§47. Studies on Steady State Spherical Tokamak by the "Plasma Boundary Dynamics Experimental Device (QUEST)" in Kyushu University

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Recent Achievement of the diverted non-inductive current driven plasma

In QUEST project aiming at proof-of principle of steady state spherical tokamak operation (SSTO) [1,2] it has been demonstrated that a diverted spherical plasma with 25 kA at Bt=0.13 T could be for 12 s non-inductively driven by 8.2 GHz at 120 kW. The main research purpose is to achieve alone the plasma current with RF both in limiter and divertor configurations. In this experiment the O-mode with $N_\parallel \sim 0.4$ was injected. The cyclotron resonance locates at R~0.29 m (0.58 m for 2nd). As shown in fig.1, I_p could be ramped up to 18 kA in the limiter configuration and then increased up to 25 kA in the single null divertor configuration. The role of energetic electrons on the formation of the magnetic surfaces have been studied[3-5]. By the inductive filed Ip exceeded above 100 kA for 0.1 s[6,7]. The current at ~ 40 kA could be feedback controlled for 2 s. The fluctuation study has been done in the slab configuration and during current ramp-up phase[8-13]. Langmuir probe is used to measure the electric filed in the blob and then the propagation velocity is derived. This has been compared those with tracing the blob image. The connection length effects on the blob velocity is found to be small[14]. Statistic aspects of the edge fluctuation have
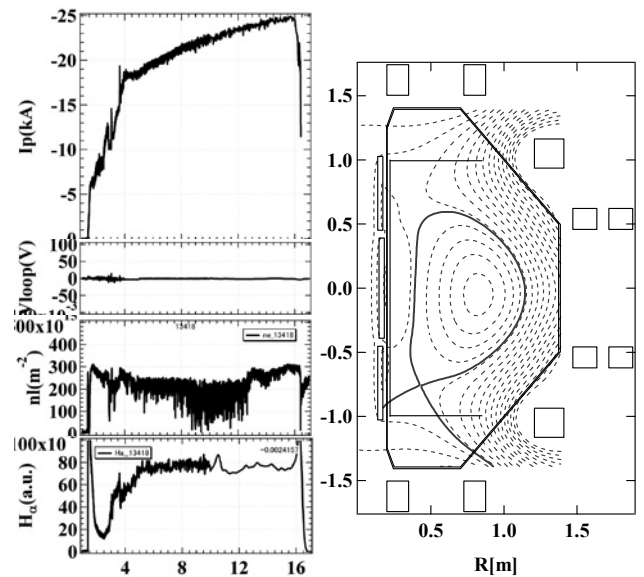

Fig. 1 Ip, Vloop,nl,Hα and magnetic surfaces

been studied by analyzing the fast camera images. A quadratic relation between skewness and kurtosis is found and the numerical coefficients describing Pearson systems are deduced by these quantities [9]. Plasma wall interaction is investigated from several views of points[15-20]. The permeation probe measurements have been compared with that in static particle balance measurements, and they also support the progress of the wall pumping in the campaign[15,17,18]. The retention of W has been studied as a function of fluence and surface temperature[19-20]. The new design of EBW antenna and FB control method have been progressed[21-22].

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