
Bridging the gap towards high performance operation through RWM stabilization

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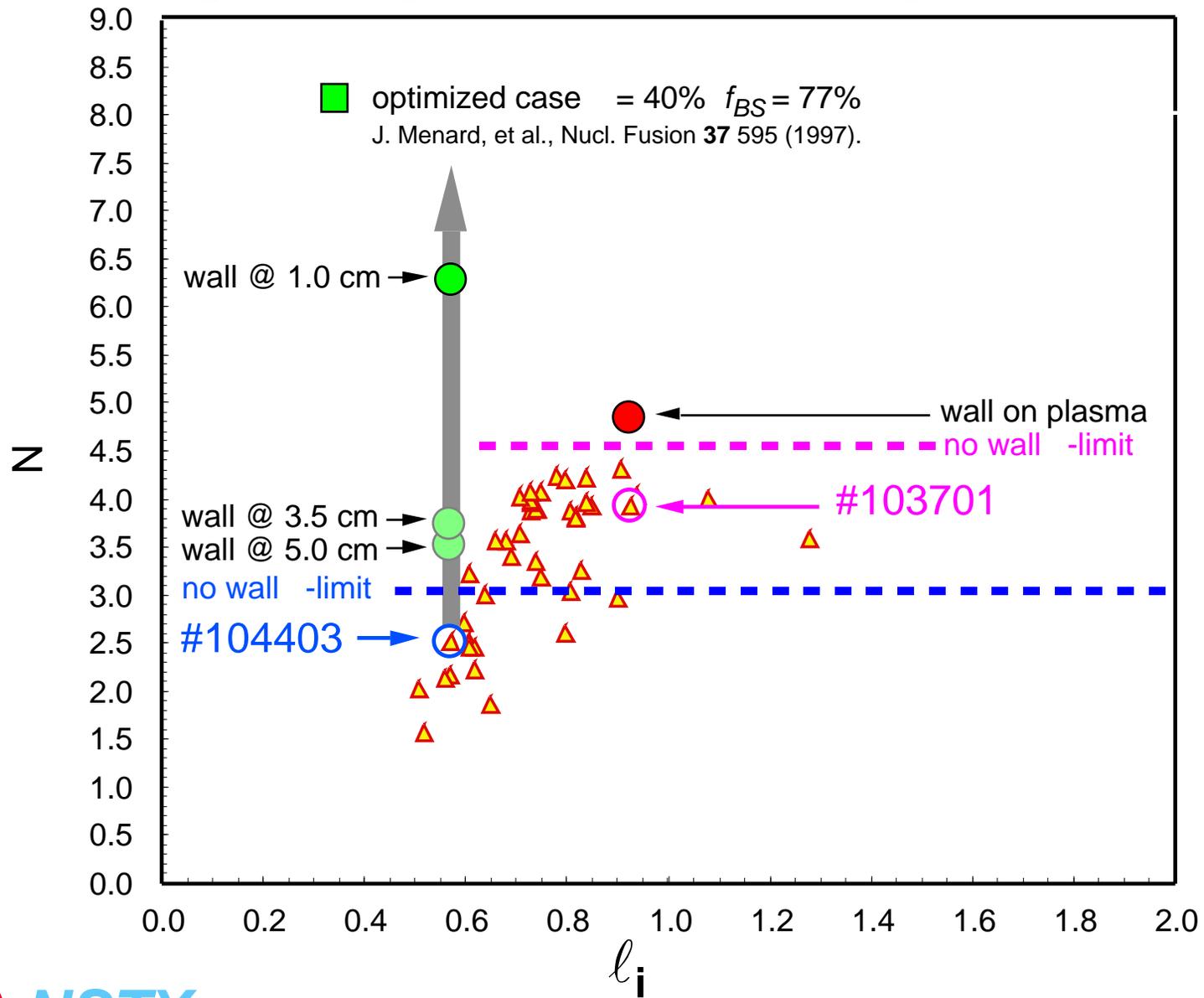
NSTX RESEARCH FORUM - PPPL January 15-19, 2001



