



**TRI ALPHA ENERGY**  
THE POWER OF INGENUITY

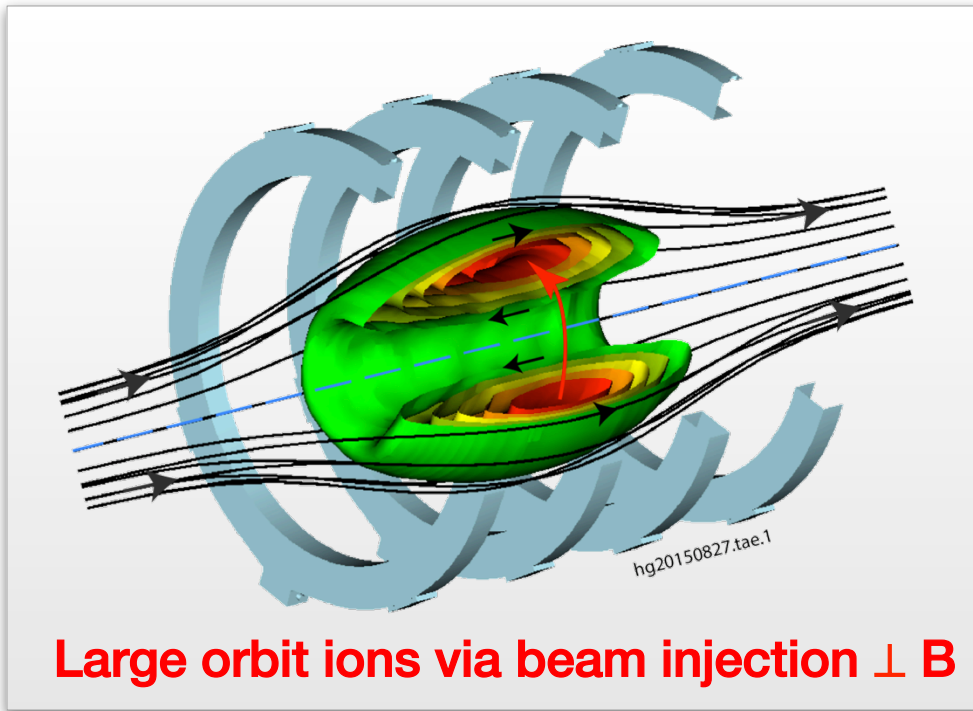
# Advances in Beam-Driven FRCs

Artem Smirnov for the TAE Team

Solved and Unsolved Problems in Plasma Physics

March 29, 2016

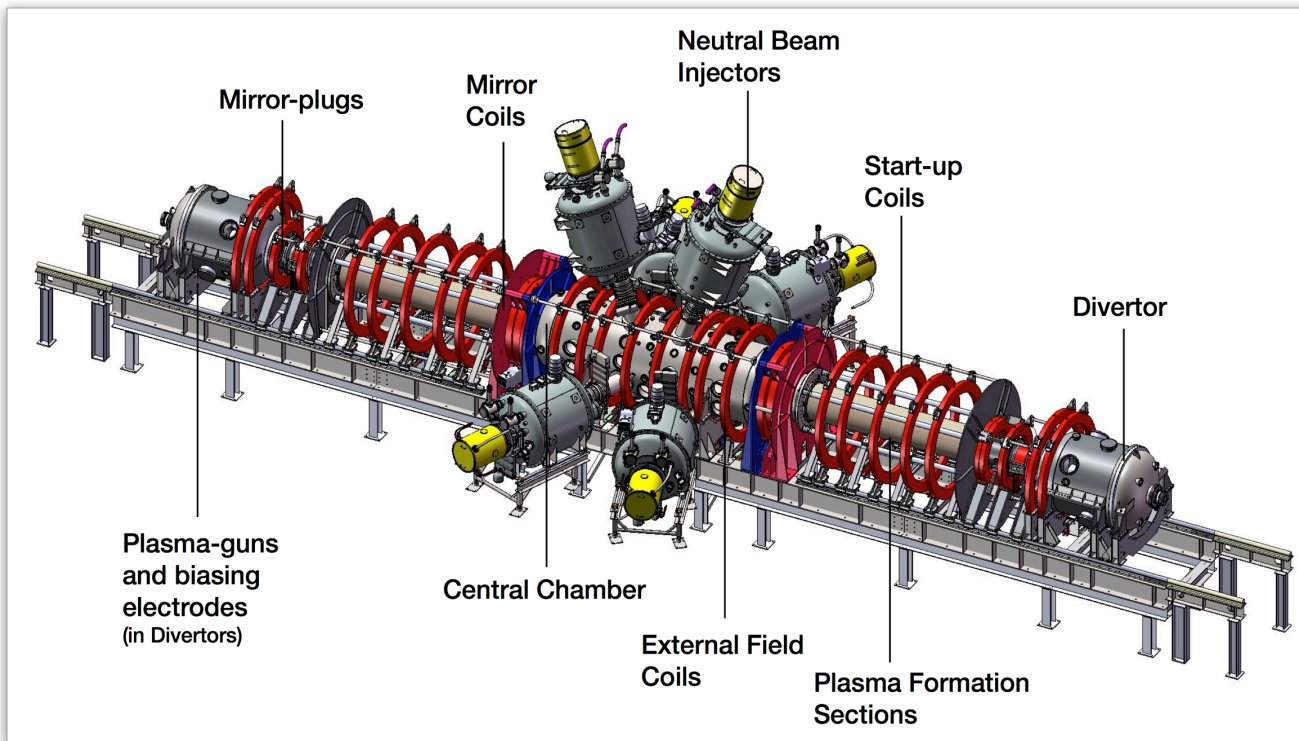
# Beam-Driven Field Reversed Configuration Offers Reactor Advantages



- High plasma  $\beta \sim 1$ 
  - High power density
