First Plasmas in the TJ-II Stellarator

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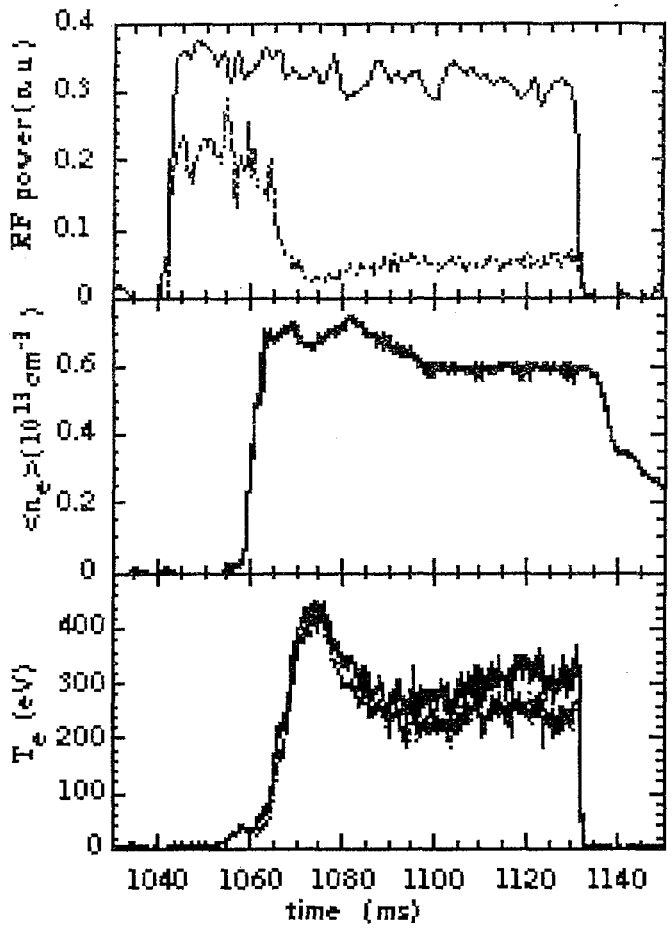
First plasmas have been recently achieved using ECR heating in the TJ-II stellarator. It is a low magnetic shear stellarator with a major radius of 1.5 m and average minor radius of 0.10-0.20 m [1]. The magnetic field (B_0 = 1 T) is generated by a system of central, toroidal and vertical coils. The central conductors, which provide the flexibility of the TJ-II device, consist of a circular solenoid and two helical coils which are wrapped around the central solenoid. TJ-II stellarator has very favourable MHD characteristics. The existence of closed and nested magnetic surfaces, in good agreement with the calculated ones, has been demonstrated in TJ-II by means of magnetic surface measurements carried out at low magnetic field.



Two gyrotrons (53.2 GHz, up to 700 kW) have been installed in the TJ-II stellarator. First plasmas have been created using one gyrotron (250 kW, Dt = 90 ms) with perpendicular injection. Helium glow discharge cleaning has been used for wall conditioning. ECRH plasmas with line average electron densities in the range n_e = (0.4 - 1.2) x 10^{19} m^{-3} and central (ECE) electron temperatures up to Te = 0.5 keV have been obtained in different plasma configurations with iota (0) = 1.4 - 1.6 and average plasma minor radius <a>= (0.12 - 0.19) m. Preliminary analysis, based on ECE profiles and density measurements, yield an energy confinement time of about 2 ms. The global particle confinement time is in the range 5-10 ms. The time evolution of an ECRH discharge with iota(0) = 1.42 and <a>= 0.19 m is shown in figure 1.

Fig. 1: Time evolution of shot 617. (a) injected and absorbed ECH power, (b) line averaged electron density (c) electron temperature from ECE diagnostic (two channels)

References

[1] C. Alejaldre et al., Fusion Technology 17 (1990) 131.