Plasma operation above the no-wall -limit

- Characterize RWM growth rate of mode vs. plasma-wall gap
- Study toroidal rotation stabilizing effect on RWM
 - Quantify effect on growth rate and attempt modification of rotation using different NBI setups
- Quantify extension of discharge length vs. plasma-wall gap
 - Quantify any increase in maximum n reached
- Compare growth rate results with modeling
 - Verify and calibrate VALEN for low aspect ratio RWM
 - Implement toroidal rotation into VALEN and compare results
 - Reconstruct full set of magnetic measurements with VALEN and compare to data
- Start active mode control design

Searching for a path to increased performance



High- equilibrium design goal: 40% target

Equilibrium parameters (EFIT*)

$R = 0.86$ m (achieved) →

$a = 0.67$ m

$= 2.0$

$= 0.45$

$A = 1.27$

$I_p = 1$ MA

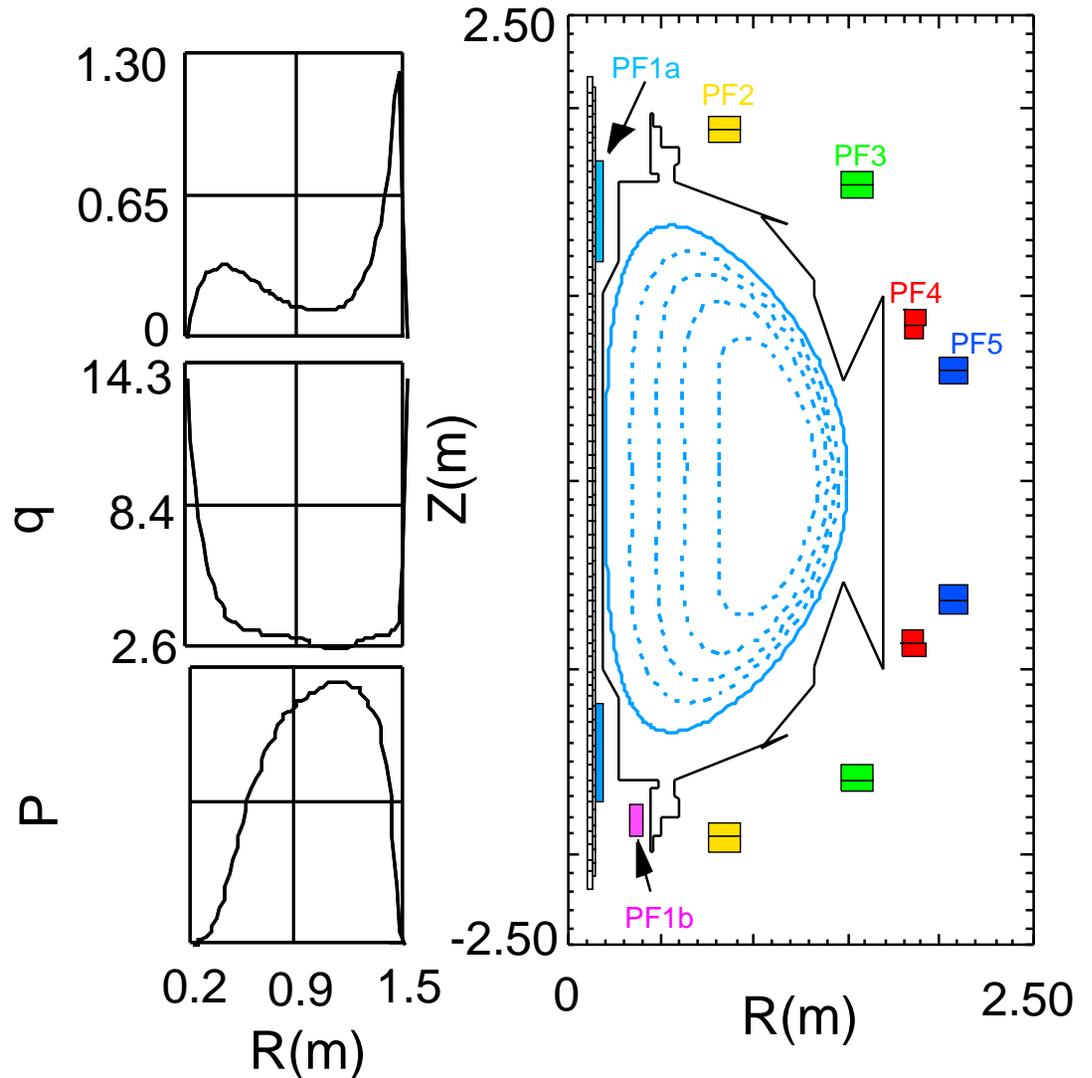
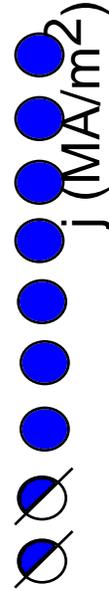
$B_T = 0.3$ T

