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

Study electron thermal transport at low density/weak $T_e-T_i$ coupling using sawteeth.
Use small toroidal field ramps to measure $\nabla T_e$ in this regime.

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

Most C-MOD discharges are at densities where $T_e$ and $T_i$ are tightly coupled. By going to much lower densities, we can have $T_e$ and $T_i$ weakly coupled and compare the electron thermal transport in this case to that at higher densities. By going from $n_e = 2 \times 10^{20} m^3, T_e = 1$ keV to $n_e = 3 \times 10^{19} m^3, T_e = 2$ keV we can change the heat exchange time between ions and electrons by over a factor of 10. Sawteeth provide a $T_e$ perturbation to find the incremental thermal diffusivity and small field ramps allow $\nabla T_e$ to be obtained.

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

Look at sawteeth at a range of low densities to find incremental thermal diffusivity. Use small toroidal field ramps to determine $\nabla T_e$.

4. Resources
4.1 Machine and Plasma Parameters

Give values or range for:

Toroidal Field: 5.4 T with 1-2% (0.05-0.1 T) ramps over 50-100 ms

Plasma Current: 0.8-1.2 MA

Working gas species: any

Density: \((3-20) \times 10^{19} \text{ m}^3\)

Equilibrium configuration (if possible, refer to database equilibria): standard

Pulse length, typical current & density waveforms, etc. Refer to database or sketch desired waveforms:

4.2 Auxiliary Systems

RF Power, pulse length, phasing:

Pellet Injection (species):

Impurity blow-off injection:

Diagnostic Neutral Beam: if available

Special gas puffing:

Other:

4.3 Diagnostics

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

Heterodyne ECE, \(n_e\), \(T_i\) and soft x-ray

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.

8 shots, piggybacked if possible

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.

Shots at \((3, 5, 7, 20) \times 10^{19} \text{ m}^3\) density. Two shots at each density.
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, or an external database.

This should provide information on differences between incremental electron thermal diffusivity at strong and weak $T_e - T_i$ coupling. The $T_e$ profile and gradients will be useful for comparison with theoretical models.

7. References

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