1. Purpose of Experiments

The purpose of this experiment is to study the conditions which lead to the spontaneous formation of Ohmic H-Mode ITB’s and the effect of introducing small amounts of rf power into them.

2. Background

It has been observed that Internal Transport Barriers often arise during Ohmic H-mode operation. Examination of density profiles from the Ohmic H-Mode run on 9/15/2000 shows that most of the shots were developing ITB like density profiles as the shot evolved during the time period between 1 and 1.5 s. While several showed very strong density peaking of a factor of 2 or higher, most had peaking of around 1.5. They all showed the characteristic knee formation that is frequently seen in the density profiles, however. The shots on this day were taken with a variety of magnetic fields, with the field steady at low or intermediate values, as well as ramping up or down. The result was that ITB density profiles were seen at all field values between 3.5T and 5.3T. The values of q95 varied significantly as well.

In order to explore the limits of centrally heating an ITB plasma, it is proposed that we set up an Ohmic ITB plasma by ramping the toroidal field, continuing it up to a value suitable for central ICRF heating at 70 Mhz. We would then proceed to pulse ICRF power into it, beginning at quite low values and gradually increasing the power. This would allow us to study the limits of central power input into an ITB plasma, as well as the degradation of core transport as the heating power is increased.
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.

Set up an Ohmic H-mode ITB shot such as 1000915009. Once it is established that an ITB is formed, begin adding rf power in small increments at the time that the toroidal field reaches 4.6 T so that the ICRF power will be absorbed near the plasma center.

4. Resources

4.1 Machine and Plasma Parameters
Give values or range for :

**Toroidal Field:** As in shot 1000915009, 5.3 T ramped down to 3.2 T then up to 4.6 T

**Plasma Current:** 0.8 MA

**Working gas species:** D, H minority

**Density:** target for obtaining EDA H-mode: 6e19 on nl04.

**Equilibrium configuration** (if possible, refer to database equilibria): Shot 1000915009

**Pulse length, typical current & density waveforms, etc.** Refer to database or sketch desired waveforms. Setup as shot 1000915009 Note: In the 9/15/00 run various exotic gases were being used for plume studies. These will not be necessary.

4.2 Auxiliary Systems

**RF Power, pulse length, phasing:** 70 Mhz, incrementally increase power beginning at 0.2 MW in 0.2 MW steps, pulse length 0.2 s, heating phasing.

**Pellet Injection (species):** none

**Impurity blow-off injection:** none

**Special gas puffing:** none

**Other:**

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

**Hirex for Ti profiles and rotation**

**Thomson Scattering**

**CHERS if available**

**Visible Bremmstrahlung array**
GPC 1 and 2
Neutron diagnostics
All standard core diagnostics
MSE
BES

4.4 Neutron Budget
Estimate the neutron dose rate at the site boundary. Give basis for estimate. (Once some experience has been gained a standard formula will be provided for estimating dose rates.)

less than $5 \times 10^{15}$

5. Experimental Plan

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.

This experiments should take only one 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.

First run:

Part 1. (4-6 shots) Set up Ohmic H-mode target shots with an ITB using a field ramp which starts at 5.3 T, decreases to 3.2 T, then increases to 4.6 T. Confirm that an ITB forms, and try to obtain Ti and rotation profile data from reproducible shots.

Part 2. (4 shots) Continue as in part 1, but add 200 kW rf power at 70 Mhz after the 4.6 T plateau is reached. Depending on the effect on the ITB, repeat to obtain Ti profile data.

Part 3. (10 shots) Continue incrementing the rf power up in 200 kW rf power until degradation of the ITB is apparent, repeating shots if necessary to get TI profiles.

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.

We expect to gain information about both the Ohmic H-mode ITB formation and about the role of central heating power in affecting the transport physics after the ITB has been established. This will improve our knowledge of how to control the formation and lifetime of internal transport barriers. It will also provide much needed data on ion temperature and rotation profiles for further transport (TRANSP) and stability (GS2) modelling efforts.
7. References

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