$t = 40.4\%$ (@ -limit)

$N = 8.1$ (@ -limit)

$F_p = 1.7$ (pressure peaking)

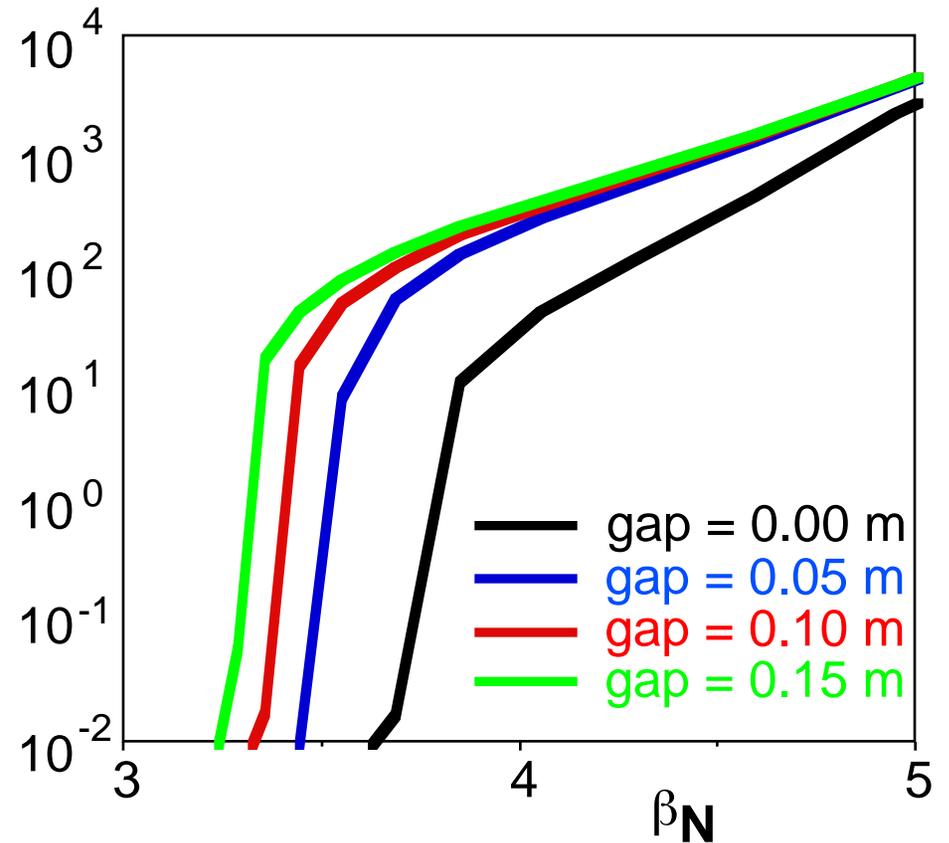
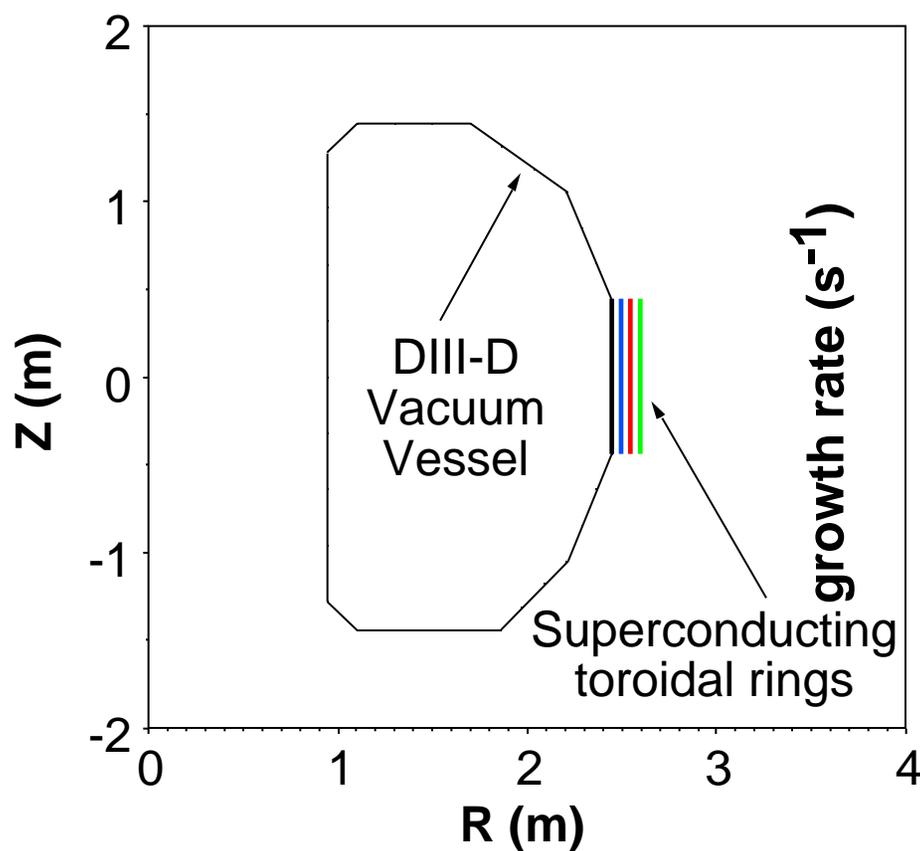
Optimized for high aligned bootstrap fraction ~ 80%



