1. Purpose of Experiments

Include immediate goal of the experiments, scientific importance and/or programmatic relevance. Refer to any relevant program milestones.

The purpose of this experiment is to determine if there is a dependence of the intrinsic rotation velocity on $\rho_*$.

2. Background

Discuss Physics basis of the proposed research, Prior results at Alcator or elsewhere, and any related work being carried out separately.

In previous studies of intrinsic rotation, there was no evidence for any dependence on $\rho_*$ [1]. Most of the rotation points were found to occupy vertical strips at $\rho_*$ values corresponding to standard magnetic field operation, so no systematic $\rho_*$ scans have been performed. A recent theory [2] of intrinsic rotation predicts that the rotation should depend on $\rho_*$ as

$$\langle V_\| \rangle / v_{thi} \approx \frac{1}{2} \rho_* (\chi_i / \chi_\phi) (L_s / L_T) \sqrt{T_i / T_e}.$$

The dependences on $\nabla T$ and $\nabla s$ have been confirmed but a systematic scan in $\rho_*$ has not yet been performed.

3. Approach

Describe the methodology to be employed; explain the rationale for the choice of parameters, etc. Describe the analysis techniques to be employed in interpreting the data, if applicable. If the approach is standard or otherwise self-evident, this section may be absorbed into the Experimental Plan.

The approach is to compare the intrinsic rotation in H-mode plasmas over a large range of magnetic field.
4. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

Toroidal Field: 3 - 8 T
Plasma Current: 0.7 - 1.1 MA
Working gas species: D
Density: 1.0 - 3.0 x 10^{20}/m^3

Equilibrium configuration (if possible, refer to database equilibria): LSN and USN
Pulse length, typical current & density waveforms, etc. Refer to database or sketch desired waveforms: 2 s

4.2 Auxiliary Systems

ICRF Power, pulse length, phasing: 1-3 MW, some 50 MHz, some 80 MHz
LHCD Power, pulse length, phasing: n/a
Pellet Injection (species): n/a
Impurity blow-off injection: n/a
Diagnostic Neutral Beam: yes
Special gas puffing: Ar, ^3He
Cryopump: yes
Non-axisymmetric Coils (Connections, Current): yes
Boronization (previous night or between-shot): maybe
Other:

4.3 Diagnostics

List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

HIREX-Sr, Hirex-Jr, CXRS, PCI, edge Thomson scattering

5. Experimental Plan

Both sections must be filled in.

5.1 Run sequence plan

Specify total number of runs required, and any special requirements, such as consecutive days, no Monday runs, extended run period (10 hours maximum), etc.

requires half of a run with 50 MHz ICRF and half of a run at 80 MHz
5.2 Shot sequence plan

For each run day, give detailed specification for proposed shot sequence: number of shots at each condition, specific parameters and auxiliary systems requirements, etc. Include contingency plans, if appropriate.

establish H-modes at 3.4 T using D(H) heating with 50 MHz ICRF, a few shots at \( q_{95} \sim 4 \), and a few at 0.8 MA, both at the highest (\( \sim 1.5 \) MW) and lowest ICRF power. document velocity and temperature profiles.

repeat a few shots at 5.4 T with D\(^3\)He heating at 50 MHz, highest and lowest powers, 0.8 MA.

run a few shots at 5.4 T with D(H) heating at 80 MHz, 0.8 MA with both 3 MW and 1 MW.

run a few shots at 7.9 T with D\(^3\)He heating at 80 MHz, \( q_{95} \sim 4 \) and 0.8 MA, with both highest and lowest ICRF power.

6. Anticipated Results

Discuss possible experimental outcomes and implications. Indicate if the program may be expected to lead to publications, milestone completions, improved operating techniques, etc. Indicate if the experiments are intended to contribute to a joint research effort, an ITER request, or an external database.

test the above formula, publish results

7. References

Include references both to external and internal literature or communications which bear on this proposal. See Section 2.
