

D majority heating in JET plasmas: ICRH modelling and analysis of the experimental RF deposition profiles

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Recent experiments in JET have provided information on the potential of using majority RF heating schemes in large plasmas. Adopting a wide range of available diagnostics, the plasma behaviour was monitored. The main results of the experiments are that – due to the poor antenna coupling at low frequency, the low (Ohmic) plasma temperature and the reduced RF electric field amplitude near the ion-cyclotron resonance layer of the majority ions - RF alone was barely capable of heating the plasma with the limited RF power available at 25MHz. On the other hand, when preheating the plasma using neutral beam injection, the wave-plasma coupling was noticeably improved and considerable plasma heating, followed by increased neutron yield were observed in several diagnostics. This effect is not only attributed to the lower collisionality of the pre-heated plasma but also to the Doppler-shifted resonance layer of the fast beam ions. By studying the response of the plasma to sudden changes in the RF and NBI power levels, the experimental RF power deposition profile was determined and compared to theoretical predictions. The numerical modelling was done adopting a coupled wave/Fokker-Planck code that enables accounting for the non-Maxwellian distributions of the RF heated particles and the injected beam ions in the wave equation, and for the actual local RF electric field in the Fokker-Planck description. The theoretical results confirm the experimental finding that the beam ions do play a crucial role in this heating scheme.

* See the Appendix of M.L.Watkins et al., Fusion Energy 2006 (Proc. 21st Int. Conf. Chengdu, 2006) IAEA, (2006)