*L. Lao, et al., Nucl. Fus. **25** (1985) 1611.

DIII-D RWM growth rate depends on wall position

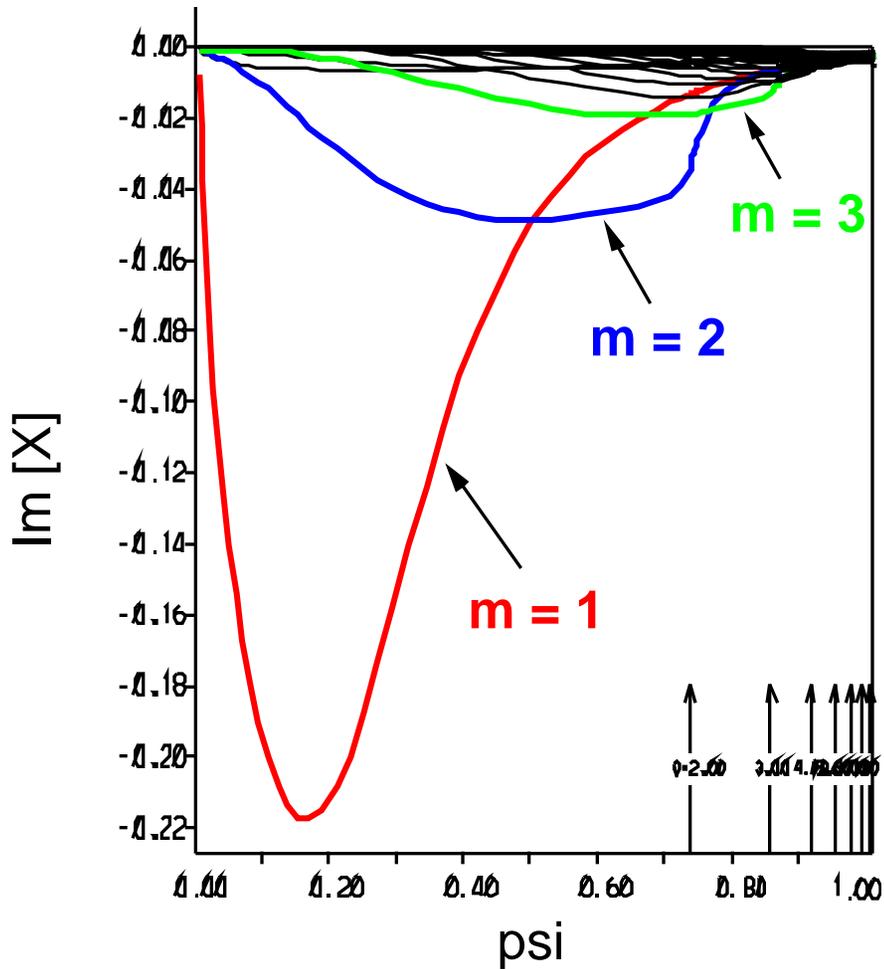
- Increasing growth rate as superconducting toroidal ring is moved away from plasma



