Plasma parameters (n_e, T_e) were monitored by a movable Langmuir probe, located in the same cross-section as the grill. The radial profiles of n_e and T_e between the liner and the radius $r/a = 0{\cdot}45$ can be measured by this probe. The probe consists of a molybdenum wire (0·8 mm in diameter, 3 mm long).

In addition to the standard plasma parameters (the plasma current, the loop voltage, the line average density n_e measured by the 4 mm interferometer and visible line intensities), the integral electron cyclotron radiation in the range of 36 GHz and the HXR emission $(E \gtrsim 0{\cdot}2\ \mathrm{MeV})$ were monitored during the experiment.

3. EXPERIMENTAL RESULTS AND DISCUSSION

Plasma is generated by RF power launched into the toroidal chamber by a grill. The RF pulse is applied simultaneously with the start-up of the toroidal magnetic field B_T, which reaches its maximum value $(B_T^{max} = 1{\cdot}3\ \mathrm{T})$ after 30 ms. As B_T increases, ECR zone arises at the inner side of the vacuum chamber at about $t \sim 0{\cdot}5$ ms (according to fig. 3) and the ECR plasma is created. Due to the mechanism of waves transformation [5], this plasma is then sustained during the whole RF pulse, in spite of the fact that in consequence of the increasing magnetic field the ECR zone is already outside the chamber.

The evolution of plasma parameters during the RF pulse is demonstrated in figs. 4a–h. After reaching its maximum value at $t \sim 1{\cdot}3$ ms, the line average density decreases, at first rapidly, then slowly until the end of the RF pulse is reached. A similar character exhibits the ion saturated current I_s^+ (see. fig. 4b) corresponding in some sense to a local electron density at the radius $r = 40$ mm.

A toroidal plasma current I_p appears during the ECR breakdown. It rises with a rate of about 40 kA/s and approaches the maximum value $I_p^{max} \simeq 0{\cdot}2$ kA at $t \doteq 5$ ms. At this time the toroidal magnetic field is about one order of magnitude higher than the cyclotron value for the pumping wave. Therefore, the resonant (ECR) mechanism of the wave energy absorption is absent during the current rise. Most probably, the observed current is generated by a lower hybrid wave $(2f_{LH} \lesssim f \ll f_{ce}$ in our case), launched into the existing target plasma by the multijunction grill. It is necessary to note, however, that the direction of the electron drift is opposite to the direction of the $\boldsymbol{k}$-vector of the main branch of the calculated RF spectrum. It seems to be probable[1]) that the observed toroidal current is driven in this case by the "parasitic" branch of the spectrum due to the enhanced population of higher $N_\parallel$ (see fig. 2). Such an assumption is fully justified by the relatively low velocities of the primary plasma electrons. In view of this fact, an efficient interaction between the target plasma and RF wave can be expected just at high $N_\parallel$ only [6].

The total efficiency of the noninductive current drive is rather low in our case. This fact may be connected with the low value of the RF power in this high $N_\parallel$

[1]) Private communication from R. Klíma, August 1985.

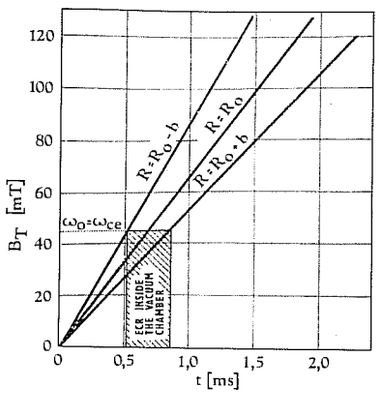

Fig. 3. Evolution of the toroidal magnetic field in the tokamak chamber.

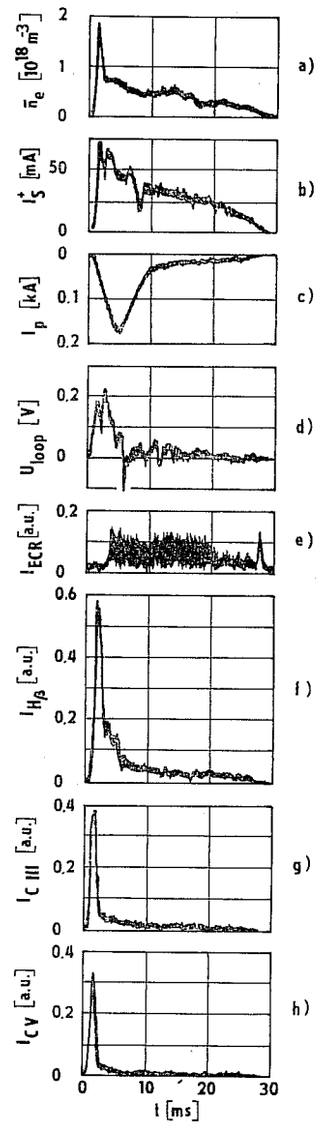

Fig. 4. Evolution of the following quantities: a) average plasma density; b) ion saturated current; c) plasma RF driven current; d) loop voltage; e) electron cyclotron radiation; f) H_β-line intensity; g) CIII-line intensity; h) CV-line intensity.

part of the "parasitic" branch of the spectrum (only a few % of the total power). Secondly, plasma equilibrium has been performed only passively by the conducting copper shell of the tokamak. As we have mentioned above, we did not employ the dynamic vertical magnetic field required for the successful long-term equilibrium of the current channel. The value of the toroidal current should be limited by this fact as well.

Moreover, it has been shown recently [7] that even such low values of toroidal electric field E_T as $\pm 0{\cdot}1$ V/m change the electron distribution function and conse-