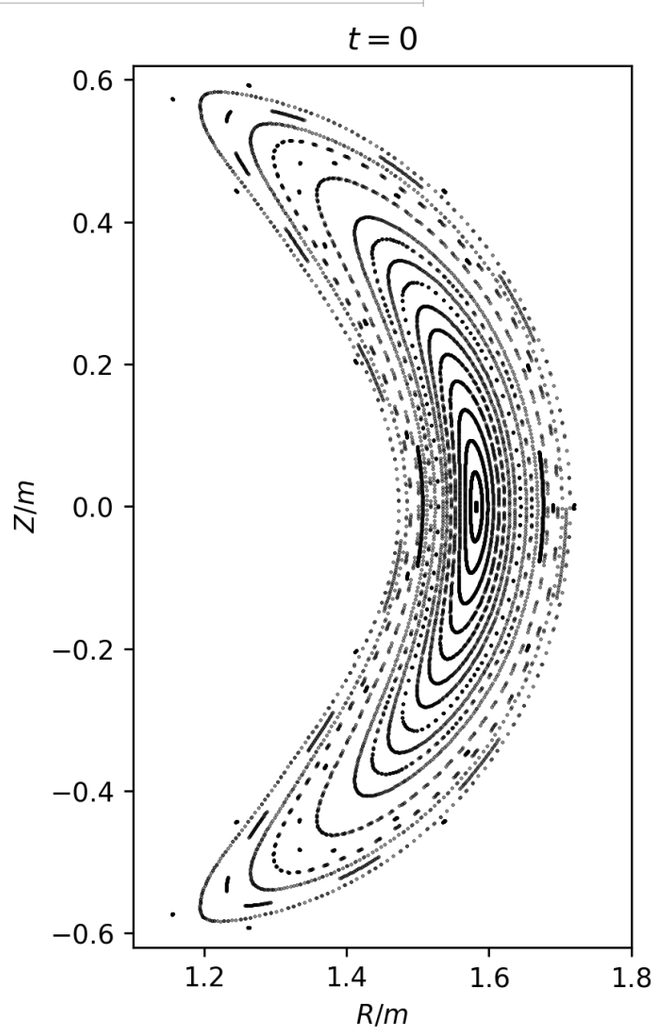


- Convergence rate is more sensitive to viscosity.

Convergence is very challenging in more complex stellarator geometry

NCSX VMEC equilibrium

nplane = 8, dt = 5				
amu (and amuc)	1E-03	8E-04	6E-04	5E-04
# of iterations	~189	~223	~407	>1000
amu = 1e-3, nplane = 8				
dt	2	5	10	
# of iterations	~111	~189	>1000	
amu = 1e-3, dt = 5				
nplane	8	16	24	
	~189	~349	~635	



- Convergence rate is dictated by viscosity.