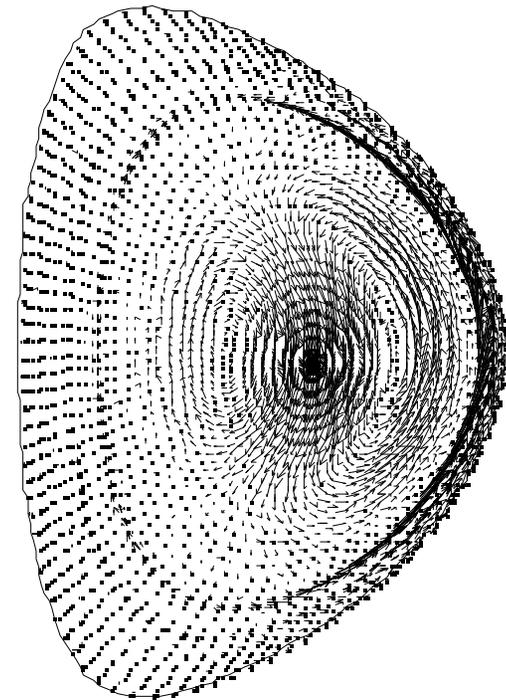
VALEN - (J. Bialek)

Centrally localized mode structure at high ℓ_i

Sh#: 103701 extrapolated