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

We wish to assemble an H-mode data set, for the primary purpose of testing models for the pedestal structure, edge relaxation mechanisms and transport. This desire is directly motivated by the FES FY11 Joint Research Target, the goal of which, in brief, is to develop predictive models for pedestal structure. This is a joint effort among C-Mod, DIII-D, NSTX, as well as the theoretical/modeling community (including, but not limited to General Atomics, LLNL and the Center for Plasma Edge Simulation). It is essential that we gather all the C-Mod data required to satisfy our JRT commitment before the end of the current campaign.

For this high-level milestone, C-mod contributes several regimes of interest with edge transport barriers, or pedestals. ELMy H-mode is being examined through MP578 and MP636. The I-mode pedestal is also the focus of extensive ongoing investigation. This MP focuses on the EDA H-mode. We propose to document carefully the pedestal and edge profiles (including radial electric field) and fluctuation characteristics, while attempting to vary the intrinsic profile scale lengths systematically via current and triangularity scans.

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

As a part of the FY11 JRT, a substantial modeling effort is being organized for the testing of models of pedestal profile structure, transport and micro-instabilities, all with the aim of enhancing confidence in our predictive capability for both the pedestal and global
confinement on ITER and other future devices. While the baseline operational regime for ITER is ELMy H-mode, we can still learn things from modeling the pedestal region in other confinement regimes. On C-Mod we have considerable operational experience in EDA and ELM-free H-modes, and we find these regimes relatively easy to make and diagnose. Diagnostics and capabilities we have been able to utilize in the past include

- High resolution $T_e, n_e$ from Thomson scattering
- Edge flows and $E_r$ from CXRS
- Fluctuations from magnetics, reflectometry, PCI, GPI
- Power flow into SOL, heat flux to divertor plate with IR, probes
- Low-Z seeding for flexibility in setting $P_{SOL}$, and in improving ICRF performance.

This experiment will attempt to integrate all these capabilities in a series of discharges, in which the pedestal will be changed by scanning operational parameters. Guidance is taken from prior experimental observations. It has long been seen that reduced plasma current favors the onset of the quasi-coherent mode (QCM) and results in higher edge particle transport, accompanied by relaxation of the density pedestal [1—3]. More recently, in work for the FY10 JRT on characterizing SOL heat flux, the width of the edge power channel was also found to decrease with increasing $I_p$, suggesting links between the profiles on open field lines and the pedestal profile characteristics [4]. Positive correlations between density pedestal width and triangularity have also been observed [2]. In a fixed magnetic equilibrium, QCM strength and effective particle diffusivity have also been shown to increase with density/collisionality [1].

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.

H-modes will be obtained at 5.4T using D(H) ICRF heating, using typical values of elongation and triangularity, as well as X-point and strike point locations. We will try to have very similar shape parameters to plasmas previously used in identity experiments between C-Mod and DIII-D, including those run as a part of the FY10 JRT.

$I_p$ will be scanned from 1.2MA to 0.5MA, giving a $q_{95}$ range that will span the onset of strong QCM fluctuations and EDA access. At an intermediate current value (e.g., 0.9MA) a target density scan will be carried out. Scans of triangularity will be made at one or two intermediate values of current.

In order to obtain high quality, steady H-modes with low core radiation, a fresh boronization will be required. Seeding with Ne will be used during boronization recovery and perhaps also during later scans to reduce Mo build-up.

In all discharges we will attempt to obtain significant time in H-mode during the current flattop, and optimize diagnostics to obtain the best possible data set. Items to watch will include:

- Radial coverage of edge Thomson
- Beam timing for the edge CXRS
• Gaps, puff timing for edge CXRS, GPI
• Strike point positioning for IR camera, probes

