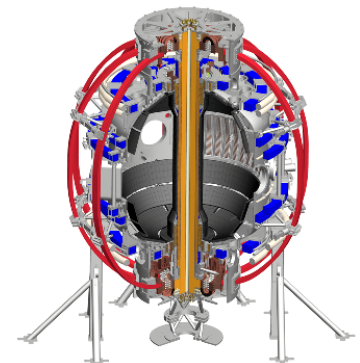# Experiments for
DIII-D National Campaign

Nate Ferraro
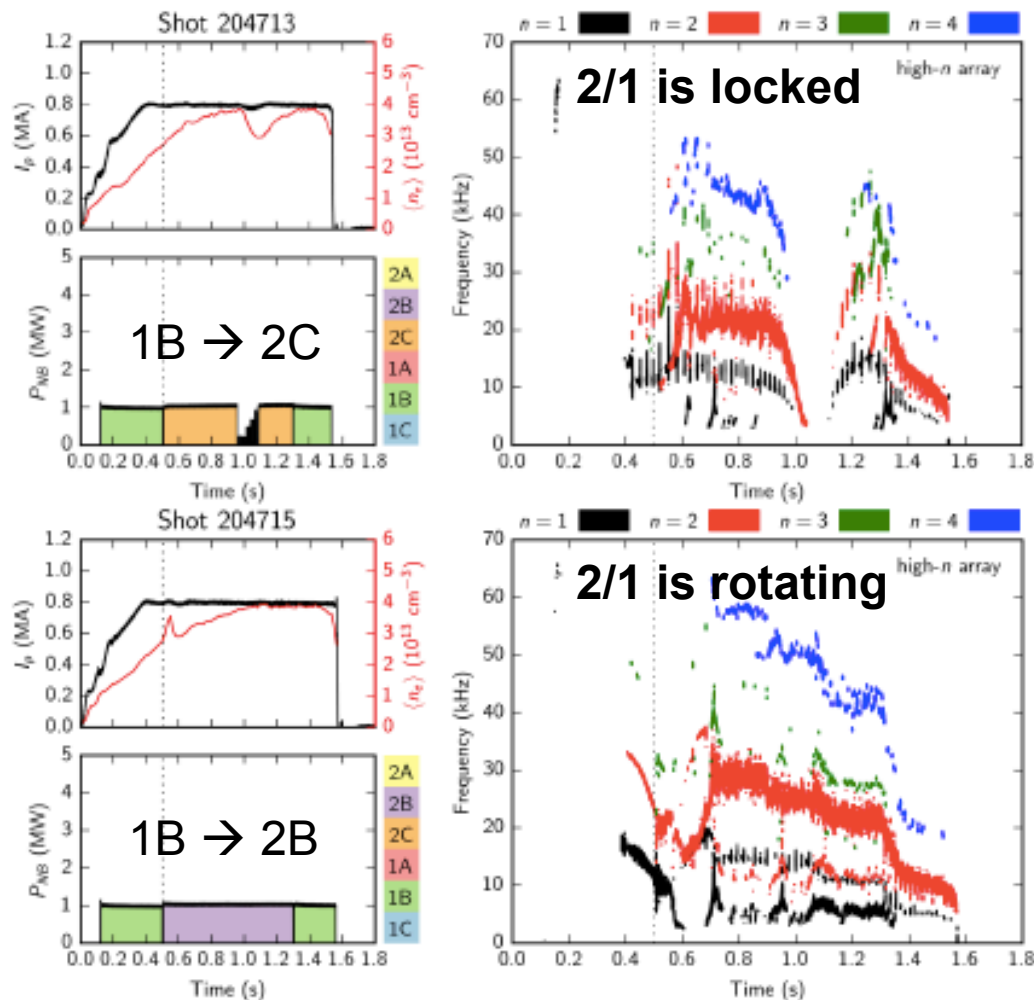
Core Science Group Meeting
PPPL
October 13, 2016

