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EX/P8-09: Disruption Mitigation Experiments with Two Gas Jets on Alcator C-Mod

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Massive gas injection (MGI) disruption mitigation experiments have shown that this technique can quickly convert a large fraction of plasma thermal and magnetic energy into radiated power. To date, gas has been injected from a single spatial location, and bolometric measurements have shown that the resulting radiated power is often toroidally asymmetric, which could cause melting of beryllium first wall surfaces in ITER. Therefore, the ITER MGI system proposes multiple gas jets distributed around the torus.
On Alcator C-Mod, a 2nd gas jet has been installed 154 degrees around the torus from the existing gas jet. The hardware components of both gas jets are nominally identical. A pair of AXUV photodiode arrays viewing the plasma midplane is used to measure the n=1 component of the toroidal asymmetry, and a toroidally-distributed set of six individual detectors, each viewing a collimated slice of the plasma, provides toroidal resolution higher than n=1 and is used to calculate the toroidal peaking factor (TPF) of the radiated power.
Experiments have begun to characterise the effect of using two jets on the radiation TPF, varying the relative timing between the firing of the gas jets from shot-to-shot. It is observed that the TPF depends on the phase of the disruption. During the pre-TQ, when the gas is cooling the plasma edge, the TPF varies reproducibly with the relative gas jet timing. However, during the thermal quench (TQ) and current quench (CQ), when most of the plasma energy is radiated, the results are more complicated. At large positive delay times (i.e. jet #2 fires well after jet #1) the TPF is seen to be variable and often high, agreeing with earlier results using only this jet. However, at large negative delay times (jet #2 fires well before jet #1), the TPF is significantly lower and more reproducible. This may indicate that slight differences in hardware and/or geometry between the two gas jet systems are important. The growth of n=1 MHD modes may also be playing a role.
Observations of the radiation asymmetry during the TQ and CQ phases, as well as the effectiveness of two gas jets with respect to mitigation of thermal deposition in the divertor, halo currents, runaways, etcetera, will also be presented.

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