Alcator C-MOD

Mini-Proposal

Subject: Exercise the Flapper and Associated Diagnostics in Ohmic Discharges

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Date: 4 January, 1999

Approved by: ___________________________ Date Approved: ______________

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

   The purpose of this experiment is to obtain preliminary information on flapper operation, its effect on divertor and midplane gas pressures and on argon/neon screening efficiency. In addition, a considerable number of relevant diagnostics need to be checked out. Only Ohmic discharges are considered.

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

   The flapper has been tested in air in the large magnet in the Tara cell, but has not yet been tested in vacuum or after vacuum baking. Testing in C-Mod is required.

   During the vacuum break in late 1995, the gas bypass was effectively closed with glass sock. Significant changes in machine performance were observed, including, changes in the divertor and midplane gas pressures, changes in H-mode performance (EDA was first obtained) and a reduction in impurity penetration factors (Granetz 1996 PSI).

   The flapper is designed to give in situ control of this bypass. The flapper will be used to investigate the effect of divertor baffle geometry on gas pressures and impurity screening.

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 discharges with the flapper closed, achieve a steady state flat-top, and then open the flaps, observing the effect on gas pressures, etc. Once basic flapper operation is established, we will puff argon, and later neon, to look for an effect on impurity penetration factors.

   We will investigate the behaviour at different discharge densities and plasma currents.
4. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

Toroidal Field: 5.3 T

Plasma Current: 0.8, 1.0 MA

Working gas species: $D_2$

Density: start with a nominal density of $n_e = 1.5 \times 10^{20}$ and then chose one lower density, say $n_e = 1.0 \times 10^{20}$, and one higher density, say $n_e = 2.4 \times 10^{20}$

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

Pulse length, typical current & density waveforms, etc. Refer to database or sketch desired waveforms: standard fiducial will be acceptable perhaps with some modification of the separatrix strike point locations.

4.2 Auxiliary Systems

RF Power, pulse length, phasing: not needed

Pellet Injection (species): No

Impurity blow-off injection: No

Special gas puffing: argon and later neon

Other:

4.3 Diagnostics

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

RGA, all MKS and ion gauges, FSP, ASP (A horizontal probe), HIREX (Ar), McPherson (Ne), Omegatron, chromex

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.)

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.

First, establish a base discharge with moderate density at 5.3 T and 0.8 MA. Program the flappers to open in the middle of the flat-top, observing the effect on gas pressures and all Langmuir probes. Introduce, shortly thereafter, argon gas as a trace impurity and observe with the HIREX and the divertor RGA. Experiment with different flapper programs. A considerable number of repeat shots are expected to allow all relevant diagnostics to be checked out.

Repeat, at a lower density, and a higher density.
Repeat, above at 1 MA.
Repeat, at one current and at three densities with neon.

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) 10 Ohmic discharges, 0.8 MA, moderate density, no argon.
(2) 4 Ohmic discharges, 0.8 MA, moderate density, argon.
(3) 4 Ohmic discharges, 0.8 MA, low density, argon.
(4) 4 Ohmic discharges, 0.8 MA, high density, argon.
(5) 4 Ohmic discharges, 1.0 MA, moderate density, argon.
(6) 4 Ohmic discharges, 1.0 MA, low density, argon.
(7) 4 Ohmic discharges, 1.0 MA, high density, argon.
(8) 10 Ohmic discharges, 1.0 MA, low, moderate and high density, neon.

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 anticipate that opening the flaps should strongly affect the divertor and midplane pressures, as well as the impurity penetration factors.

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