A successful run will deliver a thorough set of data for sharing with our collaborators in the pedestal modeling community. Key profile data (kinetic profiles, toroidal and poloidal flows, $E_r$) will be analyzed and packaged along with high-resolution kinetic EFITs, for use as inputs to modeling codes. Examples of modeling that will be performed include:
• Evaluation of stability of peeling-ballooning modes (ELITE), perhaps kinetic ballooning modes (GYRO, TGLF)
• Study role of flows, neutral physics and QCM on the pedestal structure (UEDGE/BOUT)
• Computation of neoclassical pedestal, and study effects of residual turbulence on transport/structure (XGC0/XGC1)
• Parametric dependence of QCM amplitude, mode numbers, particle flux, etc. (BOUT/M3D)

4. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

Toroidal Field: 5.4T
Plasma Current: 0.5—1.2MA
Working Gas Species: $D_2$
Density: Target $n_{l04}$ from 0.6 to $1.2 \times 10^{20}$ m$^{-2}$
Boronization Requested (if yes, specify whether overnight or between-shot, how recently needed, and any special conditions.): yes, overnight
Equilibrium configuration (if possible, refer to database equilibria): LSN

4.2 Auxiliary Systems

ICRF Power, pulse length, phasing: 2—4MW, D(H) heating
LHCD Power, pulse length, phasing: none, although launcher should be positioned so that X-mode reflectometer can take data
Pellet Injection (species): none
Impurity blow-off injection: none
Diagnostic Neutral Beam: yes, for CXRS
Special gas puffing: A D/He mix from NINJA for GPI and edge CXRS, diagnostic Ar, seeding Ne
Cryopump: no
Non-axisymmetric Coils (Connections, Current); standard locked-mode correction
Other:

4.3 Diagnostics

List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.
Thomson, ECEs, TCI (with fast digitization of an appropriate channel), Hirex Sr., edge CXRS.
PCI (masked for optimal edge mode diagnosis, i.e. 6—7 degrees), GPI, O-mode and X-mode reflectometers, fast magnetics
IR camera, divertor probes
All working bolometry.

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.
1 run day is required for this experiment, following an overnight boronization. Due to the importance of this exercise in the context of our programmatic milestone, and the increasingly constrained run schedule, it may be desirable to extend the run day to 10 hours, should we encounter delays early in the run. This would be contingent on still having good wall conditions and clean H-modes in the 7th hour of the run.

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.

(1) Recover from boronization. Begin with a 0.9MA plasma and condition all ICRF antennas. Employ Ne seeding from the first shot. Use these shots to optimize diagnostics as discussed in Section 3. (5 shots)

(2) Scan flattop current on a shot-by-shot basis: 1.2, 0.9, 0.7, 0.5MA. Adjust the target density so that the L-mode n/n0 is roughly constant over the scan, with the target n04 at 0.9MA being 0.9x10^{20} m^{-2}. Run ICRF from 0.7s to 1.1s at P_0 and from 1.1s to 1.5s at P_0 + 1MW, where P_0 will depend on the details of the target discharge. Modest levels of Ne seeding may continue, if needed to reduce injections from PFCs. (~3 shots at each current = 12 shots)

(3) At 0.9MA, perform a target density scan using the same ICRF prescription called out in step 2. Target n04 should range from 0.6 to 1.2 x10^{20} m^{-2}. The higher density range may prove inaccessible due to neutral pressure limits on the ICRF. (4 shots)

(4) At 0.9MA, scan upper triangularity on a shot-by-shot basis, attempting to achieve a range of 0.2 to 0.8, holding lower triangularity roughly fixed. This will give us some variation in average triangularity while still yielding good divertor profiles. If the extremes in δ_U result in railed power supplies or loss of steady H-mode, we can try lowering the plasma current. Some repositioning of the edge TS fibers may be needed to handle the extremes in shaping. We will attempt to hold the right gap constant, to the benefit of the midplane diagnostics. (8 shots)

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(5) Reprise some interesting shots from earlier in the run and make desired diagnostic changes, if any, to enhance the data set.

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.

We will obtain a complete set of input data for pedestal modeling efforts contributing to the FY11 JRT. Numerous publications with collaborators can be expected. Data will also support other proposals discussed at the 2011 C-Mod Ideas Forum.

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