1. Purpose of Experiments

Begin pellet fueling experiments which include, fueling and density limit studies, pellet tracking and ablation studies, particle and energy transport studies. There is interest from ITER in studies of pellet ablation. We may also get some early data on the interaction of pellet fueling and divertor physics.

2. Background

The highest performance plasmas on Alcator C were obtained with pellet fueling. We discovered a new regime of enhanced confinement and spurred great interest in transport studies due to the theorized connection between peaked density profile and suppression of the ITG modes. The pellet injector is now installed on the tokamak and should be ready for operation in a few weeks. Note that at present, C-Mod has been running far below the density limit.

3. Approach

The first experiments should probably be piggy-backed on other programs. We would like to fire some small pellets into the end of discharges. This would verify the operation of the injector, synchronization of the injector and C-Mod, and evaluation of the pellet and plasma diagnostics.

The next stage would be dedicated pellet runs where we attempt to fuel plasmas primarily with pellets.

4. Resources
4.1 Machine and Plasma Parameters

Toroidal Field: 5 T
Plasma Current: at or near max available
Working gas species: D2
Density: target, .5 to 1 \times 10^{20}
Equilibrium configuration at this point, is probably unimportant. (The exceptions would be to 1. get higher plasma current by elongating and 2. Studying the interaction of pellet fueling and divertor physics; the timing for this depends on the availability of edge and divertor diagnostics)

Pulse length, typical current & density waveforms, etc. Current flat-topped, pulse as long as possible.

4.2 Auxiliary Systems

RF Power, pulse length, phasing: not yet
Pellet Injection (species): of course, D2
Impurity blow-off injection: not yet
Special gas puffing:
Other:

4.3 Diagnostics

All core diagnostics are needed including the soft x-ray arrays. Pellet diagnostics will be digitized at high rates. Some importance sampling of the TCI and the soft x-rays would be useful. Fast digitization of other diagnostics can wait until later experiments.

4.4 Neutron Budget

At currents at or below .5 MA the maximum neutron rate is estimated to be in the 10^{12} per second range. This will last for a few tenths of a second.

5. Experimental Plan

5.1 Run sequence plan

Initial experiments will not involve C-Mod plasmas; we will fire pellets into our target in synchronization with the C-Mod shots. When this works, we will get approval from
the current session leader to open our gate valve and fire into the end of the discharges. (This may cause disruptions.) This would probably take several run days to allow for gain adjustment and so forth on the pellet diagnostics.

Once we verified operation of the injector and diagnostics, we would have 2-4 runs where we attempt to fuel the plasmas principally with pellets. We will try to produce peaked density profiles and access the enhanced confinement mode.

6. Anticipated Results

Due to the new and unique pellet tracker diagnostic we should get new and unique data on pellet trajectories and ablation. We should be able to push to our density limit and begin studies of the limit mechanism. In the transport studies, we should make contact with our work from Alcator C and begin investigating any differences that appear.

7. References

See our seminal work in Phys. Rev. Letters or the 84 and 86 IAEA meetings.