2.5 Proposed Experiments

1. Effect of beam tangency on MHD stability
   a. Effect on locking thresholds
   b. Effect on tearing mode thresholds

2. Dependence of Plasma Response and ELM Mitigation on n=3 spectrum
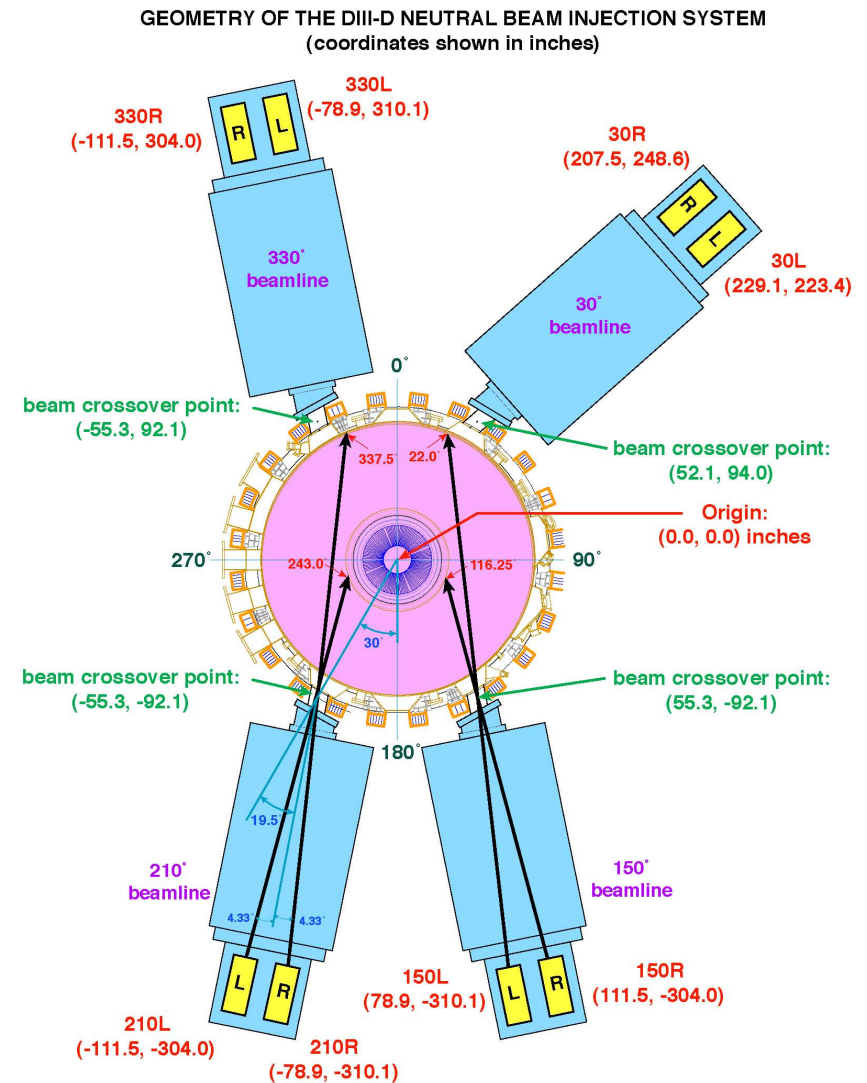
Effect of Beam Tangency on Locking Threshold and Tearing Stability: Motivation

- Beam source strongly affected locked-mode behavior on NSTX-U

- Effect of rotation profile on mode locking has not been explored

- Could be very useful tool for avoiding or killing locked modes

Effect of Beam Tangency on Locking Threshold and Tearing Stability: Plan

- NB tangency on DIII-D differs between L & R sources

- Repeat torque threshold scan (like 154921)
  - First with only L sources
  - Then with only R sources

- Can do similar expt. to look at tearing stability in low-torque IBS
  - High priority in DIII-D program

GEOMETRY OF THE DIII-D NEUTRAL BEAM INJECTION SYSTEM
(coordinates shown in inches)

330L (-78.9, 310.1)
330R (-111.5, 304.0)
30R (207.5, 248.6)
30L (229.1, 223.4)
330° beamline
30° beamline
0°
beam crossover point: (-55.3, 92.1)
beam crossover point: (52.1, 94.0)
337.5
22.0
Origin: (0.0, 0.0) inches
270°
243.0
116.25
90°
30°
beam crossover point: (-55.3, -92.1)
beam crossover point: (55.3, -92.1)
180°
19.5
210° beamline
150° beamline
4.33
4.33
150L (78.9, -310.1)
150R (111.5, -304.0)
210L (-111.5, -304.0)
210R (-78.9, -310.1)

Effect of n=3 Spectrum on Plasma Response & ELM Mitigation: Motivation

- The optimal n=3 spectrum for ELM suppression is known to depend on collisionality in DIII-D
  - "Odd Parity" works best at high collisionality
  - "Even Parity" works best at low collisionality
  - Single-row can work in different q95 regimes

- This is important for NSTX-U
  - Provides motivation of, and basis for optimization for, NCC
  - Can we explain why RWM coil

- Smoothly varying n=2 spectrum on DIII-D has led to new understanding and high-profile publications
  - We can't rotate n=3 fields, but we can smoothly vary the poloidal spectrum

Effect of n=3 Spectrum on Plasma Response & ELM Mitigation: Plan

- Vary n=3 spectrum from Even Parity to Odd Parity in ~7 discrete steps
  - Perform q scan within each discharge

- Start with standard low-collisionality DIII-D reference case (e.g. 126006)

- Repeat for high-collisionality reference case

- Key data will be magnetic response
  - Evidence of multiple modes? (I bet yes)
  - Signatures of island penetration on entering ELM suppression?
  - Great data for model validation