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

The primary aim is to match, to the extent possible, the shape and key dimensionless parameters of small ELM regimes on Alcator C-Mod, including the Enhanced Dα H-mode and higher power ELMy H-mode, and on NSTX and MAST, in order to compare access conditions and fluctuation properties. The overall aim is to improve our understanding of the relationships between these regimes, and their access conditions including the role of aspect ratio. Since all three groups also have good edge profile diagnostics, these data will also be useful for checking models and scalings of pedestal width.

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

The recently completed, ITPA-sponsored dimensionless comparison between C-MOD and the higher aspect ratio JFT-2M (PEP-12, MP 397) showed much commonality between EDA H-mode and the HRS-mode [1]. It is of interest to find out whether the “type-V” ELM regime in NSTX, and possibly also observed in MAST, has the same physical mechanism as HRS/EDA or type-II; some properties appear similar, although the details seem to be different. A similar comparison between C-MOD, NSTX and MAST would help to understand the differences and commonalities of these regimes, and improve the reliability of extrapolations to ITER. They should also help establish such operation more routinely on MAST. The difference in field line pitch between small and large aspect ratio would highlight the role of $q_{95}$ for the instabilities. The ratios of $\beta_{\text{tor}}$ and $\beta_{\text{pol}}$ are very different, especially on the outer midplane where C-Mod typically has much larger $\beta_{\text{pol}}$. It should be noted that the expected pedestal densities in these
experiments differ by more than an order of magnitude, so that measurements of pedestal width and structure, which were not possible on JFT2M due to lack of diagnostics, should provide an interesting test of recent neutral fuelling model being done by Hughes, LaBombard et al [2].

This experiment (PEP-16) was proposed as a high priority activity by the Pedestal ITPA group at its meeting in Lisbon (Nov 2004), and accepted by the representatives of MAST, NSTX and C-Mod at the IAE Program Leaders’ meeting in Culham, Dec 2004. Similar proposal have been submitted to NSTX and MAST. Run time is anticipated on NSTX in mid-April 2006, and later in the year on MAST. If possible, completing part of this experiment (~1/2 day) in advance of the NSTX run would be advantageous since C-Mod is likely to set the attainable beta.

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.

We will start by matching NSTX shape (previously demonstrated on C-Mod, shot 10506180) and q95. Raise power to maximum available, at moderate target density. This will set beta limit; the aim is to overlap the \( \beta_{\text{tor}} \) ranges accessible on NSTX and MAST, with \( \beta_{\text{tor}} \sim 0.6\% \) referenced to \( B_{\text{T,0}} \). Then perform density scan to vary \( \nu^* \), assess ELM/H-mode type.

4. Resources

4.1 Machine and Plasma Parameters
Give values or range for:

- Toroidal Field: 5.4
- Plasma Current: 670-730 kA (for \( q_{95} = 5.5-6 \))
- Working Gas Species: D
- Density: starting target range nel 7e19 m^{-2}
- Equilibrium configuration (if possible, refer to database equilibria): 1050608018, with current reduced.

4.2 Auxiliary Systems

- RF Power, pulse length, phasing: 5 MW, all 80 MHz preferred (70+80 possible, would reduce B to 5 T and Ip)
- Pellet Injection (species): Impurity blow-off injection:
- Diagnostic Neutral Beam: desirable for CXRS
- Special gas puffing:
- Non-axisymmetric Coils (Connections, Current): If needed for locked mode control
- Other:
4.3 Diagnostics
List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

Critical diagnostics are Edge TS, PCI, fast magnetics. Highly desirable include CXRS, ECE, core TS, fast cameras to record ELMs.

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.

Requesting one run day in 2006 campaign. This could be divided into two half-days; there would be some advantage in doing part (Steps 1&2) before an NSTX run and part after, though this is not essential. Optimal boronization and demonstrated high quality H-modes prior to the run are essential, as are D, E and J-port RF. If we find conditions deteriorating, consider option of between-shot boronization; this decision would be made before the run based on experience with other runs.

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. **Set up target discharge.** Start with shot 1050608018 (LSN, κ=1.72, δ_L=0.52, δ_t=0.34) but reduce Ip to 730 kA to get q_95=5.5, the present lower limit on NSTX. Compare with target and adjust shape and/or q_95 as necessary. Use target NL04=7x 10^{19} m^{-2}, which should give EDA H-mode, and modest ICRF (2-3 MW) for these shots so it can tune up.
   4 shots.

2. **Power/beta scan.** Increase power shot to shot in 0.5 MW increments (2.5 MW, 3 MW, 3.5 MW, 4.0 MW, 4.5 MW, 5.0 MW). Monitor ELM type (expect to start getting ELMy regime) and pedestal beta. At some point β_{ped} may saturate. This or the power limit would set the achievable beta for this q_95, which will be a key constraint on the experiment (given STs can more easily achieve high beta). It is not clear a priori whether beta referenced to B_{tor} at the outboard midplane or flux average is more critical. Obtaining a range on each device will help clarify this.
   **10 shots.**

3. **Density/v* scan.** Keeping power, and hopefully beta, in its upper range, scan target density shot to shot to vary n_{ped}, T_{ped} and thus v*. Start by raising target nel (9x 10^{19} m^{-2}, 1.1x 10^{20} m^{-2}, 1.3x10^{20} m^{-2}, 1.5x10^{20} m^{-2}). Upper limit will probably be set by neutral pressure limit of J-port, or if we are lucky a transition to Type III ELMs. Then scan downwards, 7x 10^{19} m^{-2}, 6x 10^{19} m^{-2}. The limit in this case will be losing EDA and getting either transient ELM-free H-modes or, more interestingly, discrete
Type I ELMs.
\~15 shots, anticipating need for RF retuning.

4. 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 experiment, combined with runs on NSTX and MAST, should lead to the successful completion of ITPA experiment PEP-16 and to the better understanding of small ELM regimes. Results would be presented at ITPA and profiles submitted to pedestal profile database for comparison with emerging models. Presentation at conferences and subsequent journal publication is expected. Combined with other intermachine experiments (JFT-2M, JET) this might contribute to an APS invited talk nomination.

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