Disruption Mitigation Experiments with Two Gas Jets on Alcator C-Mod

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INTRODUCTION

Disruption mitigation using reactive gas injection (MRI) on present-day tokamaks has shown great success at mitigating the thermal load that would otherwise be concentrated on the divertor at the time of disruption. The two gas jets can be fired independently, i.e. either simultaneously, staggered, or with different times delays. The two plena are supplied from a single gas bottle initially.

During pre-thermal quench (p-TQ), the asymmetry does not vary much during the discharge. During current quench (CQ), the asymmetry can be consistent with the relative timing of the two gas jets.

Experiments with two gas jets on C-Mod have been done in two plasma regimes: L-mode and I-mode.

A 2nd gas jet has been installed on Alcator C-Mod near the halfway around torus from 1st gas jet.

6 new fast diode detectors (Dumbo) have been installed, and supplement existing arrays.

Optimised for measuring during disruptions.

New DMBolo detectors measure $P_{mic}$ from k-slices of plasma at 6 toroidal locations.

Experiments show that slightly different trigger scenarios are required for different plasma regimes.

Growth of n=1 MHD may affect $P_{mic}$ asymmetry at least as much as using multiple gas jets.

Summary

- Two gas jets, at nearly opposite toroidal locations, are currently operating on Alcator C-Mod to investigate $P_{mic}$ asymmetries during disruption mitigation.
- A new set of $P_{mic}$ diagnostics (AXUV photodiodes), in addition to a pair of previously existing arrays, has been installed for these asymmetry studies.
- During the pre-thermal quench, the $P_{mic}$ asymmetry can be reproduced controlled by the relative timing between the firing of the two gas jet valves, in both L-mode and I-mode plasmas.
- Dependence on the relative timing is as expected.
- During the thermal quench, however, the $P_{mic}$ asymmetry is not well-controlled with the two gas jets, and is not reproducible.
- There is strong evidence that the growth of n=1 MHD (triggered by the gas jets) plays an important role in the $P_{mic}$ asymmetry, and may dominate in the TQ phase.
- This effect has been independently seen in NIMROD modeling by Val Izzo (this conference, paper THIP3-13).