# Advanced Stability Analysis for Magnetized Target Fusion

Topic Area: Modeling and simulation

| Partner | Company |
|---|---|
| PPPL | generalfusion |
| Chang Liu, Dylan Brennan | Matt Miles, Aaron Froese |


Project Summary:
*Computational stability analyses were applied to GF's Magnetized Target Fusion (MTF) concept. Pressure-driven interchange modes were investigated using M3D-C1 code developed at PPPL. The effect of plasma rotation on stability was studied using RDCON and NIMROD.*

Fusion Impact:
*These results showed that maintaining plasma stability during compression is possible. We developed code that helps General Fusion design stable plasma equilibria for MTF devices.*

Business/Market Impact:
*Stability analysis of magnetized plasma was extended to MTF. The collaborative relationship between GF and PPPL was strengthened.*


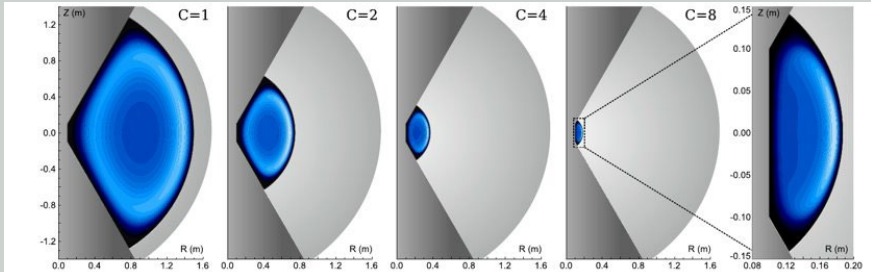


**Figure 1.** CORSICA equilibria showing compression of plasma by converging liquid metal flow. Contours indicate normalized parallel current density, $J_{\|}/B$. The liquid metal is light gray and solid metal is dark gray.

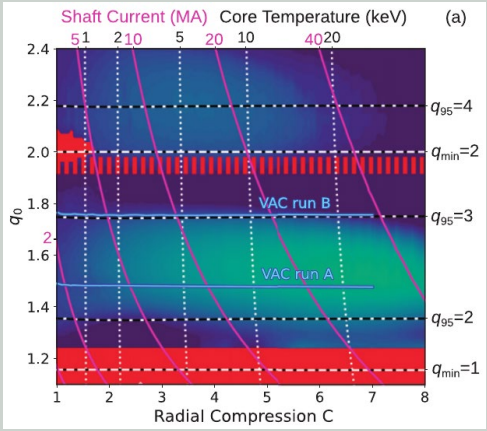


**Figure 2.** Stability results from RDCON showing n=1 modes in an MTF prototype-sized device. Regions of ideal instability are shown in red, resistive instability in green/yellow, and stability in dark blue.

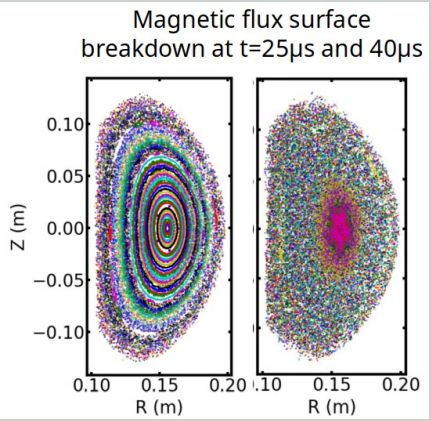


**Figure 3.** Poincare plot of magnetic fields at t = 25 μs and t = 40 μs in M3D-C1 simulation. At 25 μs, linear growth of n=3 and n=4 has caused disruption of the outer flux surfaces. At 40 μs, the entire domain has become stochastic.

| Period of Performance: | Federal Share: | Cost Share: |
|---|---|---|
| 2021/08 - 2022/11 | $160,000 | $75,000 |