  - Aneutronic fuel capability
- Simple geometry
  - Easier design & maintenance
  - Linear unrestricted divertor

TAE demonstrated current drive and sustainment of FRCs with dramatically increased stability and reduced transport

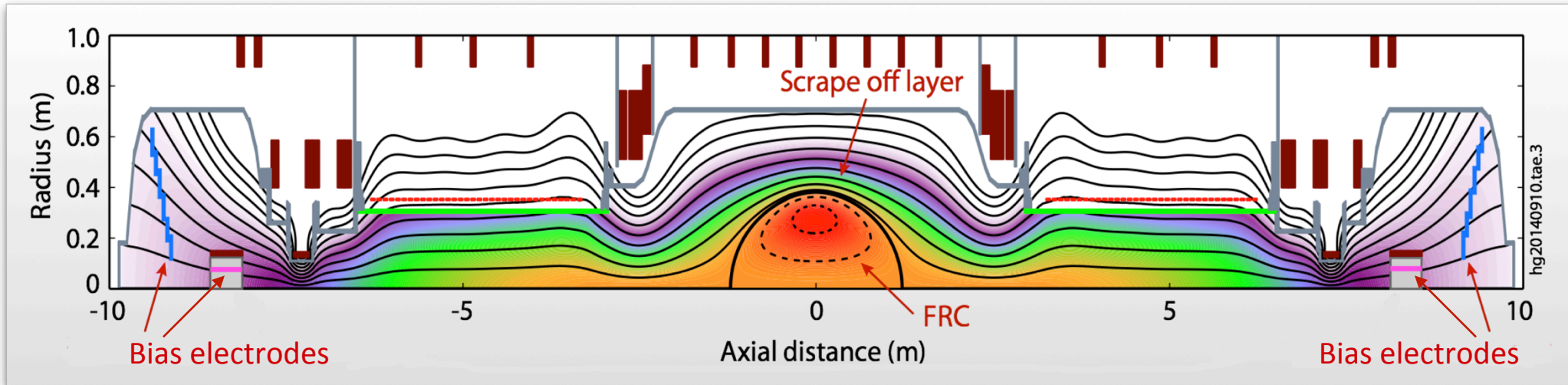
# Tri Alpha Energy's C-2U Research Facility is a National Lab Scale, Privately Funded Effort



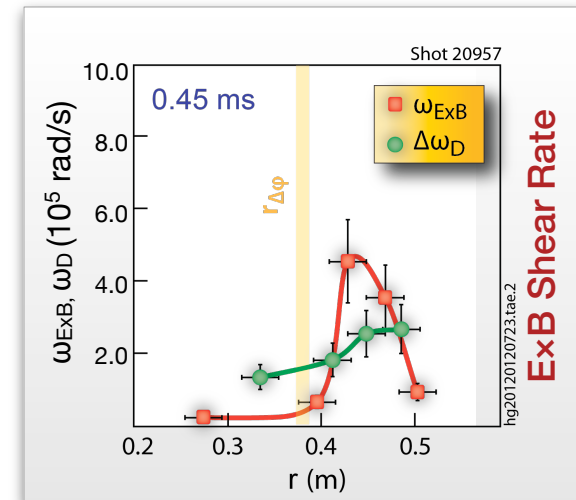
Parameter	Value
$B_{ext}$ , kG	~1
$r_s$ , cm	~ 35
L, m	2 – 3
$P_{NB}$ , MW	10
$E_{NB}$ , keV	15
$N_e$ , $cm^{-3}$	~ $3 \times 10^{13}$
$T_i$ , eV	500 – 800
$T_e$ , eV	100 – 150

**TAE collaborates with:** PPPL, LLNL, UCI, UCLA, UW-Madison, Budker Institute (Russia), University of Pisa (Italy), Nihon University (Japan)

# Global Stability Control and Transport Reduction Achieved via Edge Biasing

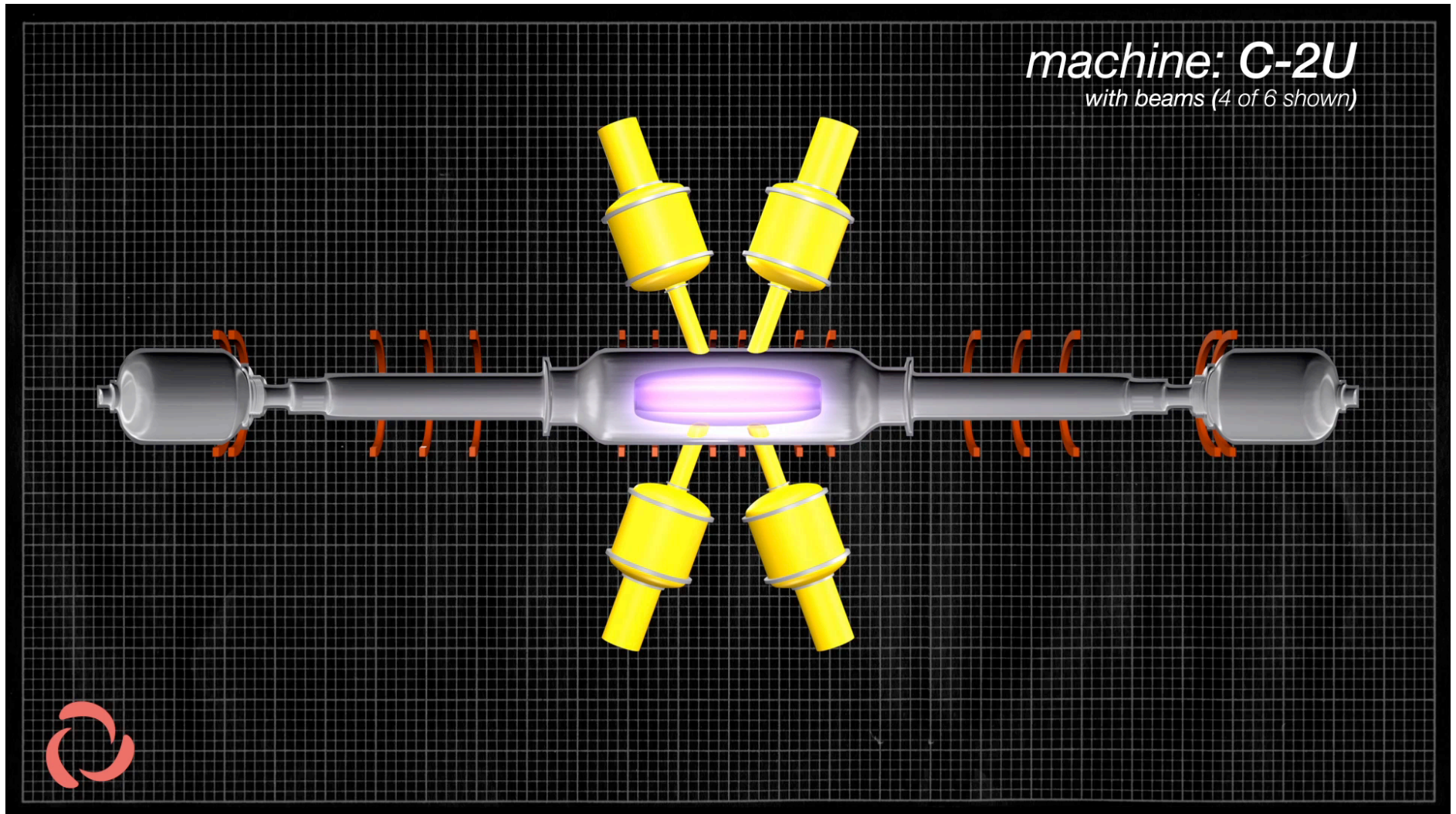


- Active and passive bias electrodes “communicate” with FRC separatrix via scrape-off layer
- Generate inward  $E_r$  that counters usual FRC spin-up, and stabilize global rotational modes in axisymmetric way
- Suppress fluctuations via sheared flow

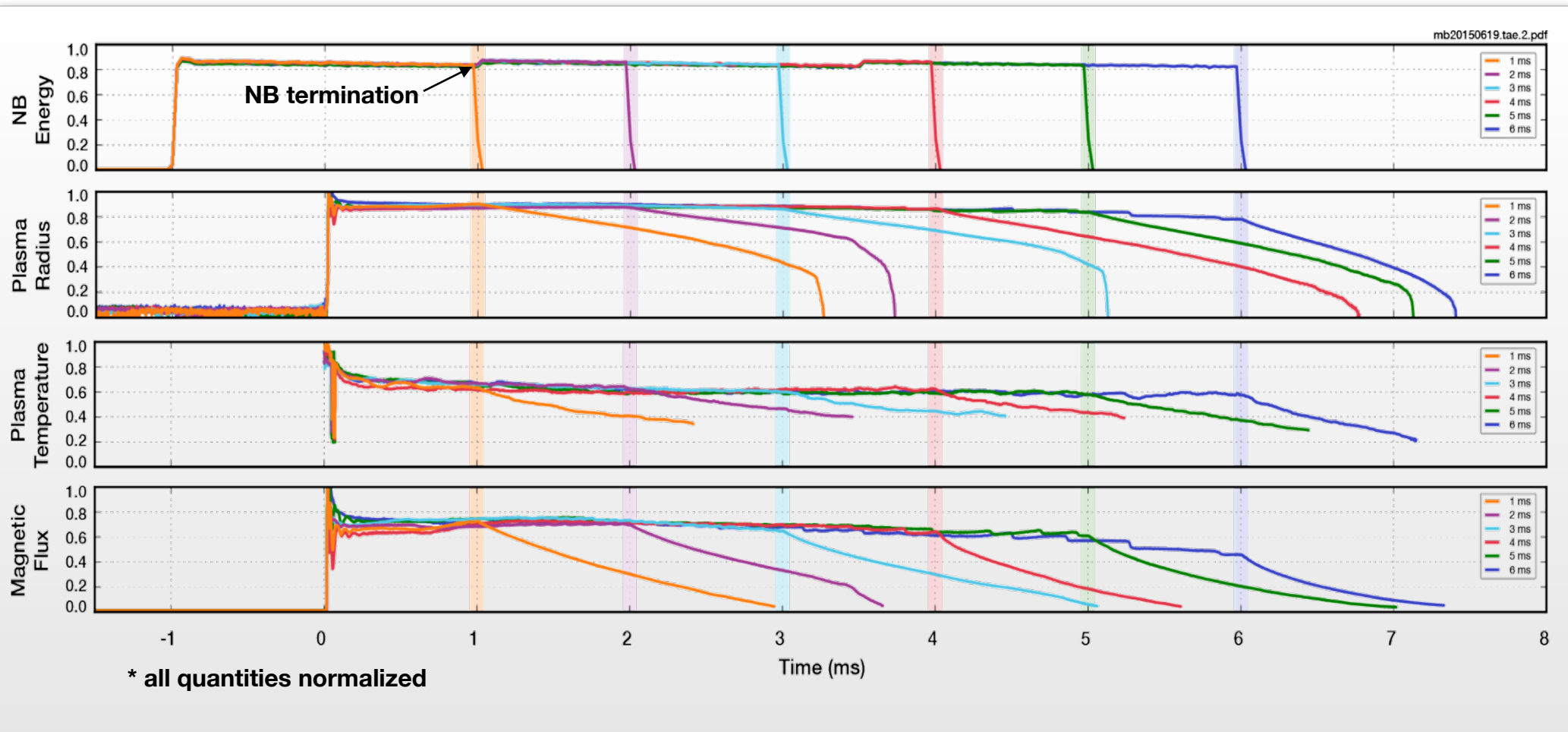




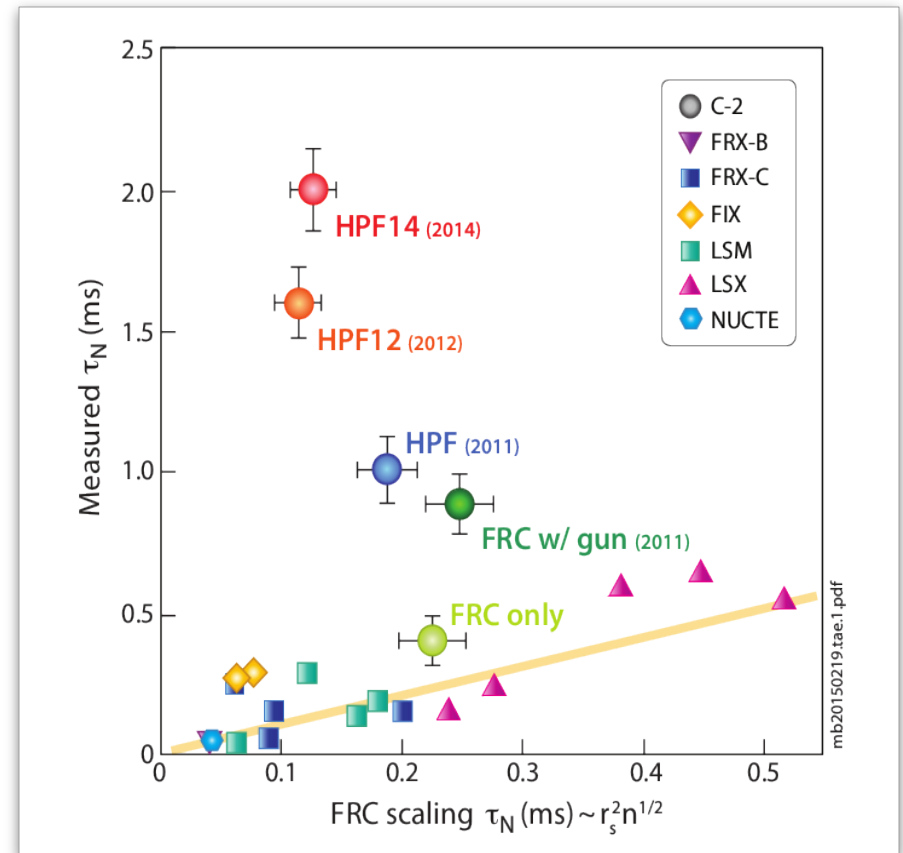
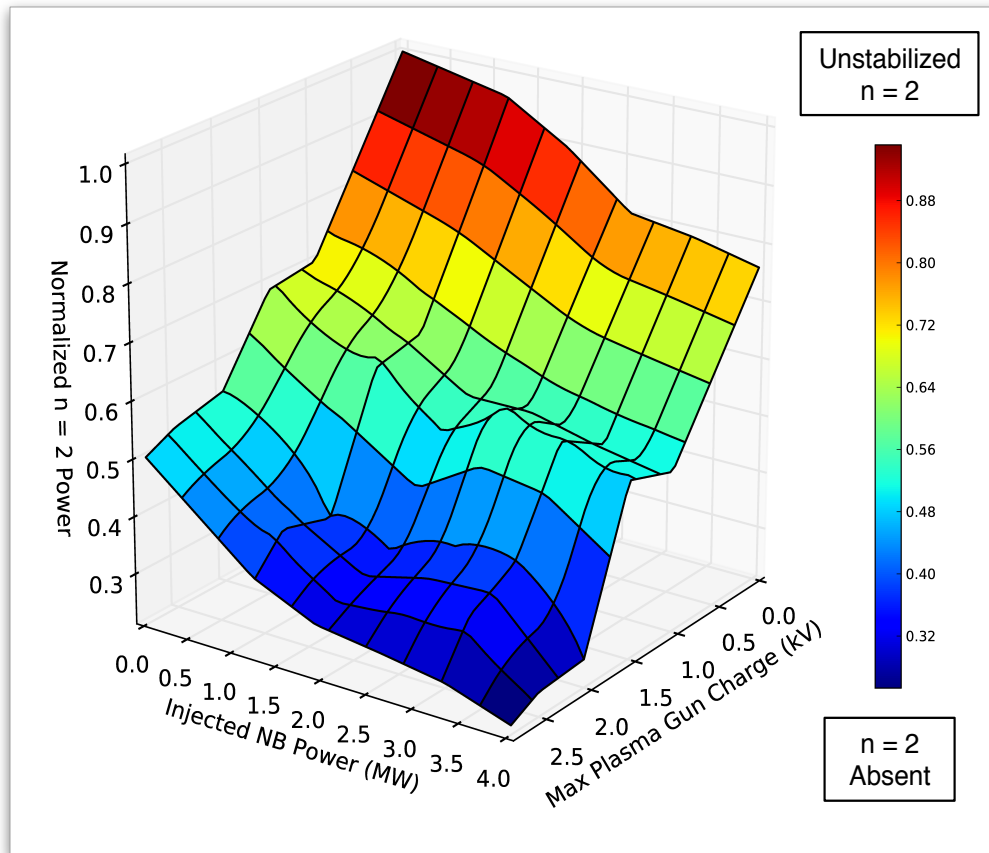
# Beam-Driven FRC Sustainment Enabled by Edge Biasing and Wall Conditioning



# FRC Sustainment Correlates with Neutral Beam Injection



# Benefits of Fast Ion-Dominated FRC State



■ Further suppression of global modes

■ Factor x10 reduction in transport





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[www.trialphaenergy.com/research-library](http://www.trialphaenergy.com/research-library)