Main Chamber Neutral Pressure in Alcator C-Mod and JET

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Main chamber gas can have a number of deleterious effects in divertor tokamaks. First, the gas-plasma interaction will generate neutrals which freely cross field lines and bombard the vessel walls, resulting in the production of impurities. It is expected that the resulting impurities, entering the plasma via the main chamber, are particularly efficient at contaminating the plasma core. Second, and more speculatively, it is thought that high levels of neutrals in the main chamber can degrade the energy confinement properties of the discharge.

In a divertor tokamak it is usually assumed that the main plasma-wall interaction is at the target plates and that the gas resulting from this interaction is confined to the divertor and associated plenums/ducts by the divertor baffle structure. However, recent results from Alcator C-Mod have found relatively high levels of main chamber gas (~ 10^{-3} mbar) which appear to be in part related to plasma-limiter interaction in the main chamber [1] and in part due to gas leakage through the mechanical baffle structure driven by the relatively high divertor pressure (~ 10^{-1} mbar) [2]. This view is supported by observations that the main chamber gas pressure is affected both by the plasma to limiter separation (factor ~ 2) and by abrupt changes in the leakage conductance between the divertor plenum and the main chamber. The leakage conductance can be controlled *in situ* in C-Mod using a novel divertor 'bypass' [2].

In the case of JET, detailed measurements during the 2000 campaign have found a strong correlation between the divertor gas pressure and the mid-plane pressure over a wide range of discharge conditions with relatively high pressure ratios (~ 100)—behaviour that is similar to that observed on C-Mod. In contrast, however, Langmuir probe measurements in the main chamber indicate a relatively low level of plasma-limiter interaction and no correlation between the separatrix-limiter separation and the main chamber gas pressure. These results suggest that the main chamber gas in JET is maintained by leakage of divertor gas through openings in the mechanical baffle structure. The observed level of leakage flux is relatively small in comparison to the ion flux to the target plates (~ 5%), in contrast to C-Mod where the comparable figure is many times larger (~ 30%).

[1] B LaBombard et al, PSI Conference, Rosenheim, 2000
[2] C S Pitcher et al, PSI Conference, Rosenheim, 2000

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