to $\beta_N = 4.6$



$\Phi = 90^\circ$

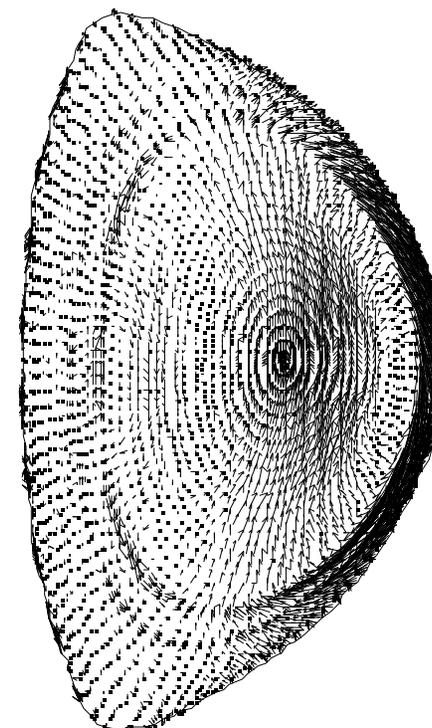
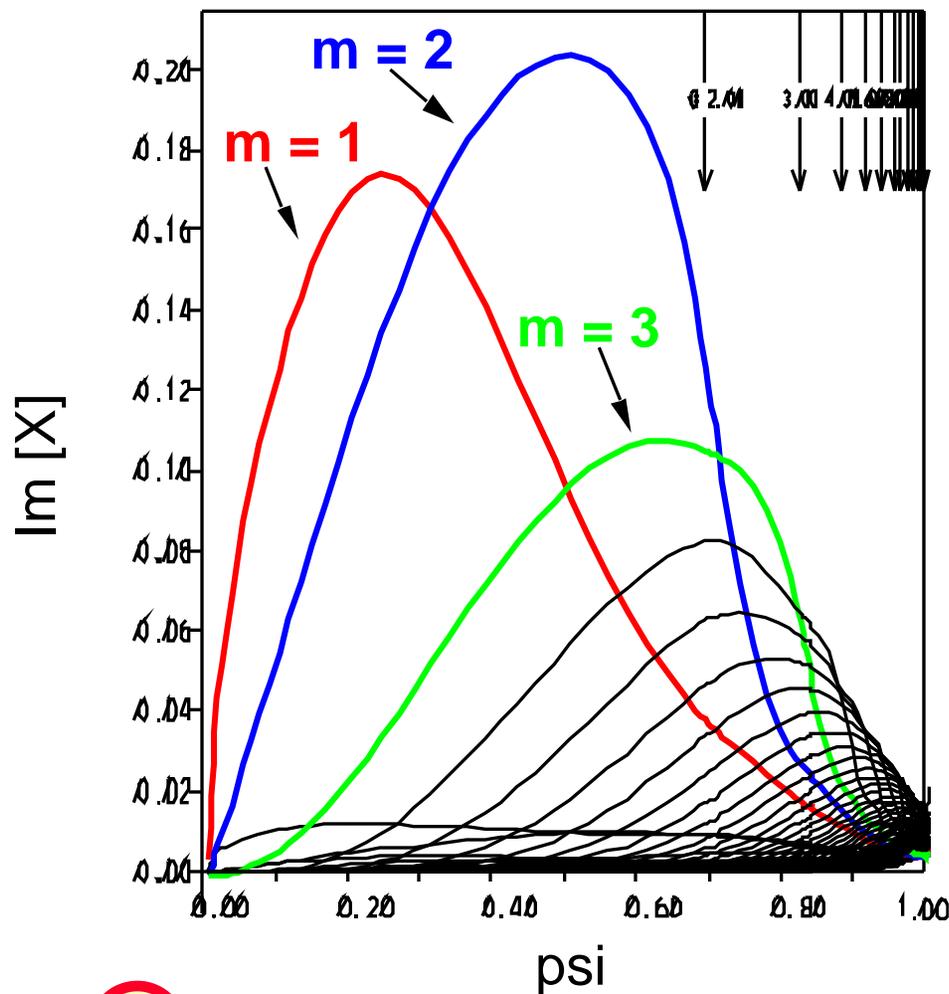


Plasma displacement - GATO -

Global internal mode structure at low ℓ_i

Sh#: 104403 extrapolated to $\beta_N = 6.3$

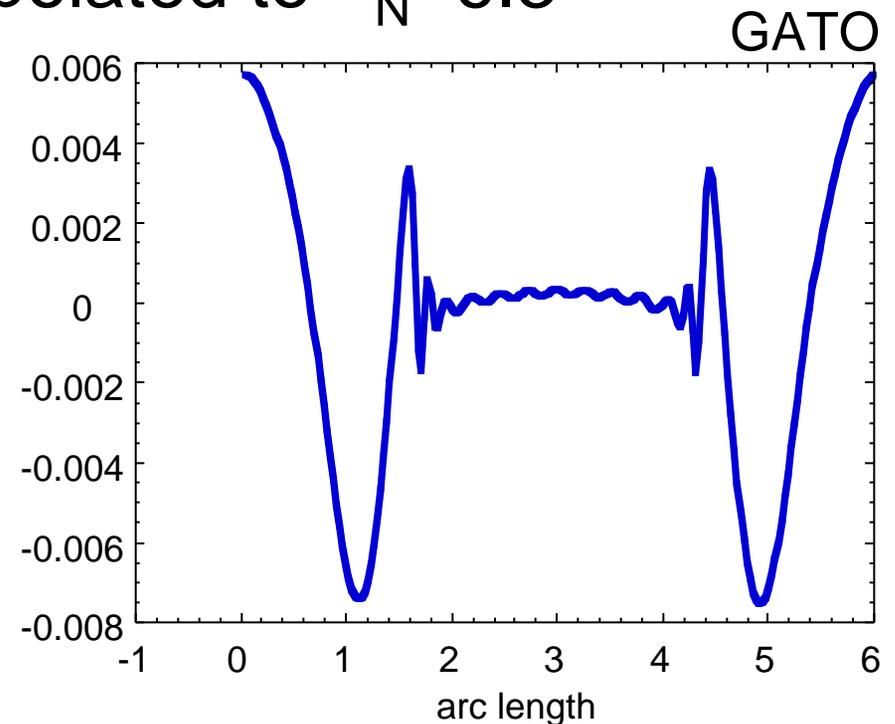
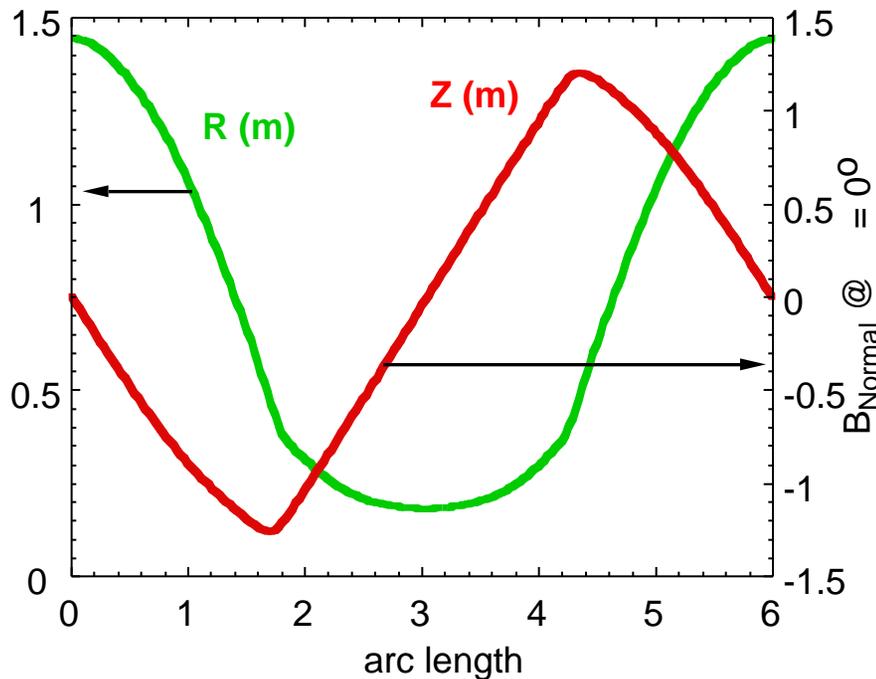
$\Phi = 90^\circ$



Plasma displacement - GATO -

High B_{Normal} perturbation allows active stabilization

sh. #104403 extrapolated to $N=6.3$



- Larger B_{Normal} perturbation on outboard compared to inboard
- Active stabilization system placed on passive plates can affect mode

Present research is showing the path to high-

- Passive stabilization of RWM using existing passive plate structure
 - Characterize RWM at low A (growth rate, toroidal rotation, ..., etc.)
 - Test the present configuration look for possible improvements
- Use of NBI and HHFW to create scenarios leading to high-
 - NBI to attempt modification of toroidal rotation and study effect on RWM
 - HHFW to attempt generation of broad P profiles through off axis CD
- Use analysis tools (ideal MHD codes + VALEN) to lead